PERSONALITY, COGNITIVE STYLE AND APPROACHES TO LEARNING IN UNIVERSITY UNDERGRADUATES

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Andrew J. Flett

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ABSTRACT

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Andrew J. Flett

This thesis examines the experience of students in higher education and investigates the relationship between concepts of approach to learning, cognitive style and personality. In March 1993 Entwistle and Ramsden's (1983) Lancaster Approaches to Studying Inventory and Saville and Holdsworth's (1990) Concept 5.2 Occupational Personality Questionnaire were administered to 378 first year undergraduate students from all subject disciplines at the University of Leicester. 311 of these participants returned to resit the tests one year later in 1994, and 116 also returned in 1995 to sit the tests for a third time. The data-set yielded through this core methodology was factor analysed in order to establish a conceptual framework which could be used to assess the determinants of deep and surface approaches to learning, and holist and serialist learning styles. Differences in learning characteristics between male and female students, mature and non-mature students and students of different subject disciplines were investigated and the development of these characteristics over three years was charted. In addition, the academic performance of the students was recorded and correlated with each of the personality and learning characteristics tested. A consistent and conceptually useful eleven-factor model emerged which was used to inform all subsequent analysis. The findings suggest that in the first year of study, cognitive style is strongly linked to personality and only marginally related to approach to learning, but that over time approach to learning becomes associated with aspects of both cognitive style and personality, in particular conscientiousness, ambitiousness and abstract/holist orientation. The results also show that arts and science, and male and female students differ significantly in their respective cognitive styles and that mature students are more likely to seek meaning in their work than non-mature students. In addition, it was found that the personality trait 'conscientious' was highly predictive of academic performance at both first year and final degree levels. The theoretical and practical implications of these findings are discussed in terms of both cognitive theory and educational policy and practice.

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CHAPTER 1 - INTRODUCTION

1.1 Overview

This thesis presents the findings and contributions of a three year research project which sought to investigate the influence of individual personality on the learning strategies and styles of higher education students. By using established psychological constructs and psychometric instruments from phenomenographic, cognitive and personality focused areas of research, the project aimed to highlight those factors and relationships most pertinent to the experiences of students on degree level courses. This introductory chapter outlines the principle tenets and concepts of each these bodies of research - reviewing in turn, models of approaches to learning, cognitive learning styles, learning orientations and personality measurement - in addition to describing alternative theories and models relating to student learning and personality. The chapter thus establishes the central rationale for the programme of research and concludes with an outline of the chapters to follow.

1.21 Approaches to learning

Perhaps the most important development in the field of student learning has been the appreciation of knowledge as a form of meaningful understanding, rather than as the accumulation and retention of discrete items of information. Bartlett (1932) pioneered the concept of memory as personal re-interpretation of the outside world, rather than as a simple storage device, and since then, research into student learning has in one way or another concerned itself with the elements inherent in this process.

An influential and frequently quoted body of research took place at the University of Gothenburg in the mid 1970s. Learning was studied from the perspective of the learner rather than the teacher or researcher, and instead of charting the objective characteristics of the educational situation, the model of research involved looking at how the learner interprets this situation. Marton (1981) termed this model 'phenomenography' and used it to refer to research which focuses on a *second-order* perspective of learning. Initial research investigated the reading and understanding of academic articles - a task familiar to virtually every student. The approach used was fairly novel - previous work had tended to assess learning outcome in quantitative terms, such as total number of correct answers given in a class test, or number of discrete facts and figures recalled for the experimenter. Marton and

Säljö (1976(a)) were interested in the *qualitative* elements of students' learning, such as differences in their comprehension of theoretical ideas and principles. With this in mind the researchers proposed that 'a description of *what* the student learns is preferable to the description of *how much* they learn.' (Marton and Säljö, 1976(a), p3).

The methodology involved analyzing the individual meanings, concepts and ideas which different students were able to extract from a set tract of academic text. From this it was possible to assess the different ways in which the same learning material could be approached and comprehended. Students were asked to read passages of prose and then answer specific questions about the passage and explain the meaning of the article to their best ability. The students were also requested to provide introspective reports detailing the ways in which they perceived themselves to have approached the task, and in addition, a series of open questions were asked about their 'everyday' approaches to study. The responses to these questions were rich in information about *how* individual students had interpreted the instruction to read the passage.

The researchers reported four basic levels of comprehension - dubbing them 'levels of outcome'. These levels represented *qualitative* differences in learning. The first level of outcome was characterized by answers which satisfactorily demonstrated a comprehensive understanding of the author's intended message. This level, Fransson (1977) described as 'conclusion-oriented and detailed'. In it, the student is able to present a clear summary of the main argument, along with relevant evidence and clear explanation of how they personally came to understand the argument. On the second level - 'conclusion-oriented and mentioning' - answers contained at least one important point of the author's argument. The main argument is summarized satisfactorily, but supporting evidence is lacking. On the third level - 'description-oriented and detailed' - the student's answer highlights the prominent points of the message but fails to demonstrate how these inter-relate to address the author's argument. On the final, fourth level - 'description-oriented and mentioning' - the students' answers are relatively empty of content. At most a few relevant points are put forward, but typically the answers demonstrate confusion and a failure to understand the author's argument.

These tests were repeated after six and a half weeks and the level of outcome category appropriate for each student's responses was found to be largely consistent over time.

When asked about how they had tackled the task of reading the article, the students' responses seemed to suggest that each had adopted one of two approaches to learning - a *deep* approach or a *surface* approach.

The students adopting a deep approach claimed that their initial intention was to *understand* the meaning of the passage. Their response to the set questions on the article suggested that they had actively considered the author's arguments in the dual contexts of previous knowledge and their own experience, and attempted to offer criticism of the article based on rational assessment of the evidence presented.

Students adopting a surface approach said that their initial intention was to memorize certain aspects of the text, recall of which (they believed) would be required in subsequent assessment tasks. Their performance on the set questions betrayed a lack of any real understanding of the author's argument.

Marton and Säljö (1976b) used these distinct categories to assess the subsequent learning patterns exhibited by the students, considering the distinction to be a fundamental factor in determining differences in learning outcomes.

Svensson (1977) sought to assess the relationship between a student's approach to learning, (as demonstrated by the experimental Gothenburg studies), and his or her normal - or 'real-life' - approach to learning using interview data yielded by students in Marton and Säljö's research and additional data gathered using a similar methodology.

He observed that a student's subjective report of how he or she had tackled the reading of the passage was *directly* related to their subsequent understanding of the implicit meaning in terms of the two distinct levels of learning process identified by Marton and Säljö. A similar differentiation in the approaches to the reading of texts to that of Marton and Säljö was proposed, which focused on the relationship between knowledge and skill. Much previous research tended to emphasize *either* knowledge acquired or the skill of 'learning to learn'. Svensson argued that the two are inevitably linked, and that the cognitive structures developed by individuals to handle their conceptions of various phenomena are central to subsequent level of knowledge, and - more importantly - they are fundamental in determining how that knowledge is acquired and used.

By reviewing the transcripts collected by Marton and Säljö, Svensson developed two categories to describe different approaches to learning. These were termed '*holistic*' and '*atomistic*', and rather than describing the depth of interest in meaning that the surface and deep categories did, they represented the different ways in which the students structured their answers. Students in the holistic category tended to identify the major components of the argument, search for supporting evidence and integrate this evidence into a broader overall structure, thereby setting the message in a wider context. Atomistic students, on the other hand, tended to amass or aggregate discrete items of information without attempting to assemble a structured overall picture. They did this by memorizing details and reviewing specific sections of the text in a serial, unrelated fashion.

The students' introspective reports also highlighted these differences. Holistic approach students claimed to have tried to focus on the main message while atomistic approach students admitted to concentrating on recalling specific sentences and words.

Categorisations of the students' learning using Svensson's distinction were compared with the deep/surface categorisations offered by Marton and Säljö, and very close agreement between the concepts was observed, suggesting that outcome and process should be unified not separated. Svensson argued that for a student to reach a deep level of understanding, he or she *must* adopt a deep/holistic approach to learning. A student using a surface approach will - by definition - *never* reach anything other than a superficial level of understanding. Such students cannot fully recognize basic structures, concepts or ideas because they conceptualize knowledge as a series of loosely associated parts to be memorized and uncritically accepted.

Relating this distinction to real life outcomes, Svensson demonstrated that students adopting a deep approach studied for longer hours. This suggested that approaching study with a view to extracting meaning and developing understanding makes the learning material seem more interesting and easier to understand to the student, and makes study itself a more rewarding and fulfilling activity. Conversely, students adopting a surface approach by utilizing rote memorization, will spend more time covering less material, and will generally find studying unrewarding, irrelevant and arid - leading to a spiralling decline in effort over time.

Svennson's assessment of the relationship between approach to study and examination performance would appear to support this theory (Svensson 1977). A far greater proportion of the students classed as adopting a deep/holistic cognitive approach were successful in their first year examination performance than those adopting a surface/atomistic approach. However, these findings may not be typical of all academic environments, especially those where assessment procedures fail to reward demonstration of real understanding.

Ramsden (1979) claimed that individual study approaches would become deeper as students progessed through their course and the tendency to adopt surface approaches would die out after the first year of university as a student's maturity and experience develop. Gibbs (1992) rejected this suggestion, claiming that evidence of the prevalence of surface approach in tertiary education is widespread, and that surface approaches are adopted *more* as students progress through their courses. Gibbs also outlined the deleterious nature of the surface approach to learning on the quality of learning outcome. This, he noted, is even apparent in students who have successfully completed courses at different subjects and levels, who lack understanding of central concepts and theories. Conventional examinations it appears, often fail to expose this shortfall.

Marton and Säljö (1976b) considered the nature of formal student assessment, and how it influenced the approach to study adopted. In doing so they asked the critical question of whether approaches to study could be manipulated by varying assessment methods.

Two groups of students, all previously assessed for approach to learning habits, read the same three passages of text, with questions set after each passage. After the first and second passage readings, one group were posed questions designed to elicit a deep approach - i.e., ones which related to the meaning of the text. The other group was given surface approach rewarding questions - i.e., ones dealing with specific, discrete facts. After the third passage reading, all the students were asked firstly, to complete a mixed set containing both types of question, and secondly, to summarize the article briefly. The results suggested that the characteristics of the task demanded of the student had a notable impact on his or her level of processing. Students initially identified as preferring to adopt a deep approach, but placed in the 'surface-question group', tended to have adopted a surface approach by the third set. The assessment method had clearly influenced their approach. However, students in the 'deep-question group' initially identified as adopting a surface approach showed difficulty moving fully to a deep approach in order to fulfil the requirements of the questions. They managed to summarize the author's argument, but were unable to actively question this argument in any detail. Marton and Säljö termed this 'technified learning', and concluded that while it is relatively easy to induce a surface approach, attempts at engendering a deep approach may meet with limited success. However, the study did demonstrate that an individual's conception of learning is both open to modification and dependent on context. They claimed that in educational contexts learning may be 'reduced to a search for the type of knowledge expected on the test', (Marton and Säljö, 1976b, p124), even if the standard of learning appropriate for that test is poor when judged by any other criteria.

Dahlgren and Marton (1978) reviewed first year economics students' understanding of basic academic concepts and reported that only a minority of students had the level of understanding deemed necessary by teachers and text-book authors. Problems were frequently approached using memorizing techniques and procedures *without* development of adequate understanding of the reasoning behind their solutions. This was attributed to an 'overwhelming curriculum' and it was claimed that many students can only cope by directing most of their attention towards passing examinations - even those students who had set out with hopes of understanding the material fully. Such students end up conceiving knowledge as 'a quantity', a conception reinforced by a bias towards facts and fact recall in syllabuses and examinations.

An important aspect of the Gothenburg research was its assertion that the *content* and *context* of the learning environment are strong determinants of a student's approach to learning and that it is the *approach* taken to an academic task which may be described as surface or deep, or atomistic or holistic, *not* the student. Fransson (1977) experimentally manipulated students' feelings of interest and anxiety towards a learning task - by selecting learning materials that either were or were not relevant to their discipline, and by running the tests in either a stressful or a relaxed environment. He found that surface processing and reproductive attempts at recall were more likely when the students felt threatened, either as a result of anxiety-producing test demands, the irrelevance of the subject to the student or an interaction between the two. Thus qualitatively different levels of processing and outcome can be influenced by an educational environment's perceived relevance *and* perceived threat to the learner.

The use of the phenomenographic model and its concepts have become fairly widespread since their inception and current research within educational environments is steadily adopting, applying and evolving the principles of the theory, taking advantage of the qualitative richness of the model's central premise that it is the perspective of the learner that is paramount.

1.22 Learning styles

Other bodies of research have sought to show that in addition to context-dependent approaches to learning, there exist dispositional learning *styles*, which consistently influence the student's learning characteristics. These styles may be thought of as stable personality or cognitive traits which shape the student's underlying approach to gathering and assimilating information, and which are evident throughout a variety of learning contexts.[1]

Pask's (1976a) research into knowledge structures and styles of learning resulted in the formation of 'Conversation Theory', a complex yet comprehensive theoretical concept concerned with the processes of student learning. The theory considers learning in terms of dialogue and behaviour, and asserts that true learning is only accomplished through 'conversation' involving communication between two participants, the learner and the teacher. The roles of learner and teacher need not necessarily be assumed by two individuals. The brain of the person learning 'can operate in two distinct modes which can be viewed as 'teacher' - directing attention to what needs to be done - and 'learner' - assimilating the subject matter' (Pask, 1976a, p13). According to the theory, the student can only reach full understanding by testing theories or hypotheses against an alternative cognitive structure, either that of another individual or one represented by their own 'alter-ego'. 'Understanding', by Pask's stringent definition, only occurs when the student is able to reconstruct and apply their knowledge in an unfamiliar and non-verbal 'concrete' context. Using this definition Pask was able to 'exteriorize' and thus measure the individual's level of understanding. Styles of learning were examined using tasks in which the student was *forced* to reach a deep level of understanding. This examination involved analysis of the use of logical steps, processes and analogy by students when teaching knowledge structures back to the experimenter - as an indicator of what they would 'teach back' to themselves when learning. Pask was able to identify different strategies used by students to reach understanding of a topic and different types of hypotheses selected by their alternative cognitive structures in order to reach this understanding.

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[1] The terms 'learning style' and 'cognitive style' are synonymous and frequently used to apply to the same concept.

Two principal types of learning style emerged when Pask's experimental cognitive tasks were undertaken; *viz*, 'serialist' and 'holist'. 'Serialists' tended to follow a step-by-step or linear progression from one narrow simple hypothesis to another, focusing on one characteristic of the problem at a time. 'Holists' [2] tended to formulate more complex hypotheses made up of several aspects of the problem at hand, sometimes making wider use of analogies which may or may not have been entirely accurate, but which acted as useful props in helping them reach understanding.

> 'Serialists learn, remember and recapitulate a body of information in terms of string-like cognitive structures where items are related by simple data links... Holists, learn, remember and recapitulate as a whole' (Pask and Scott, 1972, p218).

Pask claimed that while some students tend to be predominantly serialist or holist learners, others - termed 'versatile learners' - were able to use both strategies successfully.

In Pask's studies, the students were required to learn certain topics. Characteristically, holists started out with many learning goals and assimilated information from many topics, whereas serialists selected one learning goal and working topic, and focused on it exclusively until they were satisfied that it was understood.

Pask suggested that holists often hold certain beliefs about other topics related to the one being studied, whereas serialists generally hold little or no conception of other topics at that time. Consequently holists tend to develop a global picture of the subject area while serialists are restricted to the topic under scrutiny. By analyzing the students' styles of teaching their newly-learnt knowledge *back* to the experimenter, Pask demonstrated that holists tended to describe broad relations and develop hypotheses from generalizations. Some holists - termed 'redundant holists' - invented descriptions of concepts which bordered on the irrelevant and in some cases incoherent. Serialists focused on narrower relations and much more specific hypotheses.

Pask (1976b) looked at teaching strategies and observed that it was possible to distinguish between holist and serialist modes of instruction. In these experiments, the holist learning materials contained much 'enrichment material' which encouraged use of analogical relationships, while the serialist materials were designed to follow a linear progression of

[2] Pask's conception of 'holist' is distinct from Svensson's, in that Pask is referring to consistent general tendencies rather than situation specific strategies.

information. Students will consistently prefer one particular type of learning strategy when given a choice, but in real life tend to receive information in predominantly one way - the latter serialist way. If the teaching strategy is matched with the appropriate learning strategy the subject material will be learnt more quickly and the information will be retained for much longer. Where the teaching strategy and learning style are mismatched, there is a greater likelihood of poor learning performance and lack of comprehension of the concepts and principles underpinning the subject matter. These effects emerged very strongly in Pask's controlled learning systems - mismatched students learned little or no relevant knowledge, while matched students generally exhibited enhanced performance.

Pask also noted that students' preferences for any particular learning strategy were not always related to their competence in using them. He claimed that some students feel that a particular strategy is required of them, even if it is not one they are disposed to use effectively. Typically, students adopt a serialist strategy because of a strong tendency for material to be serially structured and presented in higher education, and because most examinations reward serial recall of information.(Pask, 1977b). Such students, he felt, would be unable to develop a true understanding of any subject unless they were encouraged to adopt a holist strategy. The reverse situation, where students who would make more effective serialist learners yet feel impelled to take a more global approach was also observed, albeit less frequently.

Pask's observations were made after assessing students placed under very strict learning environments where they were *forced* to acquire a certain standard of understanding, and holist or serialist strategies themselves may have been adopted to a greater degree only as a reaction to the specific tasks at hand than would normally be the case in typical, less stringent learning environments. As Entwistle (1978) noted, 'normal teaching and learning situations in schools or higher education rarely, if ever, match up to the requirements of conversation theory in ensuring that a deep level of understanding is *necessarily* reached'. A general learning 'style' can, however, be identified which would emerge as a result of the student's disposition to consistently adopt either learning strategy. 'Comprehension' learners, according to Entwistle, would be disposed to adopt holist strategies, while 'operation' learners would be disposed to adopt serialist strategies. The extent of their success in using these strategies in the real world of higher education is variable. Thus the labels 'comprehension learner' and 'operation learner' more accurately describe the real world student. While holist and serialist strategies are distinct and dichotomized in nature, comprehension and operation learning styles are not mutually exclusive.

Comprehension learners will typically build up an overall picture of the subject matter through focusing on relationships between topics. Only once an overall picture of the subject is constructed will the comprehension learner begin to involve details. They prefer to use analogies, anecdotes and illustrations in building the framework for their understanding and will often start at a point which involves human or personal interest. They are able to move freely between real world and abstract topics.

Operation learners, on the other hand, accumulate and assimilate rules, methods and details, and will build concepts for each isolated topic as it is encountered. They will focus *either* on real world or abstract topics, linking the two only if this is essential for understanding of the topic. An overall picture is developed much later in the learning process.

Pask suggested that while comprehension learners are cognitively equipped with effective '*description* building operations', operation learners are equipped with effective '*procedure* building operations'. Because *both* description building and procedure building are needed to ensure understanding of any topic, the individual student's ability to apply these operations will also depend on their grasp of complementary procedural or descriptive information. One without the other will result in identifiable 'learning pathologies'- negative characteristics brought about through unbalanced use of either holist or serialist strategies. Because the holist concentrates on broad perspectives and topic relationships early in the learning task, there is a real risk that the logical sequences and details relevant to the subject area may be overlooked and that inappropriate or 'vacuous' analogies may be made because detail evidence is lacking. Pask termed this tendency 'globetrotting' (Pask, 1976a). Conversely, serialists may be over-concerned with details and logistics, not recognizing and exploiting relevant analogies, thereby failing to build a overview of the subject, leaving relationships between subject elements poorly understood. Pask referred to this pathology as 'improvidence'. According to Pask then, the most successful students are likely to be those consistently able to adapt their learning strategy to the task at hand and its specific requirements.

Pask's learning styles and pathologies have developed in tandem with the phenomenographic approaches since being introduced, but have tended to be explored in rather different ways.

Other theories of learning/cognitive styles incorporate similar conceptions - some introduced later in this chapter - and the domain of application has tended towards occupational environments as well as educational ones - unlike the phenomenographic work which is relatively bound to education. Much educational research seems to focus on just one of the two areas, with relatively little research investigating the relationship between them.

1.23 Learning orientations

Between 1968 and 1981 two five-year research programmes were carried out by Noel Entwistle and colleagues. The first of these dealt with investigating a range of student factors and their relationship with academic success and failure at university (Entwistle and Wilson 1977) - see chapter six. The second programme centred around the development of an inventory designed to investigate students' approaches to learning, the 'Lancaster Approaches to Studying Inventory' - or ASI. Their intention was to measure the concepts identified and explored by the Gothenburg and Pask bodies of research, and assess the ways in which these concepts shaped the experience of students' learning in a natural setting.

From Marton *et al's* research the categories of deep and surface approach were drawn and their definitions extended. While Marton's categories were limited to students reading of academic articles, Entwistle and Ramsden's (1979) definitions of surface and deep approaches were applicable to a much wider range of academic tasks within typical educational environments.

The deep approach concept required modification, as Entwistle *et al* (1983) found that *intention* to adopt a deep approach did not always result in subsequent effective use of such an approach. Also, the academic demands made of students in different disciplines led to different interpretations of what a deep approach necessarily implied. Science students for example, required comprehensive prior knowledge of the topic in question before a deep approach could be taken.

Laurillard (1978) concluded that student's approaches to learning were context dependent and that students could not be labelled as 'surface' or 'deep' in anything other than particular learning environments. The Gothenburg researchers too, consistently emphasized that approaches to studying are modes of learning behaviour adopted within specific contexts. However, the Lancaster work sought to operationalize these approaches and, in interviews with students, they found that most demonstrated sufficient consistency in their approach across different academic contexts to justify attributing these definitions of general strategies and characteristic processes to individuals. This stability in learning approach was felt by Entwistle *et al* (1979) to validate the development of an inventory designed to measure these characteristics.

Pask's work on learning strategies (Pask 1976a, 1976b) was central to much of the development of the ASI, and the inventory includes items based on his 'holist' and 'serialist' categories. Again the definitions were broadened to take into account the ASI's use in more natural settings. 'Comprehension learning' was defined as 'personalizing understanding by relating ideas to other topic areas and everyday experience', while 'operation learning' was defined as 'reliance more on previous knowledge and tendency to concentrate on the most relevant facts and details' (Entwistle *et al,* 1979). Also included were items designed to measure Pask's pathologies of learning 'improvidence' and 'globetrotting'.

Ramsden (1979) added a third category, 'strategic approach', to supplement Marton's deep and surface approaches. This was partly derived from the work of Becker *et al* (1968) and Miller and Parlett (1974) who noted that student perceptions of the assessment demands of their courses were distinctly disparate. Becker (1968) and his researchers attended classes as participant observers taking extensive field notes and discussing comments made by students. Their conclusions illustrate that students' academic lives appear to be dominated by assessment demands, and that students are often restricted in their learning by pressures of assessment, in consequence becoming demotivated and resentful. Similarly, Miller and Parlett (1974) used semi-structured interviews to focus on student experiences of assessment procedures. They were able to identify students who recognized and/or sought to find out about certain 'cues' which they believed would help them make a good impression on the staff. While some students believed the assessment system to be objective and beyond such influence, others single-mindedly pursued these cues, perceiving them to hold the very meaning of knowledge itself. Some students believed that only through solid application of their own knowledge and effort could they achieve academic success, and that teachers and lecturers were wholly objective in their evaluation of students' work. Others looked upon the assessment system as be a 'game' to be played, believing that they could attain higher marks by exploiting cues about marking systems, by studying only those topics likely to field examination questions, and by tailoring their work to suit the perceived preferences of the lecturer.

Through their initial exploratory interviews with students, Entwistle and Ramsden (1983) had ascertained that a major determinant of approach to learning was the student's motivation for study, and by relating approaches to study with motivation they were able to develop four 'learning orientations'. They found that intrinsic motivation - study undertaken to actualise interest and develop competence in a particular field - was associated with a deep approach, thereby characterising a 'meaning orientation'. Extrinsic motivation could be broken down into identifiable elements. Students' fear of failure was associated with adoption of a surface approach - yielding the 'reproducing orientation' - while their hoping for success and studying with the principle aim of acquiring a vocational qualification was associated with use of a strategic approach - yielding an 'achieving orientation'. Finally, social motivation appeared to correlate positively with disorganized study methods and negative attitudes towards learning and studying, giving rise to a 'non-academic' orientation. These four orientations emerged through factor analysis of an early form of the inventory, itself derived from interview data. Each orientation is measured within the first three sections of the ASI. (The 'reproducing' and 'non-academic' orientations were subsumed under a general 'reproducing' orientation heading). The final section measures Pask's styles and pathologies of learning. (Figure 1.01). These orientations, styles and pathologies formed the basis for much of the subsequent Lancaster research.

Figure 1.01 Lancaster Approaches to Studying Inventory Subscales

Meaning Orientation
- Deep Approach
- Relating Ideas
- Use of Evidence
- Intrinsic Motivation

Achieving Orientation
- Strategic Approach
- Disorganized Study Methods
- Negative Attitudes to Study
- Achievement Motivation

Reproducing Orientation
- Surface Approach
- Syllabus Boundness
- Fear of Failure
- Extrinsic Motivation

Styles and Pathologies of Learning
- Comprehension Learning
- Operation Learning
- Globetrotting
- Improvidence

1.24 Systems model of learning

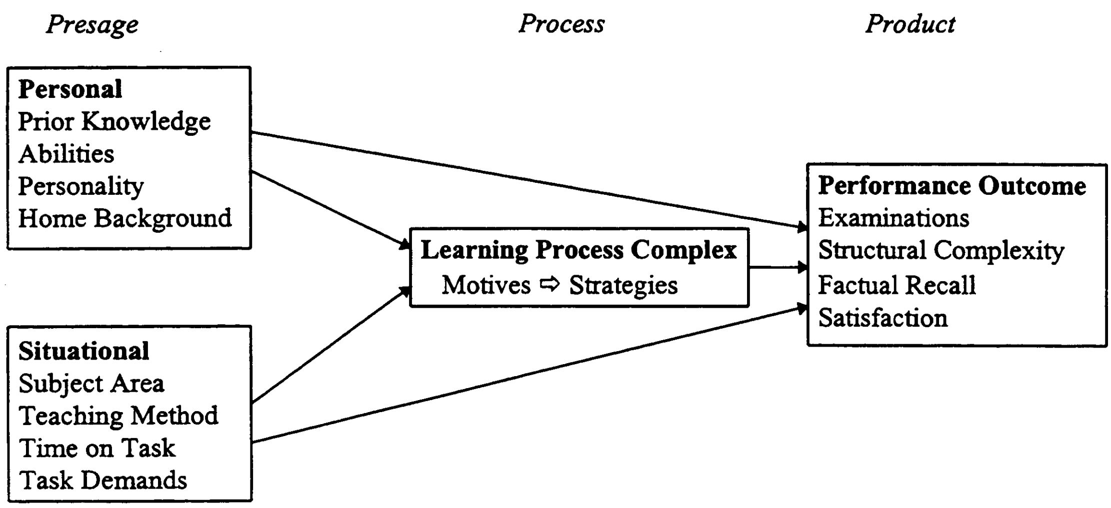
A model of student learning similar to that developed by the Lancaster team was presented by Biggs (1978, 1979). This model also considered motivation to be important in shaping approach to learning and was based on the theory that by the time students reach university they have developed stable motives and strategies for their learning. Three dimensions of the study process were identified, each of which had a corresponding motivational and strategic - or cognitive - element. These three processes correspond closely with the ASI orientations reproducing, meaning and achieving.

The first dimension 'utilizing' was applied to those whose motives for study are either extrinsic or based on avoidance of failure, - *c.f.* reproducing orientation. Strategies used by such a student would be geared towards avoiding academic failure through carrying out only the minimal amount of work possible. The student often becomes syllabus-bound and concentrates on rote-learning information for reproduction in examinations. The second dimension 'internalizing' applied to students with intrinsic motivation, who see university as a means of achieving self-actualization and who exhibit genuine interest in the subject matter, - *c.f.* meaning orientation. Strategically these students are not bound by their syllabus, read widely and attempt to extract meaning through interrelating material and assimilating information into an overall framework. The third of Bigg's dimensions, 'achieving', described those whose motives for study are based on need for achievement and competition. - *c.f.* achieving orientation. The strategic element sees the student as being highly organized and alert to assessment cues. Academically they 'play the game'. Within Bigg's model the student's motives may be mixed and more than one set of strategies may be adopted. The model stresses the *generic* nature of approaches to learning, that is, they are largely dependent on context, the nature of the task, and how the individual encodes both. While a strategy such as rote learning may be more readily associated with surface approach, it *may* be used in situations where accurate recall of well-understood information is required - for example, in interviews or examinations. In this case rote learning does not indicate a surface approach, but one which may be described as 'deep memorizing'.

The three congruent motive-strategy approaches make up the 'process' element of a broader three-stage model of student learning (Biggs, 1978, 1985). These study processes are dictated by what Biggs calls 'presage' factors - such as ability, cognitive style, personality, home background, previous experience and institutional/situational factors such as subject area, teaching methods, course structures, evaluation procedures and time spent on task. The personological and situational factors interact with students' perceptions of the teaching environment to shape their motives for learning, while teachers' perceptions of those same student motives help shape various aspects of their teaching. These perceptions represent a form of metacognition - that Biggs (1985) terms 'metalearning' - in which students' control over their own cognitive resources determines how aware they are of task demands and to what extent they choose to meet these demands. Metalearning governs the students' cognitive *engaging* with the learning material.

As *process* is determined by *presage*, so the *product* - academic performance, understanding of subject, satisfaction through learning - is determined by *process*. Thus, study processes mediate between personality and environmental factors and academic performance. Biggs (1994) referred to this model - and the Lancaster model - as *systems models*. They seek to

Figure 1.02. General Model of Student Learning (Biggs, 1985)



assess personal traits, contextual factors, level of processing and quality of outcome within an open-ended and recursive system, (Figure 1.02).

From the motive-strategy congruence model Biggs developed the Study Process Questionnaire (SPQ) (Biggs, 1978), which operationalized the three motive-strategy approaches. The scale scores on the SPQ - like those on the Lancaster ASI - are designed to reflect individual student's stable preferences within a specific learning context. The SPQ is currently used as widely as the ASI, mainly within higher education environments.

1.25 Information processing models

While the work of Marton *et al*, Entwistle *et al* and Biggs concentrated on deriving salient descriptive concepts and categories from qualitative evaluation of students' assessments of their own study processes, the work of Schmeck, Ribich and Ramanaiah (1977) sought to develop inventories of student learning derived from a pre-existing theoretical rationale. Schmeck (1983) worked from an Information Processing (I.P.) perspective and defined learning style as 'a predisposition to display a particular pattern of information-processing activities when preparing for a test of memory.' Thus, learning styles are seen as simply cognitive styles in a learning context. Schmeck *et al* (1977) developed the Inventory of Learning Processes (ILP) which was derived from lists of cognitive processes yielded by research or forwarded by prominent theories of human learning and memory. Three experts in these areas composed behavioural descriptions of these learning and memory processes and phrased them from the perspective of a typical student, taking account of student activities and the college environment. Through factor analysis of these items, four main scales were derived which assessed dimensions of learning behaviour and characteristic conceptual processes of students.

The rationale behind the first scale 'deep processing' comes from Craik and Lockhart's (1972) concept of Levels of Processing (LOP) which maintains that information processing activities lead to memory traces, and that depth of processing is variable, with deeper processing resulting in more lasting memory traces. The scale was made up of items which measured the extent to which individual students were able to critically evaluate, conceptually organize, and compare and contrast information. Deep processing in this sense is comparable, yet not identical to, the 'deep approach' concept of Marton and Säljö (1976a). While Marton's analysis described a *general* 'level-of-processing' which incorporated interest, approach and relating of evidence to personal experience, Schmeck's use of the term carries the definition;

> 'an information process involving the cognitive tasks of verbal classification and categorical comparison'. (Schmeck, Ribich and Ramanaiah, 1977)

Schmeck sees personalization of knowledge as a *separate* learning strategy from conceptual understanding. This elicits the second scale, 'elaborative processing' which is again based on the I.P. work of Craik. This scale looks at the student's capacity to use their own terminology in assessing new information, use their own experience to produce concrete examples, apply learned information and employ visual imagery when encoding ideas and concepts. Craik and Tulving (1975) claimed that 'spread of processing' was important in forming enduring and complex memory traces. It refers to the *amount* of processing that takes place at any given depth. While elaborative processing constitutes a more practical, personal exercise, deep processing is more academic and critical in nature.

The third scale 'fact retention' assesses the extent to which students concentrate on processing details and specific items of information. This strategy works independently of any of the other information-processing scales. The final scale 'methodical study' evaluates the student's organization, planning and adoption of systematic study techniques.

These four concepts, though derived from a 'top-down' - as opposed to a 'bottom-up'- mode of research, are similar to many of the learning styles and strategies forwarded by the phenomenographic researchers. If the deep and elaborative processing scales are considered together, then there is some conceptual overlap with Entwistle's 'meaning orientation', Bigg's 'internalizing' domain and Pask's 'versatile' learning style. Similarly, 'methodical study' seems to draw on the same characteristics as Entwistle's 'achieving orientation' and Bigg's 'achieving' domain, and high scores on the 'fact retention' scale might be validly compared with Pask's 'operation learning'.

Schmeck's work has been heavily criticized for its apparent neglect of situational and contextual factors in determining adopted learning strategy - see Christensen, Massey and Isaacs (1991) and Biggs (1993), for example. Schmeck suggested that there exists a *predisposition* to follow any one learning strategy, whereas the phenomenographic/systems model researchers emphasized the contextual nature of patterns of strategy adoption. He noted that in tasks where subjects were presented with information - but *not* instructed to learn it - those individuals with high scores on the deep and elaborative strategies for processing scales could store and retrieve the information more readily than low scorers. According to Schmeck this demonstrates that 'intent to learn' seems to be of secondary importance to type of information processing strategy preferred in establishing long-term storage of knowledge and increased retrievability of that knowledge.

Weinstein and Mayer (1986) also derived their conception of student's learning approaches from cognitive theory. They identified three main resources available to the active learner; rehearsal, elaboration and organization. These three behaviours can be related to four main components of the cognitive encoding process which they set out as follows;

> **Selection** - The learner actively pays attention to some of the information that is impinging on the sense receptors, and transfers this information into working memory (or 'active consciousness').
>
> **Acquisition** - The learner actively transfers the information from working memory into long-term memory for permanent storage.

Construction - The learner actively builds connection between ideas in the information that have reached working memory. This building of internal connection involves the development of a coherent outline organization or schema that holds the information together.

Integration - The learner actively searches for prior knowledge in long-term memory and transfers this knowledge to working memory. The learner may then build external connections between the incoming information and prior knowledge.

(Weinstein and Mayer, 1986, p317)

'Rehearsal' strategies - defined as repetition of information that has not undergone any cognitive transformation - tend to involve mainly selection and acquisition processing. 'Organizational' strategies - defined as attempts to learn information by categorizing, clustering or re-organizing the new knowledge - involve construction processing, while 'elaboration' strategies - defined as attempts to learn information through comprehensive transformation of new knowledge - involve integration processing.

In addition to these three categories of cognitive strategy Weinstein and Mayer added 'comprehension monitoring' strategies which represent metacognition of the student's own learning, and 'affective/motivational' strategies. These represent the strategies learners use to focus attention, maintain concentration, manage performance anxiety, establish and maintain motivation and manage time effectively. They distinguished between basic and complex learning tasks, and claimed that individuals will adopt specific learning behaviours according to the type and complexity of the task performed. (Basic tasks might include paired-associate learning or serial list learning, while complex tasks usually involve extraction of meaning from text or other materials.) Applied to the three cognitive strategies, Weinstein and Mayer developed eight categories of learning strategy;

1. Basic Rehearsal Strategies. (e.g. repeating names of items on a list).
2. Complex Rehearsal Strategies. (e.g. copying, underlining or shadowing course material).
3. Basic Elaboration Strategies. (e.g. forming mental images of keywords in a text).
4. Complex Elaboration Strategies. (e.g. paraphrasing, summarizing, relating new knowledge to existing knowledge)
5. Basic Organization Strategies. (e.g. Grouping or ordering items from a list).
6. Complex Organization Strategies (e.g. Outlining a passage or forming a hierarchy).
7. Comprehension Monitoring Strategies (e.g. checking for comprehension failures.)
8. Affective Strategies (e.g. careful selection of study environment, attempts to restrict negative thoughts/anxiety).

(Weinstein and Mayer, 1986, p316)

These strategies, they hypothesized, could be described and even taught to student learners in order to enhance academic performance.

Christiensen, Massey and Isaacs (1991) assessed students' performance on both basic and complex tasks using Weinstein and Mayer's cognitive strategies framework and compared them with scores on the 'utilizing', 'internalizing' and 'achieving' scales of Biggs' SPQ suggesting that the high utilizing strategy scores would predict rehearsal, that high internalizing strategy scores would predict elaboration and that high achieving strategy scores would predict organization. In fact, they found no significant differences on either the basic or complex tasks between the utilizing or internalizing scores of students using any of the three cognitive strategies. Christiensen *et al* also sorted the items making up the SPQ into categories of 'cognitive strategy' or 'study habit', depending on whether each related to active cognitive processing or organization of time, space or learning resources. By factor analysing these items they were able to demonstrate that this reclassification of the SPQ based on cognitive strategies was more consistent with the factor loadings extracted than Biggs' original utilizing, internalizing and achieving constructs. This suggested that Weinstein and Mayer's theoretical basis constituted a more sound method of examining learning strategies.

Biggs (1993) conceded that the theoretical foundations of many of the inventories developed to measure learning processes needed clarification. He attempted to distinguish between 'processes' - which are adopted during learning and which directly affect learning outcome - and 'predisposition' - which reflects the *usual* ways of learning. Both have been termed 'approaches to learning' and while cognitive psychologists will use the former definition, researchers using the 'Student Approaches to Learning' (SAL) framework will use the latter. Biggs suggested that Christiensen *et al* misinterpret some of the terms used by the SPQ and in particular the term 'strategy'. He would define 'strategy' as 'a complex fusion of intention and purpose' (Biggs 1993), rather than Christiensen *et al's* (1991) use of the term as meaning a tactic or procedure for handling a set task. An example Biggs cited is 'surface approach', which in the SAL framework stems from 'a guiding principle or intention that is *extrinsic to the real purpose of the task*' (Biggs 1993). Rehearsal strategies therefore do *not* necessarily imply surface processing. He also criticised information processing and 'top-down' theory's insistence on keeping the cognitive and affective elements of learning distinct, claiming that educational institutions are complex and rich environments, *not* clinical laboratory settings, and that the influence of contextual, attitudinal and motivational aspects cannot be underestimated, thus stressing that learning takes place 'within the teaching/learning context' rather than 'within the student', and that the SAL framework best accounts for the variable motives, contexts, strategies and quality of learning outcome. Biggs claimed that since information processing approaches are rarely drawn from educational contexts they can be of only limited value.

Dyne, Taylor and Boulton-Lewis (1994) acknowledged that many applications of Levels of Processing theory fail to judge the quality of information processing within the context of its encoding and retrieval. However, they looked at two more recent IP theories - 'Transfer Appropriate Processing' (TAP) and the 'item and relational distinction' theory - which incorporate and involve elements of the learning task and context. TAP theory proposes that different types of information about any specific stimulus or learning material will be encoded when different types of processing take place. Dyne *et al* suggested that semantic orienting tasks will, in general, result in the *meaning* of the stimulus being encoded, while rhyme-orienting tasks will tend to result in the phonetic elements of the stimulus being encoded. TAP theory also holds that the relationship between cognitive functions carried out when a student studies, and when he or she is being tested is highly important. It stresses that learners are able to form memory codes that *are* relevant to the retrieval context. This ties in with the SAL tenet that certain learning strategies tend to be followed when certain learning goals are set.

Dyne *et al* also assessed the value of the IP concepts of 'item' and 'relational' information. 'Item' information is defined as information relating to study materials which is encoded and retrieved *outwith* the learning context. Similarities between this concept and Biggs' SPQ's utilizing-scale, which seeks to measure rote learning of discrete pieces of information, become readily apparent. 'Relational' information is defined as the characteristics or elements which are shared by events or items of learning material, which form their own memory code quite distinct from the individual memory encoding of each event or item. This relates to the internalizing scale of Biggs' SPQ which measures intention to integrate learned material. If deep approach to learning involves increased encoding of relational information then the availability of this information when a student is tested should result in increased quality of learning outcome. As with Pask's description of 'versatile learners', Dyne *et al* specified that in order for a student to succeed, he or she must be able to use a combination of approaches to learning and thus be able to encode and retrieve *both* item and relational information. In this sense learning occurs as much 'within the student' as 'within the teaching/learning context'. They suggested that by making the distinction between item and relational information available to students they will maximize their ability to adopt 'strategic information processing', i.e., focus on the most valuable aspects of the learning material.

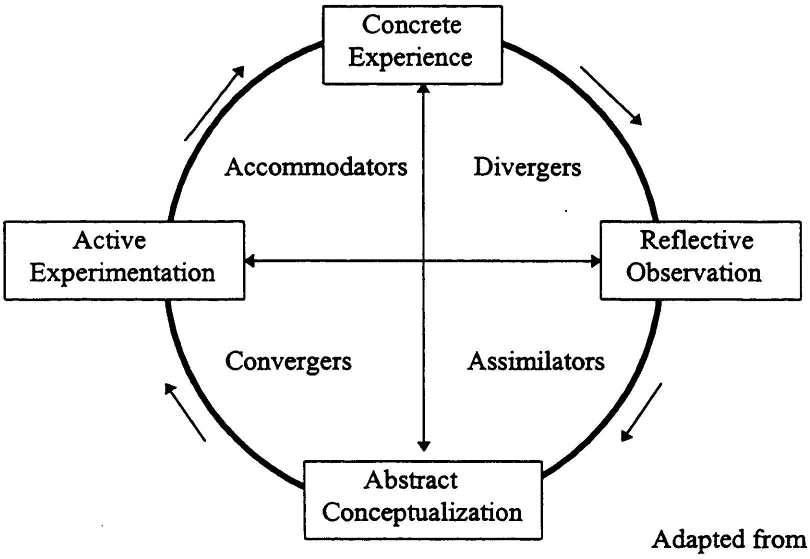
The question of whether learning strategy is adopted 'within the student' or 'between the student and their context' is fundamental to applied educational research since the former would assume that cognitive training techniques might be successfully applied in order to improve the quality of student learning, while the latter would assume that the augmentation of aspects of instruction, environment, motivation etc., would be more effective in reaching the same ends.

Supporters of information processing theories within the current fields of student learning research and educational policy are relatively few, with the SAL/phenomenographic conceptual framework forming the basis of most lines of theoretical and applied enquiry.

1.26 Experiential learning models

Another - quite popular - model of learning was developed by Kolb (1976, 1983), which incorporated two orthogonal, bipolar dimensions of cognitive growth; an active/reflective dimension and an abstract/concrete dimension. Kolb developed his Learning Styles Inventory (1976) to categorize respondents in terms of their preferred learning style. The active/reflective domain represents a sliding-scale running from preference for direct participation and experimentation, to preference for detached, reflective observation. The abstract/concrete dimension represents the range from preference for dealing with tangible objects and concrete experiences, to preference for dealing with theoretical concepts and abstract conceptualizations. His model involves a four stage experiential cycle of learning, starting with the acquisition of concrete experiences, reflective observation of these experiences, theory building and finally, active experimentation. The cycle begins again because the experimentation yields new concrete experiences. Each of these stages requires different skills and abilities. Learners tend to be more skilled in some areas than others, and therefore tend to favour a particular learning style. Four prevailing learning styles were defined by Kolb stemming from the combination of the two cognitive dimensions. (Figure 1.03)

Figure 1.03 Experiential Learning Model, Kolb (1976)



Adapted from Kolb (1983)

'Divergers' are characterized by a preference for concrete experience and reflective observation, and like to reflect on specific experiences from a number of different perspectives. 'Assimilators', who tend towards reflective observation and abstract conceptualization, are good at developing theoretical frameworks on the basis of reflection. 'Convergers', who show liking for abstract conceptualization and active experimentation, test theories in practical ways, and 'accomodators', characterized by preference for concrete experience and active experiementation, like to use their findings as a platform for new learning.

Kolb (1984) claimed that the findings of the Learning Style Inventory showed clear links between academic discipline and subsequent career choices, thereby demonstrating the instrument's utility. He claimed that it may also be a valid tool for assessing students prior to their entrance to university in order to help them select suitable courses, etc. However, Green, Snell and Parimaneth (1990) report that although the LSI is quite accurate in predicting certain academic and vocational variables, its role in helping optimize academic choices in rather limited. Hudak (1985) has reported low reliablity and questionable validity in trials of the LSI.

A similar model to Kolb's experiential learning cycle was forwarded by Honey and Mumford (1982) who also proposed the existence of four distinct learning styles - which parallel Kolb's conceptions quite closely - each of which exhibits certain positive and negative attributes. 'Activists', they claimed, are flexible and open-minded learners, but tend to get bored easily. 'Reflectors' are careful, thorough and methodical learners, but can be over cautious and insular. 'Theorists' are strong on logic, objectivity and rationality, yet are poor at lateral thinking and cannot tolerate ambiguity and subjectivity. 'Pragmatists' are practical, realistic and task-oriented, but tend to avoid theory or abstraction.

The Learning Style Questionnaire (Honey and Mumford, 1982) - like Kolb's LSI - was designed to categorize individuals, but unlike the LSI uses statements of observable behaviour to which respondents are required to express agreement or disagreement. Allinson and Hayes (1990) reported it to be more reliable than the LSI, but suggested that it measures specific abilities rather than learning styles.

Both the Learning Styles Questionnaire and the Learning Styles Inventory, while designed primarily for a managerial population, have begun to find favour in some educational environments, especially as tools for evaluating career choices. However, neither seems to be quite as relevant or as useful in establishing the 'mechanics' of learning in higher education as the instruments developed from phenomenographic models - e.g. Entwistle and Ramsden's Approaches to Studying Inventory or Biggs' Study Processes Questionnaire. Newstead (1992) conducted a factor analytic study comparing the ASI to Kolb's LSI, aiming to test the reliability and validity of each. The results validated the predicted theoretical structure of the ASI, but failed to do so for the LSI, though Newstead does note some conceptual overlap between the 'meaning orientation' dimension of the ASI and the 'activity' dimension of the LSI. The Kolb model is interesting though, because like the information processing learning models it works on the assumption that personality is central in dictating modes of learning - and despite overlooking contextual, situation specific factors, the model is currently used in diverse contexts and situations quite successfully.

1.27 Cognitive style and learning

Many theorists - including Schmeck and Kolb - have questioned whether the distinctive approaches to learning proposed by the phenomenographic research can be linked to more intrinsic psychological processes and styles of thinking. Messick (1976) claimed that cognitive styles represent relatively stable modes of operation, consistent across various contexts of behaviour, and that these modes stem from underlying personality structure. Cognitive styles, he suggested, interact with affective, temperamental and motivational structures in forming the complete personality. These styles may be thought of as dealing with *how* information is processed as opposed to *what* information is processed. As noted previously, the term 'cognitive style' is considered by some to mean the same as learning style (Entwistle, 1981), and is generally used to describe an individual's typical or habitual mode of problem solving, thinking, perceiving and remembering (Riding and Cheema, 1991).

Entwistle and Ramsden (1983) assessed the relationship between Pask's (1976a) concepts of holistic and serialist learning styles, and Hudson's (1966) distinction between divergent and convergent thinking. Divergent thinking might be thought of as a productive or imaginative cognitive style, while convergent thinking relies on more logical and analytical modes of cognition. Hudson was able to designate two sixth-form students as either 'convergent' or 'divergent' thinkers on the basis of the 'Uses of Objects Test'. Divergent thinkers were able to elicit many and more novel uses for everyday objects such as a barrel or a brick, while convergent thinkers could only suggest the most obvious uses. These differences, Hudson claimed, were not due to the relative intellectual abilities of the two students, but rather to alternative cognitive styles. One student was an arts specialist - the 'diverger' - while the other was a mathematician - the 'converger'. Hudson noted that convergers tend toward science subjects, while divergers tend toward arts subjects.

The strategies inherent in each style of thinking can be readily related to Pask's serialist/holist conception. Divergent thinking starts with a broad focus and facilitates links between diverse ideas, even when connections are not readily apparent. This broad scope of operation - or lateral thinking - is likely to access both episodic elements of long term memory - those which store episodes of experience - *and* semantic elements - those which store and relate concepts - in much the same way proposed by Pask to describe holistic thought. Convergent thinking, which parallels serialist thinking, is likely to be much more narrow in focus, accessing only episodic parts of long term memory.

The educational implications of convergent/divergent thought research are many. Science subjects are often characterized by logical, structured teaching methods which encourage convergent thinking and discourage divergent thinking. Arts subjects often require students to carry out research projects based on often loosely defined areas of study which would encourage divergent thinking. Riding and Cheema (1991) considered that the 'inherently rulebound and conservative nature' of educational institutions - especially schools - leads to general bias in favour of convergent thinking and discouragement of divergent thinking which may even be seen as irritating, disruptive or even threatening by certain teachers.

Entwistle and Ramsden (1983) also assessed the cognitive styles derived from the perceptual tasks of the Matching Familiar Figures Test (Kagan, 1965), and the Embedded Figures Test (Witkin, Moore, Goodenough and Cox, 1977). Kagan's test involved a selection task in which the individual is not only required to pick the correct answer, but to make the selection decision quickly. Kagan noted two cognitive styles emergent in the participants. 'Impulsive' subjects tended to focus on making decisions quickly - making more mistakes - while 'reflective' subjects were more cautious, resulting in more accuracy but longer completion times. The impulsivity-reflectivity domain has been related to learning tasks with 'reflectives' performing consistently better than 'impulsives' on tasks requiring detail processing. However, 'impulsives' perform *no* better than 'reflectives' on global-processing tasks.

Witkin *et al's* test dealt with the field dependence/independence of subjects faced with the task of identifying simple geometric figures embedded in complex ones. Those able to extract the figures quickly were labelled 'field-independent', while those who had more trouble with the task were termed 'field-dependent'. They claimed that this difference was not due to relative perceptual skills, but rather the existence of underlying cognitive styles. Field independent styles were called 'articulated', and were claimed to demonstrate a preference for analysing and structuring information as it is processed. Field-dependent styles were referred to as 'global', which it was claimed, demonstrate the acceptance of the entirety of the stimulus.

Witkin *et al* also noticed a tendency for field-dependent students to be more sociable and interested in people, with this interest expressing itself in their opting for humanities and social science subjects, while avoiding science and mathematics. Field-independent students were more prominent in science. Field-dependent students tended to prefer to learn in groups and interact frequently with one another and with the teacher, while field-independent students responded better to independent, individual approaches. Field-independent learners tended to define their own learning goals and respond to intrinsic reinforcement, while field-dependent learners prefered their work to be stimulated by the teacher and tended to require more extrinsic reinforcement, assistance in problem solving strategies and performance feedback (Witkin *et al*, 1977). Witkin also noted that the teaching methods of teachers were influenced by *their* own cognitive styles. Field-independent teachers used more logically structured material and formal teaching methods than field-dependent teachers. This suggested that the success or failure of students to learn may be influenced by the match/mismatch of their teacher's or lecturer's cognitive style.

Another cognitive/learning style distinction was proposed by Holzman and Klein (1954) in which individual's perceptions in a visual task - the Schematising Test - were categorized as being either 'levelling' or 'sharpening'. 'Levellers' over-simplified their perceptions while 'sharpeners' perceived the task in a complex, differentiated manner. Levellers tended to assimilate new events with stored ones, while sharpeners did not, instead preferring to treat the new event as separate and discrete. Educationally these effects could be thought to manifest themselves in either a tendency to neglect important differences in theories or examples, or a tendency to 'caricature' information, where new knowledge is poorly integrated with existing knowledge.

Curry (1983) devised a model in which sought to integrate concepts of dispositionally determined and contextually determined learning characteristics. Measures of cognitive/learning style were grouped into three main types which form nested 'strata' resembling the layers of an onion. At the innermost centre of this 'learning-style onion' lay 'cognitive personality style', which Curry defined as the learners' underlying approach to adapting and assimilating information. This was thought of as a relatively stable personality dimension, apparent over a variety of learning contexts, and could be measured using tools such as Witkin *et al's* (1977) Embedded Figures Test and Kagan's (1965) Matching Familiar Figures Test. The second layer was termed 'information processing style', which refers to the learner's intellectual approach to processing information. Again, this is not directly influenced by the learning environment, but it *is* modifiable by events over time. Schmeck's (1977) Inventory of Learning Processes and Kolb's (1976) Learning Style Inventory might both be thought to measure the information processing concepts applicable at this level. The third, outermost - and hence most visible - layer of the onion Curry terms 'instructional preference'. This refers to the learner's real-life involvement with their learning environment, and aspects of learning strategy and preference - as perhaps measured by inventories such as Bigg's SPQ and Entwistle and Ramsden's ASI - could therefore be considered to be the least stable and most readily influenced by environmental factors. Curry encapsulates her model by stating that;

> '...learning behaviour is fundamentally controlled by the central personality dimension, translated through middle strata information processing dimensions and, given a final twist by interaction with environmental factors encountered in the other strata.' (Curry, 1983, p185)

Riding and Cheema (1991) criticize much of the research in cognitive/learning styles because of its tendency to focus on only one aspect of style, disregarding all the others. They also highlight that cognitive/learning styles can be thought of in one of three ways - as a structure, as a process or as a combination of the two. If it is perceived as a stable structure then research will tend to concentrate on assessing individual differences. Some measure of the style being researched is thus conferred onto the individual in certain educational environments, and hypothetically optimal teaching variables can be tailored to match. Alternatively, if cognitive/learning style is viewed as a process, the focus tends to be on how it changes, thus raising practical issues about how best to foster change in the student. Style, in this case is viewed as dynamic rather than static. An amalgam of both viewpoints may also be proposed in which a relatively stable style structure exists but which may be modified by events over time. Here, both individual differences *and* capacity for change must be a considered.

Riding and Cheema assessed the relationships between field dependent/independent, impulsive/ reflective, levelling/sharpening, divergent/convergent and holist/serialist learners, and concluded that they are all likely to be correlates of the same single cognitive style - which they termed 'wholist - analytic'. This simply refers to whether a learner tends to process information as a whole or in parts. They propose that this distinction constitutes one of two basic dimensions of cognitive style - both of which could be placed in the innermost layer of Curry's onion model. The other dimension they called 'verbaliser-imager' which refers to whether a learner tends to represent incoming information verbally or using imagery. In educational contexts 'verbalisers' tend to learn better from text-based teaching materials and perform better on verbal tasks, while 'imagers' learn better from pictorial presentations, and perform better on concrete, descriptive, imaginal tasks. Again, a mismatch between learning style, and material or mode of presentation may result in performance deficits.

Riding and Cheema presented evidence that the 'verbaliser-imager' dimension may be linked to Eysenck's personality dimension of 'extraversion-introversion', implying that verbalisers are extraverts and imagers introverts. They suggest that when introverts process information large amounts of spontaneous imagery is generated which is unstable and difficult to manage, and which is therefore constantly replaced by fresh imagery as thought continues. Extraverts experience much less spontaneous imagery but are able to voluntarily control the image forming process. The situation is reversed for verbal associations, with introverts experiencing lesser fluency, but increased ability to control the flow of words.

This last relationship is interesting because it suggests - as Curry hypothesized - that learning behaviour is influenced quite fundamentally by dimensions of the learner's personality.

1.31 The trait concept of personality and effects on learning

Personality as a term is resistant to definition and is very broad in usage. Cattell defined it as,

> 'that which permits a prediction of what a person will do in a given situation. The goal of psychological research in personality is thus to establish laws about what different people will do in all kinds of social and general environmental situations. Personality is...concerned with *all* the behaviour of the individual, both overt and under the skin.' Cattell (1950, p4)

Allport (1963) claimed that personality may be best described and measured by identifying relatively consistent 'common traits'. Evidence of the existence of such traits may come from demonstration of an individuals *consistent* behaviour. To be useful, the trait must be stable both over time *and* between situations. The existence of such traits, and their influence on learning - either style *or* strategy - is a central issue here.

1.32 Personality measurement - Factor analytic approaches

Personality psychologists working in the factor analytic tradition believed that there could exist a clearly defined set of variables which would act as a basis for understanding human personality. Within this field there is much debate about the definition of these variables, however the principles by which the variables are created is shared. Typically, questionnaire items are developed with a view to measuring a wide range of personality traits. These are administered to a large group of people and scores on each 'scale' are correlated with each other so that the degree of association between the variables can be measured. Where a strong agreement between the scales is found, it is considered that the scales measure the same underlying personality variable. The statistical process of factor analysis involves constituting a set number of clusters or 'factors', with the items in any single factor being highly related to one another, but only slightly related or unrelated to items in other factors. Trait theory assumes that people have broad dispositions to behave in certain ways, and suggests that natural structures exist within personality which may be defined using factor analytic techniques. This works on the supposition that behaviours that function with one another are related.

Eysenck (1947a, 1972) - employing factor analytic techniques - claimed to have identified the basic dimensions underlying the traits or factors forwarded by previous trait research. He called these dimensions 'types'. His early research defined two such types; 'extraversion', (introversion - extraversion), and 'neuroticism', (emotional stability - neuroticism). Later research lead to the addition of a third type - 'psychoticism'.

The neuroticism vs. emotional stability factor is perhaps the most firmly established dimension in personality literature. Neuroticism is commonly defined by such terms as 'worrying', 'insecure', 'self-conscious' and 'temperamental', and theorists generally view negative affect as central to neuroticism - along with emotional distress related thought and behaviour in more extreme cases.

Individuals with high scores on the extraversion vs. introversion factor are characterised by their sociability, friendliness, need for excitement, and impulsiveness, while low scores indicate a reserved nature, preference for books rather than people, generally a rather introspective individual. Some theorists - e.g. Heist and Yonge (1968) - would have prefered to see the sociability aspects of the extraversion factor distinguished from the impulsiveness aspects, though most considered both to be central to the concept of extraversion.

Eysenck's two main instruments for measuring extraversion and neuroticism, the Maudsley Personality Inventory and the Eysenck Personality Inventory are still widely used today.

Cattell's Sixteen Personality Factor (16PF) questionnaire (1965) was designed to measure what Cattell thought to be the sixteen first-order or primary 'source traits' which represent the universal basic variables forming the entire structure of personality. These variables were derived from a great many 'surface' traits which according to Cattell form the directly observable components of human behaviour (figure 1.04)

Figure 1.04 Cattell's 16 Personality Factors Derived from Questionnaire Data

Reserved	⇔	Outgoing
Less intelligent	⇔	More intelligent
Stable, Ego Strength	⇔	Emotionality/ Neuroticism
Humble	⇔	Assertive
Sober	⇔	Happy-go-lucky
Expedient	⇔	Conscientious
Shy	⇔	Venturesome
Tough-minded	⇔	Tender-minded
Trusting	⇔	Suspicious
Practical	⇔	Imaginative
Forthright	⇔	Shrewd
Placid	⇔	Apprehensive
Conservative	⇔	Experimenting
Group-dependent	⇔	Self-sufficient
Undisciplined	⇔	Controlled
Relaxed	⇔	Tense

(from Pervin, 1993 p294)

Cattell favoured the multivariate study of the interrelationships between these variables rather than the simple bivariate study of the relationships between two, an approach which he considered piecemeal and unrepresentative of complex human behaviour.

While Allport, Cattell and Eysenck shared the view that traits are the fundamental units of personality, they differed in their views concerning the number of basic trait dimensions used in the description of personality. Recent research has seen a rise in the popularity of a five-factor model of personality, - the 'Big-Five' model - such as that presented by Costa and McCrae (1985, 1988). Although terms used vary, the five basic variables proposed are outlined below (see figure 1.05)

Figure 1.05 The Big Five Trait Factors and Illustrative Scales

Characteristics of the High Scorer	**Trait Scales**	**Characteristics of the Low Scorer**
	NEUROTICISM (N)	
Worrying, nervous, emotional, insecure, inadequate, hypochondriacal	Assess adjustment vs. emotional instability. Identifies individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges, and maladaptive coping responses.	Calm, relaxed, unemotional, hardy, secure, self-satisfied
	EXTRAVERSION (E)	
Sociable, active talkative, person-oriented, optimistic, fun-loving, affectionate	Assesses quantity and intensity of interpersonal interaction; activity level; need for stimulation; and capacity for joy.	Reserved, sober, unexuberant, aloof, task-oriented, retiring, quiet

(continued overleaf)

Figure 1.05 The Big Five Trait Factors and Illustrative Scales (continued)

	OPENNESS (O)	
Curious, broad interests, creative original, imaginative, untraditional	Assesses proactive seeking and appreciation of experience for it's own sake; toleration for and exploration of the unfamiliar.	Conventional, down-to-earth, narrow interests, unartistic, unanalytical
	AGREEABLENESS (A)	
Soft-hearted, good-natured, trusting, helpful, forgiving, gullible, straightforward	Assesses the quality of one's interpersonal orientation along a continuum from compassion to antagonism in thoughts, feelings and actions.	Cynical, rude, suspicious, uncooperative, vengeful, ruthless, irritable,manipulative.
	CONSCIENTIOUSNESS (C)	
Organized, reliable, hard-working, self-disciplined, punctual, scrupulous, neat, ambitious, persevering	Assesses the individual's degree of organization, persistance, and motivation in goal-directed behaviour. Contrasts dependable, fastidious people with those who are lackadaisical and sloppy.	Aimless, unreliable, lazy, careless, lax, negligent,weak-willed hedonistic

(from Pervin, 1993, p307)

Costa and McCrae (1985) developed the NEO Personality Inventory to measure these five dimensions and both theory and instrument has drawn wide support. However, Cattell - who criticized Eysenck for reducing personality to too few dimensions (Cattell, 1950, 1965) - has also criticized the five factor model as too simplistic (Cattell, 1995). Within any factor derived model of personality, there is always the issue of interpretation to contend with, and here the debate centres on number of core traits - as opposed to *facets* of such traits. It seems wise therefore to use an instrument designed to measure as wide a range of characteristics as possible - be they core traits *or* facets, and select the most appropriate model on the evidence of factor analysis. Perhaps the most comprehensive indicators of personality in this sense, are the instruments developed for use in occupational contexts. Such an instrument - Saville and Holdsworth's Occupational Personality Questionnaire (OPQ) - is based on a conceptual model measuring up to 31 scales, based on existing personality inventories, repertory grid studies and criteria for occupational success. Designed for use in mainly in industrial and work-place settings, the traits it purports to measure represent a broad overview of personality, many of which could, on the basis of the variables outlined above, be expected to influence learning (see figure 1.06).

Figure 1.06 OPQ Concept Model Scales

RELATIONSHIPS WITH PEOPLE

R1 **Persuasive** - Enjoys selling, changes opinions of others, convincing with arguments, negotiates
R2 **Controlling** - Takes charge, directs, manages, organises, supervises others
R3 **Independent** - Has strong views on things, difficult to manage, speaks up, argues, dislikes ties
R4 **Outgoing** - Fun loving, humourous, sociable, vibrant, talkative, jovial
R5 **Affiliative** - Has many friends, enjoys being in groups, likes companionship, shares things with friends
R6 **Socially confident** - Puts people at ease, knows what to say, good with words
R7 **Modest** - Reserved about achievements, avoids talking about self, accepts others, avoids trappings of status
R8 **Democratic** - encourages others to contribute, consults, listens and refers to others
R9 **Caring** - Considerate to others, helps those in need, sympathetic, tolerant

THINKING STYLE
T1 **Practical** - Down-to-earth, likes repairing and mending things, better with the concrete
T2 **Data rational** - Good with data, operates on facts, enjoys assessing and measuring
T3 **Artisitic** - Appreciates culture, shows artistic flair, sensitive to visual arts and music
T4 **Behavioural** - Analyses thoughts and behaviour, psychologically minded, likes to understand people
T5 **Traditional** - Preserves well-proven methods, prefers the orthodox, disciplined. conventional
T6 **Change oriented** - Enjoys doing new things, seeks variety, prefers novelty to routine, accepts changes
T7 **Conceptual** - Theoretical, intellectually curious, enjoys the complex and abstract
T8 **Innovative** - Generates ideas, shows ingenuity, thinks up solutions
T9 **Forward planning** - Prepares well in advance, enjoys target setting, forecasts trends, plans projects
T10 **Detail conscious** - Methodical, keeps things neat and tidy, precise, accurate
T11 **Conscienctious** - Sticks to deadlines, completes jobs, perseveres with routines, likes fixed schedules

FEELINGS AND EMOTIONS
F1 **Relaxed** - Calm, relaxed, cool under pressure, free from anxiety, can switch off
F2 **Worrying** - Worry when things go wrong, keyed-up before important events, anxious to do well
F3 **Tough-minded** - Difficult to hurt or upset, can brush off insults, unaffected by unfair remarks
F4 **Emotional control** - Restrained in showing emotions, keeps feelings back, avoids outbursts
F5 **Optimistic** - Cheerful, happy, keeps spirits up despite setbacks
F6 **Critical** - Good at probing the facts, sees the disadvantages, challenges assumptions
F7 **Active** - Has energy, moves quickly, enjoys physical exercise, doesn't sit still
F8 **Competitive** - Plays to win, determined to beat others, poor loser
F9 **Acheiving** - Ambitious, sets sights high, career centred, results orientated
F10 **Decisive** - Quick at conclusions, weighs things up rapidly, may be hasty, takes risks

D1 **Social desirability response** - Has tended to respond in a socially desirable way
(Saville and Holdsworth, 1990)

The OPQ is not yet used in many educational settings, though a student version has been developed and graduate applicant norms are available. Matthews, Stanton, Graham and Brimelow (1990) administered the OPQ to undergraduate students with a view to assessing its conceptual overlap with the 'big five ' personality model, but did not attempt to evaluate their results in terms of learning issues. They concluded that, although the individual scales were reliable, the OPQ could be factor analysed to produce a 'big five-like' set of higher-order factors.

1.33 Studies relating personality to learning

There is an extensive body of literature dealing with the relationship between personality and student academic achievement - e.g. Eysenck (1947b), Kline and Gale (1971), Furneaux (1962, 1980), Entwistle (1972), Entwistle and Wilson (1977), Entwistle and Entwistle (1970), Holder and Wankowski (1980) - see chapter six. However, research into the relationship between personality and the actual learning characteristics of students is relatively sparse.

Eysenck's (1981) findings as regards extaversion and neuroticism and learning in college students is summarized as follows;

> 1. Reward enhances the performance of extraverts more than introverts, whereas punishment impairs the performance of introverts more than extraverts.
> 2. Introverts are more susceptible than extraverts to distraction.
> 3. Introverts are more affected than extraverts by response competition.
> 4. Introverts take longer than extraverts to retrieve information from long-term or permanent storage, especially non-dominant information.
> 5. Introverts have higher response criteria than extraverts.
> 6. Extraverts show better retention-test performance than introverts at short retention intervals, but the opposite happens at long retention intervals.
>
> (Eysenck, 1981).

These findings relate mainly to specific cognitive tasks and seem removed from the real-life learning experience of students, since they are derived from experimental protocol without regard to motivational or affective elements of behaviour. The learning behaviour of students is subject to a vast array of emotional, intellectual and situational factors (Gibbs, 1991), thus it is important that the effect of personality is considered within an appropriate context.

Leith (1972) looked at how children's creativity is influenced by both their personality and by the stress levels attached to the testing procedure employed. He found that the relative extraversion and anxiety levels of the children did interact with the test conditions in determining task performance, suggesting that ability to achieve well on high stress assessment procedures such as examinations may be heavily influenced by the student's personality.

In a later study, Leith (1973) reported that extraverts scored more highly on a criterion measure having been exposed to an unstructured style of teaching, while introverts performed better with more highly structured learning materials. Shadbolt (1978) presented similar findings in a study with first-year undergraduates, finding an interactive effect between extraversion/neuroticism and level of success following exposure to structured-deductive or unstructured-inductive teaching methods.

While these three studies use achievement outcomes as indicators of learning rather than make any attempt to investigate the actual learning processes themselves, they do demonstrate the importance of personality in determining the preferences of students to learn in different ways.

Biggs (1970a) reported correlations between study strategies, as measured by the Study Processes Questionnaire, and certain personality characteristics measured by the Maudsley Personality Inventory. 'Tolerance of ambiguity' - dealing with the student's reaction to novelty and complexity - was found to be related to emotional stability in arts students, while 'cognitive simplicity' - referring to the student's inability to inter-relate subject areas and ideas, and tendency to accept only one official 'answer' to problems - *and* 'intrinsic motivation' - absorption in subject of study - were both related to introversion, also in arts students.

Biggs concluded that study strategies do indeed involve the translation of personality characteristics into study-relevant operations, thereby acting as 'moderators' between disposition and task. He qualified this however, by commenting that the correlations found in the study were low, possibly as a result of small and rather unrepresentative samples.

Entwistle and Ramsden (1983) administered their Approaches to Studying Inventory to a much larger sample of undergraduate students. Participants with particularly low or high scores on the 'meaning' and/or 'reproducing' dimensions went on to complete a battery of cognitive and personality profiling tests. This 'sub-sample' was classified into one of four groups, 'meaning' - low scores on surface/operation learning, high scores on deep/comprehension learning - 'reproducing' - high scores on surface/operation learning, low scores on deep/comprehension learning - 'strategic' - high scores on *both* surface/operation and deep comprehension learning - and 'unmotivated' - low scores on both surface/operation and deep comprehension learning. The tests administered included the Omnibus Personality

Inventory (Heist and Yonge, 1968). This test measures fourteen scales; 'thinking introversion', 'theoretical orientation', 'aestheticism', 'complexity', 'autonomy', 'religious scepticism', 'social extraversion', 'impulse expression', 'personal integration', 'anxiety denial', 'altruism', 'practical outlook', 'masculinity' and 'response bias' - an indicator of the honesty of the responses. They reported higher scores on thinking introversion, theoretical orientation, complexity, autonomy, aestheticism and religious scepticism for the 'meaning' orientation students. The 'reproducing' student group scored more highly on practical outlook and masculinity, with low scores on thinking introversion, theoretical orientation, complexity and autonomy. 'Strategic' students returned higher scores on anxiety and impulse expression, and low scores on personal integration, while 'unmotivated' students scored low on autonomy and impulse expression, earning them the description 'unresponsive and conventional'.

Two main problems were inherent in this study. Firstly, as Entwistle and Ramsden themselves admit, the group sizes on which comparisons were made were small, and therefore the findings could serve only as a preliminary indication of the nature of the relationship under investigation. Secondly, the students were classified on the basis of both a learning *approach* - deep/surface approach - and a learning *style* - comprehension/operation learning. As one is hypothesized to be contextually dependent, while the other stems from dispositional psychological attributes, the rationale behind the pairing is quite likely to be unsound. Indeed the relationship between the two may well be much less close than the classifications assume, i.e., a deep or surface approach may be undertaken entirely independently of a student's disposition to learn in either a comprehension -holistic - or operation - serialist - fashion.

Further analysis of the data (Entwistle and Ramsden, 1983) side-stepped this problem by independently correlating the personality traits with both the approaches and the styles of learning. They noted that the learning styles were indeed more closely linked with these traits than were the learning approaches. More of the item scales from the personality inventory correlated significantly with the ASI scales of comprehension and operation learning than with the deep and surface approaches. Entwistle and Ramsden suggested that comprehension learners tend to score highly on those traits determined by interest in ideas, as well as those indicating impulsivity and anxiety. Operation learning, on the other hand, tended to show greater links with interest in practical, concrete ideas and greater cautiousness. These findings, though interesting, seem to suggest a fair amount of overlap between the (Pask derived) styles and pathologies of learning domains of the ASI and the traits which the Omnibus instrument purports to measure.

Entwistle and Ramsden also factor analyzed the total set of variables - including the other cognitive tests administered in the test battery - and extracted six factors, two relating to learning orientation, - meaning and reproduction - two relating to personality - one grouping complexity, autonomy and impulse expression, the other - reminiscent of Eysenck's neuroticism scale - grouping anxiety and low personal integration - one relating to ability to solve ideas and the final one relating to Hudson's convergence/divergence dimension. They concluded that underlying personality traits *can* be used to predict a student's preference for adoption of comprehension or operation styles of learning, and add that in general a deep orientation seems to be linked with a high level of 'sceptical, intellectual autonomy' implicit in the student's personality makeup. Again, their conclusions may be somewhat flawed by the conceptual overlap of the two main inventories. Additionally, there may be the problem of neglecting the contextual specificity of approaches to learning by claiming that their roots lie in stable personality traits.

More recently, Furnham (1992) reported strong correlations between personality - as measured by the EPQ - and the learning styles defined by Kolb's Learning Style Inventory (Kolb, 1976). He noted that extraversion correlated positively with 'converger' and 'accomodator' learning styles. Neuroticism was negatively related to the 'assimilator' learning style, while psychoticism formed a strong positive correlation with the 'diverger' style.

Furnham also reported strong positive correlations between extraversion and the 'activist' and 'pragmatist' traits of the Honey and Mumford (1982) Learning Style Questionnaire. Extraversion correlated negatively with the 'reflector' profile, while neuroticism correlated positively with the 'theorist' profile. Psychoticism was linked positively with the 'activist' trait and negatively with the 'theorist' trait. 'Activism', he noted, is the learning style most closely related to personality. He concluded that student personality determines strong differences in cognitive styles and use of decision-making strategies, as well as influencing which academic discipline the student selects in the first place. He also posited that because cognitive styles underpin learning approaches, certain personality types are likely to be better predisposed to cope with and succeed in certain educational tasks. This, he suggested, means that the use of personality assessment procedures could profitably be undertaken in tandem with use of learning style instruments in educational research.

Wankowski (1991) claimed that a student is more likely to deal successfully with the conditions of tertiary learning if he or she is of a 'certain temperamental disposition' which facilitates the adjustment of their attitudes towards, and habits of, study. His findings linked emotionality with unsystematic working style, feelings of being unable to cope in higher education, a desire to be more methodical, vagueness about the future and a tendency not to use reference books when studying. Extraversion, he found correlated - again - with unsystematic approach to work, with a preference for tutorials and confidence in succeeding at university.

There has however been considerable opposition to the concept of deconstructing learning in terms of personality characteristics or cognitive styles. Gibbs (1981) argued that learning-style variables are not in themselves adequately stable to suppose that they are based upon such fixed cognitive characteristics. Indeed, Wankowski (1991) despite his support of personality measurements in predicting learning behaviour in students, admitted that uniqueness of each individual and the transformation of their persona through learning are complex and important factors.

Laurillard (1979) set students the task of teaching material back to her. She demonstrated that opting for a surface or deep approach depended very much on the nature of the task, with the content and context of learning emerging as vastly more influential than cognitive traits, while Säljö (1979) noted that students could identify with *both* surface and deep approaches to learning when asked about their own learning experiences. It seems students perceive learning approach as being very contexually dependent. Gibbs (1981), like William Perry, believed that the students' conceptions of learning should take precedent over their individual personalities when researching the ways in which students learn.

1.4 Research programme

Review of the previous research strongly suggests that the most useful - and probably the most ecologically valid - means of assessing student learning are those instruments developed from the phenomenological research model. This project - the central concern of which is the relationship between personality and learning in higher education students -

aims to investigate potential psychological origins of differences in approaches to learning as described by this model. Previous studies have shown that personality *can* influence learning, but often the theoretical models on which the measures of personality and learning are based are paid scant attention, resulting in confusion about the extent of personality's influence relative to contextual factors such as study habits, motivation and learning environment. Within this study, personality is related in turn to approaches to learning, motivation for study, study habits, and learning styles, each of which represent diverse aspects of student learning. The Lancaster Approaches to Studying Inventory (Entwistle and Ramsden, 1983), described on page 13, covers a wider range of these factors than some of the more cognitive based instruments, such as the LSI, and was therefore chosen as the best means of assessing learning in this study.

Many of the studies assessing the relationship between personality and learning use the Eysenckian conception of personality as a two dimensional plane with social extraversion and emotional neuroticism constituting the orthogonal axes. Although this theory is still popular, newer multidimensional theories - some of which have previously been set out - incorporate greater numbers of dimensions. For this project, Saville and Holdsworth's Occupational Personality Questionnaire (OPQ) provided a relatively sophisticated break-down of personality, offering measurement of a large number of specific detailed traits relating to everyday behaviour, emotions and cognitive processes.

In addition, the OPQ is a good example of the specialised questionnaire which many of the student participants in the study will go on to encounter in their career search. Many companies and institutions now recognize personality assessment as a valuable tool in recruiting employees temperamentally suited to the job at hand. The validity of using personality inventories for such selection is not at issue here, though the rapid development of the occupational personality industry in recent years, and the increasing use of such tests by employers are testament to their perceived utility.

The majority of studies of personality and learning in students take a cross-sectional look at the patterns and relationships between the two, usually by selecting and testing at one point in the education process, (e.g. Entwistle and Ramsden 1983, Furnham 1992). This neglects the possibility that the relationships examined may be neither stable nor consistent. This project adopts a longitudinal design in which the students are monitored throughout their time at university. This aspect is important in view of the fact that little evidence is available to support or reject the notion that the approaches to learning identified by Marton and Säljö (1976) can be thought of as stable attributes of the individual student. While the context specificity of these approaches is repeatedly asserted, long term preferences for certain approaches to learning may suggest a more dispositional basis.

In addition to attempting to quantify the relationship between personality and learning, the project sets out to investigate individual differences in personality and learning within the student sample, and in addition assess whether academic performance can be directly related either to learning strategy preference or to personality type.

The research was conducted at the University of Leicester between March 1993 and April 1995 and involved students from all faculties within the campus. Their progress was followed throughout their university course, with testing of personality and learning characteristics taking place on an annual basis.

1.5 Outline of later chapters

Chapter two sets out the central methodology of the project. The project involved one main large-scale programme of testing rather than a series of related but separate studies, however the data set yielded by the testing was subject to a range of statistical analyses which investigated diverse hypotheses. To avoid unnecessary repetition, the core methodology is not re-iterated in each subsequent chapter.

Chapter three investigates the conceptual relationship between approaches to learning, learning/cognitive style and personality using factor analysis and, in light of the findings, assesses the validity of a number of models of student learning.

Chapter four looks at the contrasting approaches to studying, cognitive styles and personality characteristics of students according to their academic discipline, gender and age of the student.

Chapter five describes the use of longitudinal analysis to map the development of approaches to studying, cognitive styles and personality and charts the interrelationships between the variables through the three years of an academic degree.

Chapter six investigates the predictivity of the principal learning/personality variables in determining academic performance at degree level.

Chapter seven collates the principal findings of the project and discusses their implications for educational research, present and future.

CHAPTER 2 - CORE METHODOLOGY

2.1 Overview

This chapter describes the research methodology which yielded the data for the project. The methodology was designed to draw on the most useful and tested aspects of previous research, and established inventories and questionnaires were used to provide the raw data for quantitative analysis. This strategy was deemed to be the most efficient in allowing large samples of students to be assessed while minimizing the disruption to their own study schedule as well as encouraging both initial participation and perseverance with the study in successive years.

2.21 Participants and design

The complete first year intake (n=2104), of all faculties at Leicester University in October 1992 was targeted for the original two-year longitudinal study. In January 1993, all undergraduate students in their first year of study were written to and invited to participate in a personality assessment project. The letter sent to each student set out the project's aims and encouraged participation by offering a free personality profile. Notices advertising the same offer were posted about the university campus. In March of that year, 378 students volunteered and went on to take part in the project. Table 2.01-2.05 shows the breakdown of the sample according to academic discipline, gender, and mature student status. Unlike Entwistle and Wilson (1977), who excluded foreign students, mature students, and students from medicine and law faculties in their Rowntree study, *all* first year undergraduates who volunteered were accepted for the project.

Table 2.01 Academic discipline of first-year 'arts' sample

'Arts' Students (Total n=96, 25.3% of sample)			
Gender/age breakdown		*Disciplines*	
		History of Art	3
Male/non-mature	18	History	12
Female/non-mature	89	Modern Language Studies	20
Male/mature	3	European Studies	6
Female/mature	7	American Studies	3
		English	20
		Combined Arts (exclusively arts)	10

Table 2.02 Academic discipline of first-year 'science' sample

'Science' Students (Total n=68, 17.9% of sample)

Gender/age breakdown		*Disciplines*	
		Geology	6
Male/non-mature	22	Chemistry	8
Female/non-mature	41	Physics	13
Male/mature	5	Engineering	5
Female/mature	0	Mathematics	7
		Biology	8
		Biological science	21

Table 2.03 Academic discipline of first-year 'social science' sample

'Social science' Students (Total n=87, 23.2% of sample)

Gender/age breakdown		*Disciplines*	
		Sociology	13
Male/non-mature	22	Economic and social history	13
Female/non-mature	57	Psychology	41
Male/mature	1	Economics and law	3
Female/mature	8	Economics	10
		Communications and society	3
		Politics	4

Table 2.04 Academic discipline of first-year 'vocational' sample

'Vocational' Students (Total n=59, 15.5% of sample)

Gender/age breakdown		*Disciplines**	
Male/non-mature	18	Law	43
Female/non-mature	32	Medicine	16
Male/mature	6		
Female/mature	3		

Table 2.05 Academic discipline of first-year 'broad-based' sample

'Broad based' Students (Total n=68, 17.9% of sample)

Gender/age breakdown		*Disciplines*	
Male/non-mature	15	Combined science incl. psychology	21
Female/non-mature	37	Combined arts incl. psychology	36
Male/mature	3	Geography*	11
Female/mature	37		

*NB The inclusion of the geography sample in the 'broad-based' category was considered appropriate by members of the geography teaching staff.

Table 2.06 below presents the relative numbers of male to female students and students of non-mature (aged 21 or under at time of testing) to mature status (aged 22 or over at time of testing). The significantly higher numbers of females volunteering for the study (χ^2=61.77, d.f.=1, $p<0.001$ - appendix 2.01) is not vastly dissimilar to that found in studies by Wong and Csikszentmihalyi (1990) - 40% male, 60% female , Richardson (1993) - 36% male 64% female, and Hayes and Richardson (1995) - 38% males, 62% females. The sample may be skewed by the number of psychology students participating - a relatively female-biased sample to begin with. The ratio of mature to non-mature students is comparable with the ratio for the general student population at Leicester University.

Table 2.06 Gender and Maturity Frequencies/Percentages

		Maturity		
		Non-Mature	*Mature*	*Total*
	Male	95	18	113
Gender		(25.1%)	(4.7%)	(29.8%)
	Female	235	31	266
		(62.0%)	(8.2%)	(70.2%)
	Total	330	49	
		(87.1%)	(12.9%)	

The longitudinal design of the study was considered important in view of the fact that little evidence is available to support or reject the notion that the approaches to learning identified by Marton and Säljö (1976) can be thought of as stable, consistent attributes of an individual student. While the context specificity of these approaches is repeatedly asserted, long term preferences for certain approaches to learning may suggest a more dispositional basis.

Of the original 378 who sat the tests, 311 returned the following year (March 1994), to complete the tests again. This sizeable follow-up informed the decision to run the tests for a third year, thereby charting each participant's personality and learning development through each year of their university career. 116 returned in March 1995 to sit the test for a third and final time. Although the attrition rate from year two to year three was higher than that of year one to year two, the sample retained a relatively consistent breakdown with regard to discipline, maturity and gender. Of those failing to return, a 34 were students on work placements, or on a compulsory a year abroad - mainly American, European or language studies. On analysing the breakdown of the sample after the first year's testing it was discovered that ten students who had taken part were in fact in their second year of study rather than their first. Most of these were psychology students, obviously so dedicated to their discipline that they were prepared to lie for the chance of a personality profile. Rather than exclude these students from the sample, their scores for the first and second year's tests, - their second and third years of study - were advanced a year to fit in with the rest of the students. One male student, who did not attend the first year's testing, sat the second year's tests, even though only those already involved were asked to return. His scores were included in the same way.

2.22 Materials

Saville and Holdsworth Ltd (SHL) supplied the Concept 5.2 version of the OPQ (Saville and holdsworth, 1990) for use in this study. This version is normatively scored -as opposed to ipsatively scored - and is made up of 248 statements, (eight per scale), within a sixteen page question booklet. Participants register their level of agreement with each on a five point Likert scale - 'one' representing 'strongly disagree', 'five' representing 'strongly agree'. This is printed on a separate, machine scoreable answer sheet. The thirty-one scales are reproduced on page 32 of the introduction, and Saville and Holdsworth's descriptions of each are included in appendix A-1.3. (Reproduction of the OPQ Concept 5.2 questionnaire was not possible for copyright reasons.)

The Lancaster Approaches to Studying Inventory, (ASI), was reproduced from Entwistle and Ramsden (1983) - see appendix A-1.81. Like the OPQ it is normatively scored, and participants mark their level of agreement using a five-point Likert scale. The version of the ASI comprised sixty-four statements, sixteen each relating to each of the four subscales, 'meaning orientation', 'reproducing orientation', 'achieving orientation' and 'styles and pathologies of learning'. The sixteen scales and their definitions can be found on page 13 of the introduction.

2.23 Procedure

The participants were invited to sign up for one of several testing sessions taking place at various times throughout two weeks of the spring term. Up to fifty individuals could be tested at once within the lecture hall used and ten such sessions were held. The two instruments were introduced by an administrator trained by Saville and Holdsworth. The rationale behind the testing sessions was briefly explained and instructions on completing both inventories were given - see appendix A-1.2. Participants were requested to complete a personal information form, which required name, date of birth, gender, year of study and academic subjects undertaken - see appendix A-1.1. They were encouraged to take as much time as they wished to complete both questionnaires, but were asked not to dwell too long on any one item or to miss any item out. They were also asked not to confer with neighbours and, to leave quietly when the tests were completed. Although the tests were not timed, the average time taken by the respondents to complete both tests was approximately forty minutes, though the earliest to finish - approximately 10% of a testing session of 50 students - took less than half an hour, while others - again roughly 10% - needed over an hour. Completed answer sheets and question booklets were collected at the end of the session. This procedure was followed on every testing session in years one, two and three. Following the second and third year's testing, the participants were invited to register for one of several personality profiling sessions, which took place two to three weeks after the testing session in the second year (1994) and after the examination period in June in the third year (1995). At these sessions, the trained SHL administrator distributed their individual profiles - see appendix A-1.9 for sample profile - and offered guidance about how best to interpret them. Students were not permitted to keep the profiles in the second year for fear that they might be misused. In the second year, the participants were also presented with an Approaches to Learning profile - see appendix A-1.92 for sample profile - which outlined their strengths and weaknesses in the aspects of learning measured by the ASI.

2.24 Scoring of questionnaires

The Concept 5.2 answer sheets were returned to SHL for computer reading and analysis. These were later returned along with personality profile sheets for each participant. Each profile listed the thirty-one scales and the respondent's Raw Score (RS) for each trait, which represented the following;

```
RS = Sum of the eight relevant Likert scores - 4
```

Four Likert scores out of the eight were reversed, i.e. subtracted from 5, because the items statements were negative, that is, they measured the negative or opposite forms of the specific personality trait. This score for each trait is the one used in all subsequent analysis in this project.

Also supplied for each trait was a Standard Ten or STEN score which gives an indication of the individual's score on each trait relative to the rest of the sample. Norm tables can be supplied by SHL, which may outline the norms of the whole sample, parts of the sample - e.g. different academic disciplines - or other groups of people - e.g., managers, graduate applicants, etc. With the STEN score the individual gets an impression of where they lie in comparison to all others who sat the test for each personality trait. As the study here is longitudinal in nature though, the STEN scores were of limited value, as the score varies as a function of the sample population used, and because the sample used decreased over the test period, the STEN scores were inconsistent, making comparisons invalid. In addition, the STEN norms provided by SHL were based on a managerial/professional population and were not considered appropriate for this sample.

The completed ASIs were hand coded. A score was calculated for each scale using the formula;

```
Score = Sum of subscale scores - Number of subscales
(e.g., 'deep approach' = Sum of four subscale scores - 4)
```

All scales, except 'surface approach' - 6 items, 'syllabus boundness' - 3 items, and 'fear of failure', - 3 items, were composed of 4 inventory items. The subtraction was necessary because Entwistle and Ramsden's (1983) original inventory had used Likert scales running from zero to four, whereas the ones used here ran from one to five to match those of the OPQ and avoid confusion.

The questionnaire results of the ASI do not in themselves have any absolute meaning, especially since there is no standard number of items per scale. The data yielded is used in analyses involving comparisons with other participants and between subgroups of the sample.

2.25 Recording academic performance

In October 1993, the first year marks for the students involved were requested from the university registry. A number of problems became apparent, particularly with regard to differences in the ways different faculties assess students. Most departments were able to provide marks for each first-year course taken, typically numbering three or four, so that a composite mark could be reached for the student. Generally, these marks are largely determined by examination performance, though coursework usually counts to some extent. For some courses results were unavailable - engineering, medicine and combined science. In addition, some students had changed courses, while others had withdrawn from their studies completely. However, composite marks representing first year academic performance were recorded for 272 students - 71.8% of the total sample. At the end of the student's second year, academic performance figures were unavailable, with the registry only able to supply pass/fail information. In July 1995, the month in which many of the participants graduated from Leicester University, the final degree classes for the students were recorded. The degree classes of 131 of the original sample of 378 students were not available. 53 were on courses which either required a year's work placement - e.g. European Studies - or which took longer than three years to complete - e.g. medicine. The remaining 78 were classified as having either withdrawn from their studies completely or re-taken parts of their course. Keeping track of the activities of individual students was a demanding task, made especially difficult by the number of students taking combined subject degrees, affiliated to more than one department. Students for whom degree classes were available who *also* sat the personality/learning assessments a second time numbered 225, and those who sat it a third time numbered 89.

2.3 Analysis of data

The nature of this project necessitated the use of reliable, empirically valid and conceptually useful modes of quantitative analysis. Each of the following chapters includes a detailed description of the choice of statistical analyses and the rationale behind the choice. At this point it may be useful to include an overview of the techniques employed in the succeeding chapters:

Chapter 3 - 'Principal Components Factor Analysis' with orthogonal Varimax rotation - used to determine the patterns of interrelationship between the instrument subscales, to extract a coherent workable theory relating to personality and learning characteristics and to provide factor scores for each student relating to the principal concepts observed for use in subsequent analyses.

Chapter 4 - 'Multivariate Analysis of Variance', including post hoc analysis of subcategory samples - used to assess statistical significance of subscale and factor mean score differences between students within different subject discipline, gender and maturity categories.

Chapter 5 - 'Repeated Measures Analysis of Variance' - used to chart the effect of 'year of study' on the subscale and factor mean scores within the overall sample and between the different subcategories investigated in the previous chapter.

Chapter 6 - 'Pearson Bivariate Correlation Coefficients' / 'Multiple Regression Analysis' - used to examine the relative predictivity of the subscale and factor scores and subsequent academic performance.

Each chapter also includes appropriate descriptive data and illustration where necessary.

CHAPTER 3 - A FACTOR MODEL OF PERSONALITY, COGNITIVE STYLE AND APPROACH TO LEARNING

3.1 Overview

While many studies have sought to investigate personality correlates of academic achievement - see chapter six - relatively few have set out to analyse the relationship between personality and learning, much less deconstruct the cognitive processes inherent in any such relationship. The question of whether the nature of a student's interaction with self, others and the external world is relevant in the context of their learning, is very much open to debate. This chapter describes how the technique of factor analysis was used to investigate the conceptual relationship between approaches to learning, cognitive styles and personality, and sets the framework for a comprehensive psychometric model of student learning.

3.2 Personality and approaches to learning

Biggs (1970, 1976) hypothesized that the adoption of certain study strategies may be determined by an interaction between enduring personality characteristics and environmental factors. This concept became an integral tenet of his General Model of Study Processes, (Biggs, 1978) with personality constituting a central component of the 'presage domain'. Personality characteristics relevant to study strategies within this model - such as 'tolerance of ambiguity', 'dogmatism', 'cognitive complexity' and 'convergence/divergence' - were assumed to become manifest within study contexts. As such, study strategies were said to 'involve translating personality characteristics into study relevant operations' (Biggs 1978). Consequently, students exhibiting certain personality characteristics would presumably be predisposed to follow certain study strategies as opposed to others. It must be observed that Biggs defined cognitive styles as fairly stable, deep-rooted personality-type characteristics and assumed that cognitive styles and personality were closely related, if not one and the same. He took issue with the concept of study 'habits', claiming that study behaviour involved complex modes of processing information shaped by the individual's cognitive make-up. Like Eysenck (1975), Biggs argued that arousal levels were instrumental in setting up motivational factors for learning. Students highly sensitive to changes in arousal - high scorers on neuroticism scale - and those who have high resting levels of arousal - introverts - would be more likely to be intrinsically motivated by their academic tasks than extraverts and or more emotionally stable individuals. Thus, the stable patterns of study behaviour 'form the phenotypes of underlying genotypic personality variables' (Biggs, 1978).

In addition, the tendency to use extreme scores on Likert scales of learning or personality inventories - known as an Extreme Response Set (ERS), was noted by Biggs and Das (1973) to be associated with intensity of beliefs about both internal issues,- such as the students' own academic values, practices, perceptions, attitudes and intentions - and external issues - for example, the perceived attributes of friends and learning environment. Those obtaining high *internal* ERS scores - on Biggs' SPQ, Rokeach's Dogmatism Scale and the Personal Friends Questionnaire - were found to be more introverted, divergent, non dogmatic and likely to use meaningful, as opposed to rote learning strategies. High *external* ERS scorers on the other hand, were found to be more extraverted and dogmatic, and favoured rote learning strategies. Biggs (1978) suggested that 'need for certainty' is the genotypic factor underpinning the Extreme Response Set, and that both high ERS Internal and ERS External scorers obtain certainty by adopting these respective learning strategies.

This study is important since it presents evidence that meaning and reproducing strategies may be linked to a basic genotype within the individual student's disposition - one which Biggs terms 'internality-externality'. Biggs went on to outline why personality factors are an intrinsic component of approach to learning. His definition of a 'reproducing' strategy looks at external motives for study which are based on fear of failure or neuroticism which leads to 'minimax' strategies such as class dependence and rote learning. Conversely, 'internalizing' strategies are motivated by need for certainty through self-actualization. The third strategy, 'organizing' is thought to be driven by desire for competition and success, regardless of whether the goals are internal or external.

Entwistle and Wilson (1977) reported the findings of a large scale study aiming to identify student types - identified by cluster analysis - with a view to establishing a more accurate means of predicting academic achievement. They noted clusters of students with similar descriptions of personality within both the high and low attainment groups. High attainment groups included 'highly motivated, stable scientists' who tended to be emotionally stable, theoretical, conservative and rational, 'hard-working, syllabus-free arts students who work long hours' who scored high on neuroticism and low on extraversion, and 'hard-working students with high religious values.' Low attainment groups included 'tough-minded extraverts with poor study methods', who tended towards conservative attitudes. 'Science students with low motivation and poor study methods' with low theoretical values, and 'arts students with low motivation and poor study methods', who showed high radicalism, neuroticism and extraversion.

While these clusters appear to be formed largely on the basis of subject discipline and study methods, the patterns of personality disposition do seem in accord with the second-order dimensions of study strategy outlined by Biggs.

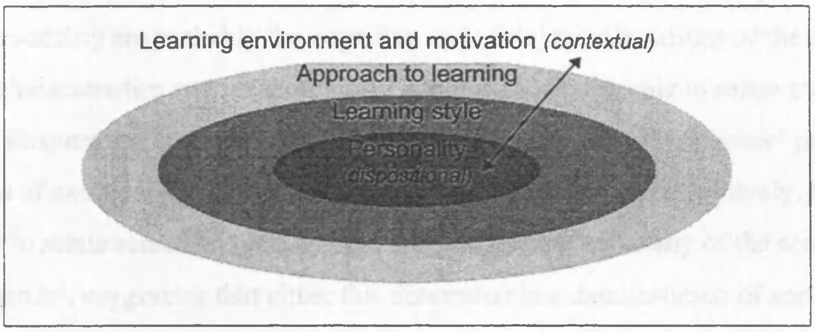
Entwistle and Ramsden (1983) chose to include indices of personality in their investigation of determinants of approaches to learning because they had noted much research indicating the influence of cognitive styles in choice of faculty. They measured traits of thinking introversion, theoretical orientation, aestheticism, complexity - i.e., tolerance of ambiguity - autonomy, religious scepticism, social extraversion, impulse expression, personal integration, anxiety denial, altruism, practical outlook, masculinity and response bias.

The validity of this study has been questioned previously - see introductory chapter - however it did demonstrate a relationship between approach to learning and aspects of psychological make-up in a similar vein to the findings of Biggs. Here, thinking introversion and theoretical outlook emerge as highly correlated with deep approach, while there existed a mild link between surface approach and anxiety, lack of personal integration, tenseness and inadequacy. Fransson's (1977) contention that it is the student's *perception* of the learning situation that is instrumental in provoking surface approaches, rather than the characteristics of the situation itself, suggests that the students disposition to be anxious may be as likely to induce surface approaches as any aspect of their learning environment.

More convincing, however, is Entwistle and Ramsden's evidence to suggest that learning *styles* are more associated with personality than they are with approaches to learning.

Schmeck (1983) defined the learning style as a 'predisposition on the part of some students to adopt a particular learning strategy regardless of the specific demands of the learning task.' Much research has been concerned with identifying basic modes of learning by studying both the underlying, pre-existing individual differences of learning processes and the situations and contexts which shape learning processes. The existence of habitual, consistent modes of processing information are thus assumed to stem from personality descriptions and shape, to some extent, actual learning strategies chosen, - as in the 'onion model' proposed by Curry (1983). A simplistic model similar to Curry's and Bigg's (1970) illustrates the hypothesised relationship between concepts under investigation here -Figure 3.1

Figure 3.1 Hypothetical model of student learning



A wide range of cognitive information processing concepts of habits have been integrated into the learning model by psychologists - for example, convergent vs divergent thinking (Hudson, 1966), reflectivity vs impulsivity (Kagan, 1965), field dependence vs independence (Witkin *et al*, 1977), levelling vs sharpening (Holzman and Klein, 1954), wholist vs analytic, verbalizing vs imaging (Riding and Cheema, 1991), concrete experience vs reflective observation, abstract conceptualization vs active experience (Kolb, 1976) and holist vs serialist (Pask, 1976).

The nature of these conceptions and their relationship to stable personality is of real importance to the education system since, as Riding and Cheema (1991) observe, students' ability to adapt to learn effectively in an environment in which learning style and teaching style are mis-matched, and the necessity for the instructional setting to change to suit the students dispositional learning style, as proposed by the 'matching' hypothesis (Witkin *et al*, 1965; Moran, 1991), must both be assessed if course design is to actively improve student learning.

This hypothesis can be tested by assessing whether predominant learning styles tend to associate themselves with aspects of the learners basic personality or other potentially more context dependent characteristics such as their predominant approaches to learning, study methods or motivations for study.

Riding, Burton, Rees and Sharrat (1995) argued that cognitive or learning styles determine the ways in which individuals mentally represent and process their social environment and situation, and this in turn is a consistent aspect of social behaviour. They noted an interaction between certain outwardly manifested personality dimensions - 'active', 'modest' and 'responsible' - and verbaliser/imager style preference. 'Active' individuals scored highest on the verbalizer score, 'responsible' individuals scored highest on the imager score and 'modest' individuals were more likely to be 'bimodal' in terms of style. They concluded that style and personality are probably the cognitive and social manifestations of the same underlying characteristics and physiological condition, and were able to relate the verbalizers, imagers and bimodals to Costa and Macrae's (1988) 'Five-Factor' personality model scales of extraversion, agreeableness and conscientiousness respectively. Notably they were unable to relate scores on their wholist-analytic dimension to any of the scales of the five-factor model, suggesting that either this dimension is a manifestation of some other psychological construct or that the big-five model neglects a fundamental domain of personality. As Brand (1984) observed; 'A serious possibility is that there are omnipresent differences between people in whether they attend narrowly to (self-) selected aspects of reality or whether they are more broadly attentive.' (p195).

Messick (1976) observed that cognitive styles were an inextricable part of the affective, temperamental and motivational structures of personality and subsequently, Miller (1991) set out a hypothetical model of relationships between personality and learning styles using the tripartite system of cognition, affection and conation domains of personality. Within the cognitive dimension he suggested that the dominant distinction could be made between cognitive narrowness and broadness, and thus the 'analytic-holistic' conception was used to describe enduring individual differences in cognitive processing. As Riding and Cheema (1991) note, the weight of evidence relating to the existence of this conception suggests that it is probably measuring the same single cognitive style as many of the other conceptions, - including Pask's 'holist/serialist' dimension. Within the affective dimension of Miller's model, Eysenck's traits of extraversion and neuroticism are included on the basis that both 'have an emotional flavour'. (His final model seems to neglect extraversion however). The conative dimension is represented in the model by an 'objectivity-subjectivity' dimension, which pertains to social and motivational aspects of the individual's personality and their sense of autonomy, assertiveness and general orientation towards others.

He concluded that since learning styles can be defined in terms of personality dynamics within such a model, behaviour change amongst students would be difficult to achieve. Attempts to encourage students to adopt styles of learning other than those usually preferred were thus deemed to be likely to be successful only on a very superficial level. As Biggs (1976) argued, the belief that simple study habits may be changed at will is rendered implausible within this type of model. Since personality characteristics, and by extension learning styles, are assumed to be either dispositional or at least learned early in life, strategies aiming to modify styles could generate distress and/or hostility. Miller suggested that attempts to impart stylistic versatility should be abandoned in favour of adjusting teaching to suit the student.

While these conceptions of learning style focus on ways in which the structure of information is tackled, the learning styles proposed by Schmeck (1983) and Weinstein and Mayer (1986) are superficially much more similar to the learning orientations described by the phenomenographers, e.g. Marton and Saljo (1976), Entwistle and Ramsden (1983), in that they are concerned with the students level of engagement with the learning material - see chapter one. Learning strategies within this context were evolved from cognitive theory and are seen as rooted in the individual's stable cognitive make-up. Though the degree of external conceptual overlap between the two schools of thought appear to be considerable, the theoretical framework for each is very different.

3.3 Relationships between approaches and style.

Factor analysis permitted many researchers to investigate the psychometric properties of learning and cognitive style/personality inventories, both in isolation and in conjunction with other tests, with relative ease.

Factor analysis of the Approaches to Studying Inventory has been carried out in a number of studies, (Entwistle and Ramsden, 1983; Meyer and Parson, 1989; Harper and Kember, 1989; Richardson, 1990, 1992; Newstead, 1992; Richardson, Landbeck and Mugler, 1995), with similar analysis conducted using the SPQ by Biggs (1976, 1978), Hattie and Watkins (1981) and O'Neil and Child (1984). These studies consistently validate the meaning and reproducing orientation dimensions originally defined by Entwistle and Ramsden (1983). The additional dimensions 'achieving' and 'styles and pathologies of learning' originally claimed to underpin the ASI scales, have proved more difficult to discern from factor analytic interpretations of the inventory's constituent structure. This has led researchers to recommend newer, shorter forms of the inventory (Richardson, 1992; Richardson, Landbeck and Mugler, 1995; Gibbs *et al*, 1988) which integrate the Pask derived styles and pathologies of learning into the approaches subscales, despite the disparity in origin and development of the two conceptions. Some factor analytic studies found that the 'comprehension learning' subscale loaded onto the 'meaning orientation' scales, (Clarke, 1986; Watkins, Hattie and Astilla, 1986; Watkins and Hattie, 1985; Harper and Kember, 1989; and Meyer and Parsons, 1989), while Richardson (1990) observed a pattern factor matrix which featured a primary factor extraction associated solely with comprehension learning. This recurred in an even more stringent second order factor matrix. Most evidence, however, seems to suggest a strong association between meaning orientation and comprehension learning style, and as Entwistle and Ramsden (1983) note, both meaning and reproducing orientations 'show a strong stylistic component'. In addition, Harper and Kember (1989) warned that studying styles and approaches independently could lead to a 'deficient' overall interpretation of learning, despite the conceptual differences between referential approaches and organizational styles. They also concluded that the comprehension learning subscale's inclusion in the meaning orientation factor suggests that unless students are able to seek overall meaning or 'gist' early on in the learning process, they will be constrained to atomistic - and presumably, surface - learning. They did not, however, note any association between operation learning and surface approach.

Richardson (1990) argued that comprehension learning could *not* be considered a diagnostic indicator of meaning orientation. Indeed, the two conceptions cannot be said to share the same underlying psychological mechanisms, since styles are derived from characteristics of cognitive problem-solving, while approaches are a general phenomenographic orientation. While one may be correlated with the other, the use of factor analysis to assess the degree to which the concepts 'fuse' in factor matrices may, according to Richardson, be of limited theoretical value. This is especially likely when the ASI is factor analysed in isolation, because the approach or style variables are given no other psychological constructs to load onto. Entwistle and Waterston (1988) did use factor analysis to assess the conceptual basis of the ASI alongside another instrument, *viz,* Schmeck's 'Inventory of Learning Processes' - derived from an information processing 'Levels of Processing' framework. Unfortunately, the comprehension and operation learning subscales of the ASI were omitted in the interests of making the (voluntary) task of completing the questionnaires less lengthy. The results suggested a fair degree of conceptual overlap between cognitive-based levels of processing and the phenomenographic approaches. The globetrotting and improvidence pathology subscales, - representing unchecked overuse of either holistic or serial learning styles respectively- were retained, however, and *both* loaded onto the reproducing orientation factor which also included Schmeck's surface processing subscale.

This link between learning pathologies and reproducing orientation has been noted elsewhere, (Entwistle and Ramsdem, 1983; Harper and Kember, 1989; Meyer and Parson, 1989; Richardson, 1990). Harper and Kember interpreted this finding as indicating that the undesirable learning pathologies will most often result in surface learning since the student is either unable to build up an appropriate conceptual framework, or lacks sufficient detail to justify conclusions reached. In both cases surface learning is *provoked* by the pathology, but this does not necessarily imply that the pathology and the approach share the same cause.

Murray-Harvey (1994) also studied the relationship between learning styles and learning strategy using factor analysis of two instruments, in this case Biggs' SPQ and the Productivity Environmental Preference Survey (PEPS). Again, it was noted that the two seemed to be measuring quite distinct conceptualisations of learning; however, the learning styles measured by PEPS cannot be said to share the same cognitive basis as Pask's learning styles. Rather they are concerned with individual preferences in immediate learning environment, emotionality, sociological needs and physical needs. Perhaps ironically, the model from which this inventory is derived included a fifth area concerned with global/analytical processing and impulsivity/reflectivity cognitive styles, but the PEPS inventory does not include items to measure these. Nevertheless this study illustrates the utility of combining administrations of student inventories and factor analysing the two in order to assess common concepts.

Clearly, there is a need here for the ASI to be factor analysed in conjunction with an instrument offering a broader measurement of basic psychological make-up more akin to the innermost 'personality' layer of the hypothetical model of student learning illustrated in Figure 3.1.

3.4 Contextual influences of learning

Elton and Laurillard (1979) critisised the prevalent reductionist approach to the study of student learning. They claimed that the situation is too complex to simply apply research paradigms drawn from physical science which would involve breaking down the situation into component parts and controlling the variation of single variables before reassembling the parts into the original whole. Their emphasis on 'interpretation *in* context' has been echoed by a number of researchers. Gibbs (1981) argued that student learning cannot be reduced to the study of individual components of a model - such as learning style or study technique - since they provide a conceptually isolated and thus inadequate means of understanding learning. As far as approaches to studying are concerned, Gibbs was in little doubt that the surface/deep distinction could not be defined as a fixed characteristic of the student - claiming that compelling evidence exists which suggests that students will adopt either a surface or a deep approach to learning depending on the characteristics of the *task*.

Proposed antecedents of approaches to learning other than dispositional factors are numerous. The student's motivation for study is commonly cited as a primary associate of approach to learning, with interest related to deep approach and lack of interest or perceived relevance related to surface approaches (Fransson, 1977). Consequently Entwistle and Ramsden (1983) and Biggs (1978) included items measuring different forms of motivation into their respective inventories of student learning, and Harper and Kember (1989) were able to verify that deep approaches - as measured by the ASI - were closely linked with intrinsic motivation.

Laurillard (1978) investigated the problem solving behaviour of a group of 31 science and engineering students. Each student was interviewed about a coursework problem and each was required to teach back the problem situation to the interviewer, - in a similar way to Pask (1976a). Each student was also asked to relate in detail *how* they had tackled the problem and *why* they chose to do what they did relative to aspects of the learning context such as relevant lectures, tutorials, assessments, etc. These interviews were analysed and interpreted in terms of deep and surface approaches. Laurillard demonstrated that the students' perception of a task was instrumental in setting his or her approach to it. This suggests that since a student's perception of a task is dependent on its form and content, how it related to other tasks, what experience the student has of that type of task and how the student perceives the task will be assessed, it follows that approach cannot be a stable trait of the learner. Students might therefore adopt a surface approach in some learning tasks while pursuing a deep approach in others, dependent on perception of task and thus intention either to understand or to memorize.

Laurillard has also attempted to establish that learning *styles* may be contextually determined too, and demonstrated that students could move from comprehension to operation learning

learning styles in order to adapt to perceived task requirements (Laurillard, 1984). Some tasks, she noted, seemed to necessitate operation learning while others required comprehension learning.

Ramsden (1984) outlined the effects of task assessment on approaches to learning, thereby illustrating that the concept of approaches to learning might not be placed solely 'within the student'. (*cf* Marton and Säljö, 1976(b), Entwistle and Ramsden, 1983). In real terms, overloaded syllabuses and inappropriate modes of assessment may be instrumental in promoting surface approaches, though not every student responds identically to any specific assessment procedure.

Perhaps the most convincing evidence to support the theory that learning approaches are contextually adaptive comes from Ramsden and Entwistle (1981) - the Lancaster study- which found that academic departments which were perceived to have a good standard of teaching, study support and freedom of both study content and method were more likely to have students reporting a meaning orientation, while departments perceived to impose a heavy workload and little choice in study content and method tended to be associated with reproducing orientation students. (These findings were independent of subject area).

It follows then, that teachers' approaches to teaching will impact on their their students' approaches to learning. Ramsden (1984) reiterated that factors such as degree of choice of subject matter, freedom to learn both in terms of subject area and method of study, and in addition, teaching structure, and commitment and enthusiasm on the part of the teacher are all influential. These factors might inform certain attitudes toward study thereby shaping a major component of the student's motivation for learning. Ramsden qualifies this theory by warning that the relationship between effective learning and structure of learning is not a simple one, and that certain students - particularly those of a more anxious disposition - may find the greater responsibility and the lack of straightforward, clear goals associated with freedom in learning problematic. Though Ramsden doesn't explicitly comment on this, it is evident that personality may well have a mediating influence.

However, Meyer and Parsons (1989) factor analysed the ASI alongside Entwistle and Ramsden's (1983) Course Perceptions Questionnaire, testing the hypothesis that certain perceptions of a range of contextual features of courses would determine and thus merge with certain approaches. They observed an association between surface learning and the 'workload' scale of the CPQ - which also measures perceptions of teaching methods, goals, vocational relevance, standard of teaching, freedom in learning, openness and social climate - but could not support Entwistle and Ramsden's contention that either approaches - or styles - were influenced by perceptions of specific learning contexts.

The importance of subject area, gender and maturity is implicit within the context of learning, with pervasive contrasts noted between students approaches to learning and learning styles as a function of these variables. (Chapter four investigates the effects of these in detail).

3.51 Methodological issues - Use of factor analysis

Several reasons exist as to why factor analysis was considered the most appropriate means of analysing the data yielded by the OPQ and ASI instruments.

Firstly, factor analysis facilitates the investigation of separate patterns of interrelationships within a matrix of intricately related variables. The existence, or otherwise, of relationships between aspects of personality and learning can thus be established. Secondly, it makes possible the description of variance within a mass of data. Data representing thirty-one personality and sixteen learning variables on nearly 400 subjects would otherwise be unwieldy to describe or manipulate. By factoring the variable matrix into its basic dimensions, the management, analysis and understanding of such data is made much easier. The dimensions then constitute a concise embodiment of the data variation in the original matrix and may be used in place of the 31 plus 16 variables. Discussion and comparison of a more parsimonious number of dimensions is more straightforward. Thirdly, the basic structure of any domain can be accurately assessed and delineated.

Factor analysis can be used to develop an empirical typology of personality and learning within which different groups of students might be assessed. Factor analysis can also assign weight to each component of any dimension derived from the variation that the component has in common with the factor thereby allowing the relative importance of variables within the dimension to be assessed.

Consequently factor analysis enables the testing of specific hypothesis relating to patterns of learning and personality, for example, whether the internal structure of the ASI is consistent with its author's claims, (*cf.* Meyers and Parson, 1984; Harper and Kember, 1989; Richardson, 1990, 1992), whether the OPQ can be explained in terms of a more parsimonious set of personality variables, (*cf.* Matthews, Stanton, Graham and Brimelow, 1990), and whether the merging of the two scales results in any common ground, (*cf.* Murray-Harvey, 1994; Wong and Czikszermihilyi, 1991; Enwistle and Waterstone, 1988).

In this sense, factor analysis is used as both an inductive and a deductive tool. It is inductive since it is being used as an exploratory device to uncover basic concepts and underlying structure, (Rummell, 1970, p22). It is also deductive since hypotheses that certain patterns do exist can be set up.

By factor analysing the data, a phenomenological map of the personality/learning terrain can be established. Empirical concepts and sources of variation can be systematically delineated. The concepts can then operate as categories for describing a substantive domain and serve as a framework for further research. Since factor analysis yields scores for each individual on each dimension, the subsequent analysis of variation as a function of subject discipline, gender and age is made more meaningful.

Since the student participants sat the tests three times over three years, it is possible to compare the factor solutions reached in each of these trials, thereby satisfying Rummel's second criterion for accurate assessment of number of factors - namely that the analysis of alternative yet comparable empirical findings should yield the same number.

3.52 Justification for the use of factor analysis in assessing underlying structure

Factor analysis is a general scientific method for analysing data (Rummell, 1970). In order to assess notions of patterned relationship, a correlation matrix composed of all independent variables is set up. All column vectors of a matrix form a 'vector space', with the position of each dependent on its values for each row. Each row thus forms a co-ordinate axis for this space and on each axis a vector may be plotted. Statistically interdependent factors will 'cluster' together in this space. Factor analysis determines the minimum number of independent co-ordinate axes necessary to plot the variation in vectors in the space, i.e., it calculates the independent sources of data variation and thereby assesses whether the same amount of variation in the data might be represented by fewer dimensions than the original number of columns.

The model of factor analysis used here, 'principal components analysis', extracts each dimension or *factor* by assigning variance associated with the original set of variables to the same number of orthogonal dimensions. It then determines the number of common factors to be extracted by selecting those with an eigenvalue (the characteristic root of the square matrix and measure of the explained variance per dimension) of over one (Kaiser, 1960). Greater eigenvalues indicate dimensions that are of greater importance in the overall solution. Richardson (1990) criticised this method of factor extraction, claiming that it lacks accuracy and tends to overestimate the number of factors, but others have supported it, with many studies utilising factor analysis employing this criterion (Clarke, 1986; Entwistle *et al*, 1979; Ramsden and Entwistle, 1981; Watkins, 1982). In addition, the more sophisticated methods of factor extraction recommended by Richardson - such as Scree Testing, Overfactoring and the use of Revelle's Very Simple Structure - were unavailable in the statistical package selected (Noruŝis, 1990). Rummell (1970) claimed however, that there is no one method that best establishes the correct number of factors, and that the only way to arrive at a conclusive solution is to re-analyse the data using alternative means of factor extraction, and repeat the analysis using alternative yet comparable empirical findings.

3.53 Factor rotation

The intial factor solution offered by Principal Components Analysis constitutes a set of linearly dependent factors that account for the variance in the data independently. Such initial solutions are usually of little substantive interest, since they represent only a basic definition of the minimum dimensionality of the data. Most variables in initial factor solutions, tend to load onto the first factor extracted, and many variables load onto more than one factor, often making the factors themselves indistinguishable and meaningless. By rotating the factor matrix axes however, a solution can be reached where each factor is maximally collinear with a distinct cluster of vectors. The factors thus represent separate groups of highly intercorrelated variables, rather than just groups maximising total variance. This serves to make the underlying model of reality as simple and parsimonious as possible. It also makes the factor results as generalisable as possible (Rummel, 1970), by ensuring that they are invariant, thereby allowing comparison of factor results from different studies, or in this case successive administration of the personality and learning tests.

The choice of method of factor rotation is a contentious issue. Orthoganal rotation - in which the factor vectors are held at right angles to each other - yields factors which are uncorrelated with each other, while oblique rotation - where the vector axes rotate independently - yields factors which may correlate. Biggs (1970, 1978), Harper and Kember (1989), Murray-Harvey (1994) and Wong and Csikszentmihalyi (1991) used Varimax orthogonal rotations to arrive at their factor solutions, while Watkins (1982), Entwistle and Ramsden (1983), Meyer and Parsons (1989) and Richardson (1992) used oblique rotations to arrive at theirs. Richardson (1992) claimed that oblique rotation is more appropriate because the factors are derived from overlapping sets of psychological processes which might well correlate with one another. However, othogonal rotation has been promoted elsewhere for its 'simplicity, mathematical elegance in result, conceptual clarity and amenability to subsequent manipulation and analyses' (Rummel, 1970, p388). These were considered to be strong reasons for choosing an othogonal rotation, since the study here was principally concerned with establishing the conceptual structure underlying the relationship between personality and specific aspects of learning, and thus required a valid *and* conceptually workable final solution. In addition, it was necessary for this solution to yield appropriate data for each participant which could be analysed in such a manner that would successfully identify individual differences in student groups, longitudinal patterns in successive years of study and correlational patterns with indicators of educational success or failure. Biggs (1970, 1978), Wong and Czikszermihilyi (1991) and Murray-Harvey (1994) have each used orthogonal rotations in studies where two instruments have been used to assess aspects of learning and cognitive style respectively, and which have consequently required factor analytic solutions in which the conceptual structure is made as clear as possible. In addition, Biggs (1970) chose orthogonal rotation as a prelude to calculating factor scores for each student to assess differences in faculty patterns in study behaviour. In this study, factor scores were calculated in a similar way for each student on each factor dimension yielded by the othogonal rotation of the intial solution. These scores formed the basis of subsequent analysis of variance and regression analyses (see chapters four and five).

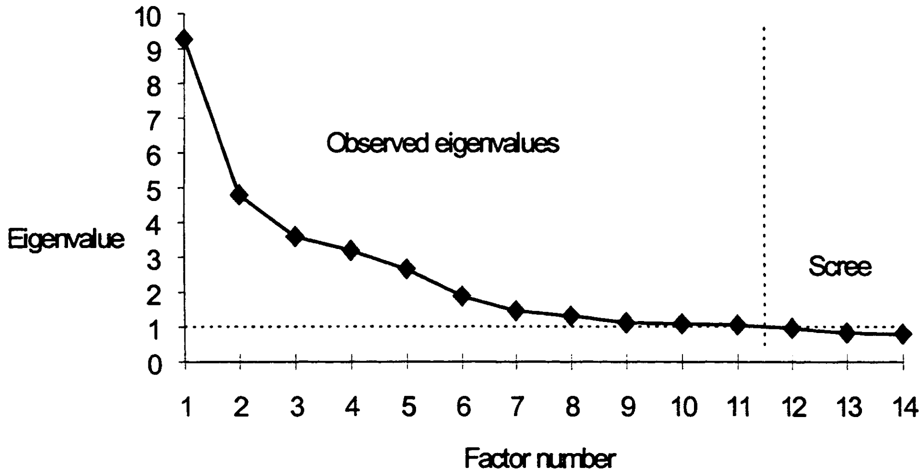
3.6 Hypotheses

The primary hypothesis of this study concerned the existence of a cognitive and possibly dispositional basis of student approaches to learning. Data yielded by administration of Entwistle and Ramsden's (1983) Approaches to Studying Inventory and Saville and Holdsworths OPQ Concept 5.2 to a large sample of undergraduate students was factor analysed in an appropriate manner to assess interrelationships between the various learning and personality characteristics. The hypotheses were both *inductive*, in the sense that factor analysis was used as an exploratory tool, and *deductive*, since they tested models of student learning, such as Curry's (1983) model, which would suggest that the relationship between approaches to learning and personality would be much less evident that the relationship between personality and learning styles. It was also hypothesized that learning styles mediate between personality and approach, with learning style subscales loading onto either personality or approach factor extractions. Furthermore, it was hypothesized that the thirty-one scales of the OPQ will factor analyse into a more parsimonious solution akin to the five-factor model (Costa and Macrae, 1988). The factor solution calculated was compared with other models of personality and learning to give a subjective indication of its conceptual validity.

3.7 Methodology and Results

A score for each scale of Saville and Holdsworth's OPQ Concept 5.2 and Entwistle and Ramsden's Lancaster Approaches to Studying Inventory was calculated for each participant by dividing the total of their scores over the number of years he or she took part in the project. Thus scores on forty-seven scales for 378 candidates were submitted to a principal components analysis followed by a varimax rotation to maximise convergent and discriminant validity. The Statistical Package for Social Sciences (SPSS) for Windows version 6.0 programme converged upon a satisfactory solution from the principal components analysis after 22 iterations, extracting eleven factors (in which the eigenvalues exceeded unity), accounting for 66.6% of the total variance. Figure 3.2 illustrates the plot of observed eigenvalues against factor number, and indicates that eleven factors should be extracted.

Fig. 3.2 Observed eigenvalues and first scree as a function of number of factors



In addition, the data were analysed using a selection of methods of factor extraction, in accordance with Rummel's (1960) assertion that alternative means of factor extraction should be sought and implemented in order for the correct number of factors to be conclusively established. Here, 'Unweighted Least Squares', 'Generalized Least Squares', 'Maximum Likelihood', 'Principal Axis Factoring', 'Alpha Factoring' and 'Image Factoring', were used to validate the factor solution arrived at by Principal Components Analysis. Each extracted eleven factors.

A trial oblique rotation (oblimin method) *was* conducted on the initial solution and a similar set of factors was yielded, however SPSS was unable to reach a convergent solution within an acceptable number of iterations, suggesting that the orthogonal solution was more appropriate. In addition, the orthogonal solution fulfilled the criteria of substantive interest and meaningful parsimony.

In order to satisfy Rummel's second criterion for accurate assessment of number of factors - the analysis of alternative yet comparable empirical findings - the factor solutions reached in each of the three annual trials were compared. These three factor solutions yielded the same number of factors - see chapter five.

Table 3.1 shows the rotated factor pattern matrix of the factor analysis for the total sample of students. The strength of the relationship between the factors and the sixteen ASI and thirty-one OPQ scales is indicated by the size of the coefficients or 'loadings'.

The first factor extracted, accounting for 19.7% of the total variance was composed of the variables 'worrying' (-), 'relaxed', 'tough minded', 'fear of failure' (-), 'optimistic', 'social confidence' and 'decisive'. Clearly this fits in with most conceptions of neuroticism, (albeit in a negative form), which relate to aspects of anxiety, emotionality, adjustment and self-esteem (Macrae and Costa, 1985); and tend to be reflected in self-reports of moodiness, insecurity, fearfulness, depression, oversensitivity, distractibility and irritability. Low scorers might tend to report themselves as calm, unflappable and resilient, though they may also be sluggish and undermotivated, (Brand 1984). Matthews et al (1990) report a similar factor extraction from their factor analysis of SHL's OPQ and in general this is the dimension of personality about which there is the least disagreement. The inclusion of the Approaches to Studying scale 'fear of failure' within this factor, suggests that its origins lie in dispositional negative affect, rather than in contextual or environmental features.

The second, eighth and tenth factors all include elements of extraversion. Macrae and Costa (1987) comment that different aspects of extraversion - including sociability, cheerfulness, activity level, assertiveness and sensation seeking - tend to co-vary with one another. Similarly, Eysenck and Eysenck (1969) made a distinction between sociability and impulsiveness, while Hogan (1983) sought to split the extraversion dimension of the 'five-factor' model into sociability and assertiveness components. The results here support such a multi-dimensional conception of extraversion.

Table 3.1 Eleven-factor varimax rotated principal component analysis solution of mean scores on the Approaches to Studying Inventory and OPQ Concept 5.2 scales, (for the entire sample, n=378)

Factor	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Eigenvalue	9.28	4.80	3.58	3.18	2.64	1.87	1.45	1.30	1.11	1.08	1.04
% of variance explained	19.7	10.2	7.6	6.8	5.6	4.0	3.1	2.8	2.4	2.3	2.2
Worrying	-0.88										
Relaxed	0.84										
Tough minded	0.81										
Fear of failure	-0.68										
Optimistic	0.60										
Social confidence	0.57	0.51						-0.40			
Decisive	0.55										
Persuasive		0.68									
Controlling		0.65									
Critical		0.64									
Outgoing		0.63						-0.43			
Independent		0.57									
Surface approach			0.73								
Improvidence			0.66								
Globetrotting			0.61								
Extrinsic motivation			0.59								
Negative attitudes to study			0.57		-0.45						
Syllabus boundness			0.55								
Conscientious				0.81							
Disorganised study methods				-0.75							
Detail conscious				0.72							
Forward planning				0.68							
Intrinsic motivation					0.65						
Relating ideas					0.59						
Strategic approach					0.57						
Use of evidence					0.54				0.49		
Deep approach					0.52						
Competitive					0.44	0.78					
Achievement motivation						0.68					
Caring						-0.67					
Achieving						0.56					
Democratic						-0.55					
Affiliative						-0.42		-0.40		0.41	
Comprehension learning							0.74				
Innovative							0.62				
Conceptual			-0.45				0.54				
Operation learning			0.40				-0.43				0.41
Behavioural							0.40				
Modest								0.74			
Emotional control								0.63			
Social desirability response								0.49			
Data rational									0.77		
Artistic							0.46		-0.46		
Active										0.74	
Practical									0.40	0.59	
Change oriented										0.47	-0.43
Traditional											0.80

Loadings sorted by size, and those between ± 0.40 omitted. Factors explain 66.6% of variance

Factor two, accounting for 10.2% of the total variance, was made up of 'persuasive', 'controlling', 'critical', 'outgoing', 'independent' and 'socially confident'. These principal variable components are similar to those found in Mathew's et al's (1990) 'extraversion' extraction, which has in turn been associated with Brand's (1984) conception of 'will'. However, some of the variables relating to sociability (e.g. 'outgoing', 'affiliative') are absent from the factor, suggesting that this dimension pertains more to assertiveness than sociability.

Factor eight, accounting for 2.8% of the total variance, was composed of 'modest', 'emotional control', 'social desirability' and 'affiliative'. These variables feature across different factors in Mathews et al's (1990) study, yet converge in one here. This factor seems to be concerned with aspects of impression management and concern over other's perceptions of self. As such it has much in common with Tellegen's (1987) extraversion factor labelled 'positive emotionality', which suggests a complimentary relationship between extraversion and neuroticism. In addition it shares features with Buss's (1980) 'self-consciousness' scale.

Factor ten, accounting for 2.3% of total variance, comprised 'active', 'practical', 'change oriented' and 'affiliative', and might therefore be connected with an active/passive orientation towards sensation seeking. Zuckerman (1983) has suggested that sensation seeking may be a valid alternative conception of the extraversion dimension, later defining it as 'the need for varied, complex or novel sensations and experiences, and the willingness to take physical and social risks for the sake of actual experience'. (Zuckerman, 1990).

Factor four, accounting for 6.8% of the total variance was made up of 'conscientiousness', 'disorganised study methods' (-), 'detail conscious' and 'forward planning'. This same personality dimension was extracted by Mathews et al (1990), and relates to the domain of conscientiousness and conscience proposed by Macrae and Costa, (1987), Costa and Macrae (1988) and Brand (1984). Here a link is noted between study methods and personality, which is unsurprising since Macrae and Costa describe individuals scoring high on conscientiousness scales as 'well-organized, habitually careful and capable of self-discipline'. This concept of self-control versus impulsivity appears to be directly translated into the student's study behaviour.

Factor six, accounting for 4.0% of the total variance, featured 'competitive', 'achievement motivation', 'caring' (-), 'achieving', 'democratic' (-), and 'affiliative' (-). Again the main components (excepting 'achievement motivation' and 'affiliative'), were present within one of the factors extracted by Mathews et al (1990). This factor seems conceptually similar to the 'agreeableness versus antagonistic' factor of the 'Five-factor' model, (Costa and Macrae, 1988). Those tending towards the antagonistic pole of this dimension have been described by Macrae and Costa as mistrustful, skeptical, callous, unsympathetic, unco-operative, stubborn and rude. They even suggest links with Eysenck and Eysenck's (1975) psychoticism dimension. The root of this tendency seems to be a drive for mastery and this is reflected in the inclusion of the ASI scale 'achievement motivation'. The OPQ tends to focus on the more positive, business-oriented aspects of this dimension, (e.g. competitive, achieving), rather than label the component traits with negatively-laden terms; hence the term 'ambitiousness' may be deemed a more appropriate label to describe this factor.

Factor seven, accounting for 3.1% of the total variance, was composed of 'comprehension learning', 'innovative', 'conceptual', 'operation learning' (-), 'artistic' and 'behavioural'. Again this factor may be directly linked to one of the 'Five-factor' model dimensions, namely 'openness to experience'. Macrae and Costa (1988) claim openness is best characterized by originality, imagination, broad interests and daring, though they also report that this is a dimension of personality difficult to describe in single adjectives. With the factor extracted here it becomes possible to sharpen the definition, since it included a strong positive loading for 'comprehension learning' (holism) and a negative loading for 'operation learning' (serialism), strongly suggesting that an element of cognitive style is intrinsic to the dimension. High scorers would tend towards the lateral, exploratory and divergent rather than the narrow and convergent. In short, this may be thought of as an 'abstract orientation'.

Factor nine, which accounts for 2.4% of the total variance, was comprised of 'data rational', 'artistic' (-), 'use of evidence' and 'practical'. This factor, which resembles none of Mathews et al's extractions, seems in some ways similar to a reversed version of the openness/ abstract orientation factor, however, since the two are orthogonal, and hence uncorrelated, it must be assumed that this factor is a measure of methodical, analytical behaviour quite distinct from the cognitive, abstract orientation dimension. Instead, it focuses on orientation towards practical, concrete modes of behaviour, - including one of the ASI scales 'use of evidence'. This factor might therefore be thought as complementary to 'abstract orientation' in describing an individual's disposition toward practical matters.

Factor eleven, accounting for 2.2% of the total variance, was made up of 'traditional', 'change oriented' (-) and 'operation learning'. As with factor seven, one of Pask's learning styles is included, suggesting a cognitive slant to this dimension. Overall, the factor seems to suggest a tendency to prefer orthodoxy, traditional values and rejection of radical ways of thinking and behaving - in general, a conservative orientation.

The remaining two factors, factor three and factor five, are composed in the main of the remaining ASI scales. Factor three, accounting for 7.6% of the total variance was composed of 'surface approach', 'improvidence', 'globetrotting', 'extrinsic motivation', 'negative attitudes to study', 'syllabus-boundness', 'conceptual' (-) and 'operation learning', while factor five, accounting for 5.6% of total variance, was made up of 'intrinsic motivation', 'relating ideas', 'strategic approach', 'use of evidence', 'deep approach', 'negative attitudes to study' (-) and 'competitive'. Clearly these two factors relate to the reproducing and meaning orientations described by Entwistle and Ramsden (1983). This finding is thus consistent with other studies, e.g. Meyer and Parsons, 1985; Clarke, 1986; Watkins and Hattie, 1985; in validating the existence of reproducing and meaning orientations through factor analytic research. The existence of a third 'strategic' orientation as suggested by Ramsden (1983) was not supported.

Descriptively, these eleven factors may be named as follows; factor one- *emotional stability*, factor two - *assertiveness*, factor three - *reproducing orientation*, factor four - *conscientiousness*, factor five - *meaning orientation*, factor six - *ambitiousness*, factor seven - *abstract orientation*, factor eight - *self-consciousness*, factor nine - *concrete orientation*, factor ten - *sensation seeking* and factor eleven - *conservative orientation*.

3.8 *Discussion*

This research investigated the correspondence between phenomenographic indicators of approaches to learning, learning styles and personality, using questionnaire scales. The principal objective was to elicit a parsimonious interpretation of the psychological structure underpinning the various learning and personality constructs, thereby substantiating or refuting the existence of dispositional determinants of certain patterns of learning.

The entire battery of personality and learning subscales was submitted to factor analysis with the result that an eleven factor solution was obtained. This is subsequently assumed to represent a reasonable and valid conception of learning/personality structure.

The factor solution demonstrates that approach to learning and personality are largely unrelated. It was speculatively hypothesized that aspects of personality - particularly those elements related to thinking style measured by the OPQ - would load onto those factors representing the core elements of meaning and reproducing orientation. They did not. Identifiable meaning and reproducing factors did emerge, strongly supporting conceptual constructs associated with the existence of two major study orientations, (as observed by Watkins, 1982, 1983; Watkins and Hattie, 1985; Clarke, 1986; and Meyer, 1988). The construct validity of four universally descriptive study orientations, as proposed by Entwistle and Ramsden (1983) was not supported. Neither were their findings of a link between deep approach and introversion replicated.

The inclusion of the 'conceptual' subscale in factor 3 - reproducing orientation, - alongside surface approach, improvidence, globetrotting, extrinsic motivation, negative attitudes to study, syllabus boundness and operation learning (-) - and the 'competitive' subscale in factor 5 - meaning orientation, with intrinsic motivation, relating ideas, strategic approach, use of evidence, deep approach and negative attitudes to study (-), - suggests that elements of personality may be associated, albeit weakly, with adoption of either type of approach. However, the assertion that personality and approach are intrinsically linked cannot be validated. Since the *direct* influence of personality appears to be minimal, it may be concluded that the two study orientations are contextually dependent rather than dispositionally determined. Gibbs' (1981) contention that study orientation is not a fixed characteristic of the student is consequently supported. Elements of motivation did appear in both orientations, again supporting the *external* bias in the students' adoption of approaches to learning.

There did emerge, however, several noteable links been certain ASI subscales and the nine personality factors extracted.

Fear of failure - defined as 'a general concern with failing, but linked with exam tension, speaking in class and pressure of work' (Meyer and Watson, 1991) - was observed to load with factor 1 - emotional stability, (or 'neuroticism'), a cardinal personality trait. Disorganized study methods - 'a general disorganisation reflected in poor time management, putting off work, distraction and amassing a backlog of important work' - emerged as an implicit component of factor 4 - conscientiousness. Achievement motivation - 'a motivation to succeed, especially in competition with others' - was strongly associated with factor 6 - ambitiousness (or 'agreeableness').

The findings here thus support Biggs' (1978) claim that arousal levels are instrumental in setting up motivational factors for learning. Since fear of failure is in itself a form of motivation, it may be concluded that study behaviour *is* to some extent influenced by dispositional attributes - especially neuroticism. Fransson's (1977) observation that the student's perception of the learning situation is often a *direct* precursor of approach is supported in principle, but it must be noted that a student predisposed to neuroticism will tend to perceive course demands with greater anxiety and thus - as Entwistle and Ramsden's (1983) findings would suggest - adopt a surface approach to learning.

Fear of failure and disorganised study methods were previously assumed to be integral features of a reproducing orientation (Watkins, 1982, 1983; Watkins and Hattie, 1985; Clarke, 1986; Meyer and Parson, 1989; Meyer, 1988) and as such were considered by many to be the result of shortcomings in the educational environment rather than manifestations of deeper psychological traits. These results support Biggs' (1978) contention that attempts to help students shift from a surface approach to a deep approach to studying by way of teaching an approved set of study skills, are likely to prove fruitless. Study methods, as measured by the ASI at any rate, are influenced more by personality than study orientation, though there may of course exist indirect links between the ways in which a student organizes their study and their success or failure in reaching a workable understanding of their subject area. Similarly, fear of failure may aggravate reproducing strategies, but conceptually the two are not interdependent. Biggs' assertion that a genotypic basis for adoption of meaning or reproducing orientation may exist, is not supported.

The aspects of student learning style derived from Pask's research and measured by the ASI, - comprehension learning, operation learning, globetrotting and improvidence - did not, as concluded by Entwistle and Ramsden (1983), form an independent, integral conceptualisation of learning style. Few studies have identified learning style as such, and most conclude that learning style is, if not analogous, then at least consistently correlated with study orientation.

Here, the learning pathologies globetrotting and improvidence, both loaded onto factor 3 - reproducing orientation, in a similar manner observed by Entwistle and Waterston (1988), Harper and Kember (1989), Meyer and Parsons (1989) and Richardson (1990). It seems that regardless of the theoretical origins of the scales, the two are inextricably linked with surface approaches. Cognitive theory would suggest that in the absence of balance between overview and attention to detail, opportunities for multiple coding are limited, leaving the student bound to store information sequentially with relatively simple linkages, via rote-learning (Entwistle and Waterston, 1988).

Comprehension learning loaded alongside personality rather than approach variables in factor 7 - abstract orientation dimension, while operation learning demonstrated strong ($> \pm 0.40$) loadings on three factors; factor 11 - conservative orientation, factor 3 - reproducing orientation and factor 7 - abstract orientation. The hypothesis that learning style would load onto either personality *or* approach is supported, suggesting that the model of student learning (figure 3.1, p51) is correct in placing learning style in between personality and approach. While Biggs (1978) claimed that study strategies were a translation of personality characteristics into study relevant operations, it seems here that learning styles rather than study strategies represent study-relevant behaviours rooted in personality. As Bem (1983) claimed, cognitive styles would appear to constitute the most promising genotypic traits within any model of personality.

The link between operation learning and reproducing orientation is one not widely encountered. It might be suggested that surface strategies, such as rote learning and memorization tend to be associated with a sequential style of navigation through learning materials. Improvidence is thus difficult to avoid for the serial learner.

Operation learning's inclusion in factor 11 - conservative orientation, as noted earlier, suggests that serialism is a function of thinking styles characterized by orthodoxy and resistance to change.

Both operation and comprehension learning subscales are included factor 7 - abstract orientation - operation learning negatively, comprehension learning positively. Again the OPQ variables constituting the other factor components are drawn from the 'thinking styles' section of the inventory. That the comprehension learning subscale did *not* load onto the meaning orientation factor, (as observed other studies), implies that the inclusion of the OPQ offered a broader psychological framework which included cognitive conceptions more akin to holism than any aspect of learning found in the ASI. (NB Further analysis of the data on a year-by-year basis reveals that comprehension learning shifts its loading from a personality factor to an approach factor over time. This is investigated in detail in chapter five).

Pask (1976) claimed that the student able to use comprehension *and* operation learning styles would make the most successful learner, however the evidence here suggests that operation learning, as measured by the ASI, is not a particularly advantageous trait.

The 'Big Five' personality factors (Brand, 1984; Costa and Macrae, 1988; Macrae and Costa, 1987) can be readily identified from the factors extracted from the OPQ and ASI. The inclusion of the learning approaches instrument has enabled the model to be expanded with the extraversion and openness traits split to encompass more specific conceptions of each. The openness factor reconstituted into abstract and concrete orientations which represents an important step, since the five-factor model did not previously address conceptions of cognitive style, and many consider these to be an intrinsic part of personality disposition, (e.g. Riding and Cheema, 1991). This perhaps explains the absence of any relationship between the 'Big five' factors and the 'wholist/analytic' style dimension reported by Riding *et al* (1995).

While the 'Big five' model is conceptually the most similar to the factor solution produced, the extraction of a greater number of factors brings the solution somewhat closer to those specified by Cattell (1965) within the 16PF model, (see p29). The 16PF includes specific conceptions of extraversion and thinking style analogous to those found here. Factor 1 - emotional stability maps directly onto Cattell's 'C' source trait 'stable, ego strength/emotionality, neuroticism', and factor 2 - assertiveness is very similar to his 'E' source trait 'humble/assertive'. Factor 4 - conscientiousness most probably measures the same disposition as source trait 'G'; 'expedient/conscientiousness'. Factor 6 - ambitiousness shares features of source traits 'N' (forthright/shrewd) and 'I' (tough-minded/tender-minded). factor 8 - self-consciousness seems to relate to source trait 'Q3' (undisciplined self-conflict/controlled), while factor 10 - sensation-seeking is similar to source trait 'H' (shy/venturesome). Factor 9 - concrete orientation is similar in some respects to source trait 'M' (practical/imaginative), while both factor 7 - abstract orientation and factor 11 - conservative orientation seem to relate to source trait 'Q1' (conservative/experimenting). This final mapping seems to suggest that the abstract and conservative orientations share the same conceptual basis, or at least overlap to some extent. It is possible that the Principal Components Analysis method used to define the number of factors, overestimated the true number of factors - a flaw that Zwick and Velicer (1986), Richardson (1990) and Mathews *et al* (1990) claim that P.C.A. may be prone to.

Further evidence to support the factor structure extracted comes from comparison of the factors produced with alternative theories and concepts developed from 'top-down' learning research. Schmeck (1977), for example, proposed an information processing conception of learning which included 'deep processing' and 'elaborative processing' dimensions (see p16). Deep processing, which Schmeck described as an operation required to reach conceptual understanding, is broadly similar to factor 5 - meaning orientation - though the criticisms regarding Schmeck's neglect of situational and contextual factors still stand. Elaborative processing was described as 'personalisation' of knowledge, in which students would assess and assimilate new information in their own terms and using their own imagery. In this sense 'spread' of processing is more relevant than depth of processing, and in many ways this seems analogous to the style of processing measured by factor 7 - abstract orientation. The inclusion of the comprehension learning (holistic cognitive style), and conceptual scales suggest that this orientation involves an element of personalisation of knowledge and a tendency to strive for personal relevance when encoding ideas and concepts. Schmeck's deep learning scale overlaps conceptually with Entwistle and Ramsden's meaning orientation, and consequently must be assumed to be largely dependent on the teaching/learning context. However this does not preclude the possibility that the elaborative learning/abstact orientation conception lies 'within the student'. The 'fact retention' and 'methodical study' scales of Schmeck's ILP are broadly similar to factor 3 - reproducing orientation and factor 4 - conscientiousness respectively.

The Experiential Learning Model proposed by Kolb (1976, 1984), (see p21), was based on the premise that styles of learning were shaped by dispositional preferences for active experience/reflectivity and abstract/concrete modes of cognition - see figure 1.03, p22. In light of the factor dimensions here, the validity of Kolb's model is brought into question. Firstly, the active experience/ reflective observation dimension is assumed to be a bipolar scale, yet the descriptions of each pole of the scale are recognisably similar to two of the factor dimensions here, which are orthogonal and hence unrelated. Active experimentation is described by Kolb as an orientation characterised by 'actively influencing people and changing situations...getting things accomplished...willing to take some risk in order to achieve their objectives...value having an influence on the environment around them' (Kolb, 1983). This would suggest that preference for active experience would be found in individuals scoring high on both factor 2 -assertiveness and factor 10 - sensation seeking dimensions - both related to social extraversion. Indeed, Furnham (1992) noted strong correlations between extraversion, as measured by the EPQ (Eysenck and Eysenck, 1975) and the learning style types 'Converger' and 'Accommodator', both derived to describe individuals prefering active experimentation rather than reflective observation.

The reflective observation pole - assumed to be conceptually the opposite of active experimentation - is described as 'focusing on the meaning of ideas and situations...emphasizing understanding...a concern with what is true or how things happen...People with a reflection orientation enjoy intuiting the meaning of situations and ideas and are good at seeing their implications' (Kolb, 1983). The description is quite similar to that proposed by Marton and Saljo's (1976) deep learning and Entwisitle and Ramsden's meaning orientation. Newstead (1992) correlated scores of Kolb's LSI with the subscale scores on the ASI, and found a weak correlation between meaning orientation and the active experimentation - reflective observation dimension, though he qualified this conclusion with the possibility that the correlation may be spurious.

The concrete experience/abstract conceptualisation dimension proves more difficult to align with the factors extracted here. This is mainly because Kolb's definitions of concrete and abstract appear in many ways to be diametrically opposed to the definitions used here. While factor 7 - abstract orientation, suggests a holistic, conceptual and people/arts oriented dimension, the abstract conceptualisation defined by Kolb 'focuses on use of logic, ideas and concepts, systematic planning, manipulation of abstract symbols and quantitative analysis...People with this orientation value precision, the rigor and discipline of analysing ideas and the aesthetic qualities of a neat conceptual system.' This definition seems to suggest a more convergent, rational orientation conceptually much closer to factor 9 - concrete orientation, which includes traits relating to data rationality and use of evidence. This dimension seems to include a preference for the *objective* application of ideas indicated by the inclusion of the OPQ trait 'practical'.

Kolb's 'concrete experience' dimension is described as 'focusing on being involved in experiences and dealing with immediate concerns in a personal way...an 'artistic', sensitive approach as opposed to the systematic, scientific approach to problems...has an open-minded approach to life' (Kolb, 1983). Here the 'concrete' aspect of style refers to relationships with people and disposition toward social situations, rather than any cognitive preference, though it is reminiscent of factor 7 - abstract orientation.

This disparity of definition seems to stem from the Kolb model's basis in Jungian theories of 'sensing and thinking' vs 'feeling and intuition'. Miller (1991) criticized this theory for confusing conative with cognitive elements within the abstract conceptualisation and concrete experience dimensions. The factors extracted here are composed of Pask's learning styles and traits from the OPQ's 'thinking styles' section. They do not involve conative/motivational elements of personality and seem conceptually similar to purely cognitive dimensions such as those summarised by Riding and Cheema (1991).

3.9 Conclusions

The present model facilitates the recognition of a broad range of student types - individuals divergent in cognitive style and personality - while acknowledging the effects of context on learning. Its structure suggests that approaches to learning, as described in the phenomenographic model, are not conceptually based on any one fundamental dimension of personality. Learning styles, developed from cognitive theory, can however be linked to specific personality characteristics, suggesting that these particular aspects of student learning are dispositional and thus likely to determine study behaviour impervious to changes in educational environment and context. Conversely, approaches to learning are concluded to be subject mainly to context and task characteristics, while being influenced to a limited extent by tendency to use serial learning style. A broad overview of the most relevant personality and learning variables has been established, and within it, other learning theories

Table 3.2 Correspondences between the eleven factor model and other personality/learning models

Factor	Eysenck (1972) Eysenck Personality Inventory	Cattell (1965) 16 Personality Factor	Brand (1984)	Costa and Macrae (1985) Five-factor model	Schmeck (1977) Inventory of Learning Processes	Kolb (1984) Learning Styles Inventory
1. Emotional Stability	Neuroticism	Ego strength	Neuroticism	Neuroticism	-	-
2. Assertiveness	Extraversion	Dominance/submissiveness	Will	Extraversion	-	Active experimentation
3. Reproducing Orientation	-	-	-	-	Fact retention	-
4. Conscientiousness	-	High/low Superego strength	Conscience	Conscientiousness	Methodical study	-
5. Meaning Orientation	-	-	-	-	Deep processing	Reflective observation
6. Ambitiousness	Psychoticism	Artlessness/shrewdness Tough/tender-mindedness	Affection (-)	Agreeableness(-)	-	-
7. Abstract Orientation	-	Radicalism/conservatism	-	Openness	Elaborative processing	Concrete experience
8. Self-consciousness	Extraversion(-)	Self-concept control	-	Extraversion(-)	-	-
9. Concrete Orientation	-	Practical/imaginative	-	Openness	-	Abstract conceptualisation
10. Sensation seeking	Extraversion	Shy/Venturesome	Energy	Extraversion	-	Active experimentation
11. Conservative Orientation	-	Radicalism/conservatism	-	-	-	-

have been integrated with relative ease, suggesting that the conceptual validity of the model is relatively robust. Table 3.2 summarises several conceptualisations of personality and learning within the eleven-factor model proposed here.

The eleven-factor model forms the framework for the empirical investigations into student learning comprising the rest of this thesis.

CHAPTER 4 - SUBJECT DISCIPLINE, GENDER AND MATURITY DIFFERENCES IN APPROACHES TO LEARNING , COGNITIVE STYLE AND PERSONALITY

4.1 Overview

This chapter seeks to investigate the existence of individual differences in those learning and personality characteristics described in the introduction - in addition to those underlying factor variables extracted and presented in the previous chapter - with a view to assessing the findings documented by previous research.

4.21 Subject discipline differences in approaches to learning, cognitive style and personality

Differences have long been observed in the learning orientations and personality characteristics of students attracted to different fields of study. The earliest work of this type was undertaken by Hudson (1966) who argued that scientists are naturally convergent thinkers and arts students are naturally divergent thinkers. Field and Poole (1970) noted - using a sample of Australian undergraduates - that the relationship between choice of faculty and intellectual style - as measured by Hudson's Uses of Objects test - emerged in accord with Hudson's theory.

Later research tended to focus on the assessment of differences in personality of arts and science students. Entwistle and Ramsden (1983) for example, described arts departments as attractive to 'more nonconformist, radical, 'person-oriented', neurotic, flexible, individualistic and divergent students', while science disciplines attract 'stable, 'thing-oriented', convergent students', who in addition, are more likely to be vocationally oriented. In terms of learning orientation this arts/science divide is reflected in the comprehension learning/operation learning dichotomy. Ramsden and Entwistle (1981) observed that comprehension learning was more common in arts and social sciences disciplines than in sciences, with the reverse being true for operation learning. Pask (1976b) claimed that the scope for *personal* interpretation of knowledge offered by arts and social science disciplines is more likely to attract comprehension learners - those students that prefer 'holist' strategies - and conversely that science departments, in which knowledge 'is hierarchically structured and related to accepted paradigms', will draw operation learners - students that prefer serialist strategies.

Once on their course, arts and science students will often find that their departments tend to encourage and reward these respective learning orientations through the teaching and assessment methods utilized. Lecturers in arts and social science departments are often considered to be more likely to employ more flexible, radical methods, while lecturers in the sciences prefer more rigid, structured methods. (Marton, Hounsell and Entwistle, 1984). Investigating this area in more detail, Brown, Bakhtar and Youngman (1984) reported that lecturers in the humanities and social sciences were less likely to openly specify the objectives of the course to students than sciences lecturers.

Biggs (1970,1978) claimed that study *processes* would vary according to the nature of the subject being studied. He supported the belief that arts material tends to be more loosely structured and open to individual interpretation than science. By analyzing the general nature of the tasks facing science and arts students, it became apparent that different study strategies were appropriate to each and correlations could be found between use of these strategies and certain personality characteristics, including extreme response set, dogmatism, neuroticism, extraversion and divergence. The results of this administration of tests of these characteristics to a group of first year students suggest that certain personality variables influence the use of specific study strategies depending on the nature of the task at hand. The study found significant differences in tolerance ambiguity - arts higher than science - intrinsic motivation, - science students higher than arts - and dogmatism - science students more dogmatic. 'Task structure' differences between arts and science curricula were held to be at the root of these findings.

Brown and Dubois (1964) used the Minnestota Multiphasic Personality Inventory (MMPI) to compare science and humanities students with engineering students. They found that those engineering students performing well academically tended to be more hard-working, energetic and conformist, while high achievers in science and humanities were more flexible, aesthetic and relaxed. This too suggests that such differences are grounded in the different natures of the curricula.

Some studies have looked beyond the traditional arts/science distinction. Horn, Turner and Davis (1975) used the Maudsley Personality Inventory to investigate personality differences in a large cohort of American social science and engineering undergraduates and school seniors intending to major in one of these two disciplines. They noted that social science majors scored significantly higher than the engineers on the neuroticism scale. This study sought to determine whether the difference was due to exposure to differing educational curricula or whether it was due to different personality types choosing different subject disciplines. Those school seniors indicating a preference for social science scored significantly higher on the neuroticism scale than those wishing to major in engineering. This study supports the commonly held perception that social science and engineering attract quite different types of people.

A more recent study (Kline and Lapham, 1992) used the Professional Personality Questionnaire to investigate differences in the 'big five' personality dimensions of a large sample of university undergraduates - sorted into five discipline categories; 'arts', 'science', 'social science', 'engineering' and 'mixed'. Unlike Horn, Turner and Davis, they found no significant differences in scores of neuroticism in any one category, though they did report that scientists and engineers scored more highly on 'conscientiousness', 'tough-mindedness', (measuring negative agreeableness), and 'conventionality', (measuring negative openness). They suggest that these findings might facilitate the selection and guidance of students, presumably with a view to steering high scorers on these three dimensions to science and engineering subjects and vocations, and low scorers towards arts and mixed subjects and vocations.

Biggs (1978) raised the important point that science subjects are usually quite familiar to students entering university due to their having been compulsory for school pupils for quite some time, whereas many arts subjects not included in the school curriculum will be completely or at least relatively new. In addition, the structure of arts material will seem much less ordered and structured. An earlier study, Biggs (1970a), noted that the first year performance of science students could be predicted using indicators of prior knowledge, whereas arts students' performances were influenced more by the specific learning strategy applied by the individual. For example, one arts student might rely solely on simple assimilation of as much information as possible without recourse to complex interpretation, while another arts student will attempt to generate structures to organize the content presented and look to other sources to contextualize and broaden the information available. Science students are likely to use less diverse learning strategies, instead building upon the knowledge and knowledge structures of which they are already familiar.

This theory is not, however, supported by Goldman and Warren (1973), who failed to find any variance in strategy used by students of different disciplines. Goldman and Warren noted that students' academic interests could be described as either 'pure' or 'applied', but found that the learning and studying orientations and resultant academic performance of those undertaking different subjects did not appear to vary significantly.

Biggs (1976) attempted to apply Cronbach's (1967) concept of 'aptitude-treatment interaction' to the question of discipline differences in student learning. He reasoned that there may exist a demonstrable interactive relationship between 'aptitude' - defined by Cronbach as those 'stable' personal characteristics governing, or at least heavily influencing, performance - and 'treatment' - methods of teaching and/or characteristics of the learning environment. Biggs looked at discipline of study as the 'treatment' variable, assuming that different faculties employ different styles of teaching - as suggested by Marton, Hounsell and Entwistle, above - and administered his Study Behaviour Questionnaire (SBQ) to both arts and science students. The study demonstrated relatively few interactions of faculty with study behaviours in terms of academic success, and those found were quite weak; for example, a high score on the 'internality' scale - 'seeing truth as coming from within and not from an external authority'- was found to be marginally advantageous to arts students but not science students. The findings did not, on the whole, support Cronbach's model.

Watkins and Hattie (1981) administered Biggs' SBQ to a large sample of undergraduates of diverse discipline. They reported arts students scoring higher on 'motivation', 'internalising', 'meaning' and 'openness' scales, with science students scoring highly on the 'pragmatism' and 'rote-learning' scales. Rural science students emerged as more worried and dependent, but tended to exhibit more organised study skills. Economics students were more pragmatic and test-anxious, but like the rural science sample, they emerged as quite dependent. They noted that arts and science students could be discriminated by assessing scores on the rote learning, pragmatism, neuroticism and study skills scales, with science students scoring more highly on each. This suggests that they are in fact more predisposed to adopt reproducing strategies or surface approaches to learning. In terms of Biggs' motive/strategy dimensions, science students are thus more likely to have undertaken further study as a means of obtaining a better job or some other extrinsic motive, and will therefore concentrate on avoiding failure while applying least amount of effort to meet requirements. Arts students, who scored higher on the internalising strategy dimension, will, conversely, have an intrinsic interest in their subject and will attempt to attain real understanding of concepts and ideas. The researchers also administered the Schmeck *et al* (1977) Inventory of Learning Processes, - an instrument developed from information processing theory - to the same sample. Arts students appeared to use deep-level processing more often than science students, who score lower on both the 'synthesis-analysis' scale - which tests tendency to opt for meaningful rather than superficial information processing - and the 'elaborative processing' scale - which tests tendency to use elaborative rather than verbatim processing strategies.

In a later study (Watkins, 1982), the Lancaster Approaches to Studying Inventory was administered to 540 first year students. Again, arts students emerged as more likely to use a deep-approach than either science or economics students, though they stress that the main factor influencing approach to learning was the individual students' interest in the subject.

A recent study Hayes and Richardson (1995) found that students on science courses scored more highly on a reproducing orientation factor scale derived from the Approaches to Studying Inventory, than those taking arts courses. However, unlike Watkins, they found no overall differences between arts and science students on a meaning orientation derived scale. They proposed that this is because science courses require the student to focus on the superficial properties of the learning material and thereby engender negative forms of motivation. This doesn't however limit their capacity to engage with the material more deeply.

In summary, research into subject discipline differences in student characteristics does generally seem to indicate a trend in which reproducing strategies are favoured by science students for whom extraction of meaning for their studies appears to be less important than for arts or social science students - though this finding is not universal. In terms of personality differences, the previous research offers less consistent trends - perhaps because a variety of diverse instruments are used which test conceptually different aspects of personality. Arguably the most enduring difference documented is that of cognitive style between arts and science students and their respective preferences for holist and serialist paths of navigating their learning materials. Few studies however have attempted to test these differences within a conceptual framework including conceptions of personality and approaches to learning.

4.22 Gender differences in approaches to learning, cogntive style and personality

Wankowski (1973) considered the relative attributes, attitudes and temperaments of males and females to be so fundamentally dissimilar in the context of education, that he implored researchers in the area to analyse males and females of any sample population separately as a means of explaining many of the emergent trends.

Richardson and King (1991) considered the lack of research into gender differences in learning to be paradoxical given the phenomenographers' claims to be predominantly concerned with individual differences. They suggest that the consequences of this shortfall are quite far reaching. Methodological categories developed from the study of male students may be inappropriate for the study of female students, and on a theoretical level many psychological processes and social trends operate differentially as a function of gender. Consequently, policy making lead by educational research may result in interventions or proposals that affect males and females in different ways.

Several studies of sex differences in academic performance have analysed males and females grades and degree classes, and gone on to conclude that females' performance is more predictable than males, in terms of the relationship between school grades and college/university attainment (Scannell, 1960; Abelson, 1952)

Clarke (1988) demonstrated a clear divergence in the respective academic performances of males and females in terms of degree results. Charting these results from 1976 to 1979, he found that male students in general achieved higher degree classes - although they also tended to get more of the weakest degrees. Clarke attributed this apparent underachievement of female students to social pressures and sex stereotyping, and even considered that assessment by examinations may be biased in males' favour.

The variance in performance of the genders is however more apparent in certain subject disciplines. Kornbrot (1987), in a similar study to Clarke's, found that women in subjects often considered stereotypically male actually do *better* than their male counterparts. Weinreich-Haste (1979) and Archer and Freedman (1989) have both demonstrated clear gender stereotypic perceptions of certain academic disciplines. In both of these studies, undergraduate students perceived engineering, physics, chemistry and maths to be 'masculine', while English, biology and psychology were rated as 'feminine'.

Entwistle and Wilson's Aberdeen study (1977), found that indicators of academic success such as school examination grades were more predictive of males in science subjects and females in arts subjects, suggesting that students undertaking subjects concordant with stereotypes of their gender - i.e. arts for females, science for males - were more likely to perform consistently throughout their academic career. Those embarking on degrees in subjects considered contrary to their perceptions of their gender seem to be less consistent in their performance and might thus potentially achieve markedly higher or lower degree classes than expected.

Much of the research relevant to gender, learning and personality also concerns itself with the prediction of grades. Lin and McKeachie (1973) for example, reported that while measures of intelligence, study habits and attitudes were central to the accurate prediction of academic achievement of both males and females, the prediction of males' success might be further enhanced by use of measures of academic motivation. Those they suggest are Fricke's 'achiever personality' scale and Gough's 'achievement via independence' scale on the CPI.

Lynn, Hampson and Magee (1983) administered the Eysenck Personality Questionnaire to 700 fifteen-year-old adolescents and found that that while neuroticism did not contribute to examination success for boys or girls, introversion did correlate with achievement for girls. They suggest that the participants of their studies are at the cross-over age when introversion and neuroticism cease to correlate negatively with academic achievement as they appear to at school age, but become positively correlated with educational success.

A similar investigation (Simon and Thomas, 1983), testing further education and college students using the Eysenck Personality Inventory, found that females scored significantly higher than males for Neuroticism, but significantly less than males for Extraversion. This pattern remained stable over one year.

In their Aberdeen study previously mentioned, Entwistle and Wilson (1970) found correlations of neuroticism and degree performance to be low across all the variables investigated, although there was a suggestion that stability was positively linked with failure in females, but not in males. This implies that an element of neuroticism in females is advantageous for educational attainment, although the authors do not elaborate on this finding.

While these studies are far from consistent in their findings, it seems that neuroticism in females but not males is generally considered to be concordant with academic achievement and by implication good learning.

Perhaps of greater relevance here are studies assessing gender and quality of learning outcome. Clarke (1986) administered the Lancaster Approaches to Studying Inventory to a sample of medical school students and found that females scored significantly lower than males on both the 'extrinsic motivation' and 'strategic orientation' scales, and significantly higher than males on the 'fear of failure' scale. He did not, however, consider sex to be associated with major differences in approach to learning - a conclusion supported by Wilson, Smart and Watson (1996), who observed no significant differences on deep, surface or achieving scales of either the Lancaster ASI (short form), or Biggs' Study Process Questionnaire between males and females.

Watkins and Hattie (1981), using Biggs' (1979) Study Process Questionnaire, set out to investigate the role of personological factors in learning. They concluded that females were more likely to be intrinsically interested in their courses and consequently adopt a deep-approach to their work. In addition, they claimed that females would be more organised in their study methods than males and less likely to utilize strategies designed simply to meet academic requirements. Contrary to Clarke's findings, they also found that *males* were more likely to fear failure and worry about work than females - however this finding may be due to the nature of the sample which included a large number of participant from a rural science faculty. A later study (Watkins and Hattie, 1985) using the Lancaster Approaches to Studying Inventory, found the reverse, that females were more likely to fear academic failure. The study concurred however, that females were more likely to embrace a deep approach to their studies.

Watkins (1982) reported that females scored significantly higher on 'fear of failure', 'operation learning' and 'improvidence' scales, and Miller *et al* (1990) - working with American undergraduates - found males scored significantly higher on 'deep approach', 'use of evidence', 'extrinsic motivation', 'negative attitudes to study', 'achievement motivation' and 'comprehension learning', while females scored higher on 'relating ideas', 'intrinisic motivation', 'surface approach', 'fear of failure', 'strategic approach' and 'improvidence'. While Richardson (1991) questions the validity of the statistical analysis of these studies, they are interesting because they hint at differences in cognitive learning style as a function of gender, suggesting that males are more oriented to holistic, comprehension learning, while females are more likely to follow a serialist, operation learning style.

In New Zealand, Burns, Clift and Duncan (1991) explored sixth form chemistry students' 'understanding of understanding' using qualitative, structured interviews. They defined a 'coherence orientation' as a recognition of order within a subject by the student, and a 'knowledge orientation' as an ability to recall relevant information. They found that the female students tended to exhibit a coherence orientation within learning contexts more than the male students. However, they also demonstrated that the male students were more able to recognize their own level of understanding than the females, who tended to rely on feedback from teachers and tests to assess their own grasp of the subject. This difference was thought by the researchers to be due to females lacking confidence in their own judgements, and not any intrinsic gender differences in metacognition.

In contrast, van Rossum and Schenk (1984) used a textual learning task to demonstrate that male students were significantly more likely to utilize 'deep-level processing' than females, who more often demonstrated 'surface-level processing' - the two categories being analogous to Marton and Saljo's deep and surface approaches to learning. In addition, when questioned about their conception of learning, female students more commonly described a 'reproductive' process - i.e., acquisition or memorization of facts - instead of the 'constructive' process more frequently defined by the male students - i.e., understanding of reality and abstraction of meaning. These differences in conceptions of learning were claimed to stem from upbringing and exposure to different educational situations.

Richardson and King (1991) suggested that this finding implies that females are less affected by certain cultural influences that encourage 'constructive' conceptions of learning than males. In their broad review of gender differences in higher education, they claimed that evidence to support the idea that males and females respond differently to those instruments designed to measure approaches to learning is somewhat lacking, and that those studies which do demonstrate differences are often flawed by serious methodological problems. They looked instead to qualitative studies of intellectual development in higher education and concluded that male and female students advance through parallel but distinct schemes of academic growth. They cited a study by Terenzini and Wright (1987) who surveyed students' self-assessments of their academic progress over a broad range of skill and growth areas. It was observed that females' intellectual development seemed to be quite distinct from that of males. While males' academic development appeared to evolve independently from their interactions with the institution's social system, females' development was facilitated by social integration in the first year of study, but inhibited by it in the second year.

In the study of Baxter-Magolda (1988) gender differences in learning were assessed using a combination of semi-structured interviews, the Learning Styles Inventory (LSI) and the 'Measure of Epistemological Reflection' questionnaire - an instrument designed to assess aspects of development analogous to those proposed in Perry's Scheme of Intellectual Development (see chapter five). She found that male and female students functioning at an equivalent stage of the scheme differed little in qualitative terms, yet exhibited some notable differences in reasoning structure. Females, she reported, tended to prefer learning with a view to reaching 'right' answers and practical solutions, while males were more likely to report seeking ways of learning that offered intrinsic interest and engagement. In addition, females tended seek social support and new ideas from their peers, while males more often sought debate and argument. Finally, when asked to evaluate their learning environment, males were more concerned with challenging the frailties of the educational system, while females were characterized by a tendency to evaluate individuals in terms of the level of knowledge they were perceived to possess.

A recent study, Richardson (1993) compared male and female students' responses to different forms of the Approaches to Studing Inventory and found no evidence of significant differences in scores on any inventory item, subscale or learning orientation.

Some research has demonstrated sex differences in learning outcomes only in conjunction with academic discipline. Biggs (1976), for example, using his Study Behaviour Questionnaire, noted that female art students were more likely to use a reproductive - i.e., surface - approach, and female science students a transformational - i.e., deep - one, while male students seemed more likely to use a transformation approach in arts and a reproduction approach in science.

In an earlier study Biggs (1970b) suggested that in science subjects the student's personal value system is not confronted by the learning materials in the same way as it is in arts subjects. However, he claimed that this relationship between 'encapsulation of values', course content and academic performance was restricted to males since many females had a rather more superficial outlook on their academic careers, with many - he suggested - interested mainly in marriage.

His later research abandoned this contention. Biggs (1976) for example claimed instead that male students performing well academically tend to look to external sources for information and often fail to integrate existing knowledge with new knowledge, while successful female students tend to strive for personal meaning, avoid rote learning and actively use transformational strategies. His assertion that motivation for study is a primary determinant of approach, and that the motivation of males and females may be disparate, remains valid.

Hayes and Richardson (1995) also report gender/subject interactions but only within certain environments. Females students scored more highly on 'meaning orientation' when they were on arts courses in an mainly female environment - found in one of a number of all-female 'Oxbridge' colleges - or when they were on science courses in a predominantly male environment. They suggest that for females on arts courses, working with other females facilitates active questioning and divergent thinking, but that for females on science courses these positive learning characteristics are encourage by working with males. It seems that a meaning orientation is promoted in females when the perceived gender of their discipline, - *cf*, Archer and Freedman, 1988 - is in accordance with the predominant gender of the learning environment. For males, the approaches to studying taken were much more independent of 'gender of discipline' or environment, although it was noted that males on science courses in a predominantly male environment emerged as more syllabus-bound than those in a more female environment, suggesting that male students look to female colleagues more than their male colleagues for guidance in defining their learning tasks.

The research into gender differences lends support to the contention that certain differences exist between males' and females' experiences of learning in higher education environments - with male students apparently more likely to seek meaning or 'transformation' in their studies than females. This view is by no means unchallenged and at face value seems simplistic, especially when the interactive effect of choice of discipline of study is considered. This seems to be an important factor in determining the relative learning charateristics of males and females.

4.23 Maturity differences in approaches to learning, cognitive style and personality

The number of mature applicants seeking entry into higher education has dramatically increased in recent years as universities and colleges have expanded to provide access to potential students other than the traditional school-leaver. This broadening of student demographics has many implications for the teaching-learning process which require investigation.

'Mature' students are generally defined as those aged 21 or over at time of enrolment, though as Lewis (1984) pointed out, the use of this definition to create a categorical dichotomy of mature/non-mature student within research can lead to a misleading homogenisation of students spanning very broad ranges of age and experience.

Richardson (1994) claimed that the general lack of research into the learning of mature students is largely down to their 'marginal role in higher education'. The presence of mature students in any quantifiable numbers is a relatively recent development and higher education is still largely seen as the preserve of the school-leaver. Richardson criticizes the research that has been conducted for its preponderance with academic performance and for its lack of attention to empirical stringency. At the same time, much of the more extensive body of research into general student learning ignores age as an influential factor. Richardson suggested that much of this research is 'ageist', since it fails to consider the potentially detrimental effects of applying research findings derived from the study of young students to the mature student. Age, he stressed, is a critical variable in many social modes of behaviour and hence it is vital that the experiences of the older student are not overlooked. A parallel may be drawn with the application of educational policy to female students which is derived from research based solely on the study of males. In the same way, policy borne of research into younger students may be entirely inappropriate for the mature student.

A common perception of the mature student is that he or she often lacks the essential study skills necessary to succeed in higher education. The problems such students face organizing their study time and coping with restrictions posed by family and job commitments, are widely thought have a detrimental effect on their ability to develop effective study strategies (Woodley *et al,* 1987). This perception is often held by mature students themselves (Woodley *et al,* 1987, Smithers and Griffin, 1986) leading to anxiety and lack of self-confidence which compound the problem. Apart from the non-academic responsibilities of family and career, mature students often need to overcome social isolation. Many report difficulty in socializing with younger students, and therefore find that they lack opportunities to discuss academic and course issues outside of seminars and tutorials (Lewis, 1984).

In addition, mature students are often able to secure university places without meeting the full standard entry requirements and may therefore be out of practice or unfamiliar with the trials of coursework, note-taking and examinations implicit in formal education. Watkins and Hattie (1981) suggest, however, that the assumption that there exists such a thing as 'good study methods' is debatable. They found that students exhibiting 'ideal' study methods - regular periods of study, methodical note-taking, summarizing information from lectures and text-books, etc., were *not* always among the most successful students. Conversely, those shunning these methods often found success anyway, suggesting that such skills do not in themselves constitute good learning.

For mature students, the 'learning gap' between school and university is frequently cited as being a problem, in particular, mature science students who have reported concern at losing the body of knowledge built up at school (Lewis 1984). Mature arts students however frequently reported that the time taken off between school and higher education actually enhanced their studies. Indeed, Smithers and Griffin (1986) noted that mature students in their study sample who took subjects in which life experience might be expected to be advantageous - such as arts, social science and education - ultimately achieved higher degree classes than mature science, engineering and economics students. (Though it must be noted that the mature students sample on the whole, achieved better degree classes than the younger students.)

Degree class is perhaps a dubious means of assessing quality of learning, so attention must be turned to other studies assessing the approaches to learning taken by mature students. Watkins and Hattie (1981) found that regardless of gender, subject discipline or year of study, mature students scored significantly lower on Bigg's SPQ 'utilizing' dimension - measuring extrinsic motivation for study - higher on the SPQ 'internalizing' dimension, - measuring intrinsic motivation - and higher on Schmeck's ILP 'elaborative processing' and 'synthesis-analysis' scales - both deep-level approaches. Watkins and Hattie suggest that further research is required to determine if these findings are due to intellectual maturation or changes in school teaching methods.

Biggs (1985) demonstrated that scores on surface approaches scales became lower as age increased from 18-40 and beyond, while scores on deep approach scales increased from 22-40. Since this study was cross-sectional, the causes for these trends - as in Watkins and Hattie's study - are difficult to pinpoint.

Studies of mature student learning using the Lancaster Approaches to Studying Inventory report relatively consistent findings - higher scores on 'meaning orientation' and lower scores on 'extrinsic motivation' (Watkins, 1982; Harper and Kember, 1986; Clennell, 1987).

Richardson (1994) posited that these studies cannot be considered to be definitive since all suffer in one way or another from sampling biases. The response rates are often markedly less than 100%, therefore the findings reflect the potentially unrepresentative approaches to learning of the students who opt to participate. In addition, many - excepting Watkins and Hattie, 1981 - fail to take into account the variability of approaches to studying known to exist among students of different subject discipline.

Richardson (1995) sought to account for these problems by conducting a study of approaches to studying in a sample who represented as close to 100% as possible and who were sourced from the same course. The results of this comprehensive study supported many of the previous findings, namely a positive correlation between meaning orientation and age, and a negative correlation between reproducing orientation and age. (Richardson chose to analyse age as a ratio variable, rather than as a simple mature/non-mature category.)

Sutherland (1995) found that career types of mature students influenced their preference for both structure of instruction and approaches to studying. He noted that while both nurses and primary school teachers - studying for an educational degree - tended to opt for strategic approaches to learning when the academic task was known to be assessed, deep approaches when the task was thought to be unassessed and a serialist learning styles in most tasks, primary school teachers seemed to prefer a 'pedagogical' model of teaching in which direction from the teacher was maximised, while nurses preferred a 'andragogical' model which encouraged more self-directed learning. While this study avoids the pitfalls of sampling bias highlighted by Richardson, the sample used was small and limited to part-time mature students. It does however demonstrate the heterogeneity of the mature student body.

Potential reasons for the more widespread adoption of deep approaches are diverse. Harper and Kember (1986) claim that mature students are much more likely to embark on studies out of intrinsic interest than out of extrinsic, vocational motivation, though Clennell (1987) claims that this may only apply to older mature students, since most mature students, like their younger counterparts, are studying with a view to improving career prospects. Students over 60 are more likely to be on a degree course because of an intrinsic interest in the subject, as a means of keeping their minds active or as a form of self-actualization or personal development, than younger mature students.

Harper and Kember (1986) also suggest that the approaches to learning developed during secondary education will be perpetuated in higher education if the student carries on from one to the other without break. The emphasis placed on examination results in order to secure entry into university may be responsible for the high scores on surface approaches and low scores on deep approaches found in sixth form students reported by studies such as Entwistle and Kozéki (1985). These approaches may persist throughout the student's immediate academic future.

Biggs (1985) attributed the increase in deep approach with age to a natural development in planning and decision-making skills which he suggested are necessary in adult life. This is echoed by Harper and Kember (1986) who comment that life and work in the community breed self-reliance and intellectual maturity in such a way that fundamentally alters approaches to learning. Perhaps in everyday experience the search for coherent meaning is more commonplace and the futility of rote-learning becomes more apparent. Ability to assess evidence and interrelate ideas might be thought to develop through experience with work and family. Richardson (1995) neatly described this maturation as being the primary benefit of experience of 'the university of life'.

To summarize, there exists a strong body of research evidence to suggest that mature students are more likely to be intrinsically motivated to study and thus pursue learning strategies characterized by an intention to extract meaning from their studies. However, the reasons attributed for this trend remain diverse and unresolved.

4.3 Rationale and hypotheses

The present study seeks to investigate several dimensions relating to the subject choice, gender and maturity of the student sample. By taking a broad, yet detailed look at differences in approaches to learning and personality of these subgroups it is hoped that the findings might shed light on some of the issues unresolved by the research studies documented.

In the first place, the core methodology makes it possible to assess the ways in which personality relates to choice of discipline, and how this in turn relates to approaches to learning. Following Kline and Lapham's lead, the long-standing arts/science dichotomy is abandoned in favour of a mode of subject categorization more reflective of the nature of discipline and degree options currently open to students. The cognitive learning styles of students might also be assessed relative to their choice of subject, assuming that the structure of knowledge and scope for personal interpretation of this knowledge - as described by Gordon Pask - will vary quite radically from one discipline to the next. These cognitive characteristics, though more subtle than the outwardly visible personality characteristics measured, have the potential to be even more influential in steering students choice of subject.

The previous chapter has already concluded that while cognitive style and personality appear to be relatively stable constructs, the approaches to learning measured by the Lancaster inventory are more subject to contextual and situational factors. It is therefore possible to assess whether the learning environments and teaching methods prevalent in any one discipline category might interact with personality characteristics attributed to that discipline, - as Biggs (1976) attempted. Rather than assess outcome in terms of academic success, however, the model can use learning orientation as an indication of educational success.

The extensive research reporting a prevalence of reproducing orientation in science students (Watkins and Hattie, 1981; Watkins, 1982; Hayes and Richardson, 1995) can also be tested.

Similarly the motivation of students to embark upon different degrees can be monitored. This is especially pertinent as the career-enhancing potential of a university degree is foremost in many students minds. The importance of including students pursuing vocationally oriented degrees such as law and medicine is emphasized.

The research into the effects of gender on student education seems to suggest quite fundamental differences in the approaches to study and motivations of male and female students. As Richardson and King (1991) stress, valid research into gender differences in learning at the higher educational level is scarce, yet it is vital to ensure that both male and female students are provided with learning environments which do not disadvantage one or the other. If the sexual inequalities present in higher education are to be eliminated then it is necessary for research to investigate the ways in which males and females come to learning in the first place, their motivations for learning, their interaction with the learning material and elements of personality and cognitive style which might mediate the ways in which the learning materials are approached.

The effects of age on the student's experience of higher education have been hypothesized to constitute a major determinant of learning approach and motivation. This study addresses a number of issues highlighted by previous research. By comparing the approaches to learning of non-mature and mature students it becomes possible to assess whether 'meaning orientation' increases with age, as suggested by Biggs (1985) and Richardson (1995), whether approaches to studying developed during education secondary are carried over by non-mature students, as proposed by Harper and Kember (1986), and whether the 'learning gap' does indeed constitute a useful period of intellectual maturation. In addition it becomes possible to assess the extent of differences in perceptions of study skills - testing Woodley *et al's* suggestion of a deficit in mature students - and the motivational differences set out by Harper and Kember (1986) and Clennell (1987).

Personality theory might suggest that the stability of individual personality characteristics over time would mean that no major differences in the profiles of older students would become apparent. However, those embarking on a university career later in life might well be hypothesized to differ in some ways from that of the typical school-leaver undergraduate. This study provides the means to test this.

Besides assessing subject discipline, gender and maturity in isolation, the effects of interactions between them can be monitored, testing the variance in approaches to learning and personality of males and females in stereotypically masculine or feminine subjects - in a similar fashion to Kornbrot (1987), Entwistle and Wilson (1977) and Hayes and Richardson, (1995) - and of non-mature and mature students in subject displines perceived to be facilitated by life experience (Smithers and Griffin, 1986).

4.41 Methodological issues - use of multivariate analysis of variance.

The use of analysis of variance (ANOVA) to test for differences in the characteristics of different categories of students is a method most firmly established by studies of this type. ANOVA facilitates the examination of the relationships between classification - or independent - variables and the dependent variables under investigation.

Preliminary screening of the descriptive statistics of each individual variable provided information about the distribution and identification of unusual or outlying values.

For the first part of this study, the scores from the scales of the ASI and OPQ were analysed for variance according to subject category, gender and maturity. For this, a multivariate analysis of variance (MANOVA) technique was chosen - for a number of reasons. Firstly, the use of fragmented univariate tests - which would test each dependent variable separately - would lead to an inflated and unacceptable type I error rate or false rejection of the null hypothesis. Secondly, univariate tests ignore correlations among the dependent variables (Stevens, 1996, p152). The factor analysis conducted in chapter 3 demonstrated the patterns of intercorrelation between the variables, so by using analysis that considers the dependent variables simultaneously, this potential source of information is integrated and accounted for. The correlation matrix of the dependent variables was investigated by Bartlett's Test of Sphericity which tests the hypothesis that the matrix in question is an identity matrix - one with diagonal values of one and non-diagonal values of zero. The results demonstrated that this was not the case, i.e. the dependent variables were sufficiently correlated for multivariate analysis to be useful - Bartlett's = 9238.5578, $p < 0.001$ - as the factor analysis proved.

Thirdly, small differences considered *jointly* within several of the dependent variables can, in some circumstances, reliably differentiate between the groups. This differentiation would not be observed if the dependent variables were to be observed individually (Norušis, 1990).

According to Stevens (1996) several assumptions must be made about the joint distribution of the variables used within any multivariate analysis of variance. The dependent variables must have a multivariate normal distribution with the same variance-covariance matrix in each group. In order to test the hypothesis that the variances in any two groups are equal it is necessary to first conduct homogeneity of variance tests.

Cochran's C test and Bartlett-Box's F test both analyse homogeneity of variance for each individual variable. For multivariate normality to hold, normality on each of the separate variables is necessary. To test the multivariate homogeneity of the variance-covariance matrices, a Box's M test is used.

Initially, it was planned to use MANOVA to test the three independent variables simultaneously fulfilling the criteria set by Richardson (1995) regarding the analysis of each independent variable within the context of other factors, which would be rendered impossible if the restrictions of simple univariate ANOVA were imposed..

However, tests of homogeneity of variance between the sub-categories produced by the multivariate analysis of the data set demonstrated early on that the group sizes were too unequal to avoid violation of the assumptions of ANOVA. Generally ANOVA and MANOVA are considered quite robust even when unequal group sizes are submitted (Stevens, 1996) - however a property of multivariate normal distribution is that the subsets of variables have normal distribution - and with subsample sizes becoming dangerously low through the process of sub-categorisation, this property was absent (in accord with the tenets of the Central Limit Theorem).

To test the validity of any further use of three-way MANOVA, homogeneity of variance tests were conducted on the 'Relationships with people' variables of the OPQ using the 3-way subsets described. The results indicated that hypothesis of equal variance among groups must be rejected in this case, since the use of three-way multivariate analysis would yield inaccurate results - see appendix B-5.5.

This preliminary test informed a re-structuring of the data. The 'medicine' and 'law' groups were combined under the title 'vocational' in order to maintain a more even distribution of numbers within each subject discipline category.

The use of the 'maturity' independent variable within the three-way analysis was suspected to be a primary source of unequal distribution, since the overall ratio of non-mature to mature ran at approximately 6:1. Two-way tests of homogeneity of variance demonstrated that MANOVA of category by gender could be undertaken - see appendices B-5.1 and B-5.2 - but that MANOVA of maturity by gender could not, since many of the tests demonstrated that the samples breached the homogeneity-of-dispersion-matrices assumption - see appendices B-5.3 and B-5.4.

The original $2 \times 2 \times 6$ design was thus rejected in favour of one one-way design and one 2×5 design. This meant that four effects were tested instead of seven; maturity effects - tested using one-way multivariate analysis - and gender effects, subject category effects and gender $\times$ subject category interactions - tested using 2×5 multivariate analysis. (NB. SPSS MANOVA tests higher order interactions before the main effects).

SPSS MANOVA output offered an estimation of linear combinations of parameters - or cell means - calculated between each group within each variable subset and displays solution matrices which contain coefficients of the linear combinations of the cell means being tested. In this way, the contrasts were used to identify subset categories likely to be underpinning any significant main effects. The 'deviation' model was chosen here which calculates deviations from the grand mean for every sub-category but one of the predictor variable. A two-tailed t-test was performed for each parameter estimate in order to establish the statistical significance of the difference between each and the grand mean .

Stevens (1996) specifies that the choice of dependent variables for inclusion into multivariate analysis is critical since inclusion of variables unpredictive of the independent factors will weaken the test. To this end, the scales from the two instruments were broken down into sections including items relating to specific aspects of the tests as proposed by the instruments authors. The ASI was analysed in four blocks - 'meaning orientation', 'reproducing orientation', 'achieving orientation' and 'styles and pathologies of learning' - the headings used by Entwistle and Ramsden (1983). The OPQ was analysed in three blocks - 'relationships with people', 'thinking style' and 'feelings and emotions' - headings used by Saville and Holdsworth (1990). Only the scale 'social desirability response' is not included under any heading and is consequently anlysed separately.

The second part of the study involved the analysis of variance of each of the sets of factor scores calculated from the varimax factor analysis described in the previous chapter. According to Norušis (1990), if the dependent variables to be used in analysis of variance are uncorrelated with each other, *univariate* tests will have greater statistical power than multivariate tests. Since the factor scores were derived from an *orthogonal* varimax rotated matrix, they are intrinsically uncorrelated - a bivariate correlation of each of the variables would produce an identity matrix. Therefore, general univariate analysis of variance was used to examine the effects and interactions of interest within this portion of the dataset.

4.42 Methodology

For the detailed core methodology, see Chapter 2..

4.43 Participants

The undergraduate student sample was categorized by subject discipline, gender and maturity. Five subject categories were created; arts *(n=96)*, science*(n=68)*, social science*(n=88)*, 'vocational', - including law *(n=43)*, medicine*(n=16)* - and 'broad-based'*(n=68)* - a category similar to Kline and Lapham's 'mixed' category.

Of the 379 participants, 113 were male and 266 were female, 330 were classified as 'non-mature' - i.e. 21 or under at time of enrolment - and 49 were classified as 'mature' - i.e. 22 or over at time of enrolment.

4.5 *Results - Subject Discipline, Gender and Maturity Effects*

Scores for each of the Approaches to Studying and OPQ scales were compared using Multivariate Analysis of Variance to unearth differences between male and female students, between mature and non-mature students, and between students of each of the five categories of subject discipline. In addition, two-way interactions between the independent variables gender and subject category were assessed. Higher order interactions were not included due to loss of normal distribution within the variance-covariance matrix within each group sample as tested by univariate homogeneity of variance tests Cochran's C and Bartlet-Box F. This is most likely a function of insufficient sample size in some of the groups when broken down three ways. Finally, generalized analysis of variance was used to compare the effects of gender, maturity and subject category on student scores assigned to each of the eleven factors outlined in chapter three. SPSS yields an individual score for each factor for every case which can then be analysed in this way (Rummel, 1950).

4.61 *Lancaster Approaches to Studying Inventory Scales*

MEANING ORIENTATION SUBCALES
- 'Deep approach'
- 'Relating ideas'
- 'Use of evidence'
- 'Intrinsic motivation'

Multivariate tests of analysis of variance of the approaches to studying inventory items measuring 'meaning orientation' - according to the original definition of Entwistle and Ramsden (1983) - found no significant differences in subscale category x gender interaction - (Wilk's λ - approx. F=0.957; d.f.=16; p=0.502), but found significant main effects of both subject category (Wilk's λ - approx. F=2.334; d.f.=16; p=0.002), and sex (Wilk's λ - exact F=0.2.752; d.f.=4; p=0.028) - see appendix B-1.1. The same tests highlighted a significant difference between mature and non-mature students in this variable set - (Wilk's λ - exact F=6.903; d.f.=4; p=0.000) - see appendix B-2.1.

Deep Approach - (Intention to understand material for self, critical interaction with subject content/theory)

Univariate F-tests uncovered a significant difference between the 'deep approach' scores of mature and non-mature students (F=4.172; d.f.=1,377; p<0.05) with the means indicating that mature students scored higher - see Table 4.01 for means.

Table 4.01 Mean scores of non-mature and mature students on 'deep approach'

	Mean	(S.D.)	
Non-mature students	10.60	(2.33)	(*n*=330)
Mature students	11.33	(2.32)	(*n*=49)

Relating Ideas - (Relating different elements of knowledge, experience and new ideas)

A significant main effect was found on 'relating ideas' between non-mature and mature students; (F=9.570; d.f.=1,377; p<0.01) with mature again scoring higher, and between students of different subject discipline (F=2.51; d.f.=4,369; p<0.05. Estimates of parameter contrasts demonstrated that students of broad-based and social science subjects - (category deviation co-efficient=0.53, t=2.25, p=0.05) - scored significantly higher than the other students - see tables 4.02 and 4.03 for means.

Table 4.02 Mean scores of non-mature and mature students on 'relating ideas'

	Mean	(S.D.)	
Non-mature students	10.59	(1.84)	(*n*=330)
Mature students	11.51	(2.52)	(*n*=49)

Table 4.03 Mean scores of subject categories on 'relating ideas'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	10.47	10.34	11.22*	10.48	11.01*
(S.D.)	(1.87)	(2.06)	(1.87)	(2.22)	(1.73)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* p<0.05

Use of Evidence - (Using evidence to arrive at answers to problems)

Main effects were found for gender (F=4.195; d.f=1,369; p<0.05), means showing males scoring significantly higher than females - see tables 4.04.

Table 4.04 Mean scores for male and female students on 'use of evidence'

	Mean	(S.D.)	
Males	10.05	(2.16)	(*n*=113)
Females	9.44	(2.36)	(*n*=266)

Intrinsic Motivation - (Interest in learning for learning's sake)

One main effect, for maturity ($F=17.806$; d.f.=1,377; $p<0.001$) was found. Mature students scored higher than non-mature students - see table 4.05.

Table 4.05 Mean scores for non-mature and mature students on 'intrinsic motivation'

	Mean	(S.D.)	
Non-mature students	9.02	(2.29)	(*n*=330)
Mature students	10.83	(2.53)	(*n*=49)

REPRODUCING ORIENTATION SUBSCALES

- 'Surface approach'
- 'Syllabus-boundness'
- 'Fear of failure'
- 'Extrinsic motivation'

Multivariate tests of analysis of variance of the 'reproducing orientation' approaches to studying inventory items - again according to the definition of Entwistle and Ramsden (1983) - found quite noteably significant multivariate differences in subscale scores by both subject category - (Wilk's λ - approx. $F=3.86$; d.f.=16; $p=0.000$), and gender - (Wilk's λ - exact $F=0.932$; d.f.=4; $p=0.000$), but no category x gender interaction - (Wilk's λ - approx. $F=1.328$; d.f.=16; $p=0.171$) - see appendix B-1.2. The same test applied to the mature vs. non-mature categorisation no significant overall difference within this dependent variable set - (Wilk's λ - exact $F=1.784$; d.f.=4; $p=0.131$) - see appendix B-2.2

Surface Approach - (Intention to reproduce content of course through memorization, passive acceptance of ideas/theory)

A main univariate effect of subject discipline ($F=4.65$; d.f.=4,369; $p<0.01$) was found. Science students scored significantly higher - according to estimates of parameter contrast (category deviation co-efficient=1.02, $t=3.11$, $p=0<0.01$) - while arts students scored significantly lower (category deviation co-efficient=-0.82, $t=-2.51$, $p=0<0.05$). See table 4.06 for mean scores.

Table 4.06 Mean scores for subject categories on 'surface approach'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	12.48*	14.22*	13.85	12.93	12.77
(S.D.)	(3.18)	(2.69)	(2.91)	(3.16)	(2.75)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.01)

Syllabus-Boundness - (Tendency to concentrate on lecturer's definition of learning tasks)

A univariate main effect was found for subject discipline (F=4.55; d.f.=4,369; p<0.01) with estimates of parameter contrast showing that arts students scored significantly lower than the others - (category deviation co-efficient=-0.82, t=-2.51, p<0.05) - see table 4.07.

Table 4.07 Mean scores for subject categories on syllabus-boundness

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	6.84*	7.75	7.78	7.25	7.22
(S.D.)	(2.17)	(1.81)	(1.96)	(2.18)	(1.85)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Fear of Failure - (Pessimism and anxiety about academic outcomes)

A significant difference was noted between male and female students' scores (F=25.44; d.f.=1,369; p<0.001) with female students scoring higher - see Table 4.08 for means.

Table 4.08 Mean scores for males and females on 'fear of failure'

	Mean	(S.D.)	
Males	4.36	(2.49)	(*n*=113)
Females	5.70	(2.74)	(*n*=266)

Extrinsic Motivation - (Interest mainly in acquiring qualifications/career)

Significant differences were found both between male and female students (F=5.374; d.f.=1,369; p<0.05) with male students scoring higher, and between students of different subject category (F=7.352; d.f.=5,257; p<0.001) with estimates of parameter contrast indicating significantly heightened 'vocational' student scores - (category deviation co-efficient=1.78, t=4.81, p<0.001) - see tables 4.09 and 4.10 for means.

Table 4.09 Mean scores for males and females on 'extrinsic motivation'

	Mean	(S.D.)	
Males	6.90	(3.86)	(*n*=113)
Females	6.00	(2.91)	(*n*=266)

Table 4.10 Mean scores for subject categories for 'extrinsic motivation'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	5.64	6.06	5.66	8.19*	6.30
(S.D.)	(2.86)	(3.25)	(3.14)	(3.24)	(3.12)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* ($p<0.001$)

ACHIEVING ORIENTATION SUBSCALES - 'Strategic approach',
- 'Disorganized study methods',
- 'Negative attitudes to study'
- 'Achievement motivation'

Multivariate tests of analysis of variance of the four items claimed by Entwistle and Ramsden (1983) to measure 'achieving-orientation' - highlighted significant multivariate differences in subscale scores by subject category - (Wilk's λ - approx. F=2.41; d.f.=16; p=0.001), but no effect of gender - (Wilk's λ - exact F=1.653; d.f.=4; p=0.160) nor category x gender interaction - (Wilk's λ - approx. F=1.138; d.f.=16; p=0.143) - see appendix B-1.3. Multivariate analysis of the mature vs. non-mature categorisation found no significant overall difference within the 'achieving orientation' variable set - (Wilk's λ - exact F=0.546; d.f.=4; p=0.702) - see appendix B-2.3.

Strategic Approach - (Awareness of assessment requirements and short cuts to improve chances of academic success)

Using univariate analysis of variance, significant differences were found between students of different subject discipline (F=2.47; d.f.=4,369; p<0.05) with estimates of parameter contrasts highlighting arts students scoring significantly lower than the others - (category deviation co-efficient=-0.45, t=-2.17, p<0.05) - and that broad-based students scored significantly higher - (category deviation co-efficient=0.48, t=-2.17, p<0.05) - see table 4.11 for means.

Table 4.11 Mean scores for subject categories for 'strategic approach'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	10.59*	10.87	11.43*	10.95	11.32
(S.D.)	(1.72)	(2.07)	(1.73)	(2.04)	(1.66)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Negative Attitudes to Study - (Lack of interest and application in academic work)

A main effect was found between different subject categories (F=2.70; d.f.=4,369; p<0.05) and an interaction effect was observed between subject category and gender (F=2.51; d.f.=4,369; p<0.05) with estimates of parameter contrast illustrating that overall 'vocational' students scored lower and 'broad based' students scored higher - (broad-based - category deviation co-efficient=0.70, t=2.01, p<0.05; vocational - category deviation co-efficient=-0.85, t=-2.51, p<0.05) - and that males scored significantly lower than females in arts subjects - (category deviation co-efficient=-0.92, t=-2.87, p<0.01) - see tables 4.12 and 4.13 for means.

Table 4.12 Mean scores for subject category on 'negative attitudes to study'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	4.99	5.31	5.35*	4.12*	4.78
(S.D.)	(2.52)	(2.54)	(2.75)	(2.96)	(2.27)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Table 4.13 Mean scores for subject category x gender on 'negative attitudes to study'

	Arts*	Science	Broad-based	Vocational	Social Science
Male	4.00	6.10	6.44	4.24	5.67
	(2.05)	(3.28)	(4.23)	(1.94)	(3.58)
	(*n*=21)	(*n*=27)	(*n*=18)	(*n*=24)	(*n*=23)
Female	5.26	4.79	4.96	4.05	4.46
	(2.96)	(1.97)	(2.99)	(3.49)	(2.39
	(*n*=75)	(*n*=41)	(*n*=50)	(*n*=35)	(*n*=65)

* (p<0.05)

Disorganised Study Methods - (Inability to work regularly and effectively)

No main effects were observed between any student category on 'disorganized study methods scores'.

Achievement Motivation - (Competitiveness and motivation to win)

Subject category was found to elicit univariate significant differences here ($F=3.16$; d.f.=4,369; $p<0.05$) with estimates of parameter contrasts showing vocational students scoring significantly higher - (category deviation co-efficient=0.97, $t=3.22$, $p<0.01$) - and science students scoring significantly lower - (category deviation co-efficient=-0.58, $t=-2.01$, $p<0.05$) - see table 4.14 for means.

Table 4.14 Mean scores for subject category on 'achievement motivation'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	8.69	8.54*	8.97	10.20*	8.79
(S.D.)	(2.52)	(2.54)	(2.75)	(2.96)	(2.27)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* ($p<0.01$)

STYLES AND PATHOLOGIES OF LEARNING - 'Comprehension learning'
- 'Globetrotting'
- 'Operation learning'
- 'Improvidence'

The four subscales designed by Entwistle and Ramsden (1983) to measure aspects of cognitive learning style were analysed simultaneoulsy within a multivariate analysis of variance test. Significant multivariate differences were found according to gender - (Wilk's λ - exact $F=3.64$; d.f.=4; $p=0.006$), and differences approaching significance were noted for subject category - (Wilk's λ - approx. $F=1.62$; d.f.=16; $p=0.057$). Again, no multivariate category x gender interaction - (Wilk's λ - approx. $F=0.96$; d.f.=16; $p=0.603$) and no multivariate effect of maturity (Wilk's λ - exact $F=1.01$; d.f.=4; $p=0.402$) were noted - see appendices B-1.4 and B-2.4.

Comprehension Learning - ('Holistic' learning style (effective) - readiness to map out subject area and think divergently)

Male and female students emerged as significantly different in univariate analysis ($F=11.03$; d.f.=1,369; $p<0.01$), with male students scoring significantly higher than females - see table 4.15 for means.

Table 4.15 Mean scores for males and females on 'comprehension learning'

	Mean	(S.D.)	
Males	10.43	(2.70)	(*n*=113)
Females	9.36	(2.76)	(*n*=266)

Globetrotting - ('Holistic' learning style (ineffective) - over-ready to jump to conclusions)

Students from different subject categories emerged as significantly different (F=3.71, d.f=4,369; p<0.01) with estimates of parameter contrast highlighting that science students report significantly higher scores on the 'improvidence' scale - (category deviation co-efficient=0.94, t=3.47, p<0.001) - see table 4.16 for means.

Table 4.16 Mean scores for subject category on 'Globetrotting'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	7.55	8.52*	7.54	7.71	7.13
(S.D.)	(2.23)	(1.97)	(1.76)	(2.39)	(1.51)
	(*n*=96)	*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Operation Learning - ('Serialist' learning style (effective) - Tackles academic tasks by focusing on facts and logic)

Main effects were found for both gender (F=6.69; d.f=1,369; p<0.05) with female students scoring significantly higher, and subject category (F=2.51, d.f.=4,369; p<0.05) with estimates of parameter contrasts showing arts students scoring significantly lower - (category deviation co-efficient=-0.62, t=-2.85, p<0.01) - see tables 4.17 and 4.18 for means.

Table 4.17 Mean scores for male and female students on 'operation learning'

	Mean	(S.D.)	
Males	9.25	(1.97)	(*n*=113)
Females	9.79	(1.98)	(*n*=266)

Table 4.18 Mean scores for subject category on 'Operation Learning'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	9.10*	9.75	9.86	9.74	9.84
(S.D.)	(2.26)	(1.87)	(1.77)	(2.29)	(1.61)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Improvidence - ('Serialist' learning style (ineffective) - Over-cautious reliance on details)

Univariate main effects were found for both subject category ($F=2.225$; d.f.=4,369; $p<0.05$) with arts students again scoring significantly lower according to estimates of parameter contrast - (category deviation co-efficient=-0.75, t=-2.94, $p<0.01$) - and gender ($F=5.37$; d.f.=1,369; $p<0.05$) with females scoring significantly higher - see tables 4.19 and 4.20 for means.

Table 4.19 Mean scores for subject categories on 'improvidence'

Subject Category	Arts	Science	Broad-based	Vocational	Social Science
Mean	6.69*	7.73	7.39	7.51	7.42
(S.D.)	(2.36)	(2.01)	(2.26)	(2.71)	(2.22)
	(*n*=96)	(*n*=68)	(*n*=68)	(*n*=59)	(*n*=88)

* (p<0.05)

Table 4.20 Mean scores for males and females on 'improvidence'

	Mean	(S.D.)	
Males	6.94	(2.31)	(*n*=113)
Females	7.45	(2.32)	(*n*=266)

4.62 Occupational Personality Questionnaire Scales

RELATIONSHIPS WITH PEOPLE SCALES (R1-R9)
- 'Persuasive'
- 'Controlling'
- 'Independent'
- 'Outgoing'
- 'Affiliative'
- 'Socially confident'
- 'Modest'
- 'Democratic'
- 'Caring'

Multivariate tests of analysis of variance of the OPQ scales grouped under the heading 'relationships with people' (Saville and Holdsworth, 1990), found no significant differences according to category (Wilk's λ - approx F=1.395; d.f.=36; p=0.061) or category/gender interaction(Wilk's λ - approx. F=1.257; d.f.=36; p=0.143) - see appendix B-3.1. However, significant differences were noted beteween male and female students (Wilk's λ - exact F=3.549; d.f.=9; p=0.000) and between mature and non-mature students (Wilk's λ - exact F=3.710; d.f.=9; p=0.000) - see appendices B-3.1 and B-4.1.

R1 Persuasive -(Enjoys selling, changes opinions of others, convincing with arguments, negotiates)

Univariate F-tests showed a significant main effect of gender ($F=8.123$; d.f.=1,369; $p<0.01$) with males scoring significantly higher than females - see table 4.21.

Table 4.21 Mean scores of male and female students on 'persuasive'

	Mean	(S.D.)	
Male	24.13	(5.15)	(n=113)
Female	22.33	(5.33)	(n=266)

R2 Controlling - (Takes, charge, directs, manages, organises, supervises others)

No significant main effects nor interactions were found for this variable.

R3 Independent - (Has strong views on things, difficult to manage, speaks up, argues, dislikes ties)

Males and females emerged as significantly different on 'independent' ($F=4.824$; d.f.=1,369; $p<0.05$) with males scoring significantly higher - see table 4.22.

Table 4.22 Mean scores of male and female students on 'independent'

	Mean	(S.D.)	
Male	26.95	(3.99)	(n=113)
Female	25.99	(4.19)	(n=266)

R4 Outgoing- (Fun loving, humourous, sociable, vibrant, talkative, jovial)

No significant effects nor interactions were found.

R5 Affiliative -(Has many friends, enjoys being in group, likes companionship, shares things with friends)

A significant main effect was found on 'affiliative' between mature and non-mature students; ($F=16.464$; d.f.=1,369; $p<0.001$) with non-mature students scoring significantly higher - see table 4.23. In addition, an interaction effect was noted between subject category and gender (F=2.450; d.f.=4,369; p<0.05). Estimates of parameter contrasts demonstrated that in the science student sample, females were significantly more affiliative than males (gender/category deviation co-efficient=-1.18, t=-2.69, p=0.003) - see table 4.24 for means.

Table 4.23 Mean scores for non-mature and mature students on 'affiliative'

	Mean	(S.D.)	
Non-mature students	28.82	(3.42)	(*n*=330)
Mature students	26.64	(4.09)	(*n*=49)

Table 4.24 Mean scores for subject category x gender on 'affiliative'

	Arts	Science	Broad-based	Vocational	Social Science
Male	28.35	26.31	29.66	28.40	28.59
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	28.75	29.10	28.62	28.40	28.64
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* (p<0.05)

R6 Socially Confident- (Puts people at ease, knows what to say, good with words)

A significant main effect was found for gender (F=5.567; d.f.=1,369; p<0.05) with males scoring significantly higher than females - see table 4.25 for means.

Table 4.25 Means for male and female students on 'socially confident'

	Mean	(S.D.)	
Male	22.75	(5.81)	(n=113)
Female	21.11	(6.52	(n=266)

R7 Modest -(Reserved about achievements, avoids talking about self, accepts others, avoids trappings of status)

Again a main effect was found for gender (F=5.622; d.f.=1,369; p<0.05) with females scoring higher than males - see table 4.26.

Table 4.26 Means for male and female students on 'modest'

	Mean	(S.D.)	
Male	17.17	(5.58)	(n=113)
Female	18.42	(5.11)	(n=266)

R8 Democratic - (Encourages others to contribute, consults, listens and refers to others)

A main effects was found for subject category ($F=2.392$; d.f.=4,369; $p<0.05$} with estimates of parameter contrasts showing science students scoring significantly higher (category deviation co-efficient=1.16, $t=2.61$, $p=0.009$) - see table 4.27 for means. Main effects were also observed for gender ($F=9.421$; d.f.=1,369; $p<0.01$) with females scoring significantly higher than males, and maturity ($F=8.631$; d.f.=1,369; $p<0.05$) with non-mature students scoring significantly higher than mature students- see tables 4.28 and 4.29 for means.

Table 4.27 Mean scores for subject categories on 'democratic'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	24.19	25.27*	23.53	23.17	24.49
(S.D.)	(3.59)	(3.49)	(4.50)	(4.01)	(3.92)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.05)

Table 4.28 Means for male and female students on 'democratic'

	Mean	(S.D.)	
Male	23.22	(4.44)	(n=113)
Female	24.58	(3.78)	(n=266)

Table 4.29 Means for non-mature and mature students on 'democratic'

	Mean	(S.D.)	
Non-mature	24.41	(3.87)	(n=113)
Mature	22.61	(4.75)	(n=266)

R9 Caring -(considerate to others, helps those in need, sympathetic, tolerant)

Again, main effects were found for category of study ($F=3.475$; d.f.=4,369; $p<0.01$) with estimates of parameter contrasts showing science students scoring significantly lower (category deviation co-efficient=-1.10, $t=-2.62$, $p=0.009$) - see table 4.30 for means. In addition, effects were observed of gender ($F=11.762$; d.f.=1,369; $p<0.01$) with female students scoring significantly higher, and maturity ($F=6.405$; d.f.=1,369; $p<0.05$) with non-mature students scoring higher than mature students - see tables 4.31 and 4.32. A category x gender interaction was also noted ($F=3.007$; d.f.=4,369; $p<0.05$) with parameter contrast estimates indicating that only the male students in the science sample are significantly less caring (gender/category deviation co-efficient --1.26, $t=-3.01$, $p=0.002$) - see table 4.33 for means.

Table 4.30 Mean scores for subject categories on 'caring'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	29.29	27.80*	28.74	28.16	29.48
(S.D.)	(3.50)	(4.71)	(3.73)	(4.16)	(4.82)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.05)

Table 4.31 Means for male and female students on 'caring'

	Mean	(S.D.)	
Male	27.65	(4.43)	(n=113)
Female	29.27	(3.53)	(n=266)

Table 4.32 Means for non-mature and mature students on 'caring'

	Mean	(S.D.)	
Non-mature	28.98	(3.87)	(n=113)
Mature	27.49	(3.79)	(n=266)

Table 4.33 Mean scores for subject category x gender on 'caring'

	Arts	Science *	Broad-based	Vocational	Social Science
Male	29.21	25.39	27.44	27.29	29.44
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	29.31	29.39	29.20	28.75	29.50
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* (p<0.05)

THINKING STYLE SCALES (T1-T11)

- 'Practical'
- 'Data rational'
- 'Artistic'
- 'Behavioural'
- 'Traditional'
- 'Change oriented'
- 'Conceptual'
- 'Innovative'
- 'Forward planning'
- 'Detail conscious'
- 'Conscientious'

Multivariate analysis of variance of the eleven thinking styles scales entered simultaneously highlighted significant main effects for gender - (Wilk's λ - exact F=7.223; d.f.=11; p=0.000) and subject category- (Wilk's λ - approx. F=3.256; d.f.=44; p=0.000) - see appendix B-3.2. No differences were observed for maturity - (Wilk's λ - exact F=1.428; d.f.=11; p=0.158) or subject category x gender - (Wilk's λ - approx. F=1.023; d.f.=44; p=0.432) - see appendices B-3.2 and B-4.2.

T1 Practical - (Down-to-earth, likes reparing and mending things, better with concrete concepts)

Univariate F-tests found a main effect for subject category ($F=3.600$; d.f.=4,369; $p<0.01$) with estimates of parameter contrasts highlighting science students scoring significantly higher and arts students scoring significantly lower (science category deviation co-efficient=2.38, $t=3.43$, $p<0.001$; arts category deviation co-efficient=-1.51, $t=-2.19$, $p<0.05$) - see table 4.34 for means. A main effect was also found for gender ($F=7.64$; d.f.=1,369; $p<0.01$) with male students scoring significantly higher than females - see table 4.35.

Table 4.34 Mean scores for subject categories on 'practical'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	20.43*	24.04*	21.43	21.85	20.77
(S.D.)	(6.61)	(6.20)	(6.58)	(5.83)	(5.79)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.01)

Table 4.35 Means for male and female students on 'practical'

	Mean	(S.D.)	
Male	23.17	(6.20)	(n=113)
Female	20.87	(7.27)	(n=266)

T2 Data Rational - (Good with data, operates on facts, enjoys assessing measuring)

Main effects emerged for subject category ($F=11.722$; d.f.=4,369; $p<0.001$) with parameter contrast estimates indicating that science students scored significantly higher while arts students scored significantly lower - (science category deviation co-efficient=4.39, $t=5.68$, $p<0.001$; arts category deviation co-efficient=-3.71, $t=-4.82$, $p<0.001$) - and for gender, males students scored significantly higher than females ($F=16.118$; d.f.=1,369; $p<0.001$) - see tables 4.36 and 4.37 for means

Table 4.36 Mean scores for subject categories on 'data rational'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	14.23*	22.88*	16.52	18.95	18.35
(S.D.)	(6.43)	(7.67)	(6.95)	(6.76)	(7.16)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.001)

Table 4.37 Means for male and female students on 'data rational'

	Mean	(S.D.)	
Male	20.62	(7.55)	(n=113)
Female	16.72	(7.27)	(n=266)

T3 Artistic- (Appreciates culture, shows artistic flair, sensitive to visul arts and music)

Significant differences were found between students of different subject category (F=10.218; d.f.=4,369; p<0.001) with estimates of parameter contrast showing arts students scoring significantly higher than science students (science category deviation co-efficient=-2.76, t=-4.44, p<0.001; arts category deviation co-efficient=3.19, t=4.13, p<0.001) - see table 4.38 for means. Between male and female students a significant difference was also noted (F=7.37; d.f.=1,369; p<0.01) with female students scoring significantly higher than males - see table 4.39.

Table 4.38 Mean scores for subject categories on 'artistic'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	28.40*	23.00*	26.56	24.45	25.58
(S.D.)	(4.43)	(6.16)	(5.25)	(7.05)	(5.82)
	(n=96)	(n=68)	(n=68)	(n=49)	(n=88)

* (P<0.001)

Table 4.39 Means for male and female students on 'artistic'

	Mean	(S.D.)	
Male	24.26	(6.86)	(n=113)
Female	26.50	(5.35)	(n=266)

T4 Behavioural -(Analyses thoughts and behaviour, psychologically minded, likes to understand people)

A main effect was found for subject category (F=4.95; d.f.=4,369; p<0.001) with estimates of parameter contrasts demonstrating that social science students scored significantly higher and that science students scored significantly lower - (social-science category deviation co-efficient=1.17, t=2.54, p<0.05; science category deviation co-efficient=-1.63, t=-3.85, p<0.001) - see table 4.40. In addition a main effect was found for gender (F=6.58; d.f.=1,369; p<0.05) with females scoring significantly higher than males - see table 4.41. A significant interaction between subject category and gender was also noted (F=2.503; d,f =4,369; p<0.05) with parameter estimates showing that male vocational students scored significantly lower than females and that female broad based students significantly lower than males - (vocational category deviation co-efficient=-1.08, t=-2.42, p<0.05; broad-based category deviation co-efficient=0.90, t=1.97, p<0.05) - see table 4.42 for means.

Table 4.40 Mean scores for subject categories on 'behavioural'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	29.16	27.48*	29.65	28.88	29.90*
(S.D.)	(3.27)	(4.21)	(3.37)	(4.91)	(3.87)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.001)

Table 4.41 Means for male and female students on 'behavioural'

	Mean	(S.D.)	
Male	28.15	(4.69)	(n=113)
Female	29.46	(3.48)	(n=266)

Table 4.42 Mean scores for subject category x gender on 'behavioural'

	Arts	Science	Broad-based*	Vocational*	Social Science
Male	28.64	26.20	30.41	26.94	29.51
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	29.30	28.33	29.72	30.21	29.70
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* (p<0.05)

T5 Traditional -(Preserves well-proven methods, prefers the orthodox, disciplined, conventional)

One main effect was found for subject category (F=2.589; d.f=4,369; p<0.05) with estimates of parameter contrasts demonstrating that vocational students scored significantly higher than other groups - (category deviation co-efficient=1.39, t=2.70, p<0.01) - see table 4.43 for means.

Table 4.43 Mean scores for subject categories on 'traditional'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	18.44	18.31	18.90	20.14*	17.63
(S.D.)	(4.84)	(4.15)	(4.47)	(4.25)	(3.90)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.05)

T6 Change Oriented -(Enjoys doing new things, seeks variety, prefers novelty to routine, accepts change)

No significant effects according to any of the main variables or interactions therein were observed.

T7 Conceptual -(Theoretical, intellectually curious, enjoys the complex and abstract)

Significant differences were noted between the 'conceptual' scores of male and female students ($F=9.33$; d.f.=1,369; $p<0.01$) with males scoring significantly higher than females - see table 4.44.

Table 4.44 Means for male and female students on 'conceptual'

	Mean	(S.D.)	
Male	25.39	(4.59)	(n=113)
Female	24.03	(4.15)	(n=266)

T8 Innovative -(Generates ideas, shows ingenuity, thinks up solutions)

One main effect was found for gender ($F=7.00$; d.f=1,369; $p<0.01$) with male students scoring again scoring significantly higher than females - see table 4.45.

Table 4.45 Means for male and female students on 'innovative'

	Mean	(S.D.)	
Male	24.27	(5.54)	(n=113)
Female	22.68	(5.41)	(n=266)

T9 Forward Planning -(Prepares well in advance, enjoys target setting, forecasts trends, plans projects)

No significant differences in any of the analysed sample groups were observed.

T10 Detail Conscious -(Methodical, keeps things neat and tidy, precise, accurate)

Gender differences in this scale were significant ($F=5.61$; d.f.=1,369, $p<0.05$) with female students scoring significantly higher than males - see table 4.46.

Table 4.46 Means for male and female students on 'detail conscious'

	Mean	(S.D.)	
Male	22.14	(5.97)	(n=113)
Female	23.60	(5.57)	(n=266)

T11 Conscientious -(Sticks to deadlines, completes jobs, perseveres with routines, likes fixed schedules)

Again effect of gender proved significant ($F=13.72$, d.f.=1,357; $P<0.001$) with females scoring significantly higher than males - see table 4.47.

Table 4.47 Means for male and female students on 'conscientiousness'

	Mean	(S.D.)	
Male	23.71	(6.03)	(n=113)
Female	25.88	(5.07)	(n=266)

FEELINGS AND EMOTIONS SCALES (R1-R10)

- 'Relaxed'
- 'Worrying'
- 'Tough-minded'
- 'Emotional control'
- 'Optimistic'
- 'Critical'
- 'Active'
- 'Competitive'
- 'Achieving'
- 'Decisive'

Multivariate analysis of variance of the ten 'feelings and emotions' scales of the OPQ highlighted significant effects of category of study, (Wilk's λ - approx $F=1.747$; d.f.=40; $p=0.03$), gender (Wilk's λ - exact $F=9.750$; d.f.=10; $p=0.000$) and an interaction effect betwen category of study and gender (Wilk's λ - approx $F=1.450$; d.f.=40; $p=0.035$) - see appendix B-3.3. Multivariate tests using maturity as the independent variable yielded a marginal but non-significant effect (Wilk's λ - exact $F=1.820$; d.f.=10; $p=0.056$) - see appendix 4.3.

F1 Relaxed -(Calm, relaxed, cool under pressure, free from anxiety, can switch off)

Univariate tests of variance noted significant differences between male and female students ($F=20.366$; d.f.=1,369, $p<0.001$) with males scoring significantly higher than females. Also noted were significant differences between males and females according to subject category ($F=2.847$; d.f.=4,369; $p<0.05$) where estimates of parameter contrasts highlight that the main gender effect is not apparent in social science sample see tables 4.48 and 4.49.

Table 4.48 Means for male and female students on 'relaxed'

	Mean	(S.D.)	
Male	21.42	(6.57)	(n=113)
Female	18.93	(6.26)	(n=266)

Table 4.49 Means for subject category x gender on 'relaxed'

	Arts	Science	Broad-Based	Vocational	Social Science*
Male	22.43	23.19	20.60	21.08	19.43
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	18.04	17.04	18.91	16.56	19.93
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* ($p<0.05$)

F2 Worrying -(Worry when things go wrong, keyed-up before important events, anxious to do well)

Once again gender effects were noted ($F=22.067$; d.f.=1,369; $p<0.001$) with female students scoring significantly higher than males - see table 4.50. In addition, an interaction between category of study and gender was observed ($F=2.804$; d.f.=4,369; $p<0.05$). Estimates of parameter contrast revealed that the gender difference was not significant within the science sample (category deviation co-efficient=-1.20, $t=-2.27$, $p<0.05$) - see table 4.51 for means.

Table 4.50 Means for male and female students on 'worrying'

	Mean	(S.D.)	
Male	22.12	(5.09)	(n=113)
Female	24.72	(4.64)	(n=266)

Table 4.51 Means for subject category x gender on 'worrying'

	Arts	Science *	Broad-Based	Vocational	Social Science
Male	21.31 (n=21)	23.19 (n=27)	20.60 (n=18)	21.08 (n=24)	19.43 (n=23)
Female	25.15 (n=75)	24.87 (n=41)	24.65 (n=50)	25.09 (n=35)	23.98 (n=65)

* (p<0.05)

F3 Tough-Minded -(Difficult to hurt or upset, can brush off insults, unaffected by unfair remarks)

Main effects were found for subject category - (F=3.637; d.f.=4,369; p<0.01) with parameter contrast estimates indicating that science students scored significantly higher (category deviation co-efficient=2.45, t=3.66, p<0.001) - and gender (F=44.177; d.f.=1,369; p<0.001) with males scoring significantly higher than females - see tables 4.52 and 4.53 for means. A two-way interaction between these two variables, (F=2.920; d.f.=5,357; p<0.05) was also observed, with the significant gender difference not applicable in social science student sample (gender/category deviation co-efficient=1.14, t=2.11, p<0.05) - see table 4.54 for means.

Table 4.52 Mean scores for subject categories on 'tough minded'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	14.76	17.71*	14.02	14.23	15.13
(S.D.)	(5.82)	(7.17)	(6.67)	(6.72)	(6.06)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.01)

Table 4.53 Means for male and female students on 'tough minded'

	Mean	(S.D.)	
Male	18.53	(5.09)	(n=113)
Female	13.87	(4.64)	(n=266)

Table 4.54 Means for subject category x gender on 'tough minded'

	Arts	Science	Broad-Based	Vocational	Social Science*
Male	18.29 (n=21)	22.16 (n=27)	16.33 (n=18)	19.02 (n=24)	15.67 (n=23)
Female	13.77 (n=75)	14.78 (n=41)	13.18 (n=50)	12.01 (n=35)	14.94 (n=65)

* (p<0.05)

F4 Emotional Control -(Restrained in showing emotions, keeps feelings back, avoids outbursts)

Main effects were noted for gender ($F=4.769$; $d.f.=1,369$; $p<0.05$) with males scoring significantly higher than females - table 4.55.

Table 4.55 Means for male and female students on 'emotional control'

	Mean	(S.D.)	
Male	21.15	(6.30)	(n=113)
Female	19.31	(6.57)	(n=266)

F5 Optimistic -(Cheerful, happy, keeps spirits up despite setbacks)

No significant effects for subject category, gender nor maturity were observed.

F6 Critical -(Good at probing the facts, sees disadvantages, challenges assumptions)

Significant differences were observed between students of different subject category - ($F=2.469$; $d.f.=5,357$; $p<0.05$) with estimates of parameter contrast showing science students scoring significantly lower (category deviation co-efficient=-1.36, $t=-3.40$, $p<0.001$), - and between males and females ($F=17.284$; $d.f.=1,369$; $p<0.001$) with males students scoring significantly higher than females -see tables 4.56 and 4.57 for means.

Table 4.56 Mean scores for subject categories on 'critical'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	24.00	23.09*	24.50	25.24	23.99
(S.D.)	(3.81)	(3.77)	(3.64)	(3.24)	(3.75)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.05)

Table 4.57 Means for male and female students on 'critical'

	Mean	(S.D.)	
Male	25.28	(3.75)	(n=113)
Female	23.62	(3.56)	(n=266)

F7 Active -(Has energy, moves quickly, enjoys physical exercise, doesn't sit still)

Main effects emerged for gender - ($F=14.379$; d.f.=1,369; $p<0.001$) with males scoring signifiacntly higher than females - and maturity ($F=5.240$; d.f.=1,369; $p<0.05$) with non-mature students scoring significantly higher than mature students - see tables 4.58 and 4.59.

Table 4.58 Means for male and female students on 'active'

	Mean	(S.D.)	
Male	24.37	(5.94)	(n=113)
Female	21.65	(5.90)	(n=266)

Table 4.59 Means for non-mature and mature students on 'active'

	Mean	(S.D.)	
Non-mature	22.73	(6.04)	(n=330)
Mature	21.65	(5.75)	(n=49

F8 Competitive -(Plays to win, determined to beat others, poor loser)

Significant differences were noted between male and female students - ($F=18.506$; d.f.=1,369; $p<0.001$) with males scoring significantly higher than females - see tables 4.60.

Table 4.60 Means for male and female students on 'competitive'

	Mean	(S.D.)	
Male	16.92	(5.08)	(n=113)
Female	14.65	(4.22)	(n=266)

F9 Achieving -(Ambitious, sets sights high, career-centred, results oriented)

No main effects were observed between any of the samples recorded.

F10 Decisive - (Quick at conclusions, weighs things up rapidly, may be hasty, takes risks)

On significant difference was observed, between male and female students ($F=15.133$; d.f.=1,369; $p<0.001$) with males emerging as significantly more decisive than females - see table 4.61.

Table 4.61 Means for male and female students on 'decisive'

	Mean	(S.D.)	
Male	18.96	(5.51)	(n=113)
Female	16.41	(5.29)	(n=266)

D1 Social Desirability Response - (Has tended to respond to questionnaire in a socially desirable way) - (Lie scale)

No significant differences in subject honesty were observed between any of the independent groups

4.63 OPQ/ASI Varimax Factor Dimensions

General univariate analysis of variance was used to examine the effects and interactions of the independent variables for each of the eleven factor score scales introduced in the previous chapter. Gender x maturity analysis was carried out on these scores since tests of homogeneity of variance indicated that the dispersion matrices of the sub-samples were similar enough for analysis of variance to be valid.

Abstract Orientation - Factor composed of 'comprehension learning', 'innovative', 'conceptual', 'operation learning' (-), 'behavioural' and 'artistic'.

A significant main effect was noted for gender ($F=4.23$; d.f.=1,369; $p<0.05$) with males' scores significantly higher than females' - see table 4.72. In addition, a significant interaction emerged between gender and maturity ($F=4.736$; d.f.=1,357; $p<0.05$) was observed, with estimates of parameter contrast indicating that the gender pattern was reversed in mature students and that mature females scored much higher than mature males - (gender/maturity deviation co-efficient=0.21, $t=-2.60$, $p<0.01$), - see table 4.73 for means.

Table 4.72 Means for male and female students on 'abstract orientation'

	Mean	(S.D.)	
Male	0.16	(1.08)	(n=113)
Female	-.0.07	(0.96)	(n=266)

Table 4.73 Mean score for gender x maturity on 'abstract orientation'

Mean (S.D.)	Non-mature	Mature
Males	0.20	-0.07
	(1.04)	(1.26)
	(n=95)	(n=18)
Females	-0.13	0.41
	(0.95)	(0.92)
	(n=235)	(n=31)

Ambitious - Factor composed of 'competitive', 'achievement motivation', 'caring' (-), 'achieving', 'democratic' (-) and 'affiliative' (-).

Main effects were reported for subject category - ($F=2.87$;d.f.=4,369; $p<0.05$) with estimates of parameter contrasts showing vocational students scoring significantly higher (category deviation co-efficient=0.36, $t=3.21$, $p<0.01$) - and gender ($F=12.28$; d.f.=1,369; $p<0.01$) with males scoring significantly higher than females - see tables 4.74 and 4.75 for means.

Table 4.74 Mean scores for subject categories on 'ambitious'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	-0.01	-0.10	-0.03	0.46*	-0.20
(S.D.)	(1.06)	(0.98)	(0.91)	(0.98)	(0.99)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.05)

Table 4.75 Means for male and female students on 'ambitious'

	Mean	(S.D.)	
Male	0.30	(1.01)	(n=113)
Female	-0.13	(0.97)	(n=266)

Assertive - Factor composed of 'persuasive', 'controlling', 'critical', 'outgoing, 'independent' and 'affiliative'.

Category of study emerged as a significant main effect - ($F=3.284$; d.f.=5,357; $p<0.01$), with parameter contrast estimates showing science students scoring significantly lower (category deviation co-efficient=-0.47, $t=-4.33$, $p<0.001$) and vocational students scoring significantly higher (category deviation co-efficient=).23, $t=2.00$, $p<0.05$). Maturity was also a significant effect - ($F=7.47$; d.f.=1,369; $p<0.01$) - with mature students emerging as significantly less assertive than non-mature students - see tables 4.76 and 4.77 for means.

Table 4.74 Mean scores for subject categories on 'assertive'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	0.02	-0.39*	0.073	0.27*	0.04
(S.D.)	(1.06)	(0.98)	(0.91)	(0.98)	(0.99)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.01)

Table 4.77 Means for non-mature and mature students on 'assertive'

	Mean	(S.D.)	
Non-mature	0.05	(1.00)	(n=330)
Mature	-0.33	(0.91)	(n=49)

Concrete Orientation - Factor composed of 'data rational', 'artistic' (-), 'use of evidence' and 'practical'.

Significant differences were noted between students of different subject category (F=11.99; d.f.=4,369; p<0.001) with parameter contrast estimates showing science students scoring significantly higher and arts students scoring significantly lower (science category deviation co-efficient=0.53, t=5.29, p<0.001 - arts category deviation co-efficient=-0.55, t=-5.51, p<0.001). Significant differences were also observed between male and female students (F=35.02; d.f.=1,369; p<0.001) where males score significantly higher than females - see tables 4.78 and 4.79 for means.

Table 4.78 Mean scores for subject categories on 'concrete orientation'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	-0.47*	0.59*	-.011	0.12	0.06
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.001)

Table 4.79 Means for male and female students on 'concrete orientation'

	Mean	(S.D.)	
Male	0.48	(1.23)	(n=113)
Female	-0.20	(0.89)	(n=266)

Conscientious - Factor composed of 'conscientious', 'disorganized study methods' (-), 'detail conscious' and 'forward planning'.

Main effects were found for gender (F=10.89; d.f.=1,369; p<0.01) with females scoring significantly higher than males - see tables 4.80 and 4.81.

Table 4.81 Means for male and female students on 'conscientious'

	Mean	(S.D.)	
Male	-0.24	(1.11)	(n=113)
Female	0.10	(0.94)	(n=266)

Conservative Orientation - Factor composed of 'traditional', 'change oriented' (-), and 'operation learning'.

No significant main effects or interactions were noted as a function of category of study, gender or maturity.

Self-consciousness - Factor composed of 'modest', 'emotional control', 'social desirability response', 'outgoing' (-), 'affiliative' (-), and 'social confidence' (-).

Again no significant main effects or interactions were noted.

Meaning Orientation - Factor composed of 'intrinsic motivation', 'relating ideas', 'strategic approach', 'use of evidence' and 'deep approach'.

A significant difference was noted between the meaning orientation scores of non-mature and mature students (F=4.73; d.f.=1,69; p<0.05) with mature students scoring higher than non-mature students - see table 4.83. In addition, an interaction was observed between category of study and gender, (F=2.63; d.f.=4,369; p<0.05) with estimates of parameter contrast indicating that male students scored signifiantly higher than females in arts and broad-based subjects - (gender/category deviation co-efficient=0.22, t=2.08, p<0.05) - see table 4.84 for means.

Table 4.83 Means for non-mature and mature students on 'meaning orientation'

	Mean	(S.D.)	
Non-mature	-0.02	(0.97)	(n=330)
Mature	0.16	(1.16)	(n=49)

Table 4.84 Means for subject category x gender on 'meaning orientation'

	Arts	Science	Broad-Based	Vocational	Social Science
Male	0.08	-0.18	0.35	-0.26	-0.23
	(0.69)	(1.25)	(1.03)	(0.86)	(1.01)
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	-0.27	0.09	0.03	0.23	0.23
	(0.96)	(0.92)	(0.99)	(1.04)	(0.90)
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* (p<0.05)

Emotional Stability - Factor composed of 'relaxed', 'worrying' (-), 'tough-minded', 'fear of failure' (-), 'optimistic', 'socially confident' and 'decisive'.

Gender differences were noted in scores on this factor (F=22.52; d.f.=1,369; p<0.001), with females scoring quite significantly lower than males - see table 4.85 for means. A category of study/gender interaction was also observed (F=3.01; d.f.=4,369; p<0.05) with the establishedgender pattern not apparent in the social science sample - (category/gender deviation co-efficient=0.22, t=2.02, p<0.05) - see table 4.86 for means.

Table 4.85 Means for male and female students on 'emotional stability'

	Mean	(S.D.)	
Male	0.38	(1.04)	(n=113)
Female	-0.16	(0.94)	(n=266)

Table 4.86 Means for subject category x gender on 'emotional stability'

	Arts	Science	Broad-Based	Vocational	Social Science*
Male	0.54	0.83	0.07	0.37	-0.06
	(0.98)	(1.25)	(1.03)	(0.71)	(0.91)
	(n=21)	(n=27)	(n=18)	(n=24)	(n=23)
Female	-0.22	-0.13	-0.21	-0.30	0.01
	(0.86)	(0.95)	(1.01)	(1.00)	(0.93)
	(n=75)	(n=41)	(n=50)	(n=35)	(n=65)

* (p<0.05)

Reproducing Orientation - Factor composed of 'surface approach', 'improvidence', 'globetrotting', 'extrinisic motivation', 'negative attitudes to study' and 'syllabus-boundness'.

One main effect was noted for subject category (F=4.45; d.f.=4,369; p<0.01), with parameter contrast estimates showing arts students scoring significantly lower than science students - (arts category deviation co-efficient=-0.39, t=-3.57, p<0.001; science category deviation co-efficient=0.31, t=2.82, p<0.01) - see table 4.87.

Table 4.87 Mean scores for subject categories on 'reproducing orientation'

	Arts	Science	Broad-based	Vocational	Social Science
Mean	-0.27*	0.30*	0.07	0.11	-0.06
(S.D.)	(0.92)	(0.95)	(0.98)	(1.14)	(1.01)
	(n=96)	(n=68)	(n=68)	(n=59)	(n=88)

* (P<0.01)

Sensation Seeking - Factor composed of 'active', 'practical', 'change oriented' and 'affiliative'.

Significant differences were observed in the scores of mature and non-mature students ($F=9.87$; $d.f.=1,369$; $p<0.01$) with non-mature students scoring significantly higher then mature students - see table 4.88 for means.

Table 4.88 Means for non-mature and mature students on 'sensation seeking'

	Mean	(S.D.)	
Non-mature	0.07	(0.96)	(n=330)
Mature	-0.47	(1.13)	(n=49)

4.71 *Discussion*

Examination of the results yielded by the analyses of variance technique applied in this section demonstrates a range of quantifiable differences in the learning and personality characteristics of students of different discipline, age and gender.

The multivariate analysis of variance of each of the ASI and OPQ blocks of inventory scales was necessary in order to compare any emergent differences with studies using the same or similar research instruments. However, the use of the eleven-factor model in assessing individual differences proved especially informative in focussing upon the psychological bases of learning behaviour, especially in light of the new findings outlined in chapter three relating to the apparent nature of cognitive styles within the approaches to learning/personality framework.

4.72 Subject discipline and personality

This study has sought to investigate two main aspects relating to subject discipline. Firstly, it assessed whether the personality of the student plays a part in dictating discipline choices. Secondly, the study looks at how personality affects learning characteristics in different ways within each subject discipline.

The results demonstrate quite clearly that those personality traits measured by the OPQ can be linked to subject category choices among the student sample. Multivariate analysis of variance indicated significant differences in the scores of the subject category samples within the 'thinking styles' and 'feelings and emotions' groups of traits within the OPQ - though not within the 'relationships with people' group. This does suggest that characteristics concerned with cognitive and emotional processes - rather than social behaviour - are influential in determining subject choice.

The traditional distinctions between arts and science students have, to some extent, been borne out by the findings. Arts students are characterised by significantly higher scores on the 'artistic' scale and significantly lower scores on the 'data rational' and 'practical' scales. This is reflected in significantly higher scores on the varimax factor 'concrete orientation', suggesting a dispositional tendency to avoid practical matters and an aversion to logic and figures. They did not, however, score more highly than other students on the 'abstract orientation' factor, suggesting that their choice of an arts subject is determined not so much by attraction to abstract issues as dislike of concrete issues.

Science students on the other hand emerge as more 'democratic', 'practical', 'data rational', 'tough minded', and more likely to enjoy concrete oriented tasks - with significantly higher scores on the 'concrete orientation' factor scale. They are also less 'artistic', 'caring', 'behavioural', 'critical' and 'assertive' - clear evidence to support Entwistle and Ramsden's (1983) contention that science students tend to be 'thing' rather than 'person' oriented.

These results suggest that arts and science students fall at opposite ends of a spectrum personality-wise, since these two samples give rise to the vast majority of significant differences emerging from analysis of the data. The other category samples would appear to fall midway with regard to most of the characteristics measured. Broad-based students, for example, do not score significantly higher or lower than the rest of the sample in any area.

Social science students were characterized here by higher scores on the 'behavioural' scale, which - given the predominance of psychology students in this category sample (see chapter 2) - suggests that the definition of the scale - 'analyses thoughts and behaviour, psychologically minded, likes to understand people' - could be quite useful in predicting choice of a social-science subject at university level.

The relative characeristics of law and medicine students could not be assessed individually since the nature of the sample dispersions dictated that the two categories be subsumed into a more general 'vocational' sample. The profiles of this sample emerged as more 'traditional', 'ambitious' and 'assertive' than the other groups, perhaps suggesting the existence of high achievement drive which operates best in well-established, person-oriented, and ultimately status-laden contexts.

4.73 Subject discipline and cognitive style

The results constitute only partial support for the longstanding belief that cognitive style is a reasonably good predictor of choice of subject - at least in terms of the arts/science 'dichotomy'. Multivariate analysis of variance of all four 'styles and pathologies of learning' indicated that the cognitive styles preferred by students of different subject discipline did not vary significantly. No significant differences were noted between the subject categories on the 'comprehension learning' scale - indicating preference for a 'holist' learning style, however, contrary to expectations, the science student sample scored significantly higher on the 'globetrotting' scale - suggesting an 'over-readiness to jump to conclusions'. This scale measures the tendency to 'misapply' a holist style, perhaps indicating that when dispositionally 'holist' learners encounter the serialist nature of science, their experiences will tend to reflect an 'over-reaching' intellectual handling of concepts and ideas. Arts students emerged as significantly less likely to prefer 'serialist' learning style than the rest of the sample - scoring lower on the 'operation learning' and 'improvidence' scales - suggesting that the cognitive makeup which predisposes these students to dislike learning in a highly structured serial fashion also serves to draw them to arts rather that science subjects. Pask's claim that social science students, like arts students, would be more likely to be comprehension rather than operation learners was not supported by these results. It might be claimed that psychology is evolving from an arts into a science discipline, and certainly the subject involves many analytical and procedural tasks requiring both holistic and serialist cognitive frameworks. Perhaps the absence of any strong inclination towards one or the other style of learning within the student, makes social science or broad-based degree courses seem more attractive.

4.74 Subject discipline and approaches to learning

The widening of the categorization of the student sample to include a vocational group paid dividends when looking at different motivations for study. Although no one subject category of student scored significantly different on intrinsic motivation, vocational students emerged as much more likely to be driven by extrinsic motivations - such as career, status, or family expectations - rather than any fundamental interest in their subject. In addition, they appear to be more achievement motivated too, suggesting a need to compete and 'win' relative to their fellow students.

Within the 'meaning orientation'[1] set of scales of the ASI multivariate ANOVA indicated the presence of a significant effect of category of study. Broad-based and social science students scored significantly higher on the 'relating ideas' scale, reflecting the requirement in both of these categories to take knowledge and apply it in different spheres and contexts. Of all the

[1] 'Meaning orientation' is used here to refer to the four scales of the ASI purported to measure deep learning by Entwistle and Ramsden (1983), *not* the eponymous factor scale described in the previous chapter.

subject categories, these two perhaps represent the most 'topic-diverse' degrees undertaken, with many of the students studying a combined timetable.

As far as the critical 'deep approach' to learning is concerned, no significant differences were noted. It appears that no one subject category inspires students to actively engage with the learning material more than any other.

Within the 'reproducing orientation'[2] domain however, multivariate ANOVA did unearth general significant differences in subject category samples. Science students scored significantly higher on the 'surface approach' scale. On the factor scale 'reproducing orientation'[3] science students scored significantly higher while arts students scored significantly lower. This supports the findings of Hayes and Richardson (1995) and the proposition that science courses naturally engender surface approaches to learning. Since this phenomenon cannot be attributed to differences in motivation or cognitive style, it must be assumed that the learning environment and materials used encourage the student to utilise passive and rote learning techniques - though as Hayes and Richardson point out, this does not preclude nor hinder the potential for them to pursue deep learning strategies. Conversely the environment offered in arts courses seem to preclude the adoption of surface learning techniques. Entwistle and Ramsden (1983) offered examples of science students' tendency to focus too much on the procedures required in carrying out a task or problem, and too little on the relationships between aspects of the task or its overall purpose. However, they suggested that in science it is often necessary for students to adopt surface approaches to learning as a *precursor* of deep approaches. In science subjects, the memorization of formulae, data, facts and figures is perhaps a vital step prior to deep learning. In many cases however, the learning process does not develop beyond the surface level. In arts and social science subjects rote learning is unhelpful since personal meaning requires that relationships between ideas and between specific procedures, facts and the overall message, are understood from the outset. Surface learning techniques serve no priming function in these subject disciplines. It seems that *either* the science students in this sample are failing to recognise that surface learning strategies are insufficient and that the superficial level of knowledge that these strategies yield is not the meaningful knowledge that they are required to attain, *or* that they are using

[2] 'Reproducing orientation' is used here as a subheading of the four scales of the ASI designed to measure surface learning by Entwistle and Ramsden (1983).

[3] 'Reproducing orientation' here refers to the factor scale extracted and described in the previous chapter derived from the ASI scales 'surface approach', 'improvidence', 'globetrotting', 'extrinsic motivation', 'negative attitudes to study' and 'syllabus-boundness'.

surface approaches to learning as a 'stepping stone' to deeper learning. The former seems to be the more likely cause of the increased 'surface approach' of science students in this study, since the use of surface approaches as a means of developing a knowledge base in a quest for deeper understanding might be thought to be related to a serialist learning style, in which knowledge is built up through understanding relationships between relatively narrow contexts and using context-specific pieces of knowledge to learn about broader, theoretical ideas - rather than vice versa. There is no evidence here to suggest that science students are any more 'serialist' than the other group.

Gow and Kember (1993) stated that in departments where transmission of knowledge is held to be the predominant function, the design of the curriculum and the methods of teaching prevalent are more likely to have 'undesirable influences' on approaches to learning. Departments which conceive their task to be 'learning facilitation' are more likely to constitute learning environments conducive to meaningful learning. The issue of whether the apparent propensity for surface learning in science students lies with departmental conceptions of learning, or with the nature of the subject itself - or even an interaction between the two - is certainly one worthy of further research.

In summary, several distinct trends were noted in the personality traits of students of different subject discipline - especially between students of arts and science subjects. The trends are principally concerned with differences in predeliction to become involved with concrete, analytical tasks rather than abstract, people-oriented tasks. It was observed that motivation for study differs radically between study discipline with vocational students being driven largely by extrinsic, achievement oriented goals and that science students - in accord with much previous research - emerged as more likely to adopt a surface approach to studying than any other subject discipline group.

4.75 Gender and personality

In terms of personality traits, male and female students were found to differ in ways which seem to conform to established gender stereotypes differed along fairly stereotyped lines (Archer and Freedman, 1989). Multivariate ANOVA highlighted gender as a significant main effect in all three group analyses - 'relationships with people', 'thinking styles' *and* 'feelings and emotions'. Males scored higher on 'persuasive', 'independent', 'social confidence', 'practical' 'data rational', 'conceptual', 'innovative', 'relaxed', 'tough minded', 'emotional control', 'critical', 'active', 'competitive' and 'decisive', while females scored higher on 'modest', 'democratic', 'caring', 'artistic', 'behavioural', 'detail conscious', 'conscientious' and 'worrying'. These individual traits reflect the differences found in the factor extracted traits - males scoring significantly higher on 'abstract orientation', 'ambitiousness', 'concrete orientation' and 'emotional stability', while females scored significantly higher on 'conscientiousness'. Intriguingly, Saville and Holdsworth - publishers of the OPQ - report similar gender differences for only the 'caring', 'data rational', 'artistic', 'behavioural' and 'tough-minded' scales, although these findings are based on a predominantly managerial sample for whom career success may be dependent - regardless of gender - on certain characteristics - typically relating to assertiveness and ambitiousness (Saville and Holdsworth, 1990).

Within the context of higher education, Wankowski's (1973) contention that males and females are fundamentally distinct in terms of temperament and personality appears to be justified. Although this study is not of gender differences in personality *per se*, it is difficult to ignore the possibility that such dispositional disparity might very well influence the learning of males and females.

4.76 Gender and learning

Perhaps more pertinent however, are the differences in cognitive style noted between males and females. A clear division is noted between males who consistently score higher on the 'holist' cognitive style scale 'comprehension learning', and females who score higher on the 'serialist' scales 'operation learning' and 'improvidence'. This trend is also observed within the factor scale 'abstract orientation' relating to preference for abstract issues and holistic styles, in which males scored significantly higher.

This gender difference in cognitive styles has not previously been reported in the studies of Pask or Entwistle.

Richardson (1993) found no gender differences in approaches to studying in his first study, and in addition found no significant differences in the responses of males and females on a factor-analysed version of the ASI which included Pask's 'styles and pathologies of learning'. However, in his study, 'comprehension learning' was grouped with 'deep approach', 'relating ideas', and 'use of evidence' to form 'meaning orientation', while 'improvidence' was grouped with 'surface approach', 'fear of failure' and 'syllabus boundness' to form 'reproducing orientation'. The cognitive styles were assumed to be analogous to the approaches to studying. However, if the theoretical rationale on which each of these concepts is based is scrutinized, it becomes apparent that their twinning is of dubious validity. One is derived from students' conceptions of their learning experiences and is largely considered to be contextually determined, the other is grounded in consistent, perhaps dispositional variances in cognitive style. While there may be some sort of correlational relationship betweeen the two, the validity of assuming that they stem from the same underlying bases is questionable. Richardson (1990) reported factor analysis solutions of the ASI which demonstrated a separate factor constituting comprehension learning quite distinct from the main meaning and reproducing orientations. He concluded that 'the significance of comprehension learning as a diagnostic indicator of meaning orientation was left in some doubt'. However the 'comprehension learning' scale is not investigated separately in subsequent studies as it is here, so gender difference in cognitive style may well have been overlooked.

Watkins (1982, 1984), Watkins, Hattie and Astilla (1986) and Miller (1990) *did* observe gender differences in learning styles, concordant with the findings here - though none of these studies took place within British universities.

The findings also support those of Terenzini and Wright (1987) and Baxter-Magolda (1988) who proposed that males' intellects tend to develop in a more independent fashion than females, and that males are more likely to construct broader structures in their reasoning, question concepts and ideas in wider contexts, and challenge the educational system, while females will tend to rely to a greater extent on the social structure of the institution, building up knowledge and reason through social interaction and peer support while seeking more immediate, yet less far-reaching solutions to problems.

Armstrong (personal communication) of Sunderland University has suggested that brain lateralisation theory may be pertinent to the finding of gender differences in cognitive style, since much evidence exists to suggest that females tend to possess more developed left cerebral hemispheres - specialized in verbal, analytical, temporal and digital operations - while males tend to have more developed right cerebral hemispheres - primarily handling non-verbal, holistic, concrete, spatial, analogue, creative and aesthetic functions (Coltheart, Hull and Slater, 1975; Kimura, 1992).

Set against this however is a great deal of evidence to suggest that there are no intrinsic differences in the learning styles of males and females (Clarke, 1986; Watkins and Hattie, 1981, 1985; Richardson, 1993; Hayes and Richardson, 1995).

In order to test further the possible existence of consistent cognitive differences in the learning styles of males and females it might be necessary to administer a problem-solving task in the style of Pask (1976), rather than rely on self-perceptions of learning, since learning styles are perhaps less open to introspective analysis than approaches to learning - Richardson (1995) has cast doubt on the validity of using formal self-report questionnaires to accurately describe an individual's cognitive structures. In addition, the effects of type of task, context, and motivation undoubtedly have a bearing on adoption of style, (Laurillard 1985), and since these are ambiguous and unspecified in the wording of the items of the ASI, the existence of dispositional links or individual differences based on gender may be clouded.

The existence of such a disparity of cognition would indeed mark important differences in males and females experiences of higher education which in turn would demand a more flexible teaching structure in which the matching of preferred, and thus most efficient individual learning style to structure of learning material was considered a priority.

In terms of motivation for study, the findings here are much easier to reconcile with past observations. Females emerged as more driven by fear of failure, while males were more extrinsically motivated - that is motivated by interests other than the subject matter itself. Looking to the varimax factors it becomes possible - for the first time - to propose a dispositional basis for the motivation of females. Fear of failure is highly associated with the emotional stability factor, which in turn can be assumed to be analogous to neuroticism. Previous studies have demonstrated that female undergraduates tend to score higher on the neuroticism scale of the EPI (Scheier and Cattel, 1961; Saville and Blinkhorn, 1976; Simon and Thomas, 1983). That females do not generally perform less well academically suggests that neuroticism forms the basis for fear of failure motivation, which drives females to learn. It seems that females are able to handle and perhaps in some cases 'harness' negative emotionality, whereas males are more easily hindered by academic uncertainty and worry. However, Entwistle and Wilson's (1970) implication that a degree of neuroticism is advantageous for females cannot be fully supported since neither the positive correlation between academic attainment and fear of failure nor the negative correlation between attainment and the emotional stability factor - see chapter six - quite reach statistical significance.

Previous research has been inconsistent in term of assigning gender as a determinant of differences in approaches to learning. While some claim to demonstrate that females are more likely to adopt a meaning orientation (Clarke, 1986; Watkins and Hattie, 1982, 1985; Miller, 1990), others reported the reverse (Van Rossum and Schenk, 1984). Here, no major differences were noted in deep, surface or strategic approach subscales, though males did emerge as higher scorers on the 'use of evidence' scale, which ties in with their higher scores on concrete orientation, perhaps suggesting some connection between cognitive disposition and approach to learning. Otherwise the lack of difference suggests that the approaches measured by the ASI are determined largely by situational and task factors rather than consistent traits - in accordance with the findings of Richardson (1993).

4.77 Subject discipline / gender interactions

The significant subject/gender interactions found here seem to contradict those of previous studies. Hayes and Richardson (1995) for example concluded that for females at least, the gendered nature of their discipline would influence their approaches to studying, with meaning orientation encouraged by a predominantly female environment in arts subjects and predominantly male environment in science subjects. Here, this pattern appears to be reversed. Females scored higher on meaning orientation in the predominantly male environment of science - as well as in the more gender neutral vocational and social science ones - while males seem more likely to assume a meaning orientation in the predominantly female environment of arts - and in the more neutral 'broad-based' category.

Thomas (1990) claimed that the males in arts degrees were likely to be successful due to a tendency to reward 'individualism' and the ability to be assertive and original. This type of 'non-conformity' may be a pre-cursor of meaning orientation in the sample here - although there is no category/gender interaction within the 'assertiveness' factor scale. The study did however find that males in arts subjects scored significantly lower on 'negative attitudes to study' than females, suggesting that a female-biased environment suits their study preferences.

According to Thomas, females in male dominated subjects such as science and, perhaps to a lesser extent, the vocational disciplines - law and medicine - often meet with both disapproval - for being unfeminine - and admiration - for 'making it in a man's world'. The female students in this sample appear to be able to transcend traditional notions of gender appropriate academic roles and accept the 'challenge to their personal identity and confidence' (Hayes and Richardson, 1995). By making an active decision *not* to follow stereotypical academic paths, the students in this sample are perhaps exercising more freedom and control over their lives, and this intellectual 'autonomy' is perhaps instrumental in their adoption of meaningful learning strategies.

That females score higher on the 'affiliative' trait in the the 'male' subjects of science and vocational categories suggests that they are not more 'masculine' in personality than the norm. Indeed it might by claimed that this social quality is advantageous in scientific rational fields since it bestows the student with the ability to develop knowledge using social interaction and peer support - as suggested by Terenzini and Wright (1987) and Baxter-Magolda (1988).

An interesting finding is the apparent absence of any gender differences in emotional stability in social science students. A potential explanation is that male social science students are intrinsically more emotionally secure than other male students - perhaps stability is a necessary quality when embarking on the study of subjects generally perceived to be 'feminine' (Archer and Freedman, 1988). An alternative, is that the sizeable psychology sub-sample might have been able to identify questions pertaining to emotional stability/neuroticism and thus responded in a more socially desirable fashion.

Overall, clear personality differences were noted between male and female students, with females emerging as more conscientious, but less assertive, ambitious and emotionally stable than males. In addition, evidence was found of a tendency for male students to prefer holistic styles of learning, and for females to prefer serialist styles of learning. No substantial difference were noted in the approaches to learning adopted by male and female students.

4.78 Maturity and personality

On the face of it, it might be thought that the personalities of mature students would not differ radically from those of non-mature students. Personality remains relatively consistent over time and the mature student sample is distinguished only by a somewhat arbitrary age marker. However, the life choices of mature students tend to be rather different to those of non-mature students. The possibility that their personality 'profiles' differ in some quantifiable way thus influencing life choices - such as choosing not to pursue higher education straight from school - has not previously been investigated. While social and practical reasons for life choices are likely to predominate, the existence of personality factors cannot be discounted.

Multivariate ANOVA indicated that 'maturity' was a main effect in the 'relationships with people' group characteristic analysis, but not on the 'thinking styles' or 'feelings and emotions'. This highlights the effect of differences in social situation generally found betweeen mature and non-mature students. Mature students differed overall on only four of the individual scales of the OPQ. They emerge as less 'affiliative', less 'democratic', less 'caring' and less 'active'. These findings are reflected in the analysis of variance of the factor scales 'assertiveness' and 'sensation seeking' - the mature student sample seemingly less assertive and sensation-seeking than the non-mature sample.

One reason for this may in fact be generational trends, with changes in modes of upbringing and socialization meaning that by adulthood, younger individuals tend in general to be more assertive and sensation-seeking.

These findings might potentially be interpreted by considering that the personality profiles of mature students are mediated by life experiences. The mature student will typically have had to make their post-school decisions without the range of options available to today's school-leaver. Many will have entered the workplace directly from school and/or raised families. The responsibilities inherent in these choices may preclude the often hectic choice of physical and social activity favoured by the non-mature student, and thus both assertiveness and sensation-seeking traits may have declined over time as more settled lifestyles have been adopted.

Mature students often return to education to enhance their employment prospects. Lack of asssertiveness may have hindered the progress of some, especially in competitive environments, and lead to disillusion with employment roles. University may have been a means for some to escape this environment - a chance to attempt new intellectual - rather than interpersonal - challenges.

4.79 Maturity and learning characteristics

The findings regarding the approaches to studying of mature compared with non-mature students are relatively straightforward to square with previous research. Mature students score more highly on three of the four subscales within the original meaning orientation domain of the ASI - 'deep approach', 'relating ideas' and 'intrinsic motivation' with multivariate analysis indicating very significant differences between the two samples. (Richardson (1995) observed higher scores in all four of the subscales). Accordingly the factor analysed meaning orientation scale also yielded significantly higher scores for mature students.[4]

Mature students were *not,* however, found to engage in reproducing strategies significantly less than the non-mature students. (The two orientations are not mutually exclusive.)

It seems that although mature students are more likely to seek meaning in their work, they are often forced by course demands to resort to surface strategies. Whereas the non-mature student is less likely to concern themselves with seeking meaning in the first place, the mature student may experience frustration at being unable to engage with the topic enough to extract meaning. Clearly they are more motivated to do so in the first place and as Harper and Kember (1986) note, come to university with the intellectual maturity to recognise the value of searching for coherent meaning.

This finding contradicts those of Watkins and Hattie (1981), Biggs (1985), Clennell (1987) and Richardson (1995), perhaps as a result of this sample's experience of greater class sizes and less individual attention leading to the adoption surface strategies.

The results do however support the contention that surface approaches to studying acquired in secondary education are carried over directly by non-mature students (*cf* Harper and Kember, 1986), although the demands of statistical rigour made it impossible to test whether life experience was more advantageous in subjects such as arts and social science than in the sciences, as proposed by Smithers and Griffith (1986).

[4] It must be noted here that the use of a simple mature/non-mature dichotomous categorization may have compromised the validity of these findings. Future research might be well advised to follow the lead of Richardson (1995) in analysing age as a ratio variable.

One interaction was noted between gender and maturity. The general trend for males to score higher on abstract orientation than females is reversed in the mature student sample, with mature females scoring significantly higher than mature males. This suggests that for females, life experience is highly beneficial is helping them set about their studies in a more broad-minded, innovative, conceptual fashion. It would seem that for the female mature student at least, the break between school and higher education constitutes a time of valuable intellectual maturation which offers the potential of a much richer educational experience in the long term.

In conclusion, mature students were distinguished mainly by their more frequent adoption of deep approaches to learning, at least according to the self-report Approaches to Studying Inventory which is likely to stem from increased intellectual maturation and intrinsic interest in the subject studied. Mature students also emerged as significantly different in terms of some of the social-related characteristics measured by the OPQ - assertiveness and sensation-seeking.

4.8 Conclusions

The results of this study highlight the value in breaking down a large sample into sub-categories in order to assess individual differences, so that the effects of subject discipline, gender and maturity might be assessed in a multivariate, interactive fashion.

Some of the principal trends recorded - the differences in the cognitive styles of arts and science students, the vocational students' largely extrinsic motivation for study, the science students' adoption of reproducing learning strategies and the mature students' adoption of meaning-oriented learning strategies - are consistent with previous research and strengthen established areas of knowledge regarding individual difference in leanring.

Other findings however have little or no precedent - for example, the clear difference found between the cognitive style preferences of male and female students, and the *absence* of any gender difference in adoption of approaches to learning, both seem to contradict previous research. However, previous studies have frequently lacked methodological rigour and clarity, and this gender trend is an area which is certainly worthy of further investigation.

It was also found that students undertaking their studies in a subject area predominantly studied by members of the opposite sex were more likely to view their work positively and adopt deep learning strategies. The gender difference in preference for abstract, complex and conceptual issues was shown to be reversed in mature students perhaps suggesting that predicition for linguistic, conceptual or procedural academic tasks of one style or another may not be as fixed as has been assumed.

CHAPTER 5 - LONGITUDINAL ANALYSIS OF LEARNING AND PERSONALITY CHARACTERISTICS

5.1 Overview

This chapter describes the use of longitudinal analysis to investigate the development of student learning over three years at university. Chapter three demonstrated that approaches to learning and personality were not intrinsically related, giving rise to the real possibility that students' learning strategies are governed by contextual and thus potentially variable factors. This part of the research seeks to assess whether the students learning develops in line with the changes in conception of learning and schemes of intellectual development proposed by researchers such as Perry (1970), Säljö (1979) and Biggs (1982)

5.2 Development in conceptions of learning over time

Perry (1970) studied closely the development of American students throughout their experience of four years of college. Through analyzing transcripts of open-ended interviews with students he was able to outline a sequence of developmental stages in which their conceptions of knowledge gradually changed from a 'dualistic' outlook, where knowledge is seen as a series of questions which have simple solutions, (either right or wrong), to a 'relativistic' outlook where knowledge is conceived of as contextual and dynamic. This process necessitates the development of an understanding that simple answers rarely exist. The final stages of this 'evolution' see the development of commitment to a personal interpretation of the world and application of this new perspective to other areas of life:

> Position 1: The student sees the world in polar terms of we-right-good vs. other-wrong-bad. Right answers for everything exist in the Absolute, known to Authority whose role is to mediate (teach) them. Knowledge and goodness are perceived as quantitative accretions of discrete rightnesses to be collected by hard work and obedience.
>
> Position 2: The student perceives diversity of opinion, and uncertainty, and accounts for them as unwarranted confusion in poorly qualified Authorities or as mere exercises set by Authority 'so we can learn to find The Answer for ourselves'.
>
> Position 3: The student accepts diversity and uncertainty as legitimate but still temporary in area where Authority 'hasn't found The Answer yet'. He supposes Authority grades him in these areas on 'good expression' but remains puzzled as to standards.
>
> Position 4: (a) The student perceives legitimate uncertainty (and therefore diversity of opinion) to be extensive and raises it to the status of an unstructured epistemological realm of it's own in which 'anyone has a right to his own opinion', a realm which he sets over against Authority's realm where right-wrong still prevails, or (b) the student discovers qualitative contextual reasoning as a special case of 'what They want' within Authority's realm.

Position 5: The student perceives all knowledge and values (including Authority's) as contextual and relativistic and subordinates dualistic right-wrong functions to the status of a special case, in context.

Position 6: The student apprehends the necessity of orienting himself in a relativistic world through some form of personal Commitment (as distinct from unquestioned or unconsidered commitment to simple belief in certainty).

Position 7: The student makes an initial Commitment in some area.

Position 8: The student experiences the implications of Commitment, and explores the subjective and stylistic issues of responsibility.

Position 9: The student experiences the affirmation of identity among multiple responsibilities and realizes Commitment as an ongoing, unfolding activity through which he expresses his life style.

(Perry, 1970, pp.9-10)

Säljö (1979) asked a group of students the question; "*What do you actually mean by learning?*". The responses revealed a broad range of conceptions which, though diverse, could be readily grouped into qualitatively distinct categories descriptive of five different conceptions of learning;

1. learning as the quantitative increase in knowledge;
2. learning as memorizing;
3. learning as acquisition of facts, procedures, etc. which can be retained and/or utilised in practice;
4. learning as extraction of meaning;
5. learning as an interpretative process aimed at the understanding of reality.

(Säljö, 1979)

The first three of these categories are distinctive in that they feature a *reproductive* conception of learning in which knowledge is perceived to be the memorization of pieces of information. Säljö (1984) commented that this 'absolutist' mode of thinking is ingrained in Western culture, - i.e., knowledge is frequently defined as symbolic, unreflective and taken-for-granted, - and so it is unsurprising that students run into difficulties when this conception of knowledge is challenged.

The latter conceptions suggest a perception of learning in which information is processed in a meaningful, personal fashion and thus *transformed* into understanding. Both van Rossum and Taylor (1987) and Marton, Dall'Alba and Beaty (1992) subsequently proposed a sixth identifiable category; 'changing as a person', which perhaps represents what many would perceive to be the ultimate goal of any course of higher education.

Each of Säljö's conceptions were demarcated by qualitative differences in perceptions of a) the relationship between the phenomena being learned and the context in which it exists, and b) the relationship between the component parts of the phenomena and how these parts interact.

According to Marton *et al* (1992), the ways in which phenomena - and their conceptual components and context - are perceived by the student, represent 'structural' aspects of each conception of learning, i.e., the dynamics of how the material is learned. These structural aspects interact with 'referential' aspects which refer to the global meaning attributed to the phenomena and associated context.

The first conception - 'learning as increasing one's knowledge' - implies identification of both structural and referential aspects of learning, however the structural aspects tend to focus only on acquiring 'knowledge' without reference to its application or context. In this sense, learning is conceived to be an accumulative process geared towards the storage of discrete, universally accepted pieces of information.

The second conception - 'learning as memorizing and reproducing' - (a definition comparable to that of Entwistle and Ramsden's 'reproducing orientation'), is similar to the first since knowledge is structurally conceptualized in quantitative, accumulative terms. In this category, learning is considered to be an artefact of whichever mode of educational assessment is anticipated. The referential aspect here is of learning as the ability to memorize and reproduce information with the ultimate goal of satisfying assessment criteria.

Within the third conception - 'learning as applying' - the referential aspect is perceived to be the ability to *apply* a body of knowledge. However, Marton *et al* found in interview studies that this conception shared much of the 'learning as consumption of knowledge' conception with the previous category. Again, knowledge is considered to be quantitative and 'external' and thus learning is assumed to be a matter of storing knowledge, retrieving it and using it in set contexts - albeit contexts beyond imminent assessment.

The fourth conception - 'learning as understanding' - marks the emergence of meaning as central to both the structural and referential aspects of learning. At this stage evidence is noted of ability to relate information and ideas, discern between different learning materials and seek them from wider sources. The quest for meaning demands that the referential and structural aspects become very closely related.

The fifth conception - 'learning as seeing something in a different way' - differs from the previous conception in that the referential aspect of learning occupies a domain broader than the immediate educational context. Here, the capability or skill to perceive phenomena in new and diverse ways has developed and the learner has changed his or her way of thinking about phenomena - a cognitive capacity which supersedes that of merely grasping an idea or meaning of phenomena.

The sixth conception - 'changing as a person' - described by Marton *et al* builds on the previous two in terms of conceptualizing learning as an integrative process. A referential aspect develops in which the new understanding(s) changes the perception of self. By conceptualizing how the elements of any phenomenon and its context are related, a radical change occurs in which the existential perspective of the learner actually shifts. Subsequent learning will be informed and influenced by the student's new 'frame of mind'.

Van Rossum and Schenk (1984) highlighted that the respective hierarchies presented by Perry and Säljö share the notion of "increased acceptance of uncertainty and a tendency to relativity in thinking". Both identify developmental steps in which the learner moves away from concrete *dualistic* thinking, begins to recognize the importance of context, flexibility and meaning, and arrives at a personal interpretation offering far richer insight and capacity for generating of new ideas and perspectives.

Säljö (1979) claimed that conceptions of learning are the most important determinants of level of information processing applied by the student in any given learning task, and ultimately determine level of outcome. For a deep approach to learning to be inspired, it is thus vital that the student holds a conception of learning *beyond* that characterised in the third stage.

A central issue to be investigated here is whether the learning strategies determined by conceptions of learning actually follow these hierarchies and developmental sequences. Perry claimed that the cognitive development of the student would indeed take place in the manner outlined, whereas Säljö considered the trends to be subject to educational context and conditions.

Marton et al's studies suggest a developmental trend, with the conceptions higher in the hierarchy evident more often towards the end of the courses of study monitored. This suggests that higher education *does* engender more sophisticated conceptions of learning. The generality of these trends must however be questioned. As Dahlgren (1978) discovered, the understanding of the fundamental principles of economics attained by a group of economic students were qualitatively very basic, even towards the end of their course. Their conceptual development certainly did not match that expected by their tutors. Clearly many of these students had failed to advance their conceptions of learning far beyond those developed at school level.

Volet and Chambers (1992) proposed a developmental hierarchy of learning goals which formed a unidimensional continuum with surface and deep levels of processing forming the opposite poles and several intermediate levels lying in between. They argued that students' academic goals determined levels of content processing and thus the goal hierarchy could be described on several levels - with the lowest level of processing predicted by an 'acquire and recall' conceptualization of learning, an intermediate level predicted by some concern for conceptual understanding and integration of new information, and the highest level predicted by in-depth critical reflection and theory building. This hierarchy is proposed as an *unfolding* model of stage development, in which characteristics are gradually acquired and then lost as the student traverses the developmental sequence. Meyer and Muller (1990) and Meyer *et al* (1990) describe similar models in which the relationship between perceptions of learning context and approaches to learning form distinct clusters supporting the existence of a deep/surface learning dichotomy, composed of individual study 'orchestrations'.

Biggs and Collis (1982) also looked at learning outcome by studying answers given by school-age subjects to academic questions. Again, qualitative differences were noted in the structure and sophistication afforded by the responses. From this they developed the SOLO taxonomy (Structure of Observed Learning Outcomes);

1. *Pre-structural* - In relationship to the prerequisites given in the question, to the answers are denying, tautological, and transducive. Bound to specifics.
2. *Unistructural* - Answers contain 'generalizations' only in terms of one aspect.
3. *Multistructural* - The answers reveal generalizations only in terms of a few limited and independent aspects.
4. *Relational* - Characterized by induction, and generalizations within a given or experienced context using related aspects.
5. *Extended abstracts* - Deduction and induction. Generalizations to situations not experienced or given in the prerequisites of a question. (Biggs and Collis, 1982)

This taxonomy includes aspects of both Piagetian stage development and some of the tenets of Information Processing theories of student learning (see p15). It is worth stressing that answers of each of these types may in fact be factually correct - the taxonomy charts increasing quality of learning in evidence in the answers.

In the study presented here, the range of learning outcomes are assumed to be predicted at least in part by variance of both conception of learning and approach to learning.

Entwistle and Entwistle (1992) described a study in which students were asked - in a fashion similar to that employed by Säljö (1979) - the question '*What is understanding?*'.

They were able to identify aspects of understanding and associated feeling and perceptions. Understanding itself was noted to have a 'feeling tone' attached to it - a strong indicator that understanding has actually been accomplished. This is generally manifested in feelings of satisfaction, insight, confidence and an appreciation of the very nature of the subject discipline. In this sense these feelings mirror that of the phenomenographic deep approach, where meaning, significance, coherence and connectedness - and perhaps a sense of 'closure' - are sought. Ultimately the student adopting a deep approach will be seeking what Entwistle and Entwistle term 'provisional wholeness' - satisfaction in understanding, with the attendant belief that current understanding may be subject to future modification and extension. Associated with this is the perception that the new interconnection of ideas will remain stable and is 'irreversible', yet may be refined and developed. Confidence about explaining the phenomena to others develops, and a new level of ability to use and apply the ideas and information in a flexible manner in order to adapt to novel situation and contexts is attained.

According to Entwistle and Entwistle, in order to experience these feelings the student must actively engage with the learning material. They suggest that internal debates may be implicit in the learning process - a concept shared with Pask's (1976) 'conversation theory' (see p7). Peer discussion is also important and may contribute to the perception of knowledge as a 'social construct'. The new information must also be related to the students own experience and past knowledge and this will shape an overall structure in which sense and meaning can be sought.

Entwistle and Marton (1994) developed a hierarchy of approaches to operationalize the observations which Entwistle and Entwistle (1992) had termed 'forms of understanding';

A- Absorbing facts, details and procedures related to exams without consideration of structure.

B - Accepting and using only the knowledge and logical structures provided in the lecture notes.

C- Relying mainly on notes to develop summary structures solely to control exam answers.

D- Developing structures from strategic reading to represent personal understanding but also to control exam answers.

E - Developing structures from wide reading which relate personal understanding to the notion of the discipline.' (from Entwistle and Marton, 1994)

These categories differ in terms of breadth, (range and amount of information processed), depth, (effort and commitment in integrating information and reaching understanding) and type of structure, (derived either from structure of lecture course or through imposition of own conceptual framework).

Entwistle and Marton (1994) conducted a learning outcome study with a view to investigating students' development of conceptual understanding focusing specifically on experiences of revising for final examinations. They were concerned with what the experience of understanding felt like for different students. This work led to the conception of the *knowledge object* - 'A tightly integrated entity - with form and structure - some aspects of which could be visualized and from which associated unfocused knowledge was available when needed.' (Entwistle and Marton, 1994).

Knowledge objects are thus a phenomenographic concept which bring together aspects of knowledge integration, the 'quasi-sensory' nature of perceptions of knowledge and the awareness of peripheral information.

The concept is based on observed outcomes and as such is valuable in informing any conceptual investigation of changes in approaches to learning. It is assumed that any shift from a surface approach to a deep approach would be associated with increased integration and restructuring of knowledge using logical, theoretical and experiential aspects of the topic, quasi-perceptual awareness of knowledge objects and increased orientation towards the actual phenomena underlying academic teaching.

The interviews informing the development of this concept involved relatively small numbers of final year students and thus could not draw inferences on the development of knowledge objects over time. This study aims to test whether by adopting deeper approaches to learning over time, students may in fact be developing knowledge objects in the manner described.

Differences in cognitive style and development of learning framework, - in particular the difference between comprehension and operation learning (see p12) - suggest that the path to understanding will be manifestly diverse within any one group of students. The study here assesses how the relationships between learning style and learning approach develop over the course of a degree. If students do move towards developing a certain cognitive structure in order to reach conceptual understanding then a convergence of certain learning styles and learning approaches might be observed. Students may develop a set learning style as a result of development in their conception of learning, and will use this style of framework to reach their own understanding. In the latter stages of their course of study one or other mode of style may be recognized. If this is the case then learning styles and approaches will be conceptually unrelated in the first year, but closely associated by the third year.

The hierarchies and taxonomies presented have established theories to suggest how learning approaches might (or even should) develop over the course of higher education. Other studies have approached the problem in a more empirical fashion. Beaty (1978) for example, interviewed students over the three years of their university course and sought to find out for each the reasons *why* they were studying. In the second and third years the students were shown transcripts of their interview from the previous year - and from this they were able to outline how and why their conceptions of learning and their study habits and behaviour had changed. The principle finding was identification of the development of a sense of personal awareness and the ability to consciously select learning strategies which suited their personal goals and motivations.

Mathias (1978) noted a similar pattern, but in addition observed a distinction between 'course-focused' and 'interest-focused' students. Interview transcripts suggested that many students moved from a weak course focus to a strong course focus over their university careers - a shift analogous to an adoption of Ramsden's 'strategic approach' (Ramsden, 1983). This shift was especially prevalent in students initially deemed 'interest-focused', who because of a growing self-awareness of the relationship between themselves, university study and other interests and activities, became disappointed with the level of intellectual stimulation offered. While at the outset these students exhibited a high level of interaction with the materials and their tutors, and were willing to invest effort to explore topics of interest, their conceptions of learning within the educational context narrowed to match quite closely those of the course-focused students.

Other studies have observed rather more consistency in study characteristics. Svennson (1977) for example, noted that the majority of students monitored did not differ in approaches used in experimental and real-life class studies. Clarke (1986), (using the Approaches to Studying Inventory), found no major differences in meaning and reproducing orientations in a cross-sectional study of first, third and final year medical students, and Newstead (1990), (also using the ASI), found no significant effect of year of study in the learning approaches of psychology students.

Several studies have used the Approaches to Studying Inventory in longitudinal trials with a view to testing the reliability of the instrument, rather than to assess changes in learning strategy over time (Cole, 1984; Newble and Gordon, 1985 - both studies testing medical students - Watkins, Hattie and Astilla, 1986; Richardson, 1990, 1995; Watkins and Hattie, 1993; Richardson, Landbeck and Mugler, 1995)

Richardson (1995) found no significant difference in orientation scores over a two week period, while Richardson, Landbeck and Mugler (1995) noted a marginal increase in reproducing orientation over a thirteen week period. Watkins and Hattie (1981) found that both meaning and reproducing orientation scores decreased with increasing seniority in a longitudinal study, as did Biggs (1985) in a cross-section study using his Study Processes Questionnaire. Cole (1984) observed a fall in meaning orientation scores and a rise in reproducing orientation scores in a traditional curriculum course, while Newble and Gordon (1985) found meaning orientation scores to rise on a cross section of medical students. This latter finding was attributed to 'either a relative lack of change in student approach with seniority, or the insensitivity of the instrument'.

Richardson (1990) administered the ASI over a two week period to assess whether the original constituent structure could be derived factor analytically in subsequent administrations and demonstrated acceptable levels of test-retest reliability and internal consistency, as well as structural consistency.

The effects of different academic departments were focused upon by Ramsden (1979), who argued that students pursuing different academic degrees would perceive their studies very differently and would consequently exhibit different patterns of adoption of study strategy. Time spent within any one department will increase their socialization into the learning environment of that department. Ramsden suggested that the advanced topics studied by senior students would necessitate a certain capacity for independent study thus distinguishing their study strategies quite clearly from those adopted by first year student.

Watkins and Hattie (1981) - using Biggs' SPQ - endorsed this claim and concluded that the more senior the student, the more likely they were to adopt internalizing and open strategies.

Watkins, Hattie and Astilla (1986) administered the shortened version of the ASI - alongside tests of self-esteem, locus of control and field independence - on two occasions six months apart. By investigating the effect of personological variables in tandem with the ASI scales Watkins *et al* were able to examine any possible moderators of shifts in learning strategy over time. A significant decline in reproducing orientation was observed over time, but no other main effects were noted. The researchers highlighted that student learning research is badly deficient in longitudinal studies and they claim that such studies would lead to improved understanding of the way students change their learning strategies over time, and perhaps facilitate initiatives designed to encourage adoption of more sophisticated and fruitful learning approaches.

This approach is encouraged by Biggs (1976) who suggested that success - or even 'survival' - within any higher educational environment might demand a relatively specific combination of characteristics which he claimed, would interact to form a 'multidimensional stance'.

5.3 Rationale and Hypotheses

The studies cited here frequently yield conflicting findings regarding the existence of any longitudinal shift in approaches to studying and the nature of the shift. The theories of conceptual development do not tally with the findings of studies using established learning inventories.

The study described here aims to test the hypothesis that approaches to learning and learning styles will evolve over time as indicated by significant differences in scores of the subscales of the Approaches to Studying Inventory, with 'year of study' as a longitudinal variable. A drop in reproducing orientation and/or a rise in meaning orientation over the three years would provide evidence of development of conceptions of learning in line with the theories of Perry, Säljö, Biggs and Entwistle, as well as indirect evidence to support the existence of Entwistle and Marton's 'knowledge objects'.

In addition, the effects of time in conjunction with those of individual categories of study, gender and mature/non-mature status will be monitored - as will the consistency and integrity of the factor analytic model extracted and presented in chapter three.

The use of the Occupational Personality Questionnaire in conjunction with the ASI will test the hypothesis that changes in personality - in particular, those traits relating to 'self-awareness' - suggested to be influential in student development by Beaty (1978) and Mathias (1978) - may be partially responsible for moderation or accentuation of certain patterns of learning.

5.4 Methodological issues

The core methodology described in chapter two yielded the data used in this section. 116 of the original 378 students who sat the tests in March 1993, carried on to complete the tests in March 1994 and March 1995. As mentioned in the methodology chapter, the breakdown of the sample with regard to subject discipline, maturity status and gender, remained relatively consistent. The data from the 116 OPQ and ASI tests completed on these three occasions is analysed here.

The results section following is comprised of two main sections. The first of these reports the findings of the repeated measure analysis of variance tests applied to each of the thirty-one OPQ and sixteen ASI variables individually. The main effect of time, with 'year of study' as the repeated measures variable is observed, in addition to longitudinal change in dependent variable scores unique to students within each subject discipline, between students of either gender and between mature and non-mature students. The previous chapter notes that the homogeneity of variance between sub-sample samples was inadequate to include all three of the dependent variables within each analysis of variance test. Consequently repeated measures tests including year, category of study and gender were conducted seperately from ANOVA of year and maturity. This ensured that the assumptions of equal variance were adequately met. Where significant interactions were observed, appropriate line graphs are included in order to make clear the effect(s).

The following section is concerned with the longitudinal consistency of the eleven factor model reported in chapter three. Here the factor matrices extracted by principal components analysis - rotated using the varimax technique - are presented, both in matrix form and in a straightforward grouped-factor comparison table.

This section also reports the bivariate correlations between factor scores calculated for each student from all three administration of the testing inventories. This provides a relatively simple, yet robust indication of any quantitative change in the structure of interrelationships between the fundamental characteristics of learning and personality over time.

5.5 Results

5.51 Test- Retest Reliability

Levels of test-retest reliability of each of the individual subscales from both the instruments were calculated and all proved satisfactory - see appendices C-4.1 and C-4.2 - in accordance with the high levels of reliability observed by Mathews *et al* (1990) for the OPQ and Richardson (1990) for the ASI.

5.52 *Repeated measures analysis of variance*

The repeated measures variable Year of Study, with three levels, had main effects on several of the OPQ and ASI scales.

Significant fluctuations were observed in the OPQ scales 'controlling' ($F=3.85$, d.f.=2,194, $p<0.05$), 'outgoing' ($F=3.33$, d.f.=2,194, $p<0.05$) and 'social confidence' ($F=6.26$, d.f.=2,194, $p<0.01$) - see table 5.01 for means. The remainder of the dependent variables did not change significantly.

Table 5.01 Mean scores and standard deviations on OPQ traits by year of administration (n=116)

Trait	Year 1 Mean *(S.D.)*	Year 2 Mean *(S.D)*	Year 3 Mean *(S.D.)*
Persuasive	22.28 *(5.63)*	21.71 *(5.56)*	22.86 *(7.60)*
Controlling*	23.82 *(6.18)*	24.41 *(6.68)*	24.91 *(5.92)*
Independent	26.10 *(4.28)*	26.63 *(4.17)*	26.47 *(4.68)*
Outgoing*	21.38 *(7.31)*	21.97 *(7.03)*	22.76 *(7.34)*
Affiliative	28.41 *(4.13)*	28.42 *(4.17)*	28.28 *(4.57)*
Socially confident**	20.79 *(6.32)*	21.62 *(6.12)*	22.30 *(7.04)*
Modest	18.29 *(5.95)*	17.65 *(5.26)*	17.29 *(5.34)*
Democratic	24.58 *(4.39)*	24.95 *(4.92)*	24.80 *(5.28)*
Caring	28.95 *(4.57)*	28.85 *(4.18)*	28.17 *(5.35)*
Practical	21.69 *(7.09)*	21.71 *(6.97)*	22.47 *(7.22)*
Data rational	18.22 *(8.54)*	18.44 *(8.18)*	18.80 *(8.30)*
Artistic	25.41 *(4.13)*	25.80 *(6.19)*	25.82 *(6.30)*
Behavioural	29.40 *(3.90)*	29.47 *(4.60)*	29.22 *(5.38)*
Traditional	19.03 *(5.01)*	19.18 *(4.74)*	19.20 *(4.73)*
Change oriented	25.08 *(4.08)*	25.21 *(4.54)*	25.23 *(4.84)*
Conceptual	24.67 *(4.79)*	24.74 *(4.73)*	24.91 *(4.97)*
Innovative	22.27 *(6.24)*	22.41 *(6.02)*	23.01 *(6.02)*
Forward planning	22.94 *(4.13)*	23.28 *(4.42)*	23.47 *(4.37)*
Detail conscious	23.32 *(5.77)*	24.05 *(5.49)*	24.06 *(5.83)*
Conscientious	25.57 *(5.96)*	25.56 *(5.73)*	26.17 *(6.07)*
Relaxed	19.32 *(7.16)*	19.45 *(7.20)*	19.84 *(7.38)*
Worrying	23.95 *(5.60)*	23.97 *(5.72)*	23.84 *(5.78)*

* $p<0.05$, ** $p<0.01$

(continued over)

Table 5.01 Mean scores and standard deviations on OPQ traits by year of administration (continued)

Trait	Year 1 Mean *(S.D.)*	Year 2 Mean *(S.D)*	Year 3 Mean *(S.D.)*
Tough-minded	15.28 *(6.78)*	15.29 *(7.38)*	15.63 *(7.03)*
Emotional control	19.79 *(7.50)*	18.87 *(7.77)*	18.96 *(7.47)*
Optimistic	25.64 *(5.98)*	26.39 *(6.06)*	26.72 *(6.23)*
Critical	24.46 *(3.29)*	24.19 *(4.15)*	24.28 *(4.94)*
Active	22.55 *(6.35)*	22.59 *(6.81)*	23.18 *(6.70)*
Competitive	14.37 *(4.38)*	14.14 *(4.28)*	14.30 *(5.18)*
Achieving	18.20 *(4.73)*	18.34 *(4.59)*	18.07 *(5.45)*
Decisive	16.51 *(5.79)*	15.94 *(5.44)*	17.46 *(9.81)*
Social Desirability	15.26 *(4.26)*	14.46 *(4.13)*	14.62 *(3.80)*

* p<0.05, ** p<0.01

Significant increases were observed in scores on the ASI scales 'relating ideas' (F=3.25; d.f. =2,194; p<0.05), 'use of evidence' (F=3.58; d.f.=2,194; p<0.05), 'intrinsic motivation' (F=3.01; d.f.=2,194; p<0.05), and 'strategic approach' (F=4.81; d.f=2,194; p<0.01), while significance decreases were observed on the 'extrinsic motivation' (F=3.38; d.f.=2,194; p<0.05), 'negative attitudes to study' (F=6.15; d.f.=2,194; p<0.01) and 'globetrotting' scales (F=5.21; d.f.=2,194; p<0.01) - see table 5.02, and appendices C-2.7-3.0. No other ASI variable shifted significantly as a function of time alone.

Table 5.02 Mean scores and standard deviations on ASI scales by year of administration (n=116)

Scale	Year 1 Mean *(S.D)*	Year 2 Mean *(S.D.)*	Year 3 Mean *(S.D.)*
Deep approach	10.67 *(2.60)*	10.82 *(2.56)*	10.91 *(2.61)*
Use of evidence*	9.74 *(2.51)*	9.87 *(2.40)*	10.35 *(2.55)*
Relating ideas*	10.63 *(2.51)*	11.05 *(2.09)*	11.18 *(2.25)*
Intrinsic motivation*	9.08 *(2.84)*	9.28 *(2.83)*	9.46 *(3.61)*
Surface approach	13.32 *(3.30)*	13.18 *(3.31)*	12.96 *(3.62)*
Syllabus boundness	7.59 *(2.12)*	7.34 *(2.26)*	7.19 *(2.24)*
Fear of failure	5.19 *(2.59)*	5.33 *(2.74)*	5.09 *(2.50)*
Extrinsic motivation*	5.77 *(3.32)*	5.59 *(3.04)*	5.50 *(3.35)*
Strategic approach**	10.89 *(1.95)*	11.31 *(1.84)*	11.53 *(1.97)*
Disorganised study methods	8.72 *(3.51)*	8.77 *(3.98)*	8.54 *(4.05)*
Negative attitudes to study**	4.97 *(2.92)*	4.44 *(3.00)*	4.21 *(3.04)*
Achievement motivation	8.64 *(2.92)*	8.77 *(2.79)*	8.79 *(3.29)*
Comprehension learning	9.98 *(2.73)*	9.72 *(2.95)*	9.65 *(3.06)*
Globetrotting**	7.70 *(2.41)*	7.55 *(2.71)*	6.97 *(2.51)*
Operation learning	9.81 *(1.96)*	9.70 *(2.14)*	9.59 *(2.23)*
Improvidence	7.53 *(2.29)*	7.34 *(2.55)*	7.02 *(2.51)*

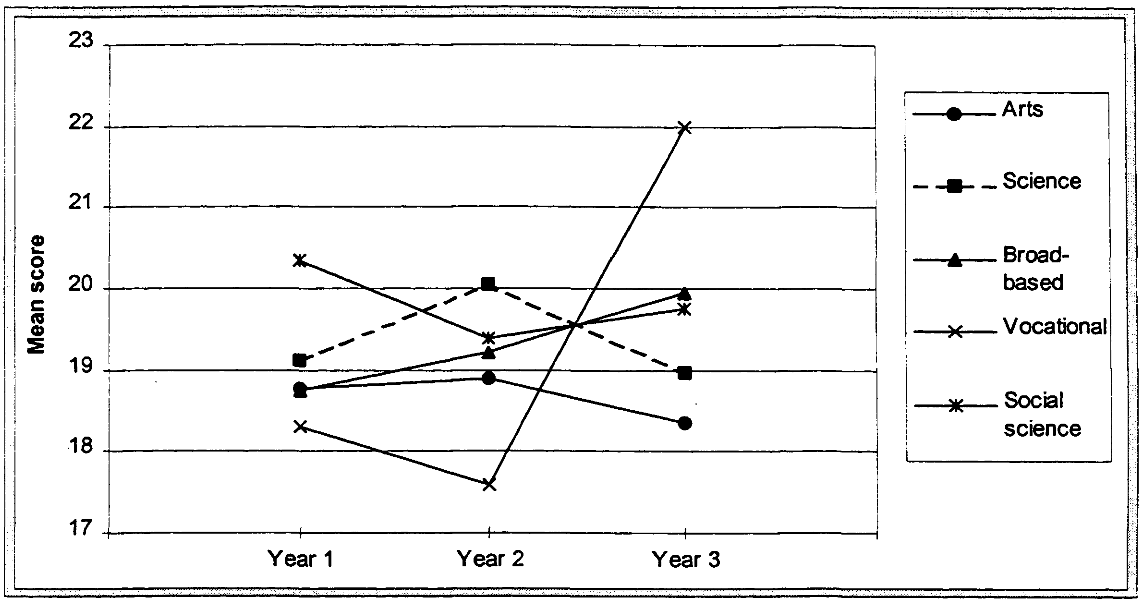
* p<0.05, ** p<0.01

(Appendices C-1.1 - C-1.8 include means for each of the ASI and OPQ scales according to subject category, gender and maturity status.)

5.53 Longitudinal effects involving subject discipline

A significant effect of year of study by subject disipline category was noted for scores on the OPQ scale 'relaxed' (F=2.74, d.f.=10,194, p<0.01) - see figure 5.01 and appendix C-2.3.

Figure 5.01 Effect of year on study on mean 'relaxed' trait scores by subject discipline



The line graph here illustrates a sharp rise in the mean 'relaxed' scores of the vocational student sample between the second and final test sessions..

Significant effects of year of study by subject discipline were also observed on scores of the ASI scales intrinsic motivation (F=2.13; d.f.=8,194; p<0.05), syllabus-boundness (F=2.00; d.f.=8,194; p<0.05) and comprehension learning (F=2.61; d.f.=8,194; p<0.05) - see figures 5.02, 5.03 and 5.04, and appendices C-2.7-3.0.

Figure 5.02 Effect of year on study on 'intrinsic-motivation' scores by subject discipline

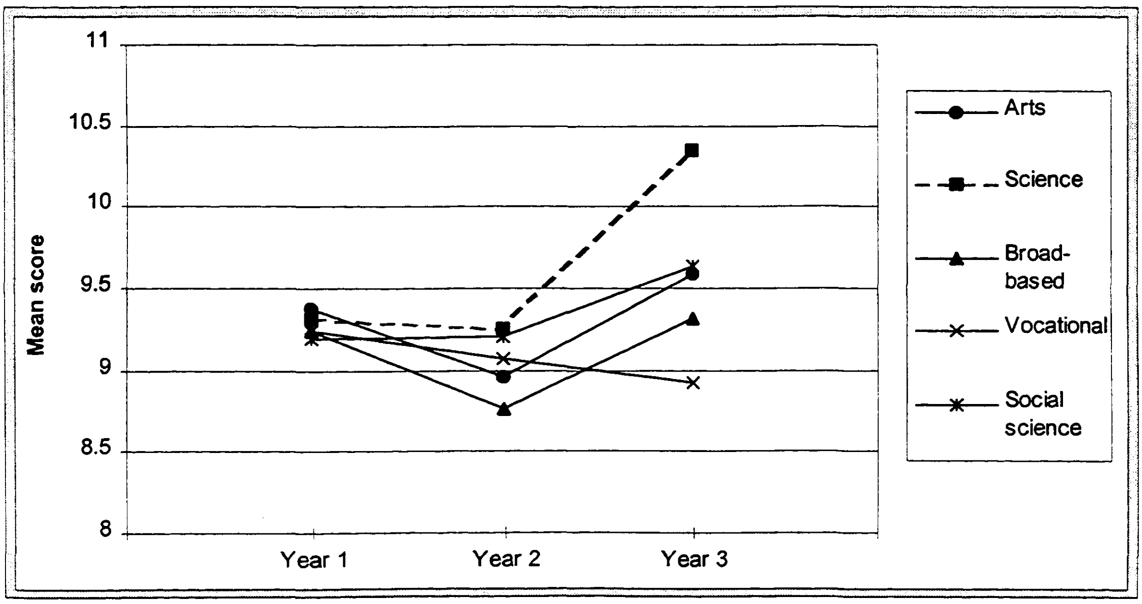
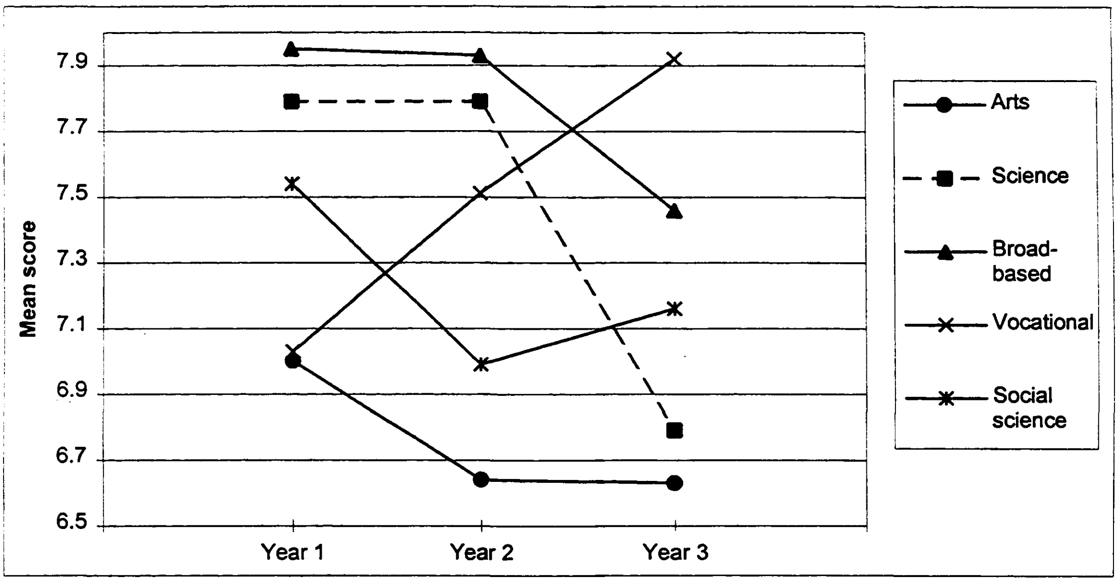


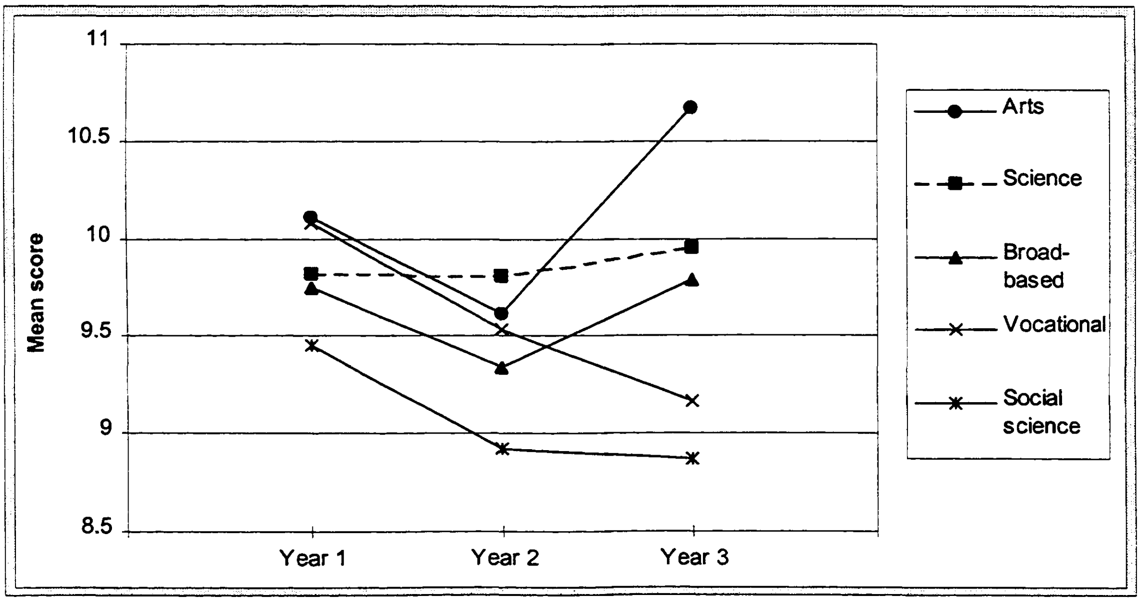
Figure 5.02 illustrates a broadly similar 'u'-shaped trend for most categories over the three years, with the second to third year rise in 'intrinsic motivation' especially pronounced in the science sample. Only in the vocational student sample was no such rise noted.

Figure 5.03 Effect of year on study on 'syllabus-boundness' scores by subject discipline



Vocational students again break with the general trend in 'syllabus-boundness' with a consistent increase in their scores between throughout their degree. For science and broad-based students a sharp drop between the second and final years is noted.

Figure 5.04 Effect of year on study on 'comprehension learning' scores by subject discipline



All sample categories - except the science sample - show decrease in 'comprehension learning' from year one to year two. Vocational and social science students' continue to fall from year two to year three, while those of broad-based and arts students rise notably. Science students' scores seem to remain relatively constant.

5.54 Longitudinal effects involving gender and maturity

Males and females yielded significantly different scores on the OPQ scales 'innovative' ($F=2.41$; d.f.=2,212; $p<0.05$) and 'critical' ($F=6.60$; d.f.=2,212; $p<0.01$) - see figures 5.05 and 5.06, and appendices C-2.2 and C-2.3.

Figure 5.05 Effect of year on study on 'innovative' scores by gender

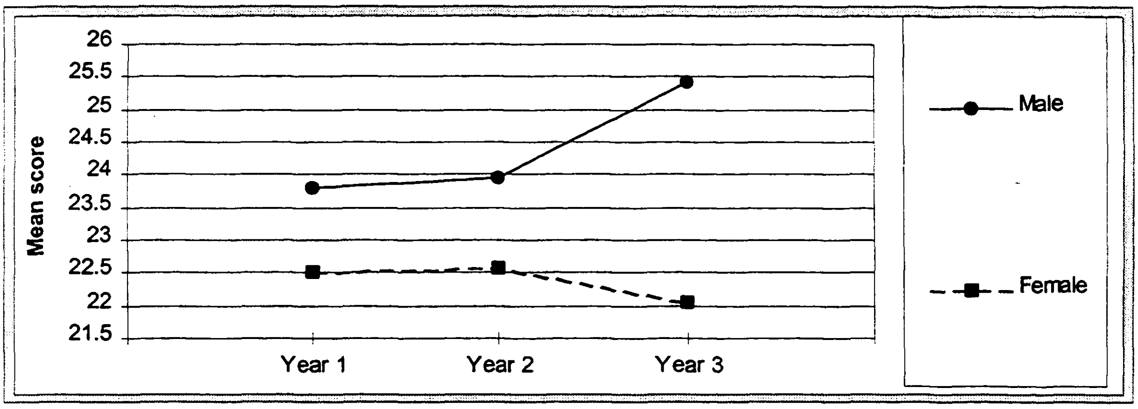
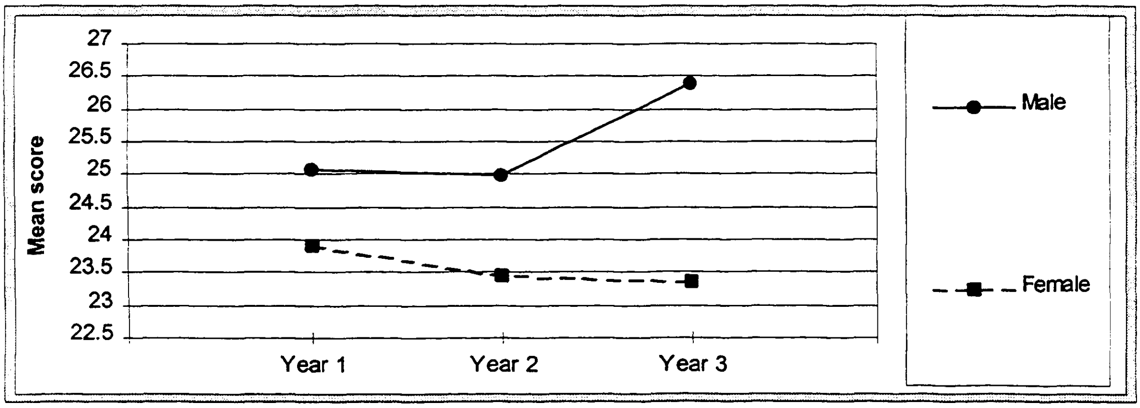


Figure 5.05 demonstrates the sharp divergence in scores on the 'innovative' scale noted in the third year of the study.

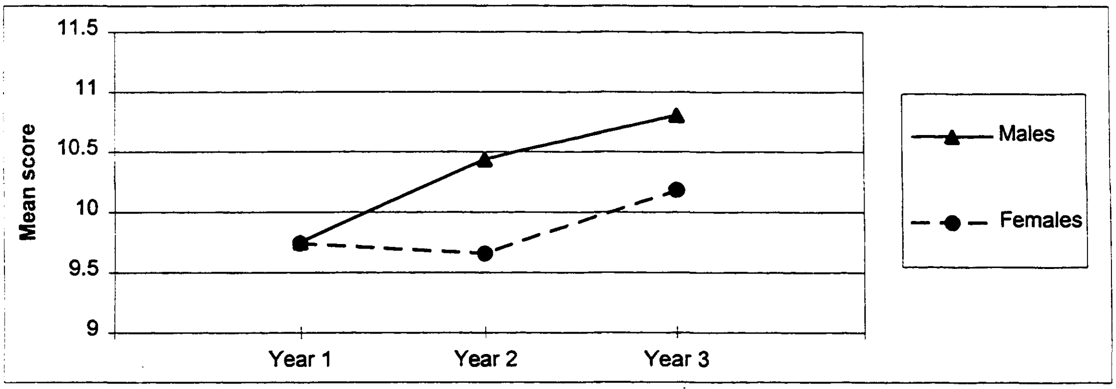
Figure 5.06 Effect of year on study on 'critical' scores by gender



Similarly, in the third year of the study, the scores on 'critical' for males rises sharply.

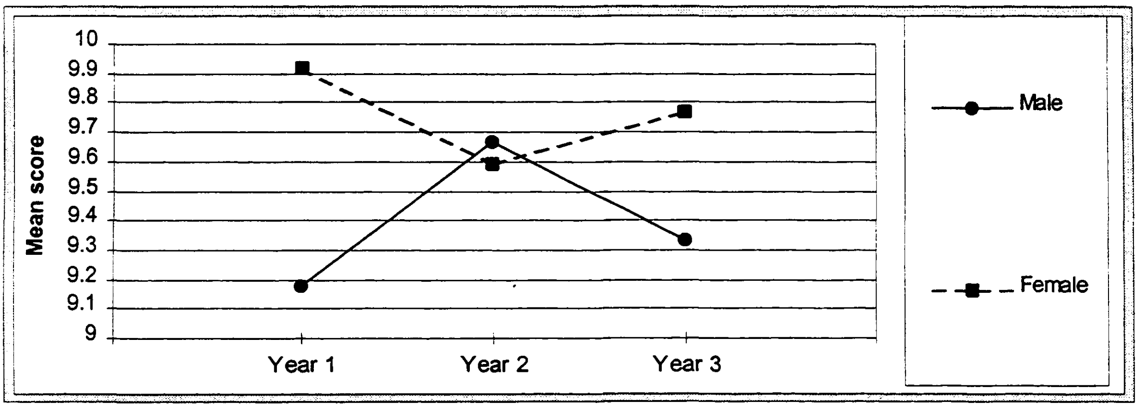
A significant effect of year of study by gender was observed on the 'use of evidence' scale (F=3.33; d.f.=2,194; p<0.05) and the 'operation learning' scale (F=3.46; d.f.=2,194; p<0.05) of the ASI - see figure 5.07 and 5.08 and appendices C-2.7 and C-3.0.

Figure 5.07 Effect of year on study on 'use of evidence' scores by gender



In chapter three it was observed that males' overall mean scores on 'use of evidence' were significantly higher than those of females. Here it is evident that this difference emerges only in the second and final years.

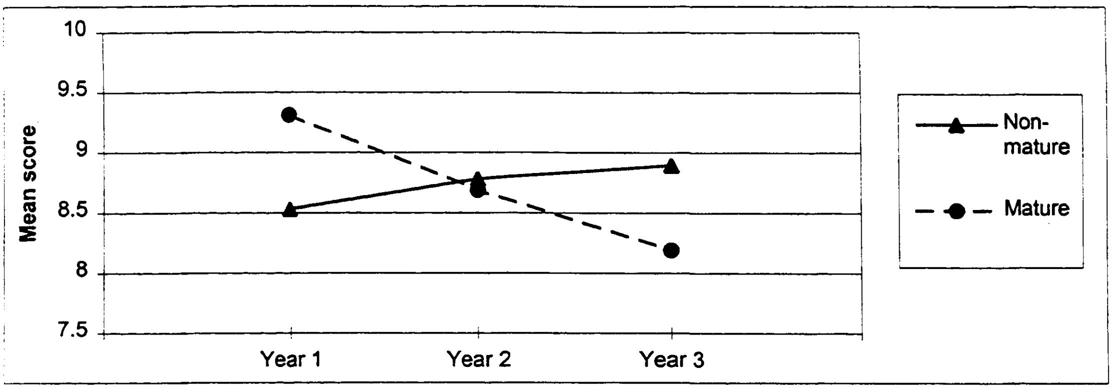
Figure 5.08 Effect of year on study on 'operation learning' scores by gender



The diagram above, illustrates that males' and females' scores on 'operation learning' are quite different in years one and three, however, during year two they are broadly equal.

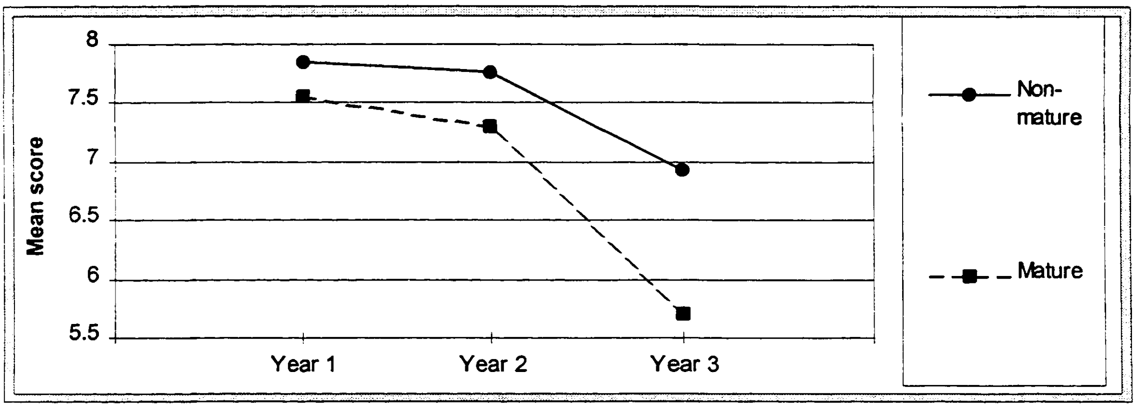
Differential longitudinal changes were noted with mature student status on 'achievement motivation' (F=3.07; d.f.=2,194; p<0.05) and 'globetrotting' (F=3.70; d.f.=2,194; p<0.05) - see figure 5.09 and 5.10, and appendices C-3.3 and C-3.4.

Figure 5.09 Effect of year on study on 'achievement motivation' scores by non-mature/mature status



A clear year by maturity interaction effect is evident in Figure 5.09. On the first administration, the mature student sample exhibit significantly higher levels of achievement motivation, but by the final year this pattern is reversed, with the non-mature sample scoring more highly on the scale.

Figure 5.10 Effect of year on study on 'globetrotting' scores by maturity



Here it is apparent that for both samples, scores on 'globetrotting' tail off sharply in the third year, however, this drop appears to be significantly more pronounced in the mature student sample.

5.6 Longitudinal comparisons of factor analyses constructs

This section of the research sought to test the temporal stability of the mean score factor matrix described in chapter three, in order to assess whether the same constructs could be extracted and identified in each successive year, and whether any quantifiable change in structure took place.

Several studies have utilised specific techniques for factor analysing repeated measures data. Watkins and Hattie (1985) for example, administered the Approaches to Studying Inventory over three years to one cohort of students - in a similar manner to this study - with a view to testing the invariance of the factor structure of the ASI over time. The technique used to factorize the data - 'Confimatory Factor Analysis' (Watkins and Hattie, 1981) - involved designing an invariant factor model yielding a variance -covariance matrix which could be compared with the observed factor model's matrix. The findings supported the validity of the factor structure of the ASI, but the technique used was subsequently criticised by Richardson (1990) for its restrictiveness in terms of offering only orthogonal solutions without the option of generating more acceptable rotated solutions.

In order to test the invariance of the factor matrix generated here using the test of invariance used (McDonald, 1974) it would be necessary to possess a hypothetical model with which to compare the observed model. Since no study to date has tested the factor integrity of both the OPQ and ASI simultaneously, this was impossible.

Richardson (1990) used the pooled dispersion matrix from the factor analysis of data from the repeated assessment of the student sample and employed a higher order factor analysis to arrive at a final pattern matrix. (When pooled data is factor analysed the very high intercorrelations between the repeated measures variables indicate an artifically high number of factors when the eigenvalue -one rule is applied). The full three-year data set from this study was factor analysed using the Principal Components method with Varimax rotation - as in chapter three - and thirty-three factors were extracted with the eigenvalue one method. However, if the scree chart of eigenvalues against factors is observed - Appendix C-4.3 - it becomes apparent that the point at which the rate of decline of between eigenvalues becomes relative constant - and thus attributable to random error influences - is closer to three than one, suggesting that the eleven factor model is indeed the most accurate and thus valid, and that analysing the models from each year's data separately would be the most appropriate course of action.

The following three tables (5.03, 5.04 and 5.05) present the factor structures extracted from the principal components analysis with varimax rotation of the OPQ and ASI data from each year of study from each of the persevering students. Table 5.06 presents each factor in with each variable sorted by loading.

Table 5.03 Eleven-factor varimax rotated principal component anlysis solution of mean scores on the Approaches to Studying Inventory and OPQ Concept 5.2 scales, (year 1, n=378)

Factor	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Eigenvalue	8.51	4.42	3.50	2.93	2.44	1.76	1.55	1.32	1.19	1.10	1.06
% of variance explained	18.1	9.4	7.4	6.2	5.2	3.7	3.3	2.8	2.5	2.3	2.2
Worrying	-0.86										
Relaxed	0.85										
Tough minded	0.79										
Fear of failure	-0.64										
Optimistic	0.62										
Social confidence	0.56							0.43			
Decisive	0.47										
Persuasive		0.67									
Controlling		0.61									
Critical		0.66									
Outgoing		0.45						0.61			
Independent		0.55									
Surface approach			0.65								
Improvidence			0.63								
Globetrotting			0.55								
Extrinsic motivation			0.56								
Negative attitudes to study			0.55								
Syllabus boundness			0.51								
Conscientious						0.77					
Disorganised study methods						-0.75					
Detail conscious						0.68					
Forward planning		0.44				0.58					
Intrinsic motivation					0.58						
Relating ideas					0.58		0.33				
Strategic approach					0.59						
Use of evidence					0.55				0.54		
Deep approach					0.52						
Competitive				-0.73							
Achievement motivation				-0.56							
Caring				0.72							
Achieving				-0.42							
Democratic				0.64							
Affiliative				0.47				0.43			
Comprehension learning							0.71				
Innovative							0.64				
Conceptual							0.45				
Operation learning					0.43						
Behavioural							0.44				
Modest								-0.70			
Emotional control								-0.60			
Social desirability response								-0.46			
Data rational									0.76		
Artistic							0.61				
Active										0.80	
Practical									0.57	0.41	
Change oriented										0.48	
Traditional											0.75

Loadings sorted by size, and those between ± 0.40 omitted. Factors explain 63.6% of variance

Table 5.04 Eleven-factor varimax rotated principal component anlysis solution of mean scores on the Approaches to Studying Inventory and OPQ Concept 5.2 scales, (year 2, n=311)

Factor	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Eigenvalue	8.70	4.24	3.26	2.98	2.36	1.86	1.43	1.34	1.24	1.14	1.10
% of variance explained	18.5	9.0	6.9	6.3	5.0	4.0	3.0	2.9	2.6	2.4	2.4
Worrying	-0.86										
Relaxed	0.87										
Tough minded	0.80										
Fear of failure	-0.65										
Optimistic	0.56										
Social confidence	0.49			0.56							
Decisive	0.45										
Persuasive				0.46							
Controlling				0.54							
Critical									0.74		
Outgoing				0.70					0.58		
Independent											
Surface approach			0.70								
Improvidence			0.72								
Globetrotting		-0.46	0.55								
Extrinsic motivation			0.43								
Negative attitudes to study			0.47							-0.45	
Syllabus boundness			0.67								
Conscientious		0.76									
Disorganised study methods		-0.56									
Detail conscious		0.77									
Forward planning		0.56									
Intrinsic motivation					0.55						
Relating ideas					0.64						
Strategic approach										0.60	
Use of evidence					0.55						
Deep approach					0.66						
Competitive						0.76					
Achievement motivation						0.67					
Caring						-0.57					
Achieving						0.62					
Democratic						-0.44					
Affiliative											
Comprehension learning					0.62		0.42				
Innovative							0.70				
Conceptual							0.51				
Operation learning											
Behavioural											
Modest				-0.68							
Emotional control				-0.69							
Social desirability response		0.44									
Data rational											0.72
Artistic							0.57				
Active								0.71			
Practical							0.45	0.48			
Change oriented								0.57			
Traditional										0.43	

Loadings sorted by size, and those between ± 0.40 omitted. Factors explain 63.1% of variance

Table 5.05 Eleven-factor varimax rotated principal component anlysis solution of mean scores on the Approaches to Studying Inventory and OPQ Concept 5.2.scales, (year 3, n=116)

Factor	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Eigenvalue	9.69	4.47	3.75	3.44	2.21	1.91	1.84	1.51	1.28	1.20	1.12
% of variance explained	20.6	9.5	8.0	7.3	4.7	4.1	3.9	3.2	2.7	2.6	2.4
Worrying	-0.80										
Relaxed	0.88										
Tough minded	0.72										
Fear of failure	-0.74										
Optimistic	0.65										
Social confidence	0.55	0.60									
Decisive				-0.42							
Persuasive											
Controlling		0.56									
Critical		0.50			-0.46						
Outgoing		0.75									
Independent		0.48									
Surface approach					0.75						
Improvidence					0.63						
Globetrotting					0.51					-0.46	
Extrinsic motivation					0.41			0.47			
Negative attitudes to study											
Syllabus boundness					0.58						
Conscientious			0.80								
Disorganised study methods			-0.63								
Detail conscious			0.83								
Forward planning			0.78								
Intrinsic motivation						0.73					
Relating ideas						0.65					
Strategic approach								0.44		0.44	
Use of evidence						0.47					
Deep approach						0.52					
Competitive				-0.46				0.46	0.44		
Achievement motivation								0.74			
Caring				0.80							
Achieving								0.76			
Democratic				0.45					-0.48		
Affiliative				0.74							
Comprehension learning						0.62					
Innovative							0.50				
Conceptual						0.46					
Operation learning					0.65						
Behavioural				0.66							
Modest		-0.58									
Emotional control		-0.75									
Social desirability response										0.78	
Data rational											0.73
Artistic				0.43							
Active							0.66				
Practical							0.72				
Change oriented							0.47				
Traditional									0.69		

Loadings sorted by size, and those between ± 0.40 omitted. Factors explain 69.0% of variance

Table 5.06 Correspondences between the three eleven-factor models (Factor loadings in brackets)

Year One	Year Two	Year Three
Factor 1 Worrying (-0.86) Relaxed (0.85) Tough minded (0.79) Fear of failure (-0.64) Optimistic (0.62) Social confidence (0.56) Decisive (0.47) Outgoing (0.37) SDR (0.34) Change oriented (0.39)	*Factor 1* Relaxed (0.87) Worrying (-0.86) Tough minded (0.80) Fear of failure (-0.65) Optimistic (0.56) Social confidence (0.49) Decisive (0.45) SDR (0.37) Behavioural (-0.37) Change oriented (0.36)	*Factor 1* Relaxed (0.88) Worrying (-0.80) Fear of failure (-0.74) Tough minded (0.72) Optimistic (0.65) Social confidence (0.55) Decisive (0.36) Change oriented (0.35)
Factor 2 Persuasive (0.67) Critical (0.66) Controlling (0.61) Independent (0.55) Outgoing (0.45) Forward planning (0.44) Innovative (0.38) Change oriented (0.36) Achieving (0.33)	*Factor 2* Detail conscious (0.77) Conscientious (0.76) Forward planning (0.56) Disorganised study methods (-0.56) Globetrotting (-0.46) SDR (0.44) Operation learning (0.33) Deep approach (0.31)	*Factor 2* Outgoing (0.75) Emotional control (-0.75) Social confidence (0.60) Modest (-0.58) Controlling (0.56) Critical (0.50) Independent (0.48) Affiliative (0.39) Improvidence (-0.39) Optimistic (0.36) Innovative (0.36) Artistic (0.31)
Factor 3 Surface approach (0.65) Improvidence (0.63) Extrinsic motivation (0.56) Globetrotting (0.55) Negative attitudes to study (0.55) Syllabus boundness (0.51) Intrinsic motivation (-0.37) Fear of failure (0.36) Operation learning (0.36)	*Factor 3* Improvidence (0.72) Surface approach (0.70) Syllabus boundness (0.67) Globetrotting (0.55) Negative attitudes to study (0.47) Extrinsic motivation (0.43) Disorganised study methods (0.36) Fear of failure (0.35) Intrinsic motivation (-0.32)	*Factor 3* Detail conscious (0.83) Conscientious (0.80) Forward planning (0.78) Disorganised study methods (-0.63) Deep approach (0.38) Globetrotting (-0.38) Use of evidence (0.37) Relating ideas (0.32)
Factor 4 Competitive (-0.73) Caring (0.72) Democratic (0.64) Achievement motivation (-0.56) Affiliative (0.47) Achieving (-0.42) Decisive (-0.39) SDR (0.37) Behavioural (0.31)	*Factor 4* Outgoing (0.70) Emotional control (-0.69) Modest (-0.68) Social confidence (0.56) Controlling (0.54) Persuasive (0.46) Independent (0.32)	*Factor 4* Caring (0.80) Affiliative (0.74) Behavioural (0.66) Competitive (-0.46) Democratic (0.45) Artistic (0.43) Decisive (-0.42) Conceptual (0.35)
Factor 5 Strategic approach (0.59) Intrinsic motivation (0.58) Relating ideas (0.58) Use of evidence (0.55) Deep approach (0.52) Operation learning (0.43)	*Factor 5* Deep approach (0.66) Relating ideas (0.64) Comprehension learning (0.62) Intrinsic motivation (0.55) Use of evidence (0.55) Behavioural (0.37) Fear of failure (0.36) Conceptual (0.35)	*Factor 5* Surface approach (0.75) Operation learning (0.65) Improvidence (0.63) Syllabus boundness (0.58) Globetrotting (0.51) Critical (-0.46) Extrinsic motivation (0.41) Traditional (0.35) Fear of failure (0.34) Deep approach (-0.33) Decisive (0.31)
Factor 6 Conscientious (0.77) Disorganised study methods (-0.75) Detail conscious (0.68) Forward planning (0.58)	*Factor 6* Competitive (0.76) Achievement motivation (0.67) Achieving (0.62) Caring (-0.57) Democratic (-0.44)	*Factor 6* Intrinsic motivation (0.73) Relating ideas (0.65) Comprehension learning (0.62) Use of evidence (0.47) Deep approach (0.52) Conceptual (0.46) Artistic (0.38) Innovative (0.35) Syllabus boundness (-0.35) Comprehension learning (0.33) Negative attitudes to study (-0.32)
Factor 7 Comprehension learning (0.71) Innovative (0.64) Artistic (0.61) Conceptual (0.45) Behavioural (0.44) Operation learning (-0.35) Relating ideas (0.33)	*Factor 7* Innovative (0.70) Artistic (0.57) Conceptual (0.51) Practical (0.45) Comprehension learning (0.42)	

(continued overleaf)

Table 5.06 (continued) Correspondences between the three eleven-factor models.

Year One	Year Two	Year Three
Factor 8	*Factor 8*	*Factor 7*
Modest (-0.70)	Active (0.71)	Practical (0.72)
Outgoing (0.61)	Change oriented (0.57)	Active (0.66)
Emotional control (-0.60)	Practical (0.48)	Innovative (0.50)
Social desirability response (-0.46)	Persuasive (0.36)	Change oriented (0.47)
Affiliative (0.43)	Affiliative (0.32)	Controlling (0.39)
Social confidence (0.43)		Achieving (0.32)
Controlling (0.38)	*Factor 9*	
Decisive (0.32)	Critical (0.74)	*Factor 8*
	Outgoing (0.58)	Achieving (0.76)
Factor 9	Controlling (0.34)	Achievement motivation (0.74)
Data rational (0.76)	Extrinsic motivation (-0.32)	Extrinsic motivation (0.47)
Practical (0.57)		Competitive (0.46)
Use of evidence (0.54)	*Factor 10*	Strategic approach (0.44)
	Strategic approach (0.60)	Negative attitudes to study (-0.39)
Factor 10	Negative attitudes to study (-0.45)	Modest (-0.33)
Active (0.80)	Traditional (0.43)	Change oriented (0.30)
Change oriented (0.48)	Operation learning (0.36)	
Practical (0.41)	Achievement motivation (0.36)	*Factor 9*
	Intrinsic motivation (0.35)	Traditional (0.69)
Factor 11		Democratic (-0.48)
Traditional (0.75)	*Factor 11*	Competitive (0.44)
Operation learning (0.31)	Data rational (0.72)	Persuasive (0.34)
Independent (-0.31)	Practical (0.39)	Syllabus boundness (0.33)
	Artistic (-0.32)	
	Use of evidence (0.31)	*Factor 10*
		SDR (0.78)
		Globetrotting (-0.46)
		Strategic approach (0.44)
		Independent (-0.32)
		Factor 11
		Data rational (0.73)
		Use of evidence (0.34)

Each of these factor groupings was studied and named in the same way as the mean factor extractions were named in chapter three. This helped test the conceptual consistency of the model described previously, with the most appropriate name chosen for each factor *before* any longitudinal statistical comparisons were conducted. The following table 5.07 lists the names chosen to subsequently represent each factor.

Table 5.07 Names representing factor extractions from each year

Factor	*Year One*	*Year Two*	*Year Three*
1	Emotional Stability	Emotional Stability	Emotional Stability
2	Assertiveness	Conscientiousness	Extraversion
3	Reproducing Orientation	Reproducing Orientation	Conscientiousness
4	Ambitiousness (-)	Self-Consciousness	Agreeableness
5	Meaning Orientation	Meaning Orientation	Reproducing Orientation
6	Conscientiousness	Ambitiousness	Meaning/Abstract Orientation
7	Abstract Orientation	Abstract Orientation	Sensation Seeking
8	Self-Consciousness	Sensation Seeking	Achievement Orientation
9	Concrete Orientation	Assertiveness	Conservative Orientation
10	Sensation Seeking	Conservative Orientation	Un-named factor - see below
11	Conservative Orientation	Concrete Orientation	Concrete Orientation

5.7 Factor score correlation coefficients

Factor scores for each of the eleven factors were calculated for each of the 116 students who had consistently attended all three test administrations over the three years. - These scores were generated by multiplying the standardized value of each observed variable by the appropriate value from the factor coefficient matrix and calculating the sum for each common factor. Pearson bivariate correlation coefficients between each of the thirty-three factor scores - eleven for each year - were obtained, in order to ascertain the variance or otherwise of the mean factor model described in chapter three. The correlation coefficient matrices are shown in Tables 5.08-5.10. NB. Since the factor scores are derived from a 'Varimax' orthogonally-rotated pattern factor matrix - which produces *uncorrelated* common factors - the correlations between factor scores within each year are always zero, hence the tables present only the correlation coeffients between factor scores of year one/year two, year one/year three and year two/year three.

Table 5.08 Correlation matrix relating year-one common factors to year-two common factors

		Year-One Factor (See Table 5.06 for factor variables)										
		1	2	3	4	5	6	7	8	9	10	11
	1	0.82**	-0.03	-0.08	-0.05	-0.02	0.04	-0.05	-0.01	0.13	0.07	-0.13
	2	-0.00	0.26*	0.03	0.12	0.27*	0.60**	-0.15	-0.12	0.12	-0.14	0.09
	3	-0.01	0.00	0.67**	-0.04	-0.01	-0.08	-0.06	0.06	0.01	-0.05	0.14
Year-	4	0.04	0.28*	0.03	0.05	0.04	0.08	0.05	0.72**	-0.13	0.06	-0.05
Two	5	0.03	0.03	-0.08	0.08	0.51**	-0.06	0.29*	0.06	0.15	-0.07	-0.12
Factor	6	-0.02	0.21	0.05	-0.74**	0.20	0.03	0.02	-0.04	-0.09	0.07	0.07
	7	0.03	0.16	-0.10	-0.04	-0.02	0.05	0.66**	-0.02	0.06	0.11	0.04
	8	0.04	0.24*	0.11	0.16	0.00	-0.03	0.02	-0.16	0.13	0.71**	-0.01
	9	-0.08	0.41**	-0.23	0.03	0.00	-0.16	-0.13	0.01	0.01	-0.07	-0.01
	10	-0.04	-0.11	-0.10	0.09	0.33*	-0.01	-0.08	0.07	-0.02	0.09	0.41**
	11	-0.01	0.00	0.04	-0.15	-0.11	0.08	-0.09	0.12	0.71**	-0.02	0.20

†p<0.001 ** p<0.01 * p<0.05
Note: Underlined figures signify components of factor structure considered to be invariant due to very high correlation coefficients

Table 5.08 demonstrates that between year one and two the factor extraction matrix remained largely constant. Each of the eleven factors extracted in year one were very highly correlated with corresponding factors in year two - with a mean bivariate correlate coefficient of 0.63.

Table 5.09 Correlation matrix relating year-one common factors to year-three common factors

		Year-One Factor (See Table 5.06 for factor variables)										
		1	2	3	4	5	6	7	8	9	10	11
	1	0.74**	-0.04	-0.20	-0.11	0.01	0.02	-0.08	-0.10	0.08	0.18	0.02
	2	0.04	0.38**	0.10	-0.07	0.01	0.00	0.07	0.60**	-0.15	0.04	-0.24
	3	-0.09	0.23	0.07	0.11	0.19	0.62**	-0.05	-0.13	0.17	-0.06	0.04
Year-	4	-0.30*	0.10	-0.21	0.46**	0.19	-0.19	0.03	0.02	-0.11	0.11	0.10
Three	5	0.05	-0.27	0.58**	-0.01	0.09	-0.04	-0.10	0.03	0.12	-0.01	0.28*
Factor	6	0.11	-0.16	-0.09	-0.11	0.47**	-0.08	0.46**	0.07	-0.03	-0.19	0.01
	7	0.10	0.21	0.21	0.01	-0.08	0.17	0.21	-0.04	0.35*	0.43**	-0.10
	8	-0.01	0.18	0.14	-0.33*	0.37*	0.05	0.08	-0.01	-0.11	0.16	0.17
	9	-0.13	0.22	-0.02	-0.36*	0.05	-0.09	-0.13	0.10	0.16	-0.12	0.37*
	10	0.18	-0.16	0.21	0.20	0.26*	0.04	0.01	-0.06	0.02	-0.01	0.06
	11	0.06	-0.11	-0.07	-0.07	0.09	-0.04	0.10	0.01	0.60**	-0.05	0.04

**p<0.001 * p<0.01

Note: Underlined figures signify components of factor structure considered to be invariant due to very high correlation coefficients

Table 5.10 Correlation matrix relating year-two common factors to year-three common factors

		Year-Two Factor (See Table 5.06 for factor variables)										
		1	2	3	4	5	6	7	8	9	10	11
	1	0.76**	-0.02	-0.17	-0.05	-0.16	0.04	0.05	0.04	-0.05	0.16	-0.13
	2	0. 06	-0.08	0.16	0.71**	-0.06	0.15	0.12	0.03	0.44**	-0.16	-0.05
	3	-0.08	0.74**	-0.09	0.00	0.21	-0.04	-0.14	0.08	0.02	-0.07	0.09
Year-	4	-0.36*	0.03	-0.11	0.09	-0.06	-0.41**	0.15	0.28*	0.14	0.30*	-0.19
Three	5	0.05	0.04	0.58**	0.00	-0.17	-0.07	-0.13	0.00	-0.18	0.14	0.02
Factor	6	0.10	-0.06	-0.06	-0.05	0.46**	0.07	0.43**	-0.07	-0.08	0.19	-0.09
	7	0.12	0.04	0.17	-0.01	0.11	0.10	0.25*	0.68**	0.08	-0.11	0.28*
	8	-0.05	0.18	0.00	0.11	-0.02	0.58**	0.17	0.15	-0.23	0.31*	-0.05
	9	-0.01	-0.12	0.16	0.06	0.03	0.18	-0.03	-0.12	0.16	0.37*	0.44**
	10	0.15	0.26*	0.18	0.08	0.20	-0.15	0.07	0.04	-0.20	0.08	-0.01
	11	-0.06	0.00	0.00	-0.08	0.19	-0.06	0.27*	-0.05	-0.01	-0.01	0.58**

**p<0.001 * p<0.01

Note: Underlined figures signify components of factor structure considered to be invariant due to very high correlation coefficients

Table 5.09 and 5.10 both demonstrate that the factors extracted in year three are again highly correlated with those in years one and two with bivariate correlation coefficients of 0.52 and 0.57 respectively.

With the factors attributed names, and the intercorrelations between each set of factor scores by year available, it becomes possible to bring the two together to assess the stability of the eleven factor model. Each construct is discussed in turn;

Emotional stability - The factor extracted first on each occasion consistently corresponded to the 'emotional stability' dimension extracted and described in chapter 3. The correlation coefficients between the three factor scores are the highest observed among any of the factors - (year 1-2); r=0.82; p<0.001, (year 1-3); r=0.74; p<0.001, (year 2-3); r=0.76; p<0.001.

Assertiveness and self-consciousness - These two traits were both originally hypothesized to be part of a broader extraversion dimension - see chapter three - representing external and internal aspects of the domain respectively. These construct hold relatively constant for the first two years - assertiveness; (year 1-2); $r=0.41$; $p<0.001$, self-consciousness, (year 1-2); $r=0.72$; $p<0.001$, - but in the final year factor matrix the two factors effectively merge into one general extraversion dimension. Correlation coefficients between the year three extraversion factor scores and the previous years' assertiveness and self-consciousness factor scores are highly significant - assertiveness/extraversion, (year 1-3); $r=0.38$; $p<0.001$, (year 2-3); $r=0.74$; $p<0.001$, self-consciousness/extraversion, (year 1-3); $r=0.60$; $p<0.001$, (year 2-3), $r=0.44$, $p<0.001$.

Sensation seeking - In chapter three this factor was also identified as a 'sub-factor' of extraversion, relating to active, practical aspects of disposition. The sensation seeking factor is readily identifiable in each three years, and correlations between factors scores from each year are consistently high, suggesting a stable characteristic - (year 1-2); $r=0.71$; $p<0.001$, (year 1-3); $r=0.43$; $p<0.001$, (year 2-3); $r=0.68$; $p<0.001$.

Ambitiousness - The factor identified as ambitiousness in chapter three - which corresponded well with the 'Big Five' dimension of 'agreeableness' - is clearly identifiable in years one and two. However, in year three the traits loaded onto the original factor split into two new independent factors, described now as 'agreeableness' and 'achievement orientation'. Both of these factors correspond with concepts described in previous studies - ambitiousness (year 1-2); $r=-0.74$; $p<0.001$, ambitiousness/agreeableness, (year 1-3); $r=0.46$; $p<0.001$, (year 2-3); $r=-0.41$; $p<0.001$, ambitiousness/achievement orientation (year 1-3); $r=-0.33$; $p<0.01$, (year 2-3); $r=0.58$; $p<0.001$). The agreeableness factor is very similar to the factor extracted by Mathews *et al* (1990) from factor analysis of the OPQ. The achievement orientation factor is noteable for its inclusion of three of the four main subscales of the achievement orientation section of the ASI, - 'strategic approach', 'achievement motivation' and 'negative attitudes to study' - hence the choice of Ramsden's (1983) original label.

Conscientiousness - Year one's conscientiousness factor resembles the overall mean conscientiousness factor described in chapter three very closely. In year two, the factor, though clearly similar, includes aspects of approaches to learning, (in particular 'deep approach'), and this trend develops into the third year, where deep approach and conscientiousness are highly related -- (year 1-2); $r=0.60$; $p<0.001$, (year 1-3); $r=0.62$; $p<0.001$, (year 2-3); $r=0.74$; $p<0.001$.

Concrete orientation - Despite some rearrangement in the variables implicit within this factor, the predominance of the data rational scale suggests that this is a relatively consistent independent cognitive/personality dimension - (year 1-2); $r=0.71$; $p<0.001$, (year 1-3); $r=0.60$; $p<0.001$, (year 2-3); $r=0.58$; $p<0.001$.

Conservative orientation - In chapter three some doubts were expressed as to the validity of this factor given that it was the last factor to be extracted through principal components analysis -a technique reputed to over-estimate numbers of factors. Over the three years the trait is consistently identifiable, chiefly by the inclusion of the traditional scale - (year 1-2); $r=0.41$; $p<0.001$, (year 1-3); $r=0.37$; $p<0.01$, (year 2-3); $r=0.37$; $p<0.01$. In year one this is associated with positive operation learning and negative independence scores. In year two aspects of approaches to studying predominate - adoption of a strategic approach and positive attitudes to study plus both achievement and intrinsic motivations. By the third year, the traditional scale ties in with a rather more 'assertive' style of dimension - including negative democratic, and positive competitive and persuasive scores - in addition to syllabus boundness. This variability of definition suggests that the absolute construct validity of this scale may be dubious.

Reproducing orientation - The factor grouping together the main surface approaches to learning remains largely consistent throughout the three years - (year 1-2); $r=0.67$; $p<0.001$, (year 1-3); $r=0.58$; $p<0.001$, (year 2-3); $r=0.58$; $p<0.001$ - although in the final year elements of thinking style measured by the OPQ - 'critical'(negative loading), 'traditional' (positive loading) and perhaps surprisingly 'decisive' (positive loading) - are included in the factor.

Meaning orientation - The factor extraction termed meaning orientation in year one was noteable for including many of the ASI meaning orientation variables alongside the 'operation learning' scale - suggesting a predominantly serialist cognitive path to deep learning in the first year. In the second and third administrations it becomes apparent that the operation learning scale is absent from the meaning orientation factor, but is replaced by comprehension learning - indicating the development of a relationship between holistic learning and deep approach during the course of study. By the third year, the meaning orientation incorporates many of the traits implicit in the abstract orientation factor identified in years one and two - traits such as 'conceptual', 'artistic' and 'innovative'. Indeed, the two factors effectively become one by the final year of study - (year 1-2); r=0.51; $p<0.001$; meaning orientation/meaning-abstract orientation, (year 1-3); r=0.47; $p<0.001$; (year 2-3); r=0.46; $p<0.001$.

Abstract orientation - As previously stated, in years one and two this factor blended concepts of learning style - positive loadings on comprehension learning, negative loadings on operation learning - with scores of personality 'thinking style' - innovative, conceptual, artistic. In the first and second years these traits appear to be relatively independent of approach to learning, although there is a link with relating ideas in the first year - (year 1-2); r=0.66; $p<0.001$. By the third year, as described above, these traits seem to be fully integrated with the central concepts of meaning orientation abstract orientation/meaning-abstract orientation, (year 1-3); r=0.46; $p<0.001$; (year 2-3); r=0.43; $p<0.001$.

The only factor unaccounted for here is year 3, factor 10 which groups positive loadings on 'social desirability response' - an OPQ 'honesty' scale - and 'strategic approach', and negative loadings on 'globetrotting' and 'independent'. The factor correlates relatively weakly with the year one, meaning orientation factor - r=0.26; $p<0.01$; - and the year two conscientiousness factor - r=0.26; $p<0.01$ - which suggests a certain mode of learning approach/style, but one which may have been arrived at through a tendency to answer the questionnaire in a socially desirable way. This factor will thus remain unnamed, since there is little conceptual clarity in its composition.

5.8 *Discussion*

The findings yielded by these modes of analysis do provide evidence of the development of learning conceptions in line with the sequential models described in the introduction.

The repeated measures analysis of variance of the Approaches to Studying Inventory subscales generated findings in line with those of Watkins and Hattie (1981) and Newble and Gordon (1985) with with yearly increases in three of the meaning orientation subscales - 'relating ideas', 'use of evidence' and 'intrinsic motivation' - and decline in only one of the reproducing orientation subscales - 'extrinsic motivation'.

The significant increase in 'relating ideas' and 'use of evidence' suggests that students are indeed accepting diversity, context and relativism in knowledge and values as per the scheme of intellectual development proposed by Perry (1970). The sharp rise in 'relating ideas' between the first and second years indicates that for many students meaning becomes a fundamental issue both structurally and referentially, i.e., the conceptual understanding of the phenomenon itself, and the attribution of meaning to the phenomena and its context becomes central to the learning process. In this sense the students would appear to have shifted their conceptions of learning through the first three *reproducing* conception categories proposed by Säljö (1979) to one of the latter three *transforming* conception categories (Säljö, 1979; Marton *et al*, 1992) in which learning is perceived to be a personal transformational process.

In terms of Biggs and Collis' (1982) SOLO Taxonomy, the increase in 'relating ideas' and 'use of evidence' subscale scores would appear to stem from greater recognition of processes inherent within meaningful learning, which according to the theory would predict a gradual shift from pre-structural and unistructural learning outcomes to relational and extended abstract outcomes - evidence of real development in sophistication of learning.

The absence of a corresponding decrease in all but one of the subscales of the reproducing orientation as defined by Entwistle and Ramsden (193) - 'surface approach', 'syllabus-boundness', 'fear of failure' and 'extrinsic motivation' - would suggest that the 'unfolding' model of stage development described by Volet and Chambers (1992) is not an accurate model of events. The model predicts that as the student's academic goals become more increasingly driven by desire for conceptual understanding and knowledge integration, the pre-existing 'acquire and recall' type of learning behaviours will gradually diminish. Reproducing orientation, as defined by these four subscales, would appear to survive in tandem - possibly within specific learning contexts - with those further along the continuum. However, the reproducing orientation defined by the factor analysis matrix in chapter three is composed of the ASI variables 'surface approach', 'improvidence', 'globetrotting','extrinsic motivation', 'negative attitudes to study' and 'syllabus-boundness'. 'Surface approach' and 'syllabus-boundness' excepting, the scores on *these* scales decreased significantly over time. If *this* definition of reproducing orientation is accepted then the trends within the data strongly support the Volet and Chambers' unfolding model. As new -meaning oriented - goals are developed, the previous - reproducing oriented - goals are abandoned as the developmental sequence progresses. The exclusion of the 'deep approach' and 'surface approach' subscales perhaps demonstrates that students do not necessarily develop a conscious recognition of any quantifiable change in their intention to actively or passively interact with learning materials, but they do recognize development in the behavioural mechanisms indicative of the orientation adopted - as might be predicted by the results of the interview studies of Beaty (1978).

The findings lend some support to the theory of 'knowledge objects' proposed by Entwistle and Marton (1994). 'Use of evidence' and 'relating ideas' would seem to be vital in the process of integrating and restructuring knowledge. These subscales directly focus on the student's handling of the logical, theoretical and experiential aspects of their studies. Entwistle and Marton drew their information from final year students revising for their examinations - and here the subscale scores in question peak in the final year of study. Undoubtedly the psychological construct of the knowledge object would require in-depth qualitative investigation to validate any more fully, but the findings here are certainly in accordance with the existence of such an entity.

The significant increase in 'strategic approach' over the three years, directly supports the findings of Mathias (1978) and the observation that 'course-focus' becomes finely tuned during a degree course. The attendant increase in scores on the OPQ scales 'controlling', 'outgoing' and 'tough-minded' endorses the theory that developing self-awareness - through increased assertiveness - leads to dissatisfaction with the level of intellectual stimulation offered. It might appear that as students progress, their perceptions of the everyday demands of their course overtake their intellectual motivation - perhaps as a function of increased workload, time contraints, excessive course material, lack of choice over subject and material of study and daunting assessment systems (*cf* Gibbs, 1992, p9).

If the 'strategic approach' ASI subscale is treated as a component of the meaning orientation factor it loads onto in chapter three - rather than treated in isolation - the significant increase in scores falls in line with the increase in meaning orientation in general. The overall factor score was composed of 'intrinsic motivation', 'relating ideas', 'use of evidence', 'deep approach' *and* 'strategic approach'. 'Deep approach' apart, each of these subscales significantly increased over time. This would suggest that all are measuring a fairly unitary learning mechanism or behaviour - one which develops over time.

As noted in chapter three, the 'globetrotting' and 'improvidence' subscales - assumed to measure preference for holist or serialist cognitive style - appear to be associated more closely with learning strategy. The 'comprehension learning' and 'operation learning' subscale scores remain relatively stable, indicating that with the ASI these measures are the only ones that validly measure dispositional cognitive style.

The OPQ scale scores which increased significantly included 'controlling', 'outgoing' and 'social confidence', and one scale 'competitive' decreased in the second year but recovered in the third. The former three variables were all associated with an overall factor trait termed 'assertiveness' in chapter three. All could reasonably be related to growth of personal extraversion and tradition 'character development' - perhaps indicating the effect of the non-academic, social activities abundant in university life.

The repeated measures changes in subscale scores within subject discipline, gender and maturity categories highlighted relatively few major trends. Results showed that in terms of personality, the vocational students - those of law and medicine - were the most changeable during their course of study, becoming more relaxed over time. This finding implies that the vocational courses demand adjustment of temperament. For these students is possible that a certain sense of emotional calm is developed in order to handle the pressure of their ultimate vocations, although a more credible reason for the change is the jump from pre-clinical to clinical studies in the medicine contingent, which perhaps introduces a feeling of purpose and hence reduced anxiety about the course. Patterns on the 'relaxed' scale are interesting here, with a 'fall before a sharp rise' trend attributed to the law and medicine students over the three years. This might be due to dissatisfaction with the content and intellectual stimulation offered by the subject - too little or too much in either case - in the second year when the external rewards of status and career attractive of these disciplines seem distant and for some unattainable.

Vocational students also varied in their approaches to studying and learning styles over time more than the other groups, steadily becoming more 'syllabus-bound' over time - perhaps suggesting that these courses encourage their students to stick rigidly to the learning materials offered. However, whether this trend continues throughout the five-year course of the medicine sample is unknown. The results contradict those of Clarke (1986) who investigated the approaches to studying of a cross-section of medical school students. He noted significant *decreases* in 'syllabus-boundness' and consistent, (though non-significant), increases in 'relating ideas', 'intrinsic motivation' and 'comprehension learning'. This discrepancy may be due to the longitudinal versus cross-sectional samples, the difference in sample sizes, (the sample size in this study was perhaps on the low side), and/or certain cultural factors (Clarke's study took place in New South Wales, Australia). The most likely source of difference however is the Australian course's integration of problem-based learning groups which address clinical and community problems designed to encourage and develop clinical reasoning, self-directed learning and practical application of knowledge. In contrast the Leicester course is taught in a relatively traditional manner.

For science students however, the sharp rise in 'intrinsic motivation' between the second and third years together with the sharp drop in 'syllabus-boundness' in the same period of time might indicate that the serialist mode of teaching prevalent within science subects - *c.f.* Pask, 1976(b) - dictates that overall frameworks of meaning are not developed or acknowledged until the later stages of the course. Since science students were *not* found to be quantitatively different in their preference for any one learning style overall - see chapter four - it may be possible that the mismatch between teaching style and learning style causes problems which manifest themselves in reproducing approaches to learning. Students who would naturally prefer to work *from* an overall framework of meaning - i.e holists - might experience difficulty adjusting to a serialist mode of teaching which works *towards* an overall framework of meaning. As the course progresses, these framework are gradually introduced thereby offering the more dispositionally holistic students the opportunity to derive meaning from the material covered thus far and consquently spurring their levels of intrinsic motivation in the subject. Such a hypothesis requires further research - perhaps of a qualitative nature - to substantiate, but nevertheless the findings are in accordance with the nature of the proposed relationship between approach and style.

Differences in shifts of motivation were apparent for students of different maturity and gender. Mature students' levels of 'achievement motivation' fell to a greater degree than that of their non-mature counterparts over time, possibly an indication of their greater personal commitment to the subject of their choice, and a developing perception of their degree as an intellectual challenge in itself rather then a means to a vocational end. The (possibly more cynical) explanation is that towards the end of their degree, they have less faith in the ultimate level of value placed on their degree by employers.

Males and females started with similar levels of 'use of evidence', 'critical' and 'innovative' in year one, but over time males' scores became significantly higher. In conjunction with the finding in chapter four - that males were significantly more 'abstract oriented' overall - this finding perhaps demonstrates a gender difference in the development of elaborative, abstract thinking within the sample. Again, this may be linked with differences between males and females development of intellectual structures, (*c.f.* Terenzini and Wright, 1987; Baxter-Magolda, 1988), or even in differences in brain physiology (Coltheart, Hull and Slater, 1975; Kimura, 1992).

The present study demonstrates that the eleven factor model described in chapter three can be readily identified in the first and second years of the study. The factor structure emergent in the third year validates many of the primary constructs of the original model, while highlighting changes in the relationships between personality, learning style and approach to learning.

The relative stability of the emotional stability, assertiveness/self-consciousness, sensation-seeking and concrete orientation structures is testament to the robustness of the factor model extracted. Only the conservative orientation factor lacks conceptual validity.

The most interesting development in terms of the relationship between approaches to learning and learning style is the apparent convergence of meaning orientation and abstract orientation factors in year three. Up until then the two remained conceptually separate. Meaning orientation related to a general approach to learning characterized by intention to seek meaning from materials, interrelate concepts and ideas, integrate new ideas using evidence sourced outwith the learning materials prescribed and evidence of an intrinsic interest in the subject of study. This factor closely resembled that originally observed by Entwistle and Ramsden (1983) and like theirs, is assumed to be contextually determined. The abstract orientation on the other hand appeared to be mainly composed of cognitive and personality elements - innovative, artistic, concepetual, behavioural - associated with aspects of learning style - comprehension and operation learning. This suggests that as a degree course is embarked upon, the student predisposition to enjoy abstract thinking has no bearing on their adoption of learning strategy. Conceivably a first-year student may be quite conceptually minded, but fail to focus on the meaning of their study materials. This finding is quite at odds with other studies which have implied that a holistic learning style is required for a meaning orientation to be used.

However, over the course of the study a relationship between learning strategy and style does develop. By year three the holistic - abstract orientation has become closely associated with meaning orientation. Since most of the component elements of meaning orientation were observed to increase significantly over the three years, while the component elements of abstract orientation remained relatively static, it can be assumed that a predisposition to abstract thinking will form a foundation upon which meaning orientation to study will be encouraged and developed.

In a similar way aspects of personality became intertwined with adoption of a reproduction orientation in the final year - negative 'critical' characteristics and positive 'traditional' characteristics - although the reproducing orientation factor remains conceptually distinctive and independent throughout the three years of the study.

Another pertinent finding is the identification of a factor relating to achievement orientation in the third year. Few studies have identified this orientation as conceptually distinct, and indeed without longitudinal analysis, the situation in which it becomes independent may never have been observed. The factor score correlation coefficients suggest that the initial ambitiousness factors from years one and two are more related to year three factor 8 - an 'achievement orientation' factor - but there is still a very strong (negative) correlation with year three factor 4 - the agreeableness factor - grouping those aspects relating to social and relationship behaviour, e.g. 'caring', 'affiliative', 'behavioural' - high scores in which were diametrically opposite to high scores in the ambition traits such as 'competitive' and 'achieving'. These findings suggest that in the first year or two of university the drive to achieve is largely determined by an ambitious personality. By the third year however, it seems that academic ambition becomes independent of personality, perhaps implying that achievement orientation is a *learned* characteristic - thus accessible to *all* students

A similar pattern occurs when the 'conscientious' factor is observed. In year one, the factor is conceptually independent of any aspect of learning measured by the ASI. By year three however several aspects of meaning orientation - 'deep approach', 'use of evidence' and 'relating ideas' - have positively loadings while some aspects of reproducing orientation -

‘disorganized study methods’, ‘globetrotting’ - have negative loadings on the factor. This suggests that a conscientious personality predisposes a student to adopt a meaning rather than a reproducing orientation. However, the meaning orientation within this factor seems to be somewhat different to the meaning/abstract orientation described, in that it appears to be borne out of methodical study skills and planning, rather than conceptual thinking and intellectual flexibility. Indeed, the inclusion of ‘operation learning’ and negative ‘globetrotting’ in the second and third year conscientiousness factors suggests that this deep approach is cognitively quite distinct from the abstract/meaning orientation factor which includes high loadings on ‘comprehension learning’. This distinction highlights the role of learning style in approach to learning and makes it clear that learning style influences the ways in which students reach understanding. High scorers on this third year conscientiousness scale are deep learning through cognitive *organization* as opposed to cognitive *elaboration*.

This reflects the theory of Weinstein and Mayer (1986) - see introduction p17 - who identified three cognitive resources available to the learner, namely rehearsal strategies - little or no cognitive transformation - organizational strategies - learning by categorization, clustering and re-organization of new information - and elaboration strategies - learning through comprehensive transformation of new knowledge. By year three, each of these strategies is evidence within an independent factor - reproducing orientation, conscientiousness and meaning/abstract orientation respectively, the latter two marking the integration of aspects of personality, learning style and approach to learning. This study provides evidence that the educational process defines and develops these strategies and this in turn generates the theory that the hypothetical model of learning style introduced in chapter three is one which develops over time. (Figure 5.13 and 5.14)

Figure 5.13 Year one model of student learning

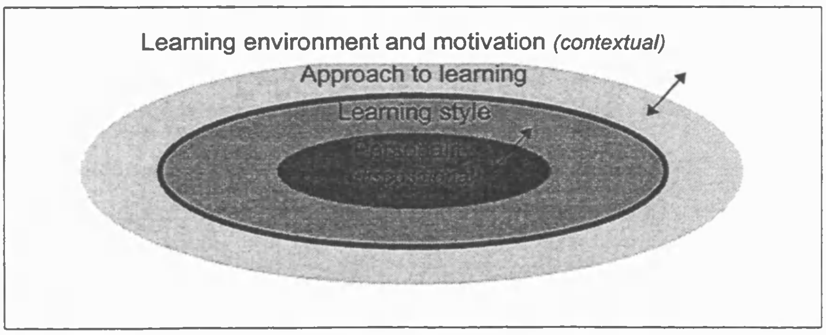
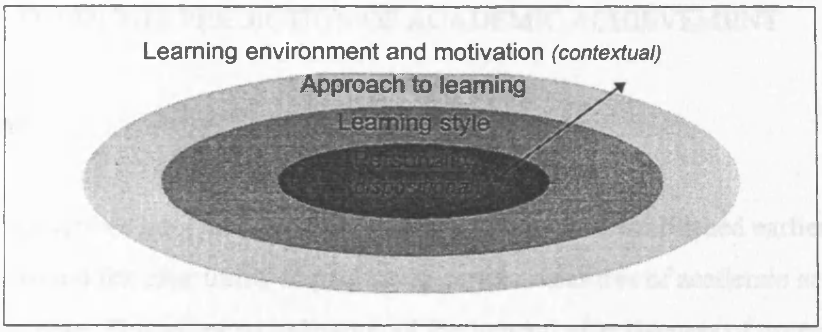


Figure 5.14 Year three Model of student learning



The longitudinal aspects of this study have highlighted that this model develops *during* the course of a university degree with personality and learning style influencing approach to learning *over time*. The model presented in chapter three and here as figure 5.14, may be inappropriate for first-year students, but it effectively illustrates the more fluid relationship between personality, style and approach in the final year of study.

CHAPTER 6 - APPROACHES TO LEARNING, COGNITIVE STYLE AND PERSONALITY IN THE PREDICTION OF ACADEMIC ACHIEVEMENT

6.1 Overview

This chapter describes how the personality/learning constructs established earlier in the project were tested for their utility in predicting certain measures of academic achievement in the student sample. This gives an indication of the general effectiveness of current methods of assessment in rewarding conceptual understanding of taught subject material.

6.21 Use of intellective measures in predicting academic performance

Much of the research carried out in higher education, especially from the mid-1960s to mid-1970's was concerned with the selection of students for entry into university and prediction of their future academic success. These studies initially aimed to assess whether degree class and/or high levels of academic performance were correlated with attainment in secondary school examinations - the English A-level and the Scottish 'Higher', or other tests of academic aptitude such as the American Scholastic Aptitude Test. High scores on the American SAT have been reported to be indicative of higher degree class (Scannell, 1960), and in Scotland Nisbet and Welsh (1966) observed that number and grades of passes in Scottish Certificate of Education examinations could quite accurately predict final degree performance. Others have reported positive correlations between school examination results and first or final year degree performance (Choppin, Orr, Kurle, Fara and James, 1973, Smithers and Batcock, 1970, Wilson, 1971, Powell, 1973, Peers and Johnston, 1994). However, some studies have found find either no relationship or in some cases a weak *inverse* relationship between the two (Barnett and Lewis, 1963, Wankowski, 1970, Entwistle and Wilson, 1977, Rees, 1981). Nisbet and Welsh (1966) warned that the predictivity of entrance qualifications tends to vary from year to year, and is rarely consistent between different subject disciplines. The diversity in findings of these studies have failed however to discredit the predictive validity of such objective tests of academic achievement and the perception of them as appropriate selection criterion for university entrance.

Tests of intellectual aptitude - or intelligence quotient - developed in Britain have also proved mildly predictive of university grades, but no more so than school examination attainment (Powell, 1973, Choppin *et al*, 1973 Entwistle and Wilson 1977). Studies suggest that the tests used widely in the United States, (Scholastic Aptitude Tests), are not appropriate in the context of British education, perhaps because of the more specialised nature of British degree courses. In general it would appear that the predictive validity of such intellective measures is not universal.

6.22 Use of non-intellective measures in predicting academic performance

Lavin (1965) stated that although measures of intellective ability represented the best single type of predictor, they account for less than half of the variation in academic performance. He suggested therefore that researchers should look at *non*-intellective factors as explanatory variables. Many studies do just this, correlating specific personality variables with academic performance either on the basis of systematic personality theory or on intuitive notions of which variables might be predictive. The practical reasons for this type of research lie in the facilitation of selection, streaming and vocational guidance and the belief that it would be highly useful to know if certain personality traits predict academic success or failure. In addition, theorists have sought to assess the nature of the relationship between personality and intelligence.

A range of factors have been empirically tested for their accuracy in predicting academic success at a higher educational level. Teachers' and head-teachers' subjective assessments of students, for example, have been demonstrated as positively correlated with degree results, though in one study this varied across different academic disciplines - mathematics and mechanical engineering students' assessments proving more predictive of performance (Wilson, 1971, Choppin *et al*, 1973). More specific ratings of the levels of ability and persistence of individual students - Nisbet and Welsh (1966) - failed to give a clear indication of success or failure for students of borderline entrance qualifications.

Studies of age and sex differences in academic performance (McCracken, 1969, Malleson, 1959, Lavin, 1965, Entwistle and Wilson, 1977, Scannell, 1960, Abelson, 1952, Wankowski, 1973, Lynn, Hampson and Magee, 1983) - though varied in conclusion - frequently suggest that younger students tend to do better academically than older students, and that the school examination attainment of females is more predictive of degree result than that of males. The age difference finding may however be a result of older students failing to obtain entrance requirements at the first attempt and thus being on average less academically able than the younger students (Entwistle and Wilson, 1977), and the higher predictability of females' degree classes may be due to the greater homogeneity of their college grades, (Abelson, 1952).

Correlations of sociodemographic variables, e.g., parental occupation/education, social class, family size, position in family, with degree results (Dale, 1963, Smithers and Batcock 1970, Hopkins, Malleson and Smarnoff, 1958, Entwistle and Wilson 1977, Lynn, Hampson and Magee, 1983), are unresolved in their conclusions, though it appears that students from working-class backgrounds tend to be more successful. This trend is attributed to the fact that historically it has been harder for such students to obtain university places and thus those reaching graduation tend to be of a higher academic standard than their middle-class colleagues. There is little evidence to suggest that the other factors above correlate to any great extent with degree results.

6.23 Use of measures of motivation in predicting academic performance

Howe (1987) and others have stressed the importance of motivational factors in any area of human achievement. Unsurprisingly then, contrasting forms and levels of academic motivation are the focus of many studies on educational attainment (Entwistle and Brennan, 1968, Entwistle and Wilson, 1977, Marsh, 1984, Hopkins *et al* 1958, Wankowski, 1973, 1980 Lavin 1965). While many conclude that a student's motives are highly influential in determining their educational success, there are considerable difficulties in identifying and measuring the many diverse forms of motivation.

As mentioned in the introduction, most studies of motivation make the distinction between *extrinsic* and *intrinsic* motivation. Fransson (1977) neatly defines the two ;

> '*Intrinsic motivation* for learning is a state where the relevance for the learner of the content of the learning material is the main reason for learning.
> *Extrinsic motivation* for learning is a state where the reasons for the learning effort have nothing to do with the content of the learning material. A good learning performance serves merely as a means for achieving some desired end result.'

Wankowski (1973) noted that students who do poorly at university are more likely to have been *extrinsically* motivated - typically entering higher education because of the expectations of their parents or because university was seen as a means of delaying important life decisions. However, he also reported that the more successful students tended to have a clearer idea of their future goals than those who were failing examinations. Conversely, students perceived to be *intrinsically* motivated, - i.e., those whose interest was aroused by the subject discipline itself - tended to attain better degree classes. People with exceptional expertise in any particular area are usually highly involved and fascinated in their work, a characteristic Renzulli (1986) dubbed 'task commitment'.

The relationship between source of motivation and success would seem to be reversed in secondary school level students. Lynn, Hampson and Magee (1983) assessed levels of intrinsic and extrinsic motivation in 16 plus adolescents and found that measures of 'status aspiration' (extrinsic motivation) to be significantly correlated with examination achievement, but measures of 'work ethic' (intrinsic motivation) to have no such predictive value. This study demonstrates the link between adolescents' perceived importance of school examinations, ambition and success. It also suggests that intrinsic motivation is of little value at the secondary level, although the questionnaire used to assess this was newly developed and may have lacked construct validity. Cassidy and Lynn (1992) noted that achievement motivation was almost three times as predictive of educational attainment than IQ. Achievement motivation was in turn predicted mainly by personality and home background variables in the student sample, with the addition of intelligence and school type for females.

The concept of 'need for achievement' has been isolated as an additional form of motivation, including elements, 'hope for success' and 'fear of failure', both of which may facilitate or inhibit academic performance (Atkinson and Feather, 1966). Finger and Schlesser (1965) claimed that quantitative measures of the extrinsic, intrinsic and achievement motivations of students were effective in predicting their degree grades, although the conclusions they reach are by no means unchallenged.

Entwistle (1984) has criticized this type of study, for their tendency to be over-simplistic, vague, and their failure to consider the individual student's educational and social context. While there is certainly a wealth of research linking motivation to achievement, the relationship between the two must be observed within a broader context.

6.24 Use of measures of study habits and attitudes towards study in predicting academic performance

Investigation of the student's actual study behaviour is perhaps a more valid line of enquiry. Brown and Holtzman's (1966) Survey of Study Habits and Attitudes broke down the concept of study habits into four distinct spheres. 'Work methods' focused on perceived effectiveness of the student's personal study activities, 'delay avoidance' assessed their punctuality in completing work, 'teacher approval' canvassed their opinions of their teachers and 'educational acceptance' noted their attitudes towards certain educational objectives. These sub-scales have correlated well with exam achievement indicators, especially 'delay avoidance' and 'educational acceptance', which suggests that certain 'good' study habits exist which *could* be applied by the whole student population. Conversely, others have suggested that students adopt study characteristics which work best for them, and that the relationship between study habits and academic performance is consequently much more complex. Hudson, (1968) drew upon the cognitive concept of 'convergent' and 'divergent' thinkers to suggest that there exist 'syllabus-bound' students who, while conscientious and systematic, tend to be constricted by course demands, and 'syllabus-free' students, who while more independent, may flout the demands of their course. Entwistle and Wilson (1977) concluded that although the relationship between study habits and academic success is made significantly more complex because of the influence of individual personalities, those study methods demonstrating an *organized* approach appear to be fairly predictive of higher academic performance. The types of study which may be described as such will take varied forms in different students.

American studies such as Keefer (1969) and Holen and Newhouse (1976) have sought to assess the accuracy of students' *own* predictions of their performance on objectively scored course examinations with a view to investigating the possibility that student self-grading might provide useful and accurate information to supplement traditional forms of assessment. Both report significant correlations between pre-examination expectancy and grades, though neither consider in sufficient detail the means by which students' self-perceptions of ability are reached. Examinations are complex tasks requiring the candidate to 'produce information, organize it into a structured whole, compare various materials, critically analyze and discuss concepts, theories and experiments, make evaluations, draw conclusions, etc.', (Vollmer, 1986). Vollmer claimed that expectancy may be related only to some of those specific activities involved in the academic examination. While the American studies assumed that performance in the exam task was influenced by general quantity of effort expended beforehand, Vollmer hypothesized that while the student must firstly demonstrate their knowledge and understanding of a topic in an exam, he or she must also critically discuss and evaluate this knowledge, a task demanding a certain degree of independent thinking . He argued that perhaps this willingness to engage in independent thinking may be related to both the student's expectancy and their subsequent examination performance. If expectancy is thought of as an expression of the stable personality dimension 'perceived ability' (Vollmer, 1986), then individual differences in this trait might strongly influence students' conceptions of how much they know prior to the exam, as well as the amount and quality of information they are able to produce in an examination.

Research relating study methods to academic success suggest strong links between the two, but in common with the motivation studies they are open to the criticism of neglecting personological factors in the complex study process.

6.25 Use of measures of personality in predicting academic performance

Eysenck's theories of extraversion/introversion and neuroticism/stability (Eysenck, 1957,1972) have elicited a great many studies linking personality type to academic success. Eysenck and Eysenck (1969), for example, claimed that *non*-neurotic introverted university students are more likely to be successful in their studies.

Kline and Gale (1971) administered the EPI to psychology students over a five year period and compared their findings with eight similar studies. Seven of the studies reported mild correlations between introversion and academic performance, and one reported none. Their own study found few performance correlations with neuroticism and extraversion. They concluded that the relationship between personality and academic success, (in psychology examinations at least), is largely unpredictable.

Some of the most interesting evidence that certain personality traits *are* related to examination performance at university is provided by Furneaux (1962). By categorising an engineering student sample into four 'types' using dichotomized scores on neuroticism and extraversion scales, it was found that 'stable extraverts' were the most likely to fail in first year examinations, (61% failure rate), and 'unstable introverts' were the least likely to fail, (21% failure rate). His explanation for the apparently counter-intuitive finding relating to emotional stability, centred around the unstable student's supposed 'tense and worrying nature' which, he suggested, may increase 'drive' and thus facilitate hard work. This widely cited study has, however, been criticised for its limited sample. Eysenck and Eysenck (1985) contended that neuroticism only correlates positively with achievement in groups that have been highly selected, i.e. in highly intelligent students. Prior to this, Furneaux (1980) had hypothesized that neuroticism might be predictive of high achievement only in students who have been selected on some 'coping' factor such as 'superego strength' or 'independence' as measured by Cattell's 16PF. This interaction is commonly termed the 'Furneaux factor'. This hypothesis has been supported by McKenzie (1989) who suggests that neuroticism does help the student as long as he or she also possesses sufficient ability to cope with stress and tolerate frustration. Kelvin, Lucas and Ojha (1965) reported that both first-class honours graduates and those students who failed, showed in general, higher than average neuroticism scores, a finding concordant with Furneaux's theory. Eysenck considered neuroticism to be a drive which induces 'stress-reduction' types of behaviour. This description would fit in well with the Furneaux factor with increased drive eliciting stress-reducing study activity.

Many studies contradict Furneaux's hypothesis. Lavin (1967) presents evidence of the superior performance of the *stable* introverted student and Entwistle and Wilson(1970), and Entwistle and Entwistle (1970) report *no* relationship between neuroticism and attainment, though the latter study did identify characteristics relating to successful students which also related positively to stability. They point out that too much drive, tension or anxiety will probably overshadow the effects of stress-reducing study and lead to poorer performance. Different students will seek to reduce stress in different ways, many of which will be unhelpful academically. Success in the neurotic student might be thought to be dependent on their ability to channel their nervous tension into *productive* forms of stress reduction. The relationship between neuroticism and performance is clearly subject to many other interactive factors making the research both contradictory and inconclusive.

As far as extraversion/introversion is concerned most researchers acknowledge that extraversion correlates negatively with academic success at the higher educational level. Kelvin, Lucas and Ojha (1965), for example, found higher extraversion scores in students obtaining poor degrees than those obtaining good degrees, and Entwistle and Wilson (1970) report a highly significant link between introversion and good honours degree status. Many other studies report similar findings. The higher success rate of the introverted student can be more easily explained than that of the neurotic/stable student. A straightforward explanation is that their success is related to their need to work alone and plan ahead, while more extraverted students preoccupy themselves with social activities. Lavin (1967) claims however that this interpretation may be rather simplistic. In an earlier study he, (Lavin, 1965), noted that students low on 'sociability' performed better in lecture-based and instructor-led educational contexts, while the more 'sociable' students performed better in leaderless discussion groups. This suggests that extraversion may important in determining performance within different educational environments requiring different degrees of social interaction, thus the student's perception of the value of academic work may be strongly mediated by their sociodemographic position within the student community. Students may consequently forgo their social standing within a group because they value intellectual pursuits more than the other members, thus making them *appear* more introverted. Eysenck (1970) suggested that because introverts are better at encoding material into long-term memory - a finding supported by empirical evidence - they are at an advantage in assessment methods requiring delayed recall of information. Lynn and Gordon (1961) drew from research in conditioning which suggests that extraverts become 'neurally fatigued' more quickly than introverts and are therefore less conditionable. They hypothesized that in academic settings involving prolonged revision and constant pressure this difference will disadvantage the extravert student.

Lynn, Hampson and Magee (1983) sought to assess the value of personality and motivational variables in predicting educational attainment, (GCE, CSE and RSA examination performance), in 16 plus year-old adolescents using Eysenck's personality factors neuroticism, extraversion and psychoticism alongside other factors 'status aspiration' and 'work ethic'. They reported a significant negative association of psychoticism with examination success. In addition they also noted a significant negative correlation with the Eysenck 'lie-scale', suggesting that the verbal analysis required to accurately interpret the items of the scale is a good indicator of a specific verbal intelligence. Neuroticism had no effect on educational achievement in the sample and introversion was a significant factor for girls but not boys. These results would appear to be supportive of the theory that introversion and neuroticism are negatively correlated with educational success in young children (Eysenck and Cookson, 1969), but positively correlated with success among university students. The sample used here was quite possibly at the 'crossover' stage of this effect.

An interesting study by Gallacher (1990) sought to evaluate the relationship between measures of neuroticism and extraversion, and the student's perception of stressful academic events as threats or challenges. This considers Gray's (1981) theory - which suggests that neurotic individuals are sensitive to punishment or 'non-rewards' in their environment, whereas extrovert individuals are sensitive to, and anticipate reward in their environment - to be applicable in an academic context. Neurotic individuals, it is argued, are at an academic disadvantage because they must focus not only on cognitions relevant to the academic task at hand, but must also manage the cognitive components of their anxiety - worry, negative self-evaluations, etc. Thus punishment-sensitive students need to exert more effort to match the performance of non-punishment sensitive students. His study bore out the hypothesis that neuroticism tended to be related to appraisal of stressors such as exams, finances, teachers, papers, etc. as threats, while extraversion was related to appraisal of these as challenges.

Lin and McKeachie (1973) found that the 'achievement via independence' scale of Gough's California Psychological Inventory to be a good predictor of course grades of male, (but not female), first year psychology students, highlighting the value of autonomy and independence as student traits.

Mental health and degree attainment studies (Banreti-Fuchs and Meadows, 1976, Malleson, 1963, Entwistle and Wilson 1977) indicate that while many students report mild psychiatric problems, (often related to anxiety or neuroticism), the effect of these on academic performance is not always detrimental. Indeed, neuroticism is considered by some to be an advantage for high degree result. Behrens and Vernon (1978) also used secondary school students for their investigation of personality and its relationship with over and under-achievement. They reported consistent correlations of school achievement, (especially in mathematics and English), with measures of aggression from the Frost Self-Description Questionnaire, (negative correlation), and self-esteem from the Coopersmith (1967) Self-Esteem Inventory, (positive correlation).

Research focusing on personality predictors of tertiary academic performance has highlighted a number of interesting trends - however many studies over-simplify the nature of the behavioural aspects of personality traits within academic contexts and fail to consider the process of study behaviour as a mediator between personality and performance.

6.26 Multivariate prediction studies

More recent research in the prediction of academic performance focuses on a broader, multivariate approach, measuring a larger number of personality variables, assessing the relationships between them.

Entwistle and Brennan (1968) applied cluster analysis to 23 psychological variables relating to 'intellectual', 'study-habit', 'personality' and 'personal value' domains. Three clusters emerged showing high academic performance among their component variables. The first cluster was formed of students characterized by high scores on introversion, stability, motivation, good study methods and examination technique, along with high empirical rationalism, tough-mindedness, conservatism and ambition. This second cluster describes students whose study methods and motivation were no better than average, yet who still did well academically. The third cluster relating to high academic performance contained high verbal ability, 'sombre' self-image, low rationalism, ambition and political and economic values, and high radical and tender-mindedness scores. Three clusters also emerged exhibiting low academic attainment. The first of these is characterized by students who score low on motivation and study habit measures, high on extraversion, social values, tough-mindedness and radicalism. The second cluster includes extraverted students, this time scoring high on tough-mindedness and conservatism, with high theoretical and economic values and low aesthetic and religious values. They have average motivation and study methods. The final cluster is notable for a predominance of students with poor examination technique. Entwistle and Brennan claim that this sort of analysis works both on an intuitive level and as a valid means of accurately portraying the processes underlying different levels of academic performance.

Kline (1979) found significant correlations between 16PF personality traits and academic achievement of secondary school children, specifically the traits 'self-sufficiency', 'superego/conformity, 'warmth' and 'impulsivity'. In a similar study Boyle and Cattell (1987) found correlations of the traits 'superego/conformity', 'dominance' (negative) and 'self-sentiment' with experimental measures of learning outcome. Boyle and Cattell consider that this suggests that individuals with broad, dynamic and ambitious outlook, who are also analytical, thoughtful and open-minded, (self-sentiment), and who tend to be more submissive as students, (negative dominance), will be more successful. The correlation with 'superego/conformity' would suggest that conscientious, hard-working and rule-abiding individuals attain better grades. Two other factors correlated with learning outcome to a lesser degree, *viz.* 'insecurity' (positive correlation) and radicalism (negative correlation). Again this would suggest that conservative but slightly insecure students achieve better academic results. Boyle and Cattell do stress that personality traits are only part of a complex interactive process involving mood states, abilities and motivational dynamic factors.

Furnham and Mitchell (1991) conducted an extensive four year longitudinal study aiming to investigate which of a range of personality measures would best predict academic performance. These measures included Eysenck's EPQ, Neulinger and Raps' 'Free-time activity scale' (measures nine different needs - order, autonomy, sentience, understanding, achievement, sex, affiliation, nurturance and activity), Snyder's 'Self-monitoring scale' (a measure of an individual's sensitivity to situational cues of social appropriateness), Watson and Friend's 'Social anxiety and distress scale', (a measure of social skill difficulties), the Rathus 'Assertiveness schedule', (a measure of assertive behaviour), and Rotter's 'Locus of control' (a measure of an individual's perception of his or her ability to control life events). The student's practical placement ratings and absenteeism records were also introduced as dependent variables. They noted performance links with extraversion (positive correlation), neuroticism (negative correlation), needs for both order and sentience, and higher self-monitoring. Social anxiety, assertiveness, and locus of control emerged as unpredictive or performance, although social anxiety was predictive of absenteeism. They concluded that the above variables interact with other ability factors such as motivation, study methods and work efficiency to determine academic performance. On their own these variables are not efficient predictors of success or failure.

Wong and Csikszentmihihalyi (1991) found high scores on a 'work orientation' personality factor derived from the five-factor theory based Personality Research Form (Jackson, 1984) to be a better predictor of high-school grade than students' self-reported experiences while studying. This factor was composed of traits such as low impulsiveness, endurance and achievement motivation which the researchers considered to be a stable personality trait. The direct and indirect effect of this factor on students' grades was mediated by the level of self-consciousness, lower levels of which predicted better grades.

6.27 Use of measures of approaches to learning in predicting academic performance

Relationships between quantitative measures of approaches to learning and academic performance have been keenly investigated, especially since research in prediction of academic attainment has generally concluded that no one personological or educational variable can be held to be more predictive than any other.

Studies relating student scores on Entwistle and Ramsden's (1983) Approaches to Studying Inventory with measures of academic performance, (for example, Entwistle *et al*, 1979; Ramsden and Entwistle, 1981; Watkins, 1982, 1983; Clarke, 1986; Miller *et al*, 1990 and Newstead, 1992) have demonstrated positive correlations between formal course assessments in higher education and scores on the 'deep approach', 'intrinsic motivation' and 'strategic approach' scales, and negative correlations between performance and scores on the 'surface approach', 'disorganised study methods' and 'negative attitudes to study' scales. This suggests that the Approaches to Studying Inventory may constitute an effective and reliable means of predicting academic outcome.

However, these findings have not proved universally consistent. Entwistle and Ramsden (1983) reported that scores on the four main study orientations - meaning, reproducing, achieving and non-academic - were not related to entrance qualifications in terms of the grades achieved at A-level. Richardson (1995) reported a negative correlation between adoption of meaning orientation and performance on third year assessments, and no correlation whatsoever with any orientation and performance in first year assessments. Scores on 'reproducing orientation' negatively correlated with performance in the first year sample, but did not correlate at all with performance in the final year. Similarly, no relationship between achievement orientation and performance in either first or third year was observed. These findings directly contradict those of Newstead (1992) who noted positive correlations between both achievement orientation and year three results, and meaning orientation and overall results. Richardson concluded that this disparity in findings suggests that the use of the Approaches to Studying Inventory as a selection instrument may be misguided.

Studies using other measures of learning strategy have demonstrated fairly consistent findings. Performance on course assessments have been positively linked with the 'internalising motivation' and 'internalising strategy' scales of Biggs' SPQ (Watkins and

Hattie, 1981), the 'synthesis-analysis' (or deep processing), 'elaborative processing' and 'study methods' scales of Schmeck's ILP (Watkins and Hattie, 1983), and the 'active experimentation' dimension of Kolb's LSI (Newstead, 1992). However, many of the correlations observed are significant only in student samples drawn from certain subject disciplines. This is consistent with Marton and Säljö's (1976) argument that surface and deep levels of study may differ conceptually in different contexts or study areas.

Richardson (1995) validated this by suggesting that the relationship between approaches to learning and measures of academic performance is heavily dependent upon the types of teaching and modes of assessment prevalent within any department. This is reflected in the comments of some researchers regarding the nature of examinations. Entwistle and Entwistle (1992) expressed concern both at the tendency of examinations to disrupt the student's efforts achieve personal understanding and the ways in which some types of exam question fail to 'tap conceptual understanding'. Ramsden, Beswick and Bowden (1986) suggested that first year assessments 'can be successfully negotiated through the use of effectively-managed surface strategies.'

These concerns suggest that the utility of studies correlating measures of academic performance and approaches to learning lies not so much in the prospect of assessing the predictivity of the learning instrument, but in assessing the effectiveness of assessment procedures in testing conceptual understanding.

6.3 Rationale

The studies outlined are far from concordant in their findings. Indeed many reach contradictory conclusions, however general trends can be identified in which certain factors do seem to be indicative of better academic performance.

Most studies use a similar methodology, involving the administration of a quantitative test of the characteristic in question to a sample of college or university students (usually undergraduates). The results for each students are matched to measures of their academic performance (typically examination scores), and correlations between the two are calculated.

The study described here aims to bring up to date many of these reports by using a more sophisticated method of assessing personality, and a more appropriate and useful form of assessing motivation, learning approach and attitudes to study, while employing the same tried and tested methodology.

6.4 Hypotheses

Many of the aforementioned studies have highlighted the efficacy of certain personality, motivational, attitudinal and study factors in predicting academic achievement. This section of the research sought to identify personality and learning approach factors which were related to both first-year and final degree performance. First year examination results provided a short-term criterion to be matched with first year personality and learning profiles, while final year degree class constituted a (much valued) indicator of overall performance, against which personality and learning measures recorded throughout the university career could be associated. It was anticipated that students with a high proportion of certain 'indicators' of academic success would tend to perform better. These included emotional stability, introversion, adoption of meaning orientation, intrinsic motivation, good study methods, rationalism, and conservatism. Conversely, students with a high proportion of certain 'symptoms' of failure were predicted to perform less well. Such symptoms might include neuroticism, (though Furneaux's theory contradicts this), extraversion, surface approaches to study, extrinsic motivation, and disorganised study methods. In addition, age, sex and academic discipline differences in the predictive variables were expected.

6.5 *Methodology*

6.51 Participants

For details of core methodology please see chapter two.

6.52 Recording Academic Performance

The method of final degree analysis was similar to that of Richardson (1995). Degree class was coded 5 for first class honours, 4 for upper-second class honours, 3 for lower-second class honours, 2 for third class honours, 1 for a pass and 0 for a failure or withdrawal. This was necessary so that higher academic grade could be represented by higher score. The assumption was made that the distribution of degree classes was derived from a ratio measurement scale approximately normal in shape, since degree classes would normally be considered categorical in nature. Cases with missing performance values were not processed in the statistical analysis.

6.6 Data Analysis

To examine the relationships between personality, approaches to learning and academic attainment, Pearson bivariate correlation coefficients were calculated between scores on both the OPQ and ASI, and the first and third year scores derived from the year-end assessments. Significant correlations between certain personality and learning variables and academic performance on this matrix suggested that clusters of items consistent with those grouped within the factor analysis extractions previously calculated were likely to correlate themselves with academic performance. (Table 6.01a and 6.01b)

The correlation coefficients between each of the eleven factor variables and the measures of academic performance were calculated in order to assess the existence of linear relationships between them. Multiple regression analysis sought to test the hypothesis that any of the independent factor variables could *predict* the dependent variable of academic performance. Regression models were used to analyse the relationships between the eleven personality/learning factors and both measures of academic attainment, specifically to assess which, if any, of the factors could explain the outcome variable.

An 'enter-method' regression model was used in which all of the independent variables were entered into the regression equation simultaneously. The residuals elicited by this model were largely consistent with those calculated by 'stepwise' and 'forward selection' methods of regression - in which the independent variables are entered sequentially depending on the correlation coefficient of each with the dependent variable. The enter-method solution was accepted on the basis of both its interpretability and parsimony.

The regression analysis identified linear and *non*-linear relationships between variables, and the coefficient for each variable was adjusted for all the other independent variables in the equation. Since all of the independent variables were measured on the same scale, the coefficients derived were directly comparable, so the beta-score (β) could serve as a valid indicator of the relative importance of each variable in predicting academic performance.

In addition to the multiple regression analyses of the student sample as a whole (Table 6.02), a series of multiple regression analyses were carried out separately for male students vs. female students (Table 6.03), for non-mature students vs. mature students (Table 6.04) and for students of each category of academic discipline (Table 6.05), - except medicine, academic results for whom were not available.

6.7 Results

6.71 Correlations between OPQ and ASI scales and academic performance

The correlation coefficients calculated between scores on each of the OPQ traits and the first year indicators of academic performance (Table 6.01a) indicated significant correlations

Table 6.01a Pearson bivariate intercorrelation coefficients between mean OPQ trait and indicators of academic performance

	***Mean Mark** (Year1)*	***Degree Class** (Year 3)*
(No. of cases)	*(274)*	*(314)*
Relationships with people		
Persuasive	-0.11	-0.05
Controlling	0.07	-0.04
Independent	-0.10	-0.07
Outgoing	-0.06	-0.05
Affiliative	0.04	0.07
Socially confident	-0.06	-0.08
Modest	-0.02	-0.03
Democratic	0.06	0.09
Caring	0.09	0.17**
Thinking style		
Practical	-0.15*	-0.12*
Data rational	0.03	-0.13*
Artistic	0.06	0.03
Behavioural	0.05	0.03
Traditional	0.01	0.00
Change oriented	-0.14*	-0.03
Conceptual	0.01	-0.11*
Innovative	-0.05	-0.05
Forward planning	0.14*	0.10
Detail conscious	0.25**	0.15**
Conscientious	0.30**	0.18**
Feelings and emotions		
Relaxed	0.01	-0.04
Worrying	0.06	0.07
Tough minded	-0.14*	-0.16**
Emotional control	-0.09	-0.05
Optimistic	0.00	0.04
Critical	0.07	-0.08
Active	-0.03	0.04
Competitive	-0.12*	-0.15**
Achieving	-0.05	-0.04
Decisive	-0.17**	-0.09
Social desirability response	-0.02	0.00

*p < 0.05, ** p < 0.01

between year one performance and the OPQ traits practical (r=-0.15, p<0.05), change oriented (r=-0.14, p<0.05), forward planning (r=0.14, p<0.05), detail conscious (r=0.25, p<0.01), conscientious (r=0.30, p<0.01), tough minded (r=-0.14, p<0.01), competitive (r=-0.12, p<0.05) and decisive (r=-0.17, p<0.01). Significant correlations between first year performance and the ASI scales surface approach (*r*=-0.17, p<0.01), syllabus boundness (*r*=-0.14, p<0.05), extrinsic motivation (*r*=-0.20, p<0.01), strategic approach (*r*=0.14, p<0.05), negative attitudes to study (*r*=-0.24, p<0.01), disorganised study methods (*r*=-0.28, p<0.01), comprehension learning, (*r*=-0.15, p<0.05) and globetrotting (*r*=-0.25, p<0.01) were observed (Table 6.01b).

Table 6.01b Pearson bivariate intercorrelation coefficients between mean Approaches to Studying scales and indicators of academic performance

(No. of cases)	***Mean Mark** (Year1)* *(274)*	***Degree Class** (Year 3)* *(314)*
Meaning Orientation		
Deep approach	0.08	0.03
Relating ideas	0.02	-0.04
Use of evidence	0.11	-0.01
Intrinsic motivation	0.10	-0.02
Reproducing Orientation		
Surface approach	-0.17**	-0.03
Syllabus boundness	-0.14*	-0.10
Fear of failure	0.06	0.00
Extrinsic motivation	-0.20**	-0.12*
Achieving Orientation		
Strategic approach	0.14*	0.13*
Negative attitudes to study	-0.24**	-0.12*
Disorganised study methods	-0.28**	-0.13*
Achievement motivation	0.04	-0.03
Styles and pathologies of learning		
Comprehension learning	-0.15*	-0.12*
Globetrotting	-0.25**	-0.07
Operation learning	0.05	0.08
Improvidence	-0.10	0.02

*p < 0.05, ** p < 0.01

Significant correlation coefficients were noted between final degree class and the OPQ traits caring (*r*=0.17, p<0.01), practical (*r*=-0.12, p<0.05), data rational (*r*= -0.13, p<0.05), innovative (*r*=-0.11, p<0.05), detail conscious (*r*=0.15, p<0.01), conscientious (*r*=0.18, p<0.01), tough minded (*r*=-0.16, p<0.01) and competitive (*r*=-0.15, p<0.01) - (Table 6.1a), and between final degree class and the ASI scales extrinsic motivation (*r*=0.12, p<0.05), strategic approach (*r*=0.13, p<0.05), negative attitudes to study (*r*=-0.12, p<0.05), disorganised study methods (*r*=-0.13, p<0.05) and comprehension learning (*r*=-0.12, p<0.05) - (Table 6.01b).

Many of the traits and scales significantly correlated with academic performance were those central to certain factor extractions derived from factor analysis of the entire dataset, - see chapter three - for example, forward planning, detail conscious, conscientious and disorganised study methods are the core elements of the 'conscientiousness' factor. This observation informed the use of the eleven factor variables in subsequent prediction analyses.

6.72 Relationships between factor scores and academic performance

Pearson correlation coefficients (Table 6.02) demonstrate that scores on reproducing orientation had the strongest correlation with first year academic performance (r=-0.28, p<0.01), with conscientiousness highly correlated too (r=0.25, p<0.01). Multiple regression analysis (Table 6.2) confirmed that this relationship was predictive; reproducing orientation (ß=-0.290, p<0.001) and conscientiousness (ß=0.257, p<0.001). Abstract orientation also emerged as both correlated with, and predictive of, first year academic performance (r=-0.13, p<0.05; ß =-0.121, p<0.05), though less emphatically than the first two factors.

Table 6.02 Pearson correlation coefficients and standardised regression coefficients for prediction of academic performance by approaches to learning and personality factor scores - (total sample)

	Dependent variables			
	Pearson correlations (r)		Standardised regression coefficients (ß)	
	Year 1 (Mean mark)	*Year 3 (Degree class)*	*Year 1 (Mean mark)*	*Year 3 (Degree class)*
Independent variables				
Emotional stability	-0.09	-0.08	-0.105	-0.081
Assertiveness	-0.05	-0.06	-0.059	-0.070
Reproducing orientation	-0.28**	-0.09	-0.290†	-0.087
Conscientiousness	0.25**	0.18**	0.257†	0.188†
Meaning orientation	0.06	0.03	0.058	0.019
Ambitiousness	-0.10	-0.13*	-0.105	-0.133*
Abstract orientation	-0.13*	-0.13*	-0.121*	-0.119*
Self-consciousness	-0.10	-0.07	-0.100	-0.067
Concrete orientation	-0.00	-0.14*	-0.021	-0.147**
Sensation seeking	-0.08	0.04	-0.085	0.027
Conservative orientation	0.06	-0.02	0.041	-0.034

* p < 0.05, ** p < 0.01, † p < 0.001

Conscientiousness became the factor most correlated with, and predictive of, final degree class (r=0.18, p<0.01; ß=0.188, p<0.001) by third year. Concrete orientation had the next most effect on degree class (r=-0.14, P<0.05; ß=-0.147, p<0.01), and significant effects were observed for both ambitiousness (r=-0.13, p<0.05; ß=-0.133, p<0.05) and abstract orientation (r=-0.13, p<0.05; ß=-0.119, p<0.05). Note that conscientiousness was the only factor positively correlative with, and predictive of, academic performance. All the others are inverse relationships.

6.73 Gender differences in relationships between factors scores and academic performance

Bivariate correlations and multiple regression analyses were conducted separately for males and females in the same way as above. The results of the analyses indicated that while there were no real differences in the predictive significance of the factor scores in the first year, there were quite striking differences in the final year - see table 6.03 and appendices D-1.3 and D-1.4. For both males and females, reproducing orientation and conscientiousness were highly predictive of first year academic performance, - reproducing orientation (males, *r*=-0.39, p<0.01, ß=-0.379, p<0.001; females, *r*=-0.22, p<0.01, ß=-0.239, p<0.001), conscientiousness (males, *r*=0.35, p<0.01, ß=-0.361, p<0.01; females, *r*=0.16, p<0.05, ß=0.170, p<0.01), reflecting the findings for the sample as

Table 6.03 Pearson correlation coefficients and standardised regression coefficients for prediction of academic performance by approaches to learning and personality factor scores - (males vs. females)

	Dependent variables							
	Pearson correlations (r)				Standardised regression coefficients (ß)			
	Year 1 (Mean mark)		*Year 3 (Degree class)*		*Year 1 (Mean mark)*		*Year 3 (Degree class)*	
	Males	Females	Males	Females	Males	Females	Males	Females
Independent variables								
Emotional stability	0.01	-0.10	0.08	-0.11	-0.026	-0.125	0.151	-0.115
Assertiveness	-0.02	-0.06	0.17	-0.08	-0.074	-0.054	0.009	-0.088
Reproducing orientation	-0.39**	-0.22**	-0.15	-0.04	-0.379†	-0.239†	-0.061	-0.025
Conscientiousness	0.35**	0.16*	0.17	0.15*	0.361**	0.170*	0.207*	0.158*
Meaning orientation	0.09	0.05	0.13	-0.05	0.036	0.077	0.008	-0.033
Ambitiousness	-0.18	-0.05	-0.20*	-0.02	-0.136	-0.090	-0.273*	-0.018
Abstract orientation	-0.11	-0.13	-0.05	-0.16*	-0.089	-0.133	-0.054	-0.146*
Self-consciousness	-0.14	-0.07	-0.21*	0.03	-0.169	-0.084	-0.263*	0.012
Concrete orientation	-0.18	0.07	-0.32**	0.07	0.023	-0.009	-0.349*	0.028
Sensation seeking	-0.04	-0.09	0.12	0.01	-0.092	-0.097	0.056	0.014
Conservative orientation	0.12	0.05	0.01	-0.03	0.116	0.028	-0.055	-0.052

* p < 0.05, ** p < 0.01, † p < 0.001

a whole. For final degree class conscientiousness was also predictive for both males and females (males, ß=0.207, p<0.05; females, ß=0.158, p<0.05). A significant correlation was observed between female degree class and conscientiousness (*r*=0.15, p<0.05), but not male degree class and conscientiousness (*r*=0.17, p not significant.)

For males the concrete orientation factor proved to be the strongest predictor of final degree class, (*r*=-0.32, p<0.01; ß=-0.349, p<0.05), with ambitiousness (*r*=-0.20, p<0.05; ß=-0.273, p<0.05) and self-consciousness (*r*=-0.21, p<0.05; ß=-0.263, p<0.05) also significantly predictive of degree class. None of these factors were significantly predictive for females.

For them abstract orientation was significantly predictive of final degree class (*r*=-0.16, p<0.05; ß=-0.146, p<0.05). Once again each of the factors associated with academic performance - except conscientiousness - were *negatively* correlated with academic score.

6.74 Maturity differences in relationships between factor scores and academic performance

Bivariate correlations and multiple regression analyses were again carried out, this time using separate 'non-mature' - under 21 at time of enrolment - and 'mature' - 21 or over at enrolment - samples- see table 6.04 and appendices D-1.1 and C-1.2. Once again, reproducing orientation was the factor most strongly linked with academic performance in the first year for both non-mature and mature students (non-mature, *r*=-0.28, p<0.01; ß=-0.302, p<0.001; mature, *r*=-0.29, p<0.01; ß=-0.523, p<0.05), and again, this relationship was not evident in the final year of study.

Table 6.04 Pearson correlation coefficients and standardised regression coefficients for prediction of academic performance by approaches to learning and personality factor scores - (non-mature vs. mature)

	Dependent variables							
	Pearson correlations (r)				Standardised regression coefficients (ß)			
	Year 1 (Mean mark)		*Year 3 (Degree class)*		*Year 1 (Mean mark)*		*Year 3 (Degree class)*	
	Non-mature	Mature	Non-mature	Mature	Non-mature	Mature	Non-mature	Mature
Independent variables								
Emotional stability	-0.06	-0.26*	-0.09	0.01	-0.060	-0.408*	-0.077	-0.092
Assertiveness	-0.08	0.09	-0.08	-0.07	-0.099	0.218	-0.079	-0.083
Reproducing orientation	-0.28**	-0.29*	-0.10	-0.11	-0.302†	-0.523*	-0.109	0.183
Conscientiousness	0.24**	0.31*	0.18**	0.23*	0.241†	0.465*	0.187**	0.498*
Meaning orientation	0.08	0.01	0.05	-0.03	0.060	0.191	0.023	0.188
Ambitiousness	-0.09	-0.05	-0.15*	0.05	-0.086	-0.193	-0.148*	0.230
Abstract orientation	-0.14*	-0.03	-0.09	-0.23*	-0.122*	-0.129	-0.070	-0.493*
Self-consciousness	-0.09	-0.13	-0.07	-0.06	-0.106	-0.088	-0.081	-0.092
Concrete orientation	-0.01	0.05	-0.15*	-0.12	-0.057	0.408	-0.169**	-0.090
Sensation seeking	-0.12	0.00	0.01	-0.03	-0.118*	0.019	0.003	-0.058
Conservative orientation	0.07	0.02	-0.13	-0.09	0.041	0.236	-0.023	-0.088

* p < 0.05, ** p < 0.01, † p < 0.001

The most consistent predictor of academic performance was again conscientiousness, which emerged as significantly related to both indicators of performance in both non-mature and mature students (non-mature, first year, *r*=0.24, p<0.01; ß=0.241, p<0.001; non-mature, third year, *r*=0.18, p<0.01; ß=0.187, p<0.01; mature, first year, *r*=0.31, p<0.05; ß=0.465, p<0.05; mature, third year, *r*=0.23, p<0.05; ß=0.498, p<0.05).

Abstract orientation was negatively related to academic performance in the *first* year for non-mature students (*r*=-0.14, $p<0.05$; ß=-0.122, $p<0.05$), and academic performance in the *third* year for mature students (*r*=-0.23, $p<0.05$; ß=-0.493, $p<0.05$).

Emotional stability -or neuroticism - was found to be related to year one performance in mature students alone (*r*=-0.26, $p<0.05$; ß=-0.408, $p<0.05$), while both ambitiousness and concrete orientation were noted to be related to final degree class in *non*-mature students alone (ambitiousness, *r*=-0.15, $p<0.05$; ß=-0.148, $p<0.05$), (concrete orientation, *r*=-0.15, $p<0.05$; ß=-0.169, $p<0.01$).

The regression analysis calculated a significant predictive relationship between sensation seeking and year one mark in the non-mature sample (ß=-0.118, $p<0.05$).

Again the all the significant factor score relationships with academic performance - excepting those involving conscientiousness - were negative, i.e. indicating an inverse relationship between the factor score and academic performance.

6.75 Academic discipline differences in relationships between factor scores and academic performance

Reproducing orientation and conscientiousness were the factors most related to academic attainment when the sample was broken down into categories of academic discipline - see table 6.05 and appendices D-1.5 - D-1.9.

Reproducing orientation was negatively correlated with and predictive of academic performance in science students in both sets of assessments (year 1, *r*=-0.51, $p<0.01$; ß=-0.436, $p<0.01$; year 3, *r*=-0.35, $p<0.01$; ß=-0.260, $p<0.05$), and in 'broad-based' students in first year assessments (*r*=-0.43, $p<0.01$; ß=-0.300, $p<0.05$). It was also (positively) correlated with final year performance in law student (*r*=0.32, $p<0.05$), but this relationship was not causal (ß=-0.304, p not significant).

Conscientiousness proved correlative with, and predictive of, academic performance for arts students in their first year (*r*=0.29, $p<0.05$; ß=0.232, $p<0.05$), law students in their final year

Table 6.05 Pearson correlation coefficients and standardised regression coefficients for prediction of academic performance by approaches to learning and personality factor scores - (subject discipline comparison)

	Dependent variables			
	Pearson correlations (r)		Standardised regression coefficients (ß)	
	Year 1 (Mean mark)	*Year 3 (Degree class)*	*Year 1 (Mean mark)*	*Year 3 (Degree class)*
Independent variables				
Emotional stability				
Arts	-0.04	-0.17	-0.064	-0.250
Science	0.05	-0.07	0.019	-0.113
Social Science	-0.14	-0.08	-0.027	0.035
Law	-0.08	0.08	-0.026	0.096
Broad-based	-0.35*	-0.10	-0.382*	-0.173
Assertiveness				
Arts	-0.30*	-0.10	-0.202	-0.002
Science	-0.01	-0.09	0.140	-0.032
Social Science	-0.09	-0.08	-0.076	-0.036
Law	0.22	-0.17	0.220	0.013
Broad-based	-0.03	-0.01	0.019	-0.095
Reproducing orientation				
Arts	-0.07	-0.02	-0.171	-0.171
Science	-0.51**	-0.35**	-0.436**	-0.260*
Social Science	-0.21	-0.11	-0.136	-0.100
Law	0.06	0.32*	-0.009	0.304
Broad-based	-0.43**	0.01	-0.300*	0.037
Conscientiousness				
Arts	0.29*	0.06	0.232*	0.016
Science	0.39**	0.40**	0.274*	0.282*
Social Science	0.07	-0.10	0.076	-0.138
Law	0.18	0.32*	0.080	0.489**
Broad-based	0.48**	0.25*	0.535†	0.327*
Meaning orientation				
Arts	-0.05	-0.13	-0.028	-0.079
Science	0.08	0.25*	0.064	0.180
Social Science	-0.03	-0.18	0.058	-0.134
Law	-0.15	0.06	-0.092	-0.103
Broad-based	0.30*	0.06	0.022	0.045
Ambitiousness				
Arts	-0.20	-0.17	-0.200	-0.126
Science	-0.10	-0.07	0.052	0.068
Social Science	-0.03	-0.11	-0.027	-0.146
Law	0.10	0.10	0.106	0.063
Broad-based	0.02	-0.24*	0.077	-0.312*
Abstract orientation				
Arts	0.19	0.24	0.118	0.196
Science	-0.36**	-0.30*	-0.270*	-0.215
Social Science	-0.22	-0.18	-0.162	-0.166
Law	-0.03	-0.23	-0.003	-0.436*
Broad-based	-0.16	-0.20	-0.251	-0.173

* $p < 0.05$, ** $p < 0.01$, † $p < 0.001$

Table continues overleaf...

Table 6.05 continued

	Dependent variables			
	Pearson correlations (r)		Standardised regression coefficients (ß)	
	Year 1 (Mean mark)	*Year 3 (Degree class)*	*Year 1 (Mean mark)*	*Year 3 (Degree class)*
Independent variables				
Self-consciousness				
Arts	-0.16	-0.11	-0.131	-0.083
Science	0.01	-0.09	-0.061	-0.128
Social Science	-0.27*	0.00	-0.171	0.037
Law	-0.44**	-0.22	-0.437*	0.066
Broad-based	0.08	0.00	0.038	-0.104
Concrete orientation				
Arts	-0.19	-0.11	-0.122	-0.042
Science	-0.01	-0.20	0.052	-0.104
Social Science	0.22	0.10	0.178	0.037
Law	0.08	-0.04	0.067	-0.355*
Broad-based	-0.01	-0.22	-0.038	-0.240
Sensation seeking				
Arts	-0.09	0.16	-0.138	0.124
Science	-0.04	0.12	-0.136	0.124
Social Science	-0.19	-0.02	-0.099	0.034
Law	0.05	-0.06	0.030	-0.199
Broad-based	-0.04	0.10	-0.049	0.055
Conservative orientation				
Arts	0.19	0.03	0.133	0.056
Science	0.17	0.13	0.159	0.161
Social Science	-0.01	-0.01	-0.056	0.013
Law	-0.04	-0.29	-0.024	-0.296
Broad-based	-0.04	0.01	-0.114	0.114

* $p < 0.05$, ** $p < 0.01$, † $p < 0.001$

(r=0.32, p<0.05; ß=0.489, p<0.01), and science and 'broad-based' students in both first and third years (science, first year, r=0.39, p<0.01; ß=0.274, p<0.05, third year, r=0.40, p<0.01; ß=0.282, p<0.05; 'broad-based', first year, r=0.48, p<0.01; ß=0.535, p<0.001, third year, r=0.25, p<0.05; ß=0.327, p<0.05). Only social science students' performance could not be explained at least in part by the conscientiousness trait.

Meaning orientation was observed to be correlated with academic performance in the first year for 'broad-based' student (r=0.30, p<0.05) and in the third year for science students (r=0.25, p<0.05), but the regression analyses demonstrated that in neither group could performance variation be explained by the meaning orientation factor.

Abstract orientation was strongly related to first year performance in science students (r=-0.36, p<0.01; ß=-0.270, p<0.05), and while third year performance was significantly correlated with the factor, the relationship was not causal (r=-0.30, p<0.05; ß=-0.215, p not significant). Conversely, abstract orientation *was* predictive of academic performance in final year law students (ß=-0.436, p<0.05), even though the relationship was not linear (*r*=-0.23, p not significant). Similarly, concrete orientation was significantly predictive of final year performance in law students (ß=-0.355, p<0.05), but again the relationship was not of a linear nature (*r*=-0.04, p not significant).

Self consciousness was correlated with first year performance in both law and social science students (law, *r*=-0.44, p<0.01, social science, *r*=-0.27, p<0.05), though the factor was only significantly predictive of performance in the law sample (ß=-0.437, p<0.05).

Emotional stability emerged as both correlated with, and predictive of, the first year academic performance of the 'broad based' students (*r*=-0.35, p<0.05; ß=-0.382, p<0.05), while ambitiousness was found to be both correlated with, and predictive of, the *final* year academic performance of the same sub-sample (*r*=-0.24, p<0.05; ß=-0.312, p<0.05).

Assertiveness was significantly correlated with first year performance of arts students (*r*=-0.30, p<0.05), however regression analyses did not support the contention that this relationship was causal (ß=-0.202, p not significant).

Sensation seeking and conservative orientation were neither correlated with, nor predictive of the academic performance of any category of student to a statistically significant degree.

6.81 Discussion

Using multidimensional profile analyses, this study sought to assess the utility of certain personality and approaches to learning characteristics in predicting the educational attainment of the student sample.

The most significant and meaningful finding of the study was that certain factor-scores derived from factor analysis of both the OPQ and ASI instruments proved to be both useful and accurate predictors of academic performance at higher educational level.

Of these 'conscientiousness' and 'reproducing orientation' were observed to be *consistently* predictive of academic performance.

6.82 Predictive value of 'conscientiousness'

Level of conscientiousness - the factor composed of the sub-scales 'conscientious', 'disorganised study methods', 'detail conscious' and 'forward planning' - was shown to predict academic attainment in both first and third year assessments, in both male and female students , mature and non-mature students and all subject discipline categories except social sciences. Chapter three demonstrated a strong conceptual link between the disorganised study methods subscale of the ASI and the personality scales underpinning the global conscientiousness dimension, suggesting that the students' organisation of study methods tends to be determined by intrinsic disposition rather than by environmental or contextual factors. That this factor is so strongly linked with academic performance suggests that the students' personality is at least instrumental in determining their ultimate success or failure in higher education. This finding is consistent with those of Brown and Holtzman (1966), Entwistle and Brennan (1968), Entwistle and Wilson (1977) and Boyle and Cattell (1987).

Daehnart and Carter (1987) concluded that theoretical knowledge was best mastered by students who exhibited high levels of conscientiousness, while Ramsden, Beswick and Bowden (1986) noted that students adopting an atomistic - or surface - approach regularly complained about problems with organising time. Interventions aimed at encouraging deep approaches by teaching learning skills related to time organization and study management were deemed to be largely ineffective. It might therefore seem that these skills, while vital to the task of meeting the requirements of academic assessments, are difficult to impart because of the dispositional nature of their psychological origins.

Both these studies hint at some sort of link between conscientiousness and approach to study, but since the measures of conscientiousness, reproducing orientation and meaning orientation used in the study here are conceptually unrelated - by dint of their varimax orthogonal extraction - no such relationship can be substantiated here.

It seems likely, however, that conscientiousness plays an influential, if indirect, role in facilitating individual approach to study through the organisation of study methods. While conscientiousness cannot be said to predict approach to learning, it is evident from the results here that high levels of conscientiousness are advantageous when tackling the task of meeting assessment criterion. Ability to plan study timetables in advance of examinations, ability to study regularly and efficiently, and ability to pay attention to detail would all certainly seem to pay dividends in the course assessment process. While the relationship of these variables to academic attainment may seem axiomatic, it cannot be assumed that cognitive understanding is the linking factor between the two. Indeed, Entwistle and Entwistle (1992) have criticised current assessment methods - particularly examinations - for their propensity to encourage and reward an almost *verbatim* reproduction of information as it was presented to the student, as well as their tendency to test a 'fairly narrow form of understanding' represented by relatively discrete or even discrepant pieces of information, without recognition of structured implicit understanding. Use of visual memory - and in particular the visualising of notes - was commonly cited by students in their survey to be an important examination technique, suggesting a lack of mental re-organization and transformation in the learning and revision process. Conscientious students will naturally be as adept at gearing their revision efforts towards memorizing information as they will be at aiming to extract personal meaning from the learning materials. They might choose *either* path, and succeed academically because the representation of knowledge which they exhibit will be well-planned and detailed, regardless of its intellectual merit.

In certain subgroups conscientiousness proved to be unrelated to performance, (final year arts and social science), supporting the contention that some disciplines require and reward greater attention to detail, - i.e. science and law - while others, - i.e. arts and social sciences - are concerned with more subjective, theoretical concepts in which detail and careful organization are less advantageous examination techniques.

6.83 Predictive value of 'reproducing orientation'

More encouraging was the finding that reproducing orientation was predictive of poorer academic performance at the end of the student's first year - though not of their final degree class. This pattern was consistent for males and females, and non-mature and mature students, but was prevalent only within science and 'broad-based' categories. (A positive yet unpredictive relationship between reproducing orientation and performance was noted in the law sample).

The subscales making up reproducing orientation - surface approach, improvidence, globetrotting, extrinsic motivation, negative attitudes to study and syllabus boundness - have all been negatively associated with poor academic performance in the past (Entwistle *et al*, 1979; Ramsden and Entwistle, 1981; Watkins, 1982, 1983; Clarke, 1986; and Miller, 1990). A number of reasons for the observed predictivity in the first, but not the third year, may be suggested. Those students in the first year who failed to proceed to the final year of their courses were likely to be those for whom adoption of reproducing orientation was both a cause and a symptom of lack of commitment and interest in academic work, and who thus abandoned further pursuit of their chosen degree. These students were perhaps unable to exercise those strategic learning techniques which facilitate success in formal academic assessments when full intellectual grasp of the material is lacking.

Richardson (1995) observed a similar negative correlation between reproducing orientation and performance in the first, but *not* the final year. This perhaps suggests that at the start of any course, lack of motivation to engage with the subject is evident in coursework and examination papers submitted, yet by the final year, students *still* without intrinsic interest in their subject will have developed strategies to help them meet the assessment criteria. Alternatively, the student may not perceive the stakes to be so high in their first year, and may thus choose to make little effort to do well in the assessment with the consequence that poor understanding is readily identified and penalized by the markers. By the final year however, the student prone to adopting a reproducing orientation may have objectified the task of tackling the degree assessments in such a way that effort *is* made, but is channelled towards memorizing and visualizing notes rather than transforming their conceptual thinking of the topic. Their efforts will rely on conscientiousness driving their acquisition of facts and figures in readiness to demonstrate some sort of grasp of the material. In this case the student scoring high on reproducing orientation may well meet the criterion quite successfully. Contrary to the findings of Ramsden, Beswick and Bowden (1986) - who suggested that it is *first* year assessments which could be passed using well managed surface strategies, - it appears that, (with the exception of science students), it is the final year assessments in which surface strategies may be used effectively.

The difference between the arts and science categories is interesting here since reproducing orientation appears to be penalized in science, but not in arts. This suggests that science departments' assessments are more effective at testing the student's grasp of the subject in question. Since the reproducing orientation factor features aspects of cognitive style and ability to structure information in an 'appropriate' manner, it may be proposed that the more formal structure of science subjects demands that students develop a conceptually 'appropriate' framework of knowledge, whereas arts subjects - in which the concepts and ideas are rather more fluid and subjective - there is scope for a relatively broad spectrum of acceptable modes of conceptual framework appropriate to the tasks set the student. Thus science students unable to organise their knowledge cognitively will be penalized in assessments, whereas arts students unable to do so will be given greater dispensation to express their knowledge in their own style. When inappropriate cognitive framework determines a surface approach to learning, the science student adopting a surface approach will be significantly less likely to perform as well in assessments than the arts student.

For law students, - a sample for which academic performance was *positively* associated with reproducing orientation - it appears that surface learning is a distinctly advantageous strategy. Reproduction of learning material with a view to demonstrating a relatively superficial level of understanding would appear on first glance to pay dividends in this subject, at final degree level at least. However, when the nature of law as an academic subject is scrutinized, it becomes apparent that ability to reproduce information - for example, case studies, legal precedents, etc. - in the exact manner in which they were originally presented, is in fact a primary skill, which is both encouraged (see chapter four), and rewarded.

Overall, it is perhaps surprising that the reproducing orientation factor was not more universally predictive of poor academic performance. Again, the contextual and individual factors must be considered in interpreting these findings. The teaching and assessment methods vary from course to course, so there is no baseline standard from which individual differences may be analyzed.

6.84 Predictive value of 'meaning orientation'

One might have predicted significant relationships between meaning orientation and academic performance given the findings of Entwistle *et al* (1979), Ramsden and Entwistle (1981), Watkins (1982, 1983), Clarke (1986), Miller (1990) and Newstead (1992), but in the sample tested here the only positive correlations between the two variables were within the science and 'broad-based' subject categories, and these correlations were not deemed predictive in the regression analysis.

These findings are in accord with the findings for reproducing orientation in as far as the depth of conceptual understanding seems to be more fully tested in science and broad-based disciplines, again perhaps demonstrating the relatively narrow band of acceptable mode of expression of knowledge prevalent in science, which if not grasped by the student will be detrimental to performance. The convergent style of problem found within science disciplines (Hudson, 1966), is perhaps less open to equivocation on the part of the student, and so lack of understanding will be more evident. In arts disciplines, where more divergent responses are sought, the student may be able to disguise their lack of understanding by offering a fairly convincing though superficial account of principles or ideas. Conversely, students in arts who have acquired a sense of personal meaning from a topic may be unable to express that meaning in exam conditions, making their efforts indistinguishable from the students pursuing surface learning strategies. Whatever the root causes of this phenomenon, the findings are certainly cause for concern. If current assessment methods are not tapping conceptual understanding then they stand accused of being perfunctory, if not harmful.

6.85 Predictive value of cognitive style

The importance of cognitive style in prediction of academic performance was demonstrated by the consistent inverse relationship between abstract orientation and academic performance - with higher abstract orientation associated with poorer academic performance. This relationship, though significant in the overall sample, was prevalent in year three females, non-mature first year students and mature final year students. Again, the science sample exhibited this phenomenon most strongly. Abstract orientation - comprising the subscales 'comprehension learning', 'innovative', 'conceptual', negative 'operation learning' and 'behavioural' refers to the degree to which students prefer to think in abstract, subjective ways, using a broad, holistic cognitive style. In the subgroups mentioned, this tendency is consistently detrimental to academic performance suggesting that in these groups at least, deviation from the prevalent structure of knowledge imparted by the teaching programme will result in penalties in terms of academic performance. This finding dovetails neatly with the observation made in chapter five that some 'holistic-oriented' science students may experience difficulties in assimilating serially-delivered information during the early stages of their courses when the overall framework of meaning is unclear.

The findings validate the theory of Pask (1976) who claimed that 'the hierarchically structured and related' knowledge which forms the accepted paradigm in most science departments will draw and reward students preferring serialist learning strategies, characterized by attention to details in order to build a conceptual framework. Marton, Hounsell and Entwistle (1984) noted that science departments tend use more rigid, structured methods of teaching and assessment, and it is clear from the findings of this study that those science students preferring an abstract orientation were indeed penalised. Notably, abstract orientation is *positively* associated with academic performance in arts students, though the coefficients did not quite reach statistical significance.

Concrete orientation, on the other hand, proved rather less predictive of academic performance. This orientation - comprised of the subscales data rational and negative artistic - was negatively associated with performance in final year males, final year non-mature students and final year law students. It is possible that for these students the range of knowledge they were able to demonstrate was too constricted and closed to generalisation. A necessity for the student to provide evidence of cognitive flexibility when applying knowledge may exist in certain assessment circumstances and thus a serialist, objective cognitive style may not be appropriate.

6.86 Predictive value of 'extraversion'

None of the three traits related to extraversion, - assertiveness, self-consciousness and sensation seeking - proved consistently related to academic performance. However, assertiveness was negatively predictive of performance in first year arts students, self-consciousness negatively predicted performance in the first year social science, law and mature sub-samples, while sensation seeking predicted poorer performance in non-mature students also in year one.

This latter finding regarding sensation seeking may be attributed to the potentially detrimental effects of an outgoing nature or lifestyle on academic work for the mature student. This may in fact be a more valid indicator of Entwistle and Ramsden's (1983) concept of 'non-academic' orientation than their original definition which grouped 'deep approach', 'negative attitude to study' and 'globetrotting' scales. Here, extraversion forms a stable behavioural characteristic determining interest predominantly in social activities at the expense of academic pursuits.

The relationships between assertiveness/self-consciousness - both traits assumed to be related to extraversion - and performance perhaps indicates that the educational environments prevalent within certain subject disciplines tend to be rather lecture-bound and instructor led - educational factors which Lavin (1965) claimed would prove detrimental to the academic performance of the more 'sociable' student.

The relationship between self-consciousness and performance in year one mature and year one social science and law samples is to an extent consistent with the findings of Behrens and Vernon (1978) who noted substantial correlations between negative self-esteem and academic performance. The findings are also indicative of the effects of the theory of Wong and Csikszentmihalyi (1981) which posits that student's affect about self hinders the ability to focus on task relevant information leading to degraded academic performance. It may be suggested that negative self-perception in these subgroups may generate a perceived lack of ability on their own part which leads them to reduce effort. Any failure encountered thus may be attributed to lack of effort rather than any intellectual shortfall. Conversely, those students with low self-consciousness may consider themselves to be more competent and will thus persevere in academic tasks because their ultimate success or failure is perceived to be associated with their true potential.

6.87 Predictive value of 'neuroticism'

Furneaux's (1962) hypothesis that emotional instability might increase academic drive and pursuit and hard work is supported only in the mature first-year sample. Here, the 'emotional stability' factor is inversely predictive of performance, suggesting that for these students a degree of anxiety generates stress-reduction behaviour in the form of study activity. Furneaux's (1980) theory that this pattern is prevalent in students selected in some 'coping' factor may be given some credence since mature students and male students opting to pursue mixed-subject degree - a relatively recent option in higher education - are noted to be significantly more likely to adopt a meaning orientation than other students. It is evident then that if the student is intrinsically motivated by their choice of subject and seeks meaning in their work, then some degree of emotional instability facilitates their performance in formal education assessments. The issue of whether this anxiety increases their efforts towards meaningful learning, surface learning or even conscientious learning is unknown at this stage, but clearly represents an important area for future research.

6.88 Predictive value of 'ambitiousness'

Motivation for achievement was noted to be a central characteristic determined by the 'ambitiousness' personality trait - see chapter three, which in turn was inversely predictive of academic performance at *final* year level for a substantial portion of the overall sample, but not *first* year performance. The trait - made up of 'competitive', 'achievement motivation', negative 'caring', 'achieving', negative 'democratic' and negative 'affiliative' would appear to promote behaviours detrimental to the final year student in assessment tasks. This finding is fairly unique in research literature perhaps because the trait itself was only recognized as a conceptually distinct from neuroticism and extraversion relatively recently and has not been assessed widely in academic contexts.

Cassidy and Lynn (1992) observed a strong association between educational attainment and achievement motivation incorporating aspects of dominance and status aspiration, but in this case the relationship was positive. The findings here demonstrate an *inverse* relationship. Cassidy and Lynn's finding related to an undifferentiated sample of school leavers tested at sixteen and twenty-three years of age, rather than selected university students. The measure of educational attainment used was far broader. It might therefore be assumed that the relationship observed is specific to the highly selected nature of the sample used here. The maladaptivity of a competitive temperament in the final degree process is quite evident and suggests that the tasks set the student are best tackled through co-operation and association with other students. Competitive students may be prone to isolation during the revision period, thus missing out on valuable co-operative study.

The relationship between ambitiousness and poorer degree performance is - while significant for the sample as a whole - especially prevalent in male students, non-mature students, and 'broad-based' subject discipline students. The gender difference suggests that for male students ambitiousness hinders degree success because the motivation for study is external to the task at hand. As a result, the effort invested is not necessarily productive. Female students, who are in general significantly less ambitious anyway - see chapter four - are less likely it seems to be 'de-railed' by ambition and may be more likely to use their drive for achievement more productively. The same pattern seems to apply to non-mature vs. mature students with non-mature students less able to harness their ambition to academically profitable ends.

6.9 Conclusions

The results of this study support the notion that the personality is an important predictor of student academic performance. In addition, the study finds that reproducing orientation, as measured by the ASI, is consistently predictive of poor academic performance.

The findings suggest that academic assessment as it stands does not reward conceptual grasp of academic knowledge so much as an ability to plan ahead and attend to details in a structured and presentable fashion. This might suggest that by the third year of study, students are able to use certain study strategies to pass assessments despite possessing only superficial knowledge of their subject, however the 'conscientiousness' factor extracted in the final year - see chapter five - includes elements of meaning orientation and is comparable with Weinstein and Meyer's (1986) concept of cognitive 'organization'. The strategies elicited by this trait would not only appear to be academically more effective than the 'rehearsal strategies' - analogous to 'reproducing orientation', - but also more effective than the 'elaboration strategies' - analogous to 'abstract orientation'.

The study here used a fairly traditional methodology involving the comparison of a set of personological indicators with scores of academic performance. The advantages of using a mix of personality *and* phenomenographic measures has proved helpful in avoiding the tradition of predicting performance using individual variables as if the student were operating in what Lavin (1965) termed 'a social vacuum'. While the study offers quite considerable evidence to support the strong predictive validity of certain factors derived from the combined OPQ and ASI instruments - in particular the 'conscientiousness' and 'reproducing orientation' factors - future research may benefit from an alternative methodology such as cluster analysis as used by Entwistle and Brennan (1968), through which the combinations of personological and phenomenographic variables making up *profiles* predictive of academic performance could be discerned.

CHAPTER 7 - DISCUSSION AND CONCLUSIONS

7.1 Overview

This discussion chapter aims to outline and explore the principal findings and contributions made by this research project. Chapters two to six set out to investigate the structural components of a phenomenographic model of student learning with particular regard to the influence of individual personality. Using a shared core methodology, each of the chapters describes findings yielded by quite diverse types of analysis of the data-set. Rather than reviewing the findings of each chapter sequentially, this section shall attempt to re-assess the concepts outlined in the introduction in light of the new findings.

7.2 The eleven-factor model of student personality and learning

The fundamental aim of the project was to gather evidence to examine the nature of the relationship between human personality and characteristics of learning in a non-compulsory, higher education setting. The study used concepts drawn from both phenomenographic *and* cognitive learning bodies of research and assessed how student self-reports of each tied in with each dimension of their personality profile and their formal academic performance.

Chapter three described how the data collected from each set of scales of the Approaches to Studying Inventory and the Occupational Personality Questionnaire was submitted to a process of factor analysis in order to establish a set of parsimonious, yet conceptually valid and useful constructs which could be used to assess the basic psychological structures influencing the patterns of student learning. The eleven-factor solution extracted appeared to represent a conceptual model which considerably clarified the relationship between personality traits, cognitive learning styles and approaches to learning - and was used throughout the study in order to assess individual sub-sample differences, development of interrelationships between traits over time, and the predictivity of certain indicators of academic attainment.

This model represents a comprehensive psychometric framework of the characteristics measured in the study, and can be validly compared to models proposed in *both* the personality and learning literature set out in the introduction. Factor analysis of the mean scores on each trait over the three years of the study extracted the eleven dimensions of 'emotional stability', 'assertiveness', 'self-consciousness', 'sensation-seeking', 'ambitiousness', 'conscientiousness', 'abstract orientation', 'concrete orientation', 'conservative orientation', 'reproducing orientation' and 'meaning orientation'.

Nine of these factors were assumed to measure salient dimensions of personality which could be related with ease to those within established personality models - in particular the 'Five-factor' model of Costa and Macrae (1985), with 'emotional stability' mapping onto 'neuroticism', 'ambitiousness' mapping onto 'agreeableness' and 'conscientiousness' mapping onto the same. 'Assertiveness', 'self-consciousness' and 'sensation-seeking' are claimed to be the social, personal and physical facets of 'extraversion' respectively, while 'abstract orientation', 'concrete orientation' and 'conservative orientation' are assumed to be complimentary facets of the 'openness' dimension. The model also resembles Cattell's 16PF (1965) personality structure - see chapter three, table 3.02.

The dispositional nature of the factors related to the five-factor dimensions was validated by the finding - in the longitudinal analysis described in chapter five - that their constituent OPQ scales remained stable over time. Exceptions to this trend were three of the scales relating to 'assertiveness' - or social extraversion - namely 'controlling', 'outgoing' and 'social confidence', scores in which were observed to rise over the three years. This is attributed to the exposure to non-academic social activities within the university environment.

The study here could only hypothesize whether measures of learning characteristics are dispositional or situational through assessing which other characteristics they associate with statistically and using the conceptual theory behind the emergence of the associated measure to comment upon the nature of each. The fact that most of the learning traits remained relatively consistent over time - as described in chapter five - does not necessarily indicate that they are rooted in stable information processing style or personality, since the learning context, teaching methods and environment experienced over the three years remained relatively unchanging.

The factor analysis was repeated using data from each year separately, and the findings suggest that the eleven factor model is relatively robust - with near identical factor solutions extracted in years one and two. In year three, the development of an increasingly interactive relationship between personality, cognitive style and approaches to learning, meant that the final eleven factor solution, while retaining most of the primary constructs of the original model, featured the inclusion of 'meaning orientation' scales in both 'abstract orientation' and 'conscientiousness' factors. This suggests that as the academic course progresses, personality *does* begin to influence learning strategy.

The model of learning emerging from the factor solution from the first and second year, would appear to lend credence to the 'information processing' conception of learning. Indeed, had the third year's data been unavailable for analysis, the IP theory would have rivalled the phenomenographic or systems theories in terms of conceptual validity. Schmeck (1983) surmized that patterns of student learning could be largely explained though theories of human memory and levels of processing - as researched by Craik and Lockhart (1972). Schmeck's distinction between 'deep processing' and 'general processing' seem to be analogous to the 'meaning orientation' and 'abstract orientation' factors respectively, since both pairs of concept carry similar descriptions - see introduction. His 'fact retention' and 'methodological study' scales can easily be transposed onto the 'reproducing orientation' and 'conscientiousness' scales described here. However, in the third year's analysis it becomes apparent that the conceptual distinctiveness of deep and elaborative processing diminishes, suggesting that the nature of one or the other forms is not fixed or dispositional.

Certainly the IP model emerges as more conceptually credible than Kolb's experiential learning model (Kolb, 1976; 1978). The integral assumption of this model is that only two main orthogonal dimensions are necessary to describe the consistent learning behaviours of individuals - a supposition that the findings presented here strongly contradict.

The findings, when considered as a whole, including the factor model of the third year, are more likely to endorse the models of Weinstein and Mayer (1986), and the subsequent theorizing by Christiensen *et al* (1991) and Dyne, Taylor and Boulton-Lewis (1994). Weinstein and Mayer's model specified that the principle cognitive resources available to the student learner were 'rehearsal', 'organization' and 'elaboration'. While the (conceptually stable) 'reproducing orientation' factor is proposed to be largely independent of personality, the ability to adopt meaning oriented strategies in the third year would seem to be at least partly influenced by disposition to be organized - through the trait of 'conscientiousness' - and/or disposition to be cognitively holistic and intellectually adventurous - through the trait of 'abstract orientation'. Much of the phenomenographic research into student learning had considered organization of study methods to be a situational phenomenon, however, the findings here indicate that ability to plan and manage study behaviour is much more likely to be determined by the level of dispositional conscientiousness of the individual. This strongly suggests that initiatives designed to improve the study skills of students by teaching them organizational strategies and techniques will be limited in their effectiveness for students who are naturally unconscientious.

7.3 Personality and learning characteristics and academic attainment

Such initiatives as the one described above may not only be ineffective, but planners hoping that they will serve to boost performance on academic assessments should note that the personality trait most consistently predictive of first year performance and final degree class was 'conscientiousness'. The conscientious personality - described by Cattell (1965) as 'persevering, staid and moralistic' - has been found to predispose a student toward meaning orientation strategies - as described in chapter five - via methodical study skills and planning, rather than through conceptual thought and intellectual flexibility. It seems that making the acquisition of such skills attractive to un-conscientious students - in Cattell's terms, 'expedient', tending to disregard rules and rejecting obligation - is very likely to be a difficult and potentially unproductive task.

Perhaps a better solution would be to design assessment techniques which reward evidence of deep learning strategies through 'abstract orientation', by allowing greater freedom in terms of expression of holistic cognitive style. The findings - described in chapter six - report that abstract orientation was, in the main, inversely predictive of academic success. It seems that holistic learning style and ability to forward innovative, conceptually imaginative ideas are penalized in higher education, particularly for science students, female students, non-mature first-year students and mature final year students.

In any case the disappointing performance predictivity of the approaches to studying scales in general, highlights the failure of assessment measures to reward conceptual grasp of academic ideas, theories and information.

7.4 The development of learning orientations and cognitive styles over three years

The eleven-factor model upheld the phenomenographic research findings of Marton and Säljö (1976), and Entwistle and Ramsden (1983), by establishing the existence of independent 'meaning' and 'reproducing' orientations, reflecting deep and surface approaches to learning respectively - albeit in a modified form from the descriptions of Watkins (1983; 1983), Watkins and Hattie (1985), Clarke (1986) and Meyer (1988). The enduring distinctions of these factors suggests that there can be little doubt that they represent perhaps the most important and consistent concepts for describing and assessing the quality of student learning. As stated previously, chapter five outlined how factor analysis was used to perform a similar conceptual breakdown of the data and how a *consistent* extraction of meaning and reproducing orientations towards learning through the three years was observed. The findings also support the hypothesis that intrinsic motivation will determine adoption of a meaning orientation to study, while extrinsic motivation will engender adoption of a reproducing orientation. This finding endorses the 'systems model' of learning proposed by Biggs (1978) by illustrating that while, elements of personality - amongst other 'presage' factors - influence learning strategy to some degree, they *cannot* be said to impose such a direct bearing on the individual student's orientation to learning as form of motivation. The findings, while highlighting the effects of personality on learning strategy, re-emphasize that approaches to learning are more a *response* to the learning situation, than a characteristic of the student, thus substantiating the similar conclusions of Säljö (1979), Laurillard (1979) and Gibbs (1991). In brief, the effects of personality on learning can be said to be *mediated* by cognitive style and source of motivation.

The contextual and situational factors pertinent to the adoption of learning orientation are in no way diminished by these findings, but it is evident that the interaction of personality and cognitive style with external factors *over time* should be important components in any student learning model.

The effect of personality via cognitive style and motivation was evident, for example, where the scale measuring academic 'fear of failure' was associated with low 'emotional stability', where 'disorganized study methods' was associated with low 'conscientiousness' and 'achievement motivation' was associated with high 'ambitiousness'. In each case the underlying personality trait is instrumental in shaping the motivational and behavioural factors which go on to influence the adoption of learning strategies of one sort or another.

The differences in levels of 'emotional stability' between males and females for example give rise to significantly higher 'fear of failure' scores in the female sample, while the significantly higher scores on 'ambitiousness' noted in the male sample can be assumed to determine their greater extrinsic motivation.

The hypothesis that approaches to learning are a function of developmental shifts in *conceptions* of learning was also appraised. The finding that adoption of a meaning orientation appeared to increase over the three years of a university course, while adoption of a reproducing orientation appeared to diminish - albeit marginally - strongly suggests that students do indeed develop meaningful learning strategies over time - though perhaps not to the extent that their lecturers might hope. The concepts of meaning and reproducing orientations used in this study were based on different scale groupings from those used in previous research (Entwistle and Ramsden, 1983; Clark, 1986) - and *only* when the scale groupings derived from the factor analysis solution described in chapter three are assessed over time is this pattern emergent - thus demonstrating the value of targeting core constructs derived from analysis of conceptual structure. This developmental shift illustrates the validity of the model of cognitive development proposed by Perry (1970) which specifies that through study, an acceptance of diversity develops and a sense of relativity is established. Volet and Chambers' (1992) unfolding model of goal development - in which new, more intrinsic goals supplant existing, extrinsic goals over time - is also supported. These models hint at a Piagetian form of cognitive development in which natural 'steps' in intellectual maturation exist which apply to all students - though it would be erroneous to suggest that *all* students experience all levels of the sequence. The structural and referential aspects of meaning for the students must be recognized and explored before development can proceed - as Säljö's (1979) distinction between 'reproducing' and 'transforming' conceptions of learning, would predict. If a student does not seek to mentally *transform* their understanding of a subject, then his or her level of cognitive development will remain at a relatively early stage. Since the findings suggest a general increase in meaning orientation and attendant decrease in reproducing orientation - chapter five - it would seem that many students are experiencing cognitive development in line with that predicted by the model.

This developmental sequence is compatible with the existence of cognitive 'knowledge objects' (Marton and Entwistle, 1994), since the observation of the longitudinal increase in the ability to use evidence and relate ideas effectively and appropriately indicates development of mental reflexivity, or as Biggs (1985) termed it, 'metalearning'. This growing capacity to cognitively reflect on the structural integration of knowledge and experience over time suggests that the resulting evolution of increasingly sophisticated and schematically connective 'knowledge objects' could very well represent development of intellectual maturity.

This theory is further supported by the findings relating to characteristic learning differences in the mature student sample. Mature students were consistently observed to score higher on the meaning orientation subscales throughout the three years of the study. This suggests that mature students come to university with greater intellectual maturity in the first place - as suggested by Harper and Kember (1986). It was also noted that the 'intrinsic motivation' to study for mature students *rose* steadily over time - this heightened intellectual commitment to their subject may be driven by the satisfaction of developing clear, contextually-relevant knowledge objects. The process of intellectual maturation, while developing over time naturally, is given a fillip by the intellectual challenge of a university course.

The existence of a 'strategic learning' orientation (Ramsden, 1979) was noted only through the factor analysis of the data from the third year's test administration. In years one and two - and in the overall mean dataset - the strategic approach scale was principally associated with a meaning orientation. This suggests that at the earlier stages of a degree course, a relatively clear perception of the assessment demands of the course is necessary to focus the effort required to reach a level of satisfactory understanding, perhaps through preventing an overload of information - the more strategic techniques narrowing the breadth of the area under study, making comprehension more manageable.

By the third year, however, a strategic approach emerges as conceptually related to an extrinsically-motivated, 'achievement orientation'. As the systems model of Biggs would suggest, personality as a 'presage' variable influences 'motive' which directly determines learning strategy. It would seem that by this stage, deep learning requires *breadth* of interaction with the subject area and that the assessment tasks experienced are perceived to require a broader comprehension of the relationship between concepts and ideas, as well as an ability to apply them. Limiting the range of study to that perceived to be under assessment is perhaps no longer compatible with the study behaviour required for deep learning. This idea is substantiated by the fact that meaning orientation in the third year is synonymous with a holistic 'abstract orientation' - with which intellectual boundaries are advanced, and the topic is conceived 'as a whole'. Students who are by nature dispositionally 'achieving' - or 'ambitious', - will have tended to have developed a strategic approach during the course of their studies as a means of coping with heavy workload, and certainly the evidence here suggests that in general strategic approach does increase significantly over the three years.

7.5 The interaction of cognitive style and approaches to learning in different student samples

The alignment of deep learning and cognitive holism by the third year of study is one of the most important contributions of this research. In the first and second years of study - and in terms of the overall means - 'meaning orientation' is conceptually unrelated to disposition to be conceptually or holistically minded - i.e. tending to consider abstract issues and build broad cognitive frameworks before concentrating on details. This suggests that for many students the tasks involved early on in their academic career can be grasped satisfactorily without a particularly broad mental framework. Ability to use evidence and relate ideas appropriately are important attributes, but the relatively narrow scope of the topics under study at the earlier stages is such that cognitive style is less important - indeed, in the first year, 'operation learning' - serialist cognitive style - is associated with both meaning *and* reproducing orientations. By the third year however, operation learning is strongly associated with reproducing orientation only - evidence that serialist cognitive styles do not permit the full conceptual understanding of a subject at that level. This suggests that in their third year, students disposed to serialist learning will be at a significant disadvantage, in terms of quality of learning, since the curriculum at that stage will have too much information to be assimilated satisfactorily through serialist processing. Students identified as serialist learners might therefore benefit from the inclusion of programmes or tasks designed to improve their stylistic flexibility - or 'versatility' as Pask (1976) termed it - so that they will be able to use both serialist and holist styles where appropriate, avoiding the propensity for serialist style to lead to surface learning strategies.

The patterns of learning orientation within different subject disciplines was investigated in chapter four. The most notable finding was that science students were significantly more likely to adopt reproducing orientation learning strategies then any other discipline, supporting the contention (Entwistle and Ramsden, 1983) that science courses tend to encourage techniques such as memorization in order to store information such as formulae, data, facts and figures, rather than offering sufficient opportunity to explore relationships between aspects of tasks and their contextual purpose. It also indicates that science students bring their approaches to studying developed at secondary level to tertiary education - science courses are generally compulsory at secondary level, where others - English and languages excepting - are not.

One possibility mentioned in chapter six, is that in science subjects a relatively narrow band of style of expression of knowledge is acceptable in assessment situations. Since convergent styles of problems are likely to predominate, the opportunities for disguising lack of understanding by use of equivocation or concentration on more general issues will be fewer.

It is possible that these seemingly superficial - and normally detrimental - learning strategies are *necessary* in science in order to establish a knowledge base from which deeper, more global science issues may be approached. In this sense surface learning at an early stage 'primes' the science student for deep learning later on. There is some evidence in chapter five that over time the 'intrinsic motivation' levels of science students rises. A plausible theory for this pattern can be derived from consideration of the finding that although science students were found to score higher on 'concrete orientation', they were *not* found to be more cognitively serialist or less cognitively holist than the rest of the sample as a whole - as has been indicated in previous studies (Hudson, 1966; Witkin, 1977; Entwistle and Ramsden, 1983, Riding and Cheema, 1991). This suggests that students preferring a holistic learning style will be as prevalent in the science sample as in any other group. Since science disciplines are acknowledged to operate with a largely serialist teaching style (Riding and Cheema, 1991), the 'holistic'-biased students will find difficulties as a result of the mismatch, (*c.f.* Pask, 1976). Their need to develop an overall cognitive framework at the earliest possible opportunity will be at odds with the sequential manner in which the information is presented, involving the progressive introduction of details, building up to an overview at a later stage.

As the course progresses over the three years, these overviews will gradually become apparent, thus encouraging the holistic student to review and extract meaning from the material covered - which in turn sparks an increase in their intrinsic motivation for the area, hence the increased scores on that scale.

This finding further supports the need for recognition and appraisal of individual cognitive styles, and the encouragement of stylistic versatility, at secondary as well as university level. Within science departments, a subtle restructuring of the curriculum with a view to making clear the broad, context-relevant framework of the issues and topics to be covered, *from the beginning,* would go some way to addressing the apparent problem of depressed standards of qualitative learning outcome recorded in the science sample. In arts subjects, this problem does not appear to be as acute, since students from this sample did emerge as less likely to be serialist learners. Presumably the holistic nature of arts courses are more attuned to their cognitive preferences from the start.

It is not only the cognitive style preferences of students within different subject disciplines that need consideration. The multivariate analysis of variance described in chapter four demonstrated a clear cognitive style difference in males and females - with males scoring consistently higher on 'holist' style scales and females scoring higher on 'serialist ' scales. These results are in line with the theories of Terenzini and Wright (1987) and Baxter-

Magolda (1988) who suggested that the intellect of males will tend to develop in an independent, broad-structured manner with concepts and ideas assimilated in wider contexts. Females, on the other hand, they claimed, will tend to develop their intellect using established sources and set ideas. The danger of this disparity is especially evident when a longitudinal perspective is taken - since it becomes apparent that while males' and females' ability to use evidence in academic tasks is roughly equal in the first year of their courses, by year three the female sample lags significantly on this score. The predominance of serialist learning style in females - as observed - appears to be maladaptive in the final year of study, and can hinder the development of deep learning strategies.

An interesting finding was that female, mature students were actually *more* likely to be holistically minded than male, mature students, perhaps suggesting that for females students, a break between school and university could help encourage them to think in a holistic manner and thereby enrich their experience of learning at the higher education level.

These gender related differences would seem to justify the concerns expressed by Richardson (1993) who claimed that educational policy informed by the results of research based predominantly on the study of males' learning behaviour, might prove unhelpful or even detrimental to the academic learning of females.

It is clear that individual differences in cognitive style abound, and it is desirable that course planners in *all* departments should consider the stylistic preferences of students and seek to offer a degree of flexibility in the structure of the teaching programme. The suggestion of Dyne, Taylor and Boulton-Lewis (1994), that students should be made aware of the distinction between 'item' information - defined as information encoded discretely as a distinct fact, procedure or formula for example - and 'relational' information - referring to the elements or characteristics shared by events or items of learning material - is fully endorsed. Gow and Kember (1993) contended that academic departments should view their role as 'learning facilitation' rather than 'knowledge transmission' - and thus learning facilitation, in the light of the findings described here, should involve the identification and accommodation of individual cognitive learning style, as well as the encouragement of stylistic versatility.

7.6 Limitations of research

The study may be criticized for certain methodological and theoretical shortcomings. On the practical side, the main limitation lay with the sample used, which while substantial when compared with some similar studies (for example, Clarke, 1986 and Richardson, 1993) was wholly composed of volunteer participants. Watkins and Hattie (1985) and Richardson (1995) have both shown that individuals who respond to requests for participation tend to differ in their general learning characteristics - in terms of having more orderly study methods and more favourable attitudes towards their work. It seems likely then that the study suffers to an extent from sampling bias - though given the limitations of resources and time, this falls within acceptable margins. The inadequacy of the size of the medicine student sample was noted early on and appropriate steps were taken to uphold statistical validity when analysis of variance was being tested. Unfortunately this meant that the characteristics of this rarely tested group of students could not be scrutinized in as much depth as hoped. The relatively high attrition rate from year two to year three also weakened the study somewhat - however once again the sample sizes were well within the bounds of statistical acceptability. It may be speculated that those failing to persevere with the study may be more prone to adopting surface learning strategies. Future studies of a similar nature would be recommended to aim for as close to 100% of the study body in question as possible - perhaps by administering the test(s) at registration or during lectures.

On a theoretical level the criticisms are those that could be levelled against any quantitative research study - namely that by relying on established psychometric tests the researcher(s) may be pre-judging and thus biasing the responses of the sample - perhaps even missing fundamental interactive aspects of individual experience. In addition, the inventories used rely on the respondents' own perceptions of their behaviour and may not accurately reflect the ways in which they actually learn. Nevertheless, the approach taken here can be justified, since it constituted by far the most efficient means of collecting such an extensive dataset covering a broad range of psychological characteristics, preferences and attitudes. Furthermore, the phenomenographic research outlined in the discussion, relied on operationalizing the findings of extensive qualitative studies of student behaviour within the Approaches to Studying Inventory, making in-depth interview-based groundwork much less of prerequisite for educational research studies of this type.

However, future research might consider small scale interview or experimental studies useful for investigating further the trends highlighted by this study - in particular the nature of cognitive style and the development of its influence on approach to learning over time. The use of computer aided learning materials - for example, 'hypertext' based systems - would seem to be ideal for this type of research since they offer the learner the opportunity to negotiate learning materials in a manner concordant with his or her own stylistic preferences.

7.7 Summary of implications of research findings

The research described in this thesis has reviewed and analyzed a complex model of student learning from a largely quantitative perspective. The rationale for the project was ultimately to contribute to the understanding of the student learning process with a view to informing issues relating to educational practice and policy.

As Entwistle and Ramsden (1983, p206) suggest, the practical implications of any piece of educational research should focus on the areas of intervention, teaching and assessment.

The findings presented here suggest that interventions in the form of practical study skills courses or modules, are unlikely to succeed, due to the difficulties of motivating the more expedient students - who have to be shown to be those performing poorly in assessments - to adopt study behaviours requiring perseverance and conscientiousness.

Arguably, it may be more useful to encourage these students to develop their conceptual skills and broaden their 'abstract orientation' as a means of encouraging them to adopt deep learning behaviour.

The recently published report of the National Committee of Inquiry into Higher Education suggests that institutions of higher education should develop and implement learning and teaching initiatives which focus on improving the quality of student learning. Research into the relationship between cognitive styles and approaches to learning would - in light of the results of this project - constitute a fundamental aspect of student learning requiring practical development. The report also recommends that higher education institutions develop 'progress files' in order to provide a 'means by which students can monitor, build and reflect upon their personal development' (Dearing, 1997). The findings from this project certainly endorse this recommendation since it has been established that personal cognitive style interacts with personal conception of learning to determine learning strategy chosen for any academic task. By raising student awareness of their own learning styles, it becomes possible to encourage stylistic versatility - as demonstrated by Laurillard (1978) - and by making clear the qualitative difference between surface, deep and strategic approaches to learning, the student will be better placed to monitor their own intellectual progress and deal appropriately and effectively with academic demands. By recognizing the futility of surface learning strategies such as rote learning and memorization, the student may be inspired to invest extra effort to attain both conceptual understanding and the attendant feelings of resolution and satisfaction in learning. Through *this* style of programme, students may become more intrinsically motivated in their studies and may consequently adopt a more ordered study schedule. The study here recognizes that the plethora of combinations of personality, cognitive style, motivation and study strategy mean that each individual student will have very different educational requirements, in turn suggesting that individual counselling for struggling students - encouraging them to reflect on these factors - may prove beneficial in improving learning.

This educational strategy would require that in addition to the encouragement of stylistic versatility on the part of the student, teaching and assessment techniques should also become more attuned to the disparate cognitive styles of the individual student. One of the principle findings of the research was that students were performing poorly and exhibiting surface learning strategies in conditions where assessment systems were designed to reward relatively exacting cognitive knowledge structures. By re-thinking teaching methods in order to allow more holistically minded students to develop their own preferred style of mental framework and subsequent expression in assessment tasks, the experience of higher education might potentially be more likely to encourage the adoption of meaning orientation strategies. In short, the intellectual development of the individual student should be nurtured by allowing greater freedom in learning, ensuring that the workload and assessment methods are manageable and appropriate, by setting clear goals and standards, and by offering comprehensive feedback to allow the student to assess their own personal development. If educational environments are more adaptive, they can accommodate individual strategic and stylistic characteristics and requirements and thus improve standards of student learning.

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Appendix A-1.1

Please complete in BLOCK CAPITALS

Full name: ....

day month year

Date of birth: / /

Sex: Male / Female (delete as applicable)

Course: (tick box(es) applicable)

American studies .... ☐
Archaeology .... ☐
Biological science* ..... ☐
Biology .... ☐
Chemistry .... ☐
Combined arts* .... ☐
Combined science* .... ☐
Communications and society .... ☐
Economic and social history .... ☐
Economics .... ☐
Engineering .... ☐
English .... ☐
European studies .... ☐

French .... ☐
Geography .... ☐
Geology .... ☐
German .... ☐
History .... ☐
History of art .... ☐
Italian .... ☐
Law .... ☐
Mathematics .... ☐
Medical biochemistry .. ☐
Medicine .... ☐
Microbiology .... ☐
Modern language studies .... ☐
Physics .... ☐

Physics with astrophysics .... ☐
Physics w. space science and technology .... ☐
Politics .... ☐
Psychology .... ☐
Sociology .... ☐

Other(s) .... ☐
(please specify)

....

....

* Combined science, combined arts and biological science students please also specify subjects taken

Have you changed course at any point?

No .... ☐
Yes .... ☐ If yes, then please specify original subject(s) ....

Year of study: 1 / 2 / 3 (circle appropriate year)

Identification number (if known): ☐☐☐☐☐☐☐☐
(If unknown / forgotten leave blank)

Appendix A-1.2

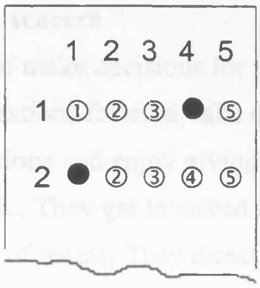
Please read these instructions

In this questionnaire you are asked to rate yourself on a number of phrases or statements

After reading each statement, mark your answer sheet according to the following rules:
Fill in circle 1 if you stongly disagree with the statement.
Fill in circle 2 if you disagree with the statement.
Fill in circle 3 if you are unsure.
Fill in circle 4 if you agree with the statement.
Fill in circle 5 if you strongly agree with the statement.

Now look at these two examples which have already been completed.

	Strongly disagree	Disagree	Unsure	Agree	Strongly agree
1. I tend to be assertive in groups	1	2	3	4	5
2. Common sense is an important attribute for managers	1	2	3	4	5



In the examples above, the person had indicated that he/she agrees that the statement, 'I tend to be assertive in groups' is an accurate description of him/herself, but strongly disagrees with the statement 'Common sense is an important attribute for managers'.

Before you start the questionnnaire, please print your name in the space provided on side A of your answer sheet, and fill in today's date.

When completing the questionnaire please try to remember the following points:

- There are no right or wrong answers, so just be as honest as you can. Do not give an answer because it seems the right thing to say or it is how you might like to be.
- Please try to avoid the middle answer (unsure) as much as possible.
- If you want to change an answer, erase it completely and fill in your new answer.
- Make no stray marks on the answer sheet.
- Although there is no time limit, you should work as quickly as you can rather than pondering at length over any one question.
- Please ensure that you complete ALL questions.

Please turn over to page 1 and begin

Appendix A-1.3

Descriptions of the Concept Model Scales, (Saville and Holdsworth, 1990).

PERSUASIVE

Low scorers
do not enjoy selling or persuading people to their point of view, They find it difficult to influence the outcome of discussions and tend not to be involved in situations requiring diplomacy. They are poor at negotiating or getting their own way by subtle means.

High scorers
enjoy negotiating, selling and changing other peoples opinions. They placate, put forward convincing arguments and try to present things to the best advantage. They enjoy influencing the outcome of discussions and persuading others to their point of view.

CONTROLLING

Low scorers
contribute less to group activities , are reluctant to put forward suggestions when decisions need to be made and dislike taking the lead in a group. The prefer not to give instructions or structure the work of other people. They contribute less in group exercises and tend to look to others when decisions need to be made.

High scorers
like to make decisions for the group, put suggestions forward, take charge of situations and enjoy giving instructions to people. They get involved in controlling the work of teams. They direct, manage and organise others. Others look to them when solutions need to be found.

INDEPENDENT

Low scorers
are more manageable, less concerned to do their own thing, and hesitant to upset other people. They tend to go along more with what the group decides even though they may have different opinions themselves. They are better at accepting constraints on how they should act or how problems should be tackled.

High scorers
speak up even if their views are unpopular, have very strong opinions on things, and like to feel free to do what they want. They make it quite plain when they disagree with a group and insist on having as few ties on their own actions as possible. They are prepared to go it alone when others disagree.

OUTGOING

Low scorers

are shy, inhibited, reserved and serious. They feel uncomfortable when in the limelight at social occasions and are less spontaneous and talkative. They become embarrassed easily and rarely let their hair down.

High scorers

are typical "extraverts". They are outgoing, fun-loving, humourous and happy-go-lucky. They enjoy being the centre of attention, are talkative and vibrant. They are good at entertaining and cheering people up, cracking jokes, and believe in being jovial and merry.

AFFILIATIVE

Low scorers

enjoy their own company, consider themselves loners and have narrower range of friendships. they do not tend to keep contacts with friends and are very happy in their own company. They tend not to join clubs and societies or build up great many friendships.

High scorers

maintain a wide circle of friends, enjoy being in groups and prefer to do things with other people. Companionship is important to them and they tend to feel lonely when not with other people. They share things with friends and tend to form strong attachments to people.

SOCIALLY CONFIDENT

Low scorers

feel under strain when meeting new people, become tongue-tied when talking to others and feel uneasy in meetings when they do not know the people well. They find it hard conversation and are unsure of exactly how are expected to behave in more unusual social situations.

High scorers

are good at putting people at ease. They are confident with new people, know the correct things to say and feel relaxed on social occasions. They are good with words and making expressing a point of view. They enjoy they giving speeches and presentations.

MODEST

Low scorers

tend to talk about their achievements, and do like to share credit for their successes. They believe that more senior people should be treated with respect, and they are concerned for their own status. They are inclined to

High scorers

are egalitarian, believe that too much not emphasis is placed on status and that all people should be treated as equal. They are reserved about their achievements and avoid talking about themselves or their successes.

show off and pull rank over other people.

They accept people as they are. They are willing to share the credit for their success.

DEMOCRATIC

Low scorers

prefer to make their own decisions rather than refer to other people. They believe that group decision-making often wastes time. They tend not to involve or consult other people, and may be autocratic.

High scorers

adopt a democratic style and encourage others to participate. They consult, refer and listen to other people. They prefer group decision-making and try to get the opinions of all those who may be affected by decisions.

CARING

Low scorers

are not interested in other peoples problems, rarely think about people less fortunate than themselves and are not interested in personal problems at work. They are less kindly, understanding and considerate,

High scorers

show consideration for other people, are good at caring for those in need and are genuinely interested in the welfare of others. They will help colleagues over difficulties and show sympathy towards them. They are often asked for advice and they are tolerant of different views and ways of life.

PRACTICAL

Low scorers

are less good at putting equipment right and doing the job in a practical way. They avoid situations involving physical work, machinery and the concrete world.

High scorers

consider themselves practical, down-to-earth and good with common-sense solutions. They make things work, enjoy mending things which have gone wrong and putting equipment right.

DATA RATIONAL

Low scorers

prefer to make decisions on the basis of opinions and feelings rather than numerical data. They attach a lot of weight to subjective feelings and are less good at absorbing facts and figures, or dealing with equations or formulae.

High scorers

enjoy dealing with statistical information, numerical problem-solving, and jobs involving measuring and assessing. They are logical thinkers, are good with data and prefer to make decisions based on objective facts.

ARTISTIC

Low scorers

are less affected by literature, music or the visual arts. They find it difficult to appreciate works of art and avoid cultural activities. They are less knowledgeable on such issues.

High scorers

appreciate the arts, are involved in cultural activities and show artistic flair. They admire literature, the visual arts and music. They are also more sensitive to the beauty of nature.

BEHAVIOURAL

Low scorers

are not interested in analysing the motives and feelings of other people. They do not spend time analysing their own behaviour and indeed feel that this rarely achieves any positive results. They do not think through how others might react to a situation or why people do things.

High scorers

spend time analysing their own thoughts and motives and reflecting on the behaviour of other people. They place great value in understanding how and why they and other people do things. They enjoy observing and analysing human behaviour.

TRADITIONAL

Low scorers

prefer the more radical method. They like to experiment with a new approach and find unconventional people interesting. They introduce changes wherever possible and would prefer to be in an area which is pioneering new methods. They do not tend to respect authority or the status quo.

High scorers

take the traditional approach, show loyalty and preserve well-proven methods. They prefer the orthodox and judge things by the traditional values. Discipline and upholding society are more important to them. They behave in a more conventional manner.

CHANGE ORIENTED

Low scorers

are less adventurous in terms of visiting new places, or doing new things and different things. They prefer to know exactly what they will be doing on a given day and have no desire to change or try out new activities.

High scorers

enjoy visiting different places, doing new things and seeking variety in their everyday life. They accept change, like trying out new activities and enjoy foreign travel. They are more adventurous and restless, and prefer to have novelty in their daily life.

CONCEPTUAL

Low scorers

are better at implementation than theory, are put off by theoretical argument and prefer straightforward tasks to complex issues. They tend to concentrate on the here and now than explore the circumstances and possible causes of a problem. They are bored by intellectual people and dislike getting involved in discussions of hypothetical situations.

High scorers

acquire knowledge quickly, take a theoretical approach and are good with hypothetical and abstract problems. They are intellectually curious and enjoy working with rather complex issues.

INNOVATIVE

Low scorers

follow other peoples ideas rather than think up their own. They are less imaginative and original and prefer testing or implementing to thinking up new projects or ways of doing things.

High scorers

produce original approaches to problems, generate creative ideas and show ingenuity. They think up imaginative solutions and are good at inventing new gadgets. They have lots of ideas and suggestions.

FORWARD PLANNING

Low scorers

prefer to deal with problems as they arise, do like to plan every eventuality and believe that planning and preparation all to often inhibit spontaneity. They prefer to play things by ear and take decisions when the need arises. They are less good at forward planning and forecasting.

High scorers

think things through carefully before not starting, enjoy making predictions and planning projects. They prepare well in advance and enjoy setting targets, forecasting trends and deciding priorities. They tend to anticipate by thinking ahead.

DETAIL CONSCIOUS

Low scorers

dislike repetitive tasks, make slips of detail and quite often lose or misplace things. They tend to be more forgetful and find checking things for accuracy tedious.

High scorers

are good at methodical work, keep things around them neat and tidy, and are good at ensuring that detail is not overlooked. They are precise with facts and enjoy task requiring precision and accuracy.

CONSCIENTIOUS

Low scorers

tend to be distracted more easily. They are less good at keeping at routine task, at completing one job at a time and will leave loose ends if most of the job has been completed. They do not see the point of getting all the details of a task right if the main objectives have been accomplished.

High scorers

adhere strictly to deadlines, complete jobs in time and ensure that things keep to a fixed schedule. They persevere with tedious tasks and are prepared to put in a lot of work to complete important projects.They see things through to the end and try to avoid being interrupted whilst at work.

RELAXED

Low scorers

find it difficult to relax, often feel uptight and find it difficult to put trivial problems out of their mind. They are tense and anxious and often get worked up about things.

High scorers

keep calm and relaxed, remain cool under pressure and are generally free from anxieties. They are calm about things, cope well with stress and are able to switch off from work.

WORRYING

Low scorers

rarely feel apprehensive about things, do not get worked up before important events and find that competition does not make them nervous. They are not apprehensive over approaching deadlines, nor do they feel guilty over mistakes they have made.

High scorers

worry when things go wrong, get tense over uncompleted work and are nervous to do well. They worry over details, feel tense until conflict is resolved and feel guilty when they have made mistakes. They are better at keying themselves up for important events.

TOUGH-MINDED

Low scorers

are sensitive, more easily hurt by unfair criticism and find it difficult to brush off insults. They suffer from hurt feelings much more frequently and find that people upset them. They also find that their moods change a great deal.

High scorers

rarely suffer from hurt feelings, do not bother what others think of them and are able to keep sentiment out of their feelings. They are good at brushing off insults and do not let things get through to them.

EMOTIONAL CONTROL

Low scorers

are more prone to showing their feelings, and having emotional outbursts. They tend to be less patient and tell people exactly what they feel too readily. Emotionally they are easy to read, and give away their feelings.

High scorers

are good at controlling their emotions, curbing their temper and generally showing restraint in expressing their emotions. They do not give away how they feel, avoid emotional outbursts and actively work to control their moods.

OPTIMISTIC

Low scorers

anticipate the worst possible outcomes to plans, are pessimistic in outlook and are inclined to become depressed when they meet setbacks. They tend to see things getting worse in the future and are not hopeful that things will go their way.

High scorers

keep their spirits up despite setbacks, keep cheerful when things go wrong and are not easily depressed. They are optimistic, keep happy and expect events to change for the good.

CRITICAL

Low scorers

are accepting of facts and assumptions. They tend to think of reasons why something will work rather than look for disadvantages. They do not tend to question other peoples ideas or discover faults others have overlooked. They like to see the advantages of a plan rather than reveal its weaknesses.

High scorers

enjoy bringing others down-to-earth, good at probing the facts and seeing disadvantages in things. They criticise poorly thought out arguments and will challenge assumptions. They will look for flaws and point out faults or problems.

ACTIVE

Low scorers

move around slowly, become more easily tired than other people and refrain from taking part in hard physical activity. They pack less into life and prefer more sedentary to active jobs.

High scorers

are physically active, have more energy than other people and move around quickly. They enjoy hard physical exercise, put a great deal into life and find it difficult to sit still. They show energy and vitality.

COMPETITIVE

Low scorers

prefer to participate than to wine. They do not need to get the better of other people and they are good losers. They are prepared to compromise rather than force themselves over others.

High scorers

play to win, enjoy overcoming the opposition and are determined to beat others. They participate for the competition more than the enjoyment. They are determined, good at putting up a fight and dislike accepting defeat.

ACHIEVING

Low scorers

do not set their sights to high, and prefer a secure but less well paid job to one involving risk. They place their family and social life over their personal career ambitions.

High scorers

enjoy achieving difficult targets, set their sights high and place their career over family and social commitments. They put a good deal of time into their job and prefer rapid promotion to security or congenial work. They accept and set ambitious targets even when this implies a high risk of failure. They prefer to be paid by quantifiable results and are motivated to be the best in their chosen field.

DECISIVE

Low scorers

refuse to make decisions until all the facts available, take time to weigh up alternatives and avoid hasty decision-making. They will sometimes spend too long thinking things over and miss chances.

High scorers

are quick at arriving at conclusion, rapidly weigh up situations and make fast decisions. They are prepared to take more risks and decide on the spur of the moment. Their decisions can sometimes be rash and poorly thought through.

Appendix A-1.81

Lancaster Approaches to Studying Inventory - *Entwistle and Ramsden (1983)*

Tick one box for each statement

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
• I generally put a lot of effort into trying to understand things which initially seem difficult	⓪	①	②	③	④
• I often find myself questioning things that I hear in lectures or read in books	⓪	①	②	③	④
• I usually set out to understand thoroughly the meaning of what I am asked to read	⓪	①	②	③	④
• When I'm tackling a new topic, I often ask myself questions about it which the new information should answer	⓪	①	②	③	④
• I try to relate ideas in one subject to those in others, whenever possible	⓪	①	②	③	④
• In trying to understand new ideas, I often try to relate them to real life situations to which they might apply	⓪	①	②	③	④
• I need to read around a subject pretty widely before I'm ready to put my ideas down on paper	⓪	①	②	③	④
• I find it helpful to 'map out' a new topic for myself by seeing how the ideas fit together	⓪	①	②	③	④
• In reporting practical work, I like to try to work out several alternative ways of interpreting the findings	⓪	①	②	③	④
• I am usually cautious in drawing conclusions unless they are well supported by evidence	⓪	①	②	③	④
• Puzzles or problems fascinate me, particularly where you have to work through the material to reach a logical conclusion	⓪	①	②	③	④
• When I'm reading an article or reseach report I generally examine the evidence carefully to decide whether the conclusion is justified	⓪	①	②	③	④
• My main reason for being here is so that I can learn more about the subjects which really interest me	⓪	①	②	③	④
• I find that studying academic topics can often be really exciting and gripping	⓪	①	②	③	④
• I spend a good deal of my spare time in finding out more about interesting topics which have been discussed in classes	⓪	①	②	③	④
• I find academic topics so interesting, I should like to continue with them after I finish this course	⓪	①	②	③	④

Appendix A-1.81 continued.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
Lecturers seem to delight in making the simple truth unnecessarily complicated	⓪	①	②	③	④
I find I have to concentrate on memorising a good deal of what we have to learn	⓪	①	②	③	④
When I'm reading I try to memorise important facts which may come in useful later	⓪	①	②	③	④
The best way for me to understand what technical terms mean is to remember the text-book definitions	⓪	①	②	③	④
I usually don't have time to think about the implications of what I have read	⓪	①	②	③	④
Often I find I have read things without having a chance to really understand them	⓪	①	②	③	④
I like to be told precisely what to do in essays or other assignments	⓪	①	②	③	④
I prefer courses to be clearly structured and highly organised	⓪	①	②	③	④
I tend to read very little beyond what's required for completing assignments	⓪	①	②	③	④
The continual pressure of work assignments, deadlines and competition often makes me tense and depressed	⓪	①	②	③	④
A poor first answer in an exam makes me panic	⓪	①	②	③	④
Having to speak in tutorials is quite an ordeal for me	⓪	①	②	③	④
I chose my present courses mainly to give me a chance of a really good job afterwards	⓪	①	②	③	④
My main reason for being here is that it will help me get a better job	⓪	①	②	③	④
I generally choose courses more from the way they fit in with career plans than from my own interests	⓪	①	②	③	④
I suppose I am more interested in the qualifications I'll get than in the courses I'm taking	⓪	①	②	③	④
Lecturers sometimes give indications of what is likely to come up in exams, so I look out for what may be hints	⓪	①	②	③	④
When I'm doing a piece of work, I try to bear in mind exactly what the lecturer seems to want	⓪	①	②	③	④

Appendix A-1.81 continued.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
• If conditions aren't right for me to study, I generally manage to do something to change them	0	1	2	3	4
• One way or another I manage to get hold of the books I need for studying	0	1	2	3	4
• I find it difficult to organise my study time effectively	0	1	2	3	4
• My habit of putting off work leaves me with far too much to do at the end of term	0	1	2	3	4
• Distractions make it difficult for me to do much effective work in the evenings	0	1	2	3	4
• I'm rather slow at starting work in the evenings	0	1	2	3	4
• Often I find myself wondering whether the work I am doing here is really worthwhile	0	1	2	3	4
• Continuing my education was something which happened to me, rather than something I really wanted for myself	0	1	2	3	4
• When I look back, I sometimes wonder why I ever decided to come here	0	1	2	3	4
• I certainly want to pass the next set of exams, but it doesn't really matter if I only just scrape through	0	1	2	3	4
• I enjoy competition: I find it really stimulating	0	1	2	3	4
• It's important to me to do really well in the courses here	0	1	2	3	4
• It is important to me to do things better than my friends	0	1	2	3	4
• I hate admitting defeat, even in trivial matters	0	1	2	3	4
• Ideas in books often set me off on long chains of thought of my own, only tenuously related to what I was reading	0	1	2	3	4
• In trying to understand a puzzling idea, I let my imagination wander freely to begin with, even if I don't seem to be much nearer a solution	0	1	2	3	4
• I like to play around with ideas of my own even if they don't get me very far	0	1	2	3	4
• Often when I'm reading books, the ideas produce vivid images which sometimes take on a life of their own	0	1	2	3	4

Appendix A-1.81 continued.

	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
• Although I have a fairly good general idea of many things, my knowledge of the detail is rather weak	⓪	①	②	③	④
• In trying to understand new topics, I often explain them to myself in ways that other people don't seem to follow	⓪	①	②	③	④
• I often get criticised for introducing irrelevant material into my essays or tutorials	⓪	①	②	③	④
• I seem to be a bit too ready to jump to conclusions without waiting for all the evidence	⓪	①	②	③	④
• I generally prefer to tackle each part of a topic or problem in order, working out one at a time	⓪	①	②	③	④
• I prefer to follow well tried out approaches to problems rather than anything too adventurous	⓪	①	②	③	④
• I find it better to start straight away with the details of a new topic and build up an overall picture in that way	⓪	①	②	③	④
• I think it is important to look at problems rationally and logically without making intuitive jumps	⓪	①	②	③	④
• Although I generally remember facts and details, I find it difficult to fit them together into an overall picture	⓪	①	②	③	④
• I find it difficult to "switch tracks" when working on a problem: I prefer to follow each line of thought as far as it will go	⓪	①	②	③	④
• Tutors seem to want me to be more adventurous in making use of my own ideas	⓪	①	②	③	④
• I find I tend to remember things best if I concentrate on the order in which the lecturer presented them	⓪	①	②	③	④

The test is now finished.

Appendix A-1.82

Notes on interpreting the Approaches to Studying Inventory profile charts

The inventory encompasses elements of learning, motivation and cognitive style and is made up of four principle sections. Three of these are headed 'orientations' which describe common approaches to learning and study. (See 'Understanding Student Learning' - Entwistle and Ramsden (1983) for further detail)

1 - **Meaning Orientation** • Identifies four positive learning characteristics.

2 - **Reproducing Orientation** • Identifies four negative learning characteristics.

3 - **Achieving Orientation** • Identifies four characteristic attitudes to learning.

4 - **Styles and Pathologies of Learning** • Identifies four common cognitive learning styles (two positive, two negative).

Calculate scores for each individual by adding together each item in the subscale.

The following definitions of each of the sixteen subscales describes a **high** score on the scale

1 - Meaning Orientation

Deep Approach - One of the most important indicators of approach to learning. Student actively questions concepts and ideas, attempts to really understand subject, good at grasping concepts, need to know how things work.

Relating Ideas - Relates ideas learnt to other parts of course and own experience, takes pieces of knowledge and attempts to fit them together to form a broader picture.

Use of Evidence - Careful to use evidence before drawing conclusions, won't rely on arguments or theories without adequate back-up evidence.

Intrinsic Motivation - Interested in learning for learning's sake, here because they enjoy learning and think that knowledge in itself is worthwhile.

2 - Reproducing Orientation

Surface Approach - Student preoccupied with memorization, often fails to grasp concepts properly, characterized by the taking of short-cuts, (e.g. learning lists before exams, lifting chunks of essays from books etc.), consequently they often have only a superficial understanding of subject.

Syllabus-Boundness - Relies on teachers or department to define learning tasks, don't go beyond what's required, very limited in their perceptions of subject, often tend to use only lecture notes for exam revision and do little extra reading.

Fear of Failure - Pessimistic and anxious about academic outcomes, worry too much about coursework, essays exams, university life in general.

Extrinsic Motivation - (Contrast with Intrinsic Motivation), Interested in courses mainly for the qualifications they offer, interested in the status of getting a degree and having letters after their name, perhaps see university only as a means to an end, e.g getting a better job.

Appendix A-1.82 continued.

3 - Achieving Orientation

Strategic Approach - Aware of the academic demands made by staff, does only the minimum of work to get by, often happy with 'scraping by', often find out what's likely to be in the exams beforehand and limit their study accordingly, focus only on areas they know will be assessed.

Disorganized Study Methods - Unable to work regularly and effectively, find it difficult to organize study time and content.

Negative Attitudes to Study - Lack of interest and application, disenchantment with university, often those who hate studying, tend to avoid it at all costs, basically don't enjoy learning.

Achievement Motivation - Competitive and confident, concerned with academic performance relative to others, like to win - i.e do better / score higher than their classmates.

4 - Styles and Pathologies of Learning (4 general cognitive types)

Comprehension Learning - Ready to map out subject area and think divergently, i.e. looks at subject as a whole, then 'fills in' detail, often good at theory, (generally a positive style).

Globetrotting - Over-ready to jump to conclusions, make inappropriate links between ideas, often fail to substantiate their conclusions with enough detail, (generally a negative style).

Operation Learning - Effectively uses facts and logical analysis, enjoy working with data, often good at projects or practical work, (another positive syle).

Improvidence - Over-cautious reliance on details, fail to use common principles, often lose sight of main objective, (summarized by 'can't see the wood for the trees' - too much attention to details hinders understanding of whole subject area - usually a negative style)

Scores on each of these subscales have no intrinsic meaning in themselves. They should be used for comparison purposes - i.e. comparing different students approaches to learning, assessing changes in learning strategy over time or correlating learning characteristics with other factors, e.g. background, academic performance, other personological measures, etc.

Appendix A-1.9

```
OPQ Concept 5.2 Profile Chart (Leicester University)  Norms: Total Student

NAME: * S A M P L E *                SEX:          AGE:

DATE:              ID:                        OTHER:

                                STEN

Scale RS SS      1  2  3  4  5  6  7  8  9 10      Description

R1    17  4      .  .  <--X-->  .  .  .  .  .      Persuasive
R2    24  6      .  .  .  .  <--X-->  .  .  .      Controlling
R3    33  9      .  .  .  .  .  .  .  <--X-->      Independent
R4    32  9      .  .  .  .  .  .  .  <--X-->      Outgoing
R5    30  7      .  .  .  .  .  <--X-->  .  .      Affiliative
R6    26  7      .  .  .  .  .  <--X-->  .  .      Socially confident
R7    22  6      .  .  .  .  <--X-->  .  .  .      Modest
R8    27  8      .  .  .  .  .  .  <--X-->  .      Democratic
R9    25  4      .  .  <--X-->  .  .  .  .  .      Caring

T1    25  6      .  .  .  .  <--X-->  .  .  .      Practical
T2    20  6      .  .  .  .  <--X-->  .  .  .      Data Rational
T3    26  7      .  .  .  .  .  <--X-->  .  .      Artistic
T4    33  9      .  .  .  .  .  .  .  <--X-->      Behavioural
T5    16  3      .  <--X-->  .  .  .  .  .  .      Traditional
T6    26  7      .  .  .  .  .  <--X-->  .  .      Change oriented
T7    31  9      .  .  .  .  .  .  .  <--X-->      Conceptual
T8    18  4      .  .  <--X-->  .  .  .  .  .      Innovative
T9    18  4      .  .  <--X-->  .  .  .  .  .      Forward planning
T10   18  3      .  <--X-->  .  .  .  .  .  .      Detail conscious
T11   24  5      .  .  .  <--X-->  .  .  .  .      Conscientious

F1    11  2      <--X-->  .  .  .  .  .  .  .      Relaxed
F2    32  9      .  .  .  .  .  .  .  <--X-->      Worrying
F3    12  4      .  .  <--X-->  .  .  .  .  .      Tough minded
F4    17  4      .  .  <--X-->  .  .  .  .  .      Emotional control
F5    29  7      .  .  .  .  .  <--X-->  .  .      Optimistic
F6    14  1     -X-->  .  .  .  .  .  .  .  .      Critical
F7    15  3      .  <--X-->  .  .  .  .  .  .      Active
F8    15  5      .  .  .  <--X-->  .  .  .  .      Competitive
F9    19  6      .  .  .  .  <--X-->  .  .  .      Achieving
F10   12  3      .  <--X-->  .  .  .  .  .  .      Decisive

D1    12  3      .  <--X-->  .  .  .  .  .  .      Social desirability response

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3 AC Court
High Street
Thames Ditton, Surrey
KT7 0SR
United Kingdom
```

Appendix A-1.92

Approaches to Studying Inventory - Profile Chart

Name: * S A M P L E *

I.D.

First Year	Second Year	Third Year	
4.00	4.00	4.25	Deep approach
3.25	3.75	3.50	Relating ideas
3.00	3.50	3.50	Use of evidence
3.50	3.50	3.75	Intrinsic motivation
2.667	2.833	2.667	Surface approach
2.667	3.333	3.00	Syllabus-boundness
1.667	2.00	2.333	Fear of failure
2.75	3.00	2.75	Extrinsic motivation
3.00	3.50	3.25	Strategic approach
3.00	3.25	3.25	Disorganized study methods
1.75	2.00	2.25	Negative attitudes to study
3.50	3.00	2.75	Achievement motivation
3.25	3.00	2.50	Comprehension learning
2.50	2.75	2.75	Globetrotting
3.50	3.75	3.75	Operation learning
3.00	2.50	2.50	Improvidence

Appendix B-1.1 Multivariate Analysis of Variance of ASI 'meaning orientation' variables by 'category' and 'sex'.

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

 EFFECT .. CATEGORY BY SEX
 Multivariate Tests of Significance (S = 4, M = -1/2, N = 182 )

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .95931     .95726      16.00    1118.79       .502

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. CATEGORY BY SEX (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 DEEPAPPM     10.26532 2027.01204    2.56633    5.49326     .46718       .760
 RELIDEAM      2.48208 1401.54244     .62052    3.79822     .16337       .957
 USEEVIDM      5.33698 1942.52861    1.33425    5.26431     .25345       .907
 INTMOTVM     65.94170 2993.73394   16.48542    8.11310    2.03195       .089

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. SEX
 Multivariate Tests of Significance (S = 1, M = 1 , N = 182 )

 Test Name         Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .97081    2.75163       4.00     366.00       .028
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. SEX (Cont.)
 Univariate F-tests with (1,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 DEEPAPPM     11.20322 2027.01204   11.20322    5.49326    2.03945       .154
 RELIDEAM      1.11494 1401.54244    1.11494    3.79822     .29354       .588
 USEEVIDM     22.08455 1942.52861   22.08455    5.26431    4.19515       .041
 INTMOTVM     14.82369 2993.73394   14.82369    8.11310    1.82713       .177

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. CATEGORY
 Multivariate Tests of Significance (S = 4, M = -1/2, N = 182 )

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .90456    2.33402      16.00    1118.79       .002

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. CATEGORY (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 DEEPAPPM     27.11420 2027.01204    6.77855    5.49326    1.23398       .296
 RELIDEAM     38.14565 1401.54244    9.53641    3.79822    2.51076       .042
 USEEVIDM     36.46062 1942.52861    9.11516    5.26431    1.73150       .142
 INTMOTVM      9.41910 2993.73394    2.35478    8.11310     .29024       .884
```

Appendix B-1.1 continued

Estimates for DEEPAPPM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.200953387	.26113	.76955	.44206	-.31254	.71444
3	-.42688540	.26188	-1.63009	.10394	-.94185	.08808
4	-.27005614	.28323	-.95347	.34098	-.82701	.28690
5	.174249419	.27539	.63273	.52730	-.36728	.71578

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.191412117	.13403	1.42809	.15411	-.07215	.45498

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.182975184	.26113	.70070	.48393	-.33051	.69647
8	.152083818	.26188	.58074	.56177	-.36288	.66705
9	-.33807878	.28323	-1.19364	.23339	-.89504	.21888
10	-.06710656	.27539	-.24368	.80762	-.60864	.47443

Estimates for RELIDEAM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.18360730	.21714	-.84559	.39833	-.61059	.24337
3	-.38790506	.21776	-1.78136	.07568	-.81611	.04030
4	.531181056	.23552	2.25539	.02469	.06806	.99430
5	-.27729778	.22899	-1.21094	.22669	-.72760	.17300

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.060384338	.11145	.54180	.58829	-.15878	.27955

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.090568043	.21714	.41710	.67685	-.33641	.51755
8	.002096843	.21776	.00963	.99232	-.42611	.43030
9	.039800848	.23552	.16899	.86589	-.42332	.50292
10	-.17486846	.22899	-.76364	.44557	-.62517	.27543

Appendix B-1.1 continued

Estimates for USEEVIDM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.39167258	.25563	-1.53218	.12633	-.89435	.11100
3	-.03251268	.25636	-.12682	.89915	-.53663	.47160
4	-.25963554	.27727	-.93640	.34968	-.80486	.28559
5	.629517900	.26959	2.33508	.02007	.09939	1.15965

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.268746104	.13121	2.04821	.04125	.01073	.52676

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.017920563	.25563	.07010	.94415	-.48475	.52060
8	.047649560	.25636	.18587	.85265	-.45647	.55177
9	.209957600	.27727	.75723	.44939	-.33527	.75518
10	-.08660325	.26959	-.32124	.74821	-.61673	.44352

- -

Estimates for INTMOTVM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.274440382	.31735	.86479	.38771	-.34960	.89848
3	.104352198	.31826	.32789	.74318	-.52147	.73018
4	-.05484533	.34421	-.15934	.87349	-.73171	.62202
5	-.12244454	.33468	-.36586	.71468	-.78056	.53567

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.22017909	.16289	-1.35171	.17729	-.54049	.10013

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.725575913	.31735	2.28637	.02280	.10154	1.34961
8	.195487730	.31826	.61424	.53943	-.43034	.82131
9	.042956865	.34421	.12480	.90075	-.63390	.71982
10	-.50749948	.33468	-1.51638	.13028	-1.16562	.15062

- -

Appendix B-1.2 Multivariate Analysis of Variance of ASI 'reproducing orientation' variables by 'category' and 'sex'.

* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

EFFECT .. CATEGORY BY SEX
Multivariate Tests of Significance (S = 4, M = -1/2, N = 182)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.94411	1.32886	16.00	1118.79	.171

\- -

EFFECT .. CATEGORY BY SEX (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
SURFAPPM	3.39008	3195.58342	.84752	8.66012	.09786	.983
SYLLBOUM	31.09892	1487.06358	7.77473	4.02998	1.92922	.105
FEARFAIM	18.64527	1986.11618	4.66132	5.38243	.86603	.484
EXTMOTVM	62.49941	3595.71561	15.62485	9.74449	1.60346	.173

\- -

EFFECT .. SEX
Multivariate Tests of Significance (S = 1, M = 1 , N = 182)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Wilks	.90758	9.31743	4.00	366.00	.000

Note.. F statistics are exact.

\- -

EFFECT .. SEX (Cont.)
Univariate F-tests with (1,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
SURFAPPM	11.15419	3195.58342	11.15419	8.66012	1.28800	.257
SYLLBOUM	.55766	1487.06358	.55766	4.02998	.13838	.710
FEARFAIM	136.94191	1986.11618	136.94191	5.38243	25.44240	.000
EXTMOTVM	33.67212	3595.71561	33.67212	9.74449	3.45551	.064

\- -

EFFECT .. CATEGORY
Multivariate Tests of Significance (S = 4, M = -1/2, N = 182)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.84870	3.85727	16.00	1118.79	.000

\- -

EFFECT .. CATEGORY (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
SURFAPPM	161.03891	3195.58342	40.25973	8.66012	4.64887	.001
SYLLBOUM	73.34156	1487.06358	18.33539	4.02998	4.54974	.001
FEARFAIM	19.57301	1986.11618	4.89325	5.38243	.90912	.459
EXTMOTVM	278.09660	3595.71561	69.52415	9.74449	7.13472	.000

Appendix B-1.2 continued

Estimates for SURFAPPM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.82420271	.32787	-2.51380	.01237	-1.46893	-.17947
3	1.02303880	.32881	3.11133	.00201	.37646	1.66962
4	.643681080	.35563	1.81000	.07111	-.05563	1.34299
5	-.26707614	.34578	-.77239	.44038	-.94702	.41287

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.19099280	.16829	-1.13490	.25715	-.52192	.13994

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.04222714	.32787	-.12879	.89759	-.68696	.60250
8	.073343520	.32881	.22306	.82361	-.57324	.71992
9	.120080871	.35563	.33766	.73581	-.57923	.81939
10	.026106607	.34578	.07550	.93986	-.65384	.70605

Estimates for SYLLBOUM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.73515688	.22366	-3.28690	.00111	-1.17497	-.29534
3	.377911957	.22430	1.68482	.09287	-.06316	.81899
4	.679368315	.24260	2.80041	.00537	.20232	1.15641
5	-.07847887	.23588	-.33271	.73954	-.54231	.38535

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.042705232	.11480	.37199	.71011	-.18304	.26845

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.40671830	.22366	-1.81844	.06981	-.84653	.03310
8	-.04884066	.22430	-.21774	.82775	-.48991	.39223
9	.529061009	.24260	2.18083	.02983	.05202	1.00610
10	.166912824	.23588	.70762	.47963	-.29692	.63075

Appendix B-1.2 continued

- -

Estimates for FEARFAIM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.33146641	.25848	-1.28235	.20052	-.83975	.17682
3	.165801362	.25922	.63961	.52282	-.34394	.67554
4	.404691534	.28036	1.44346	.14974	-.14662	.95600
5	-.16820712	.27260	-.61705	.53758	-.70425	.36784

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.66921567	.13267	-5.04405	.00000	-.93011	-.40832

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.35428414	.25848	-1.37063	.17132	-.86257	.15400
8	.310931024	.25922	1.19947	.23111	-.19881	.82067
9	-.20266298	.28036	-.72286	.47022	-.75397	.34865
10	.157214612	.27260	.57672	.56448	-.37883	.69326

- -

Estimates for EXTMOTVM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.94034364	.34779	-2.70374	.00717	-1.62425	-.25644
3	-.21982357	.34879	-.63025	.52892	-.90569	.46604
4	-.82398121	.37723	-2.18427	.02957	-1.56578	-.08218
5	1.76711668	.36679	4.81782	.00000	1.04586	2.48837

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.331843386	.17852	1.85890	.06384	-.01919	.68288

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.53866878	.34779	-1.54882	.12228	-1.22258	.14524
8	.571498981	.34879	1.63852	.10217	-.11437	1.25736
9	-.37119524	.37723	-.98399	.32576	-1.11299	.37060
10	-.11914497	.36679	-.32483	.74549	-.84040	.60211

- -

Appendix B-1.3 Multivariate Analysis of Variance of ASI 'achieving orientation' variables by 'category' and 'sex'.

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

 EFFECT .. CATEGORY BY SEX
 Multivariate Tests of Significance (S = 4, M = -1/2, N = 182 )

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .94204    1.38011      16.00    1118.79       .143

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. CATEGORY BY SEX (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 STRATAPM      9.30445 1262.93889    2.32611    3.42260     .67963       .606
 DISSTUDM      6.46738 4916.96039    1.61685   13.32510     .12134       .975
 NEGATTSM     83.57912 3076.55101   20.89478    8.33754    2.50611       .042
 ACHMOTVM     39.38984 2401.59393    9.84746    6.50838    1.51304       .198

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. SEX
 Multivariate Tests of Significance (S = 1, M = 1 , N = 182 )

 Test Name         Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .98226    1.65274       4.00     366.00       .160
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. SEX (Cont.)
 Univariate F-tests with (1,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 STRATAPM      5.70842 1262.93889    5.70842    3.42260    1.66786       .197
 DISSTUDM     25.12174 4916.96039   25.12174   13.32510    1.88530       .171
 NEGATTSM     25.88125 3076.55101   25.88125    8.33754    3.10418       .079
 ACHMOTVM      4.83561 2401.59393    4.83561    6.50838     .74298       .389

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 EFFECT .. CATEGORY
 Multivariate Tests of Significance (S = 4, M = -1/2, N = 182 )

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .90141    2.41650      16.00    1118.79       .001

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. CATEGORY (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 STRATAPM     33.86781 1262.93889    8.46695    3.42260    2.47384       .044
 DISSTUDM     32.91139 4916.96039    8.22785   13.32510     .61747       .650
 NEGATTSM     89.94559 3076.55101   22.48640    8.33754    2.69701       .031
 ACHMOTVM     82.29665 2401.59393   20.57416    6.50838    3.16118       .014
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Appendix B-1.3 continued

- -
Estimates for STRATAPM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.44749622	.20612	-2.17105	.03056	-.85281	-.04218
3	-.20124514	.20671	-.97356	.33091	-.60772	.20523
4	.484728969	.22357	2.16815	.03079	.04510	.92436
5	-.10845225	.21738	-.49891	.61814	-.53590	.31900

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.13663308	.10580	-1.29146	.19735	-.34467	.07141

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.080339748	.20612	.38977	.69693	-.32498	.48566
8	-.21529405	.20671	-1.04152	.29831	-.62177	.19118
9	.268484933	.22357	1.20091	.23056	-.17114	.70811
10	-.18231533	.21738	-.83871	.40218	-.60977	.24514

- -
Estimates for DISSTUDM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.454029137	.40670	1.11637	.26499	-.34572	1.25378
3	-.12075514	.40787	-.29606	.76735	-.92279	.68128
4	.270246068	.44113	.61262	.54050	-.59720	1.13769
5	-.16555420	.42891	-.38598	.69973	-1.00898	.67787

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.286630740	.20875	1.37306	.17057	-.12386	.69713

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.00155137	.40670	-.00381	.99696	-.80130	.79819
8	-.20630855	.40787	-.50582	.61328	-1.00835	.59573
9	.100221112	.44113	.22719	.82040	-.76722	.96767
10	-.09129344	.42891	-.21285	.83156	-.93472	.75213

Appendix B-1.3 continued

Estimates for NEGATTSM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.36530323	.32171	-1.13551	.25690	-.99791	.26731
3	.449309836	.32263	1.39265	.16456	-.18511	1.08373
4	.702844916	.34894	2.01423	.04471	.01669	1.38900
5	-.85453974	.33928	-2.51871	.01220	-1.52170	-.18738

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.290931336	.16513	1.76187	.07892	-.03378	.61564

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.92204245	.32171	-2.86609	.00439	-1.55465	-.28943
8	.362109917	.32263	1.12237	.26243	-.27231	.99653
9	.444994590	.34894	1.27528	.20301	-.24117	1.13115
10	-.19669483	.33928	-.57975	.56244	-.86385	.47046

Estimates for ACHMOTVM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.30262642	.28424	-1.06470	.28771	-.86155	.25630
3	-.57506459	.28505	-2.01741	.04438	-1.13559	-.01454
4	.070548179	.30830	.22883	.81913	-.53569	.67679
5	.965349766	.29976	3.22042	.00139	.37590	1.55480

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.125754451	.14589	.86196	.38927	-.16113	.41264

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.116626501	.28424	.41032	.68181	-.44230	.67555
8	-.06507996	.28505	-.22831	.81953	-.62561	.49545
9	.366467771	.30830	1.18869	.23533	-.23977	.97271
10	-.68111159	.29976	-2.27220	.02365	-1.27056	-.09166

Appendix B-1.4 Multivariate Analysis of Variance of ASI 'styles and pathologies of learning' variables by 'category' and 'sex'.

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

EFFECT .. CATEGORY BY SEX
Multivariate Tests of Significance (S = 4, M = -1/2, N = 182)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.96287	.87144	16.00	1118.79	.603

EFFECT .. CATEGORY BY SEX (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
COMPLNGM	21.39761	2788.18762	5.34940	7.55606	.70796	.587
GLOBETGM	17.66012	2187.31616	4.41503	5.92769	.74481	.562
OPERLNGM	17.70691	1411.72125	4.42673	3.82580	1.15707	.329
IMPROVDM	30.02565	1933.71121	7.50641	5.24041	1.43241	.223

EFFECT .. SEX
Multivariate Tests of Significance (S = 1, M = 1 , N = 182)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Wilks	.96166	3.64805	4.00	366.00	.006

Note.. F statistics are exact.

EFFECT .. SEX (Cont.)
Univariate F-tests with (1,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
COMPLNGM	83.36742	2788.18762	83.36742	7.55606	11.03318	.001
GLOBETGM	.00714	2187.31616	.00714	5.92769	.00120	.972
OPERLNGM	25.59213	1411.72125	25.59213	3.82580	6.68935	.010
IMPROVDM	28.16283	1933.71121	28.16283	5.24041	5.37417	.021

EFFECT .. CATEGORY
Multivariate Tests of Significance (S = 4, M = -1/2, N = 182)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.93238	1.62092	16.00	1118.79	.057

EFFECT .. CATEGORY (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
COMPLNGM	12.11188	2788.18762	3.02797	7.55606	.40073	.808
GLOBETGM	87.93950	2187.31616	21.98487	5.92769	3.70885	.006
OPERLNGM	34.04915	1411.72125	8.51229	3.82580	2.22497	.066
IMPROVDM	53.71411	1933.71121	13.42853	5.24041	2.56250	.038

Appendix B-1.4 continued

- -

Estimates for COMPLNGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.336108298	.30626	1.09746	.27316	-.26613	.93834
3	.092332327	.30714	.30062	.76387	-.51163	.69629
4	-.17241022	.33218	-.51902	.60406	-.82562	.48080
5	-.07256234	.32299	-.22466	.82237	-.70769	.56256

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.522150971	.15720	3.32162	.00098	.21304	.83127

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.08548430	.30626	-.27912	.78031	-.68772	.51675
8	.065699074	.30714	.21391	.83074	-.53826	.66966
9	-.19733616	.33218	-.59406	.55284	-.85055	.45588
10	-.25320256	.32299	-.78394	.43358	-.88833	.38192

- -

Estimates for GLOBETGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.27363646	.27126	-1.00876	.31375	-.80704	.25977
3	.944524163	.27204	3.47205	.00058	.40959	1.47946
4	-.10575286	.29422	-.35943	.71948	-.68431	.47281
5	.032633381	.28607	.11407	.90924	-.52991	.59517

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.00483115	.13923	-.03470	.97234	-.27862	.26896

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.26786726	.27126	-.98749	.32405	-.80128	.26554
8	.419615857	.27204	1.54250	.12381	-.11532	.95455
9	.037794117	.29422	.12845	.89786	-.54077	.61635
10	-.05429583	.28607	-.18980	.84957	-.61683	.50824

Appendix B-1.4 continued

Estimates for OPERLNGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.62041753	.21792	-2.84695	.00466	-1.04894	-.19189
3	.075539367	.21855	.34564	.72981	-.35422	.50529
4	.380534851	.23637	1.60991	.10827	-.08427	.84534
5	.081407867	.22982	.35422	.72338	-.37052	.53334

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.28930182	.11186	-2.58638	.01008	-.50926	-.06935

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.021682771	.21792	.09950	.92080	-.40684	.45021
8	-.22718418	.21855	-1.03952	.29924	-.65694	.20257
9	.477079596	.23637	2.01836	.04428	.01228	.94188
10	-.16823786	.22982	-.73203	.46462	-.62017	.28369

Estimates for IMPROVDM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.75045375	.25505	-2.94238	.00346	-1.25199	-.24892
3	.419811663	.25578	1.64130	.10159	-.08316	.92278
4	.276503924	.27664	.99951	.31820	-.26748	.82049
5	.128355776	.26898	.47720	.63350	-.40057	.65728

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.30348419	.13091	-2.31822	.02098	-.56091	-.04606

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.02365867	.25505	-.09276	.92614	-.52519	.47787
8	.008015957	.25578	.03134	.97502	-.49495	.51099
9	.598854560	.27664	2.16475	.03105	.05487	1.14284
10	-.38262692	.26898	-1.42252	.15572	-.91155	.14630

Appendix B-2.1 Multivariate Analysis of Variance of ASI 'meaning orientation' scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

EFFECT .. MATURITY
Multivariate Tests of Significance (S = 1, M = 1 , N = 186 )

Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F

Wilks             .93125    6.90319      4.00     374.00       .000
Note.. F statistics are exact.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
EFFECT .. MATURITY (Cont.)
Univariate F-tests with (1,377) D. F.

Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

DEEPAPPM     22.69370 2050.92112   22.69370    5.44011    4.17155       .042
RELIDEAM     35.86892 1413.05295   35.86892    3.74815    9.56976       .002
USEEVIDM       .52253 2026.99579     .52253    5.37665     .09719       .755
INTMOTVM    138.66366 2935.95068  138.66366    7.78767   17.80554       .000

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Estimates for DEEPAPPM
--- Individual univariate .9500 confidence intervals

MATURITY

 Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

       2   -.36465925     .17854   -2.04244     .04180    -.71572    -.01360

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Estimates for RELIDEAM
--- Individual univariate .9500 confidence intervals

MATURITY

 Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

       2   -.45845187     .14820   -3.09350     .00213    -.74985    -.16705

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Estimates for USEEVIDM
--- Individual univariate .9500 confidence intervals

MATURITY

 Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

       2   .055333952     .17750     .31175     .75541    -.29367     .40434

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Estimates for INTMOTVM
--- Individual univariate .9500 confidence intervals

MATURITY

 Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

       2   -.90139662     .21362   -4.21966     .00003   -1.32143    -.48136

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-2.2 Multivariate Analysis of Variance of ASI 'reproducing orientation' scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 1 , N = 186 )

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .98127    1.78448       4.00     374.00       .131
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 SURFAPPM     17.89131 3362.39629   17.89131    8.91882    2.00602       .158
 SYLLBOUM      9.22266 1559.22254    9.22266    4.13587    2.22992       .136
 FEARFAIM      6.83793 2161.94379    6.83793    5.73460    1.19240       .276
 EXTMOTVM       .52898 3980.64110     .52898   10.55873     .05010       .823

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for SURFAPPM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .323784226      .22861    1.41634     .15750    -.12572     .77329

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for SYLLBOUM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .232467792      .15567    1.49329     .13620    -.07363     .53857

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for FEARFAIM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   -.20016908      .18331   -1.09197     .27554    -.56061     .16027

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for EXTMOTVM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .055674397      .24874     .22383     .82301    -.43341     .54476

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-2.3 Multivariate Analysis of Variance of ASI 'achieving orientation' scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 1 , N = 186 )

 Test Name          Value     Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .99511     .45975       4.00     374.00       .765
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 STRATAPM       .51521 1316.58929     .51521    3.49228     .14753       .701
 DISSTUDM      9.85340 4985.36179    9.85340   13.22377     .74513       .389
 NEGATTSM     14.58428 3232.44799   14.58428    8.57413    1.70096       .193
 EXTMOTVM       .52898 3980.64110     .52898   10.55873     .05010       .823

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for STRATAPM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   -.05494467     .14305    -.38409     .70113    -.33622     .22633

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for DISSTUDM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .240285508     .27836     .86321     .38857    -.30705     .78763

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for NEGATTSM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .292332488     .22415    1.30421     .19296    -.14840     .73306

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for EXTMOTVM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .055674397     .24874     .22383     .82301    -.43341     .54476

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-2.4 Multivariate Analysis of Variance of ASI 'styles and pathologies of learning' scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 1 , N = 186 )

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks             .98931    1.01079       4.00     374.00       .402
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 COMPLNGM       .08455 2929.60850     .08455    7.77084     .01088       .917
 GLOBETGM     11.92656 2270.47845   11.92656    6.02249    1.98034       .160
 OPERLNGM      6.75341 1487.48787    6.75341    3.94559    1.71163       .192
 IMPROVDM     10.11719 2038.30263   10.11719    5.40664    1.87125       .172

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for COMPLNGM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .022258297     .21339     .10431     .91698    -.39732     .44184

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for GLOBETGM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .264357864     .18785    1.40724     .16018    -.10502     .63373

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for OPERLNGM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .198928056     .15205    1.30829     .19157    -.10005     .49790

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for IMPROVDM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .243480726     .17799    1.36794     .17215    -.10650     .59346

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-3.1 Multivariate Analysis of Variance of OPQ Relationships with people scales by 'category' and 'sex'

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

EFFECT .. CATEGORY BY SEX
Multivariate Tests of Significance (S = 4, M = 2 , N = 179 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.88411	1.25732	36.00	1354.57	.143

- -

EFFECT .. CATEGORY BY SEX (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PERSUASM	41.00827	10353.2997	10.25207	28.05772	.36539	.833
CONTROLM	172.32645	13247.7439	43.08161	35.90174	1.19999	.310
INDEPENM	49.67403	6262.90395	12.41851	16.97264	.73168	.571
OUTGOM	154.97288	17788.8824	38.74322	48.20835	.80366	.523
AFFILITM	124.21554	4676.63343	31.05388	12.67380	2.45024	.046
SOCCONFM	52.32526	14931.7655	13.08132	40.46549	.32327	.862
MODESTM	69.95984	10294.6735	17.48996	27.89884	.62691	.644
DEMOCRTM	32.20498	5780.42634	8.05124	15.66511	.51396	726
CARINGM	170.06163	5216.56779	42.51541	14.13704	3.00738	.018

- -

EFFECT .. SEX
Multivariate Tests of Significance (S = 1, M = 3 1/2, N = 179 1/2)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Wilks	.91871	3.54902	9.00	361.00	.000

Note.. F statistics are exact.

- -

EFFECT .. SEX (Cont.)
Univariate F-tests with (1,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PERSUASM	227.93564	10353.2997	227.93564	28.05772	8.12381	.005
CONTROLM	103.34546	13247.7439	103.34546	35.90174	2.87856	.091
INDEPENM	81.89229	6262.90395	81.89229	16.97264	4.82496	.029
OUTGOM	77.95213	17788.8824	77.95213	48.20835	1.61698	.204
AFFILITM	14.80977	4676.63343	14.80977	12.67380	1.16853	.280
SOCCONFM	225.29065	14931.7655	225.29065	40.46549	5.56748	.019
MODESTM	156.85667	10294.6735	156.85667	27.89884	5.62234	.018
DEMOCRTM	147.59023	5780.42634	147.59023	15.66511	9.42159	.002
CARINGM	166.27512	5216.56779	166.27512	14.13704	11.76166	.001

- -

EFFECT .. CATEGORY
Multivariate Tests of Significance (S = 4, M = 2 , N = 179 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.87250	1.39475	36.00	1354.57	.061

- -

EFFECT .. CATEGORY (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PERSUASM	93.46022	10353.2997	23.36506	28.05772	.83275	.505
CONTROLM	181.05035	13247.7439	45.26259	35.90174	1.26074	.285
INDEPENM	84.26264	6262.90395	21.06566	16.97264	1.24115	.293
OUTGOM	110.08879	17788.8824	27.52220	48.20835	.57090	.684
AFFILITM	63.81742	4676.63343	15.95436	12.67380	1.25885	.286
SOCCONFM	63.29975	14931.7655	15.82494	40.46549	.39107	.815
MODESTM	68.37354	10294.6735	17.09339	27.89884	.61269	.654
DEMOCRTM	149.91269	5780.42634	37.47817	15.66511	2.39246	.050
CARINGM	196.50541	5216.56779	49.12635	14.13704	3.47501	.008

- -

Appendix B-3.1 continued

Estimates for PERSUASM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.07624519	.59016	-.12919	.89727	-1.23674	1.08425
3	-.83387800	.59185	-1.40894	.15970	-1.99770	.32994
4	-.05243567	.64011	-.08192	.93476	-1.31117	1.20629
5	.914667509	.62239	1.46961	.14252	-.30921	2.13854

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.863384056	.30292	2.85023	.00461	.26772	1.45904

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.009473086	.59016	.01605	.98720	-1.15102	1.16997
8	.049292848	.59185	.08329	.93367	-1.11453	1.21311
9	-.43893961	.64011	-.68572	.49332	-1.69767	.81979
10	-.25326501	.62239	-.40692	.68430	-1.47714	.97061

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Estimates for CONTROLM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.70216040	.66757	-1.05181	.29358	-2.01489	.61057
3	-.98373651	.66949	-1.46939	.14258	-2.30023	.33275
4	.050299921	.72408	.06947	.94466	-1.37355	1.47415
5	.742184842	.70403	1.05419	.29249	-.64223	2.12660

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.581357930	.34265	1.69663	.09061	-.09244	1.25516

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.40992936	.66757	-.61406	.53956	-1.72266	.90280
8	-.80207458	.66949	-1.19804	.23167	-2.11856	.51442
9	.305864292	.72408	.42242	.67297	-1.11799	1.72971
10	-.35129841	.70403	-.49898	.61809	-1.73572	1.03312

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Estimates for INDEPENM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.292218074	.45900	.63663	.52476	-.61037	1.19481
3	-.79036419	.46032	-1.71699	.08682	-1.69554	.11481
4	-.20487187	.49786	-.41151	.68094	-1.18387	.77412
5	.787595058	.48407	1.62702	.10459	-.16429	1.73948

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.517510804	.23560	2.19658	.02867	.05423	.98080

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.49227271	.45900	-1.07248	.28421	-1.39487	.41032
8	-.43349996	.46032	-.94174	.34694	-1.33868	.47168
9	.555081788	.49786	1.11494	.26560	-.42391	1.53408
10	.106596338	.48407	.22021	.82583	-.84529	1.05848

Estimates for OUTGOM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.185765856	.77358	.24014	.81036	-1.33541	1.70694
3	-1.1370336	.77579	-1.46564	.14360	-2.66256	.38850
4	.303014533	.83906	.36114	.71820	-1.34692	1.95295
5	.137372999	.81582	.16839	.86637	-1.46687	1.74162

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.504907601	.39706	1.27161	.20431	-.27588	1.28570

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.376362240	.77358	.48652	.62689	-1.14481	1.89753
8	-.95868658	.77579	-1.23575	.21734	-2.48422	.56684
9	1.16916647	.83906	1.39343	.16433	-.48077	2.81910
10	-.15361792	.81582	-.18830	.85075	-1.75786	1.45063

Estimates for AFFILITM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.067635736	.39664	.17052	.86469	-.71232	.84759
3	-.77738900	.39778	-1.95434	.05142	-1.55958	.00480
4	.654514042	.43021	1.52137	.12902	-.19147	1.50049
5	-.08113411	.41830	-.19396	.84631	-.90369	.74142

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.22007571	.20359	-1.08099	.28041	-.62041	.18026

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.019123332	.39664	.04821	.96157	-.76083	.79908
8	-1.1764163	.39778	-2.95749	.00330	-1.95861	-.39422
9	.740446083	.43021	1.72111	.08607	-.10553	1.58643
10	.221464602	.41830	.52944	.59682	-.60109	1.04402

Estimates for SOCCONFM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.08034866	.70874	-.11337	.90980	-1.47402	1.31332
3	-.73886373	.71077	-1.03953	.29924	-2.13653	.65880
4	.384942349	.76873	.50075	.61684	-1.12670	1.89658
5	.570444995	.74744	.76320	.44583	-.89934	2.04023

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.858360032	.36378	2.35955	.01882	.14302	1.57370

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.006719333	.70874	.00948	.99244	-1.38695	1.40039
8	.144952223	.71077	.20394	.83851	-1.25271	1.54261
9	.552010338	.76873	.71808	.47316	-.95963	2.06365
10	.014655841	.74744	.01961	.98437	-1.45512	1.48444

Estimates for MODESTM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.70654156	.58848	-1.20061	.23067	-1.86375	.45066
3	.639128416	.59017	1.08295	.27954	-.52139	1.79965
4	-.29783786	.63830	-.46661	.64105	-1.55300	.95732
5	.238061612	.62062	.38358	.70151	-.98234	1.45846

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.71622487	.30206	-2.37115	.01825	-1.31020	-.12225

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.24155291	.58848	-.41047	.68170	-1.39876	.91565
8	.789320322	.59017	1.33744	.18190	-.37120	1.94984
9	-.57618254	.63830	-.90268	.36728	-1.83134	.67898
10	-.24171164	.62062	-.38947	.69716	-1.46211	.97869

Estimates for DEMOCRTM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.175201382	.44097	.39731	.69137	-.69193	1.04233
3	1.15800260	.44223	2.61853	.00919	.28839	2.02762
4	-.59329068	.47830	-1.24042	.21561	-1.53382	.34724
5	-.85592957	.46505	-1.84050	.06650	-1.77041	.05856

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.69474705	.22634	-3.06946	.00230	-1.13983	-.24967

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.476016891	.44097	1.07948	.28108	-.39111	1.34315
8	-.36833636	.44223	-.83290	.40544	-1.23795	.50128
9	.200858161	.47830	.41994	.67477	-.73967	1.14139
10	-.00178073	.46505	-.00383	.99695	-.91627	.91270

Estimates for CARINGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.765529121	.41891	1.82743	.06844	-.05822	1.58928
3	-1.1025235	.42011	-2.62436	.00904	-1.92864	-.27641
4	-.16820104	.45437	-.37018	.71146	-1.06168	.72528
5	-.47244707	.44179	-1.06940	.28559	-1.34119	.39629

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.73741429	.21502	-3.42953	.00067	-1.16023	-.31460

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.686144447	.41891	1.63793	.10229	-.13761	1.50990
8	-1.2632632	.42011	-3.00698	.00282	-2.08938	-.43715
9	-.14203016	.45437	-.31259	.75477	-1.03551	.75145
10	.009438097	.44179	.02136	.98297	-.85930	.87818

Appendix B-3.2 Multivariate Analysis of Variance of OPQ thinking style scales by 'category' and 'sex'

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

 EFFECT .. CATEGORY BY SEX
 Multivariate Tests of Significance (S = 4, M = 3 , N = 178 1/2)

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .88413    1.02260      44.00    1375.40       .432

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 EFFECT .. CATEGORY BY SEX (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 PRACTICM     89.64136 14196.9984   22.41034   38.47425     .58248       .676
 DATARATM     56.79507 17588.7191   14.19877   47.66591     .29788       .879
 ARTISTCM    214.13595 11488.0130   53.53399   31.13283    1.71954       .145
 BEHAVRLM    144.34158 5320.81768   36.08540   14.41956    2.50253       .042
 TRADITLM      9.93453 7094.30820    2.48363   19.22577     .12918       .972
 CHANGORM     22.27992 6236.72320    5.56998   16.90169     .32955       .858
 CONCEPTM     40.38853 6805.43692   10.09713   18.44292     .54748       .701
 INNOVATM     93.59244 10915.1594   23.39811   29.58038     .79100       .532
 FWDPLANM     17.93727 5256.41608    4.48432   14.24503     .31480       .868
 DETLCONM     81.23818 11933.7928   20.30954   32.34090     .62798       .643
 CONSCIEM      8.74337 10642.5702    2.18584   28.84165     .07579       .990

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 EFFECT .. SEX
 Multivariate Tests of Significance (S = 1, M = 4 1/2, N = 178 1/2)

 Test Name         Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .81878    7.22341      11.00     359.00       .000
 Note.. F statistics are exact.

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 EFFECT .. SEX (Cont.)
 Univariate F-tests with (1,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 PRACTICM    293.88299 14196.9984  293.88299   38.47425    7.63843       .006
 DATARATM    768.26228 17588.7191  768.26228   47.66591   16.11765       .000
 ARTISTCM    229.96269 11488.0130  229.96269   31.13283    7.38650       .007
 BEHAVRLM     94.93921 5320.81768   94.93921   14.41956    6.58406       .011
 TRADITLM       .13039 7094.30820     .13039   19.22577     .00678       .934
 CHANGORM      5.39450 6236.72320    5.39450   16.90169     .31917       .572
 CONCEPTM    172.06410 6805.43692  172.06410   18.44292    9.32955       .002
 INNOVATM    206.96026 10915.1594  206.96026   29.58038    6.99654       .009
 FWDPLANM     34.17676 5256.41608   34.17676   14.24503    2.39921       .122
 DETLCONM    181.28134 11933.7928  181.28134   32.34090    5.60533       .018
 CONSCIEM    395.80485 10642.5702  395.80485   28.84165   13.72338       .000

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 EFFECT .. CATEGORY
 Multivariate Tests of Significance (S = 4, M = 3 , N = 178 1/2)

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Wilks            .68447    3.25625      44.00    1375.40       .000

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 EFFECT .. CATEGORY (Cont.)
 Univariate F-tests with (4,369) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 PRACTICM    553.86738 14196.9984  138.46684   38.47425    3.59895       .007
 DATARATM   2234.88052 17588.7191  558.72013   47.66591   11.72159       .000
 ARTISTCM   1272.42494 11488.0130  318.10624   31.13283   10.21771       .000
 BEHAVRLM    285.50236 5320.81768   71.37559   14.41956    4.94991       .001
 TRADITLM    199.10252 7094.30820   49.77563   19.22577    2.58901       .037
 CHANGORM     42.50463 6236.72320   10.62616   16.90169     .62870       .642
 CONCEPTM     77.36616 6805.43692   19.34154   18.44292    1.04872       .382
 INNOVATM    154.05600 10915.1594   38.51400   29.58038    1.30201       .269
 FWDPLANM     77.31569 5256.41608   19.32892   14.24503    1.35689       .248
 DETLCONM    238.13423 11933.7928   59.53356   32.34090    1.84081       .120
 CONSCIEM    203.11678 10642.5702   50.77920   28.84165    1.76062       .136

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Appendix B-3.2 continued

Estimates for PRACTICM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-1.5121460	.69108	-2.18810	.02929	-2.87109	-.15320
3	2.37603269	.69306	3.42833	.00068	1.01319	3.73887
4	-.22166981	.74958	-.29573	.76761	-1.69565	1.25231
5	.058746860	.72882	.08061	.93580	-1.37441	1.49191

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.980358987	.35472	2.76377	.00600	.28284	1.67788

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.86194629	.69108	-1.24725	.21310	-2.22089	.49700
8	.729592834	.69306	1.05271	.29316	-.63325	2.09243
9	-.21591454	.74958	-.28805	.77347	-1.68989	1.25806
10	.191168791	.72882	.26230	.79324	-1.24199	1.62433

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Estimates for DATARATM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-3.7114360	.76921	-4.82498	.00000	-5.22403	-2.19885
3	4.38518596	.77142	5.68459	.00000	2.86826	5.90211
4	-1.1428116	.83433	-1.36974	.17160	-2.78344	.49782
5	.410270383	.81122	.50574	.61334	-1.18493	2.00547

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	1.58508539	.39482	4.01468	.00007	.80870	2.36147

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.05445047	.76921	-.07079	.94361	-1.56704	1.45814
8	-.09110767	.77142	-.11810	.90605	-1.60803	1.42582
9	.831951647	.83433	.99716	.31934	-.80868	2.47258
10	-.17020444	.81122	-.20981	.83393	-1.76540	1.42499

- -

Estimates for ARTISTCM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	3.18770601	.62166	5.12775	.00000	1.96527	4.41014
3	-2.7695827	.62344	-4.44243	.00001	-3.99552	-1.54364
4	.661727171	.67428	.98138	.32705	-.66419	1.98764
5	-1.1997543	.65561	-1.82999	.06806	-2.48895	.08944

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.86721463	.31909	-2.71781	.00688	-1.49467	-.23976

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	1.15911939	.62166	1.86456	.06304	-.06332	2.38156
8	-1.0370311	.62344	-1.66340	.09708	-2.26297	.18891
9	-.23685945	.67428	-.35128	.72558	-1.56277	1.08906
10	-.58834093	.65561	-.89740	.37009	-1.87754	.70086

Appendix B-3.2 continued

Estimates for BEHAVRLM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.077930103	.42308	.18420	.85396	-.75401	.90987
3	-1.6323211	.42429	-3.84720	.00014	-2.46665	-.79800
4	1.16631635	.45889	2.54161	.01144	.26395	2.06868
5	-.31982783	.44618	-.71681	.47394	-1.19720	.55755

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.55721233	.21716	-2.56594	.01068	-.98423	-.13019

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.226418682	.42308	.53517	.59285	-.60552	1.05836
8	-.50865638	.42429	-1.19885	.23136	-1.34298	.32567
9	.902582703	.45889	1.96689	.04995	.00022	1.80495
10	-1.0811805	.44618	-2.42319	.01587	-1.95856	-.20380

Estimates for TRADITLM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.09197628	.48852	-.18827	.85076	-1.05261	.86866
3	-.38536081	.48992	-.78658	.43203	-1.34875	.57803
4	.157282977	.52987	.29683	.76676	-.88467	1.19924
5	1.39201181	.51520	2.70188	.00721	.37891	2.40511

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.020649858	.25075	.08235	.93441	-.47243	.51373

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.304905697	.48852	.62414	.53292	-.65573	1.26554
8	.036561825	.48992	.07463	.94055	-.92683	.99995
9	-.09250171	.52987	-.17457	.86151	-1.13445	.94945
10	-.24158240	.51520	-.46891	.63941	-1.25468	.77152

Estimates for CHANGORM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.617892852	.45804	1.34898	.17817	-.28281	1.51860
3	.077944041	.45936	.16968	.86535	-.82534	.98123
4	-.49155159	.49682	-.98940	.32312	-1.46850	.48540
5	.045313487	.48306	.09381	.92532	-.90458	.99521

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.132823072	.23511	.56495	.57245	-.32949	.59514

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.374954706	.45804	.81860	.41354	-.52575	1.27566
8	-.13447920	.45936	-.29276	.76987	-1.03776	.76881
9	-.43226752	.49682	-.87007	.38483	-1.40922	.54468
10	.016978515	.48306	.03515	.97198	-.93292	.96687

Appendix B-3.2 continued

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Estimates for CONCEPTM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.592073602	.47847	1.23742	.21672	-.34880	1.53295
3	.003247947	.47984	.00677	.99460	-.94032	.94682
4	.373555083	.51897	.71979	.47211	-.64696	1.39407
5	-.90586291	.50460	-1.79520	.07344	-1.89812	.08640

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.750141235	.24559	3.05443	.00242	.26721	1.23308

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.226525432	.47847	.47343	.63618	-.71435	1.16740
8	.463499235	.47984	.96594	.33471	-.48007	1.40707
9	-.11977086	.51897	-.23078	.81761	-1.14029	.90075
10	.002239718	.50460	.00444	.99646	-.99002	.99450

- -

Estimates for INNOVATM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	1.29209344	.60596	2.13231	.03364	.10053	2.48366
3	-.76679373	.60770	-1.26180	.20782	-1.96178	.42819
4	-.21137217	.65725	-.32160	.74794	-1.50381	1.08106
5	-.08955339	.63905	-.14013	.88863	-1.34620	1.16709

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.822699795	.31103	2.64510	.00852	.21109	1.43431

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.287617665	.60596	.47465	.63532	-.90395	1.47919
8	.271548925	.60770	.44685	.65525	-.92343	1.46653
9	-.56473683	.65725	-.85924	.39077	-1.85717	.72770
10	-.73053710	.63905	-1.14316	.25372	-1.98718	.52611

- -

Estimates for FWDPLANM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.18489224	.42051	-.43969	.66042	-1.01178	.64200
3	-.57244849	.42171	-1.35744	.17547	-1.40171	.25681
4	-.32150600	.45610	-.70490	.48132	-1.21839	.57538
5	.899849820	.44347	2.02910	.04317	.02780	1.77190

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.33432078	.21584	-1.54894	.12225	-.75875	.09011

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.384638237	.42051	.91470	.36095	-.44225	1.21153
8	-.03115649	.42171	-.07388	.94115	-.86042	.79810
9	-.21419774	.45610	-.46963	.63890	-1.11109	.68269
10	-.28046097	.44347	-.63242	.52750	-1.15251	.59159

Estimates for DETLCONM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-1.2202512	.63360	-1.92589	.05489	-2.46618	.02568
3	-.56032609	.63542	-.88182	.37845	-1.80982	.68917
4	-.06607135	.68724	-.09614	.92346	-1.41747	1.28532
5	1.34385590	.66821	2.01114	.04504	.02988	2.65783

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-.76997116	.32522	-2.36756	.01842	-1.40948	-.13046

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.56939392	.63360	-.89866	.36942	-1.81532	.67653
8	-.55207039	.63542	-.86883	.38551	-1.80157	.69743
9	.148119309	.68724	.21553	.82947	-1.20328	1.49951
10	.809951320	.66821	1.21213	.22624	-.50402	2.12392

Estimates for CONSCIEM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.94291111	.59835	-1.57586	.11591	-2.11951	.23368
3	-.03129628	.60006	-.05216	.95843	-1.21126	1.14867
4	-.70510688	.64900	-1.08646	.27799	-1.98130	.57109
5	.413576982	.63102	.65541	.51261	-.82728	1.65443

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-1.1377280	.30712	-3.70451	.00024	-1.74165	-.53380

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.12433546	.59835	-.20780	.83550	-1.30093	1.05226
8	.090152005	.60006	.15024	.88066	-1.08981	1.27012
9	-.25764233	.64900	-.39699	.69161	-1.53384	1.01855
10	.065803433	.63102	.10428	.91700	-1.17505	1.30666

Appendix B-3.3 Multivariate Analysis of Variance of OPQ feelings and emotions scales by 'category' and 'sex'

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

EFFECT .. CATEGORY BY SEX
Multivariate Tests of Significance (S = 4, M = 2 1/2, N = 179)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.85422	1.44998	40.00	1366.93	.035

EFFECT .. CATEGORY BY SEX (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
RELAXEDM	451.88951	14638.5040	112.97238	39.67074	2.84775	.024
WORRYIGM	252.33850	8302.89441	63.08462	22.50107	2.80363	.026
TOUGHMDM	491.66090	13266.6973	122.91522	35.95311	3.41876	.009
EMOTCONM	291.96001	15526.0642	72.99000	42.07605	1.73472	.142
OPTIMISM	138.72811	11863.5005	34.68203	32.15041	1.07874	.367
CRITICLM	46.86750	4729.15548	11.71688	12.81614	.91423	.456
ACTIVEM	93.64673	13008.1487	23.41168	35.25244	.66412	.617
COMPETVM	170.01581	7255.01159	42.50395	19.66128	2.16181	.073
ACHIEVGM	42.27943	7998.61606	10.56986	21.67647	.48762	.745
DECISIVM	13.29194	10685.3799	3.32298	28.95767	.11475	.977

EFFECT .. SEX
Multivariate Tests of Significance (S = 1, M = 4 , N = 179)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Wilks	.78688	9.75032	10.00	360.00	.000

Note.. F statistics are exact.

EFFECT .. SEX (Cont.)
Univariate F-tests with (1,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
RELAXEDM	807.95010	14638.5040	807.95010	39.67074	20.36640	.000
WORRYIGM	496.53503	8302.89441	496.53503	22.50107	22.06718	.000
TOUGHMDM	1588.29381	13266.6973	1588.29381	35.95311	44.17681	.000
EMOTCONM	200.64549	15526.0642	200.64549	42.07605	4.76864	.030
OPTIMISM	30.41941	11863.5005	30.41941	32.15041	.94616	.331
CRITICLM	221.51355	4729.15548	221.51355	12.81614	17.28395	.000
ACTIVEM	506.86193	13008.1487	506.86193	35.25244	14.37807	.000
COMPETVM	363.84784	7255.01159	363.84784	19.66128	18.50581	.000
ACHIEVGM	79.53423	7998.61606	79.53423	21.67647	3.66915	.056
DECISIVM	438.22286	10685.3799	438.22286	28.95767	15.13322	.000

EFFECT .. CATEGORY
Multivariate Tests of Significance (S = 4, M = 2 1/2, N = 179)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.82772	1.74725	40.00	1366.93	.003

EFFECT .. CATEGORY (Cont.)
Univariate F-tests with (4,369) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
RELAXEDM	73.45357	14638.5040	18.36339	39.67074	.46290	.763
WORRYIGM	122.40782	8302.89441	30.60195	22.50107	1.36002	.247
TOUGHMDM	523.05673	13266.6973	130.76418	35.95311	3.63708	.006
EMOTCONM	134.72997	15526.0642	33.68249	42.07605	.80051	.525
OPTIMISM	277.07321	11863.5005	69.26830	32.15041	2.15451	.074
CRITICLM	175.07344	4729.15548	43.76836	12.81614	3.41510	.009
ACTIVEM	47.62953	13008.1487	11.90738	35.25244	.33777	.852
COMPETVM	151.04232	7255.01159	37.76058	19.66128	1.92056	.106
ACHIEVGM	75.83904	7998.61606	18.95976	21.67647	.87467	.479
DECISIVM	105.51397	10685.3799	26.37849	28.95767	.91093	.458

Estimates for RELAXEDM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.512929362	.70174	.73094	.46528	-.86699	1.89284
3	.393536752	.70375	.55920	.57637	-.99033	1.77741
4	.031791795	.76114	.04177	.96671	-1.46493	1.52851
5	-.89984842	.74007	-1.21590	.22480	-2.35512	.55543

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	1.62551199	.36019	4.51291	.00001	.91723	2.33380

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.567662618	.70174	.80893	.41907	-.81225	1.94758
8	1.44984182	.70375	2.06016	.04008	.06597	2.83371
9	-.77791939	.76114	-1.02204	.30743	-2.27464	.71880
10	.635202300	.74007	.85831	.39128	-.82007	2.09048

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Estimates for WORRYIGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.24247152	.52850	-.45879	.64665	-1.28172	.79678
3	-1.0810395	.53001	-2.03965	.04210	-2.12326	-.03882
4	.183877689	.57324	.32077	.74856	-.94334	1.31110
5	.556179277	.55736	.99788	.31899	-.53982	1.65218

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	-1.2743034	.27127	-4.69757	.00000	-1.80773	-.74088

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.64649022	.52850	-1.22326	.22201	-1.68574	.39276
8	-1.2038658	.53001	-2.27139	.02370	-2.24609	-.16164
9	.284303432	.57324	.49596	.62022	-.84291	1.41152
10	.217557400	.55736	.39033	.69651	-.87845	1.31356

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Estimates for TOUGHMDM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.016485081	.66805	.02468	.98033	-1.29718	1.33015
3	2.45256242	.66997	3.66072	.00029	1.13513	3.76999
4	-1.2575625	.72460	-1.73552	.08348	-2.68243	.16731
5	-.50071730	.70454	-.71070	.47772	-1.88613	.88469

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	2.27909972	.34290	6.64656	.00000	1.60482	2.95338

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.01782988	.66805	-.02669	.97872	-1.33150	1.29584
8	1.41293581	.66997	2.10897	.03562	.09550	2.73037
9	-.70409972	.72460	-.97171	.33183	-2.12897	.72077
10	1.22655504	.70454	1.74094	.08253	-.15885	2.61196

Estimates for EMOTCONM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.538769721	.72270	.74549	.45645	-.88236	1.95990
3	.878885434	.72477	1.21263	.22605	-.54632	2.30409
4	-.86498689	.78388	-1.10347	.27054	-2.40642	.67644
5	.063253848	.76217	.08299	.93390	-1.43549	1.56200

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.810051447	.37095	2.18372	.02961	.08061	1.53949

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.756297759	.72270	1.04649	.29602	-.66483	2.17743
8	1.47261943	.72477	2.03183	.04289	.04741	2.89782
9	-1.0952366	.78388	-1.39720	.16319	-2.63667	.44619
10	-.91699589	.76217	-1.20314	.22969	-2.41574	.58175

Estimates for OPTIMISM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	1.69268703	.63174	2.67942	.00770	.45043	2.93494
3	-1.0168252	.63355	-1.60497	.10935	-2.26264	.22899
4	-.45435001	.68521	-.66308	.50769	-1.80176	.89306
5	.152687030	.66624	.22918	.81886	-1.15741	1.46278

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.315408447	.32426	.97271	.33134	-.32222	.95303

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	1.22236933	.63174	1.93494	.05376	-.01988	2.46462
8	-.40145181	.63355	-.63366	.52670	-1.64726	.84436
9	.045332294	.68521	.06616	.94729	-1.30208	1.39274
10	-.23763067	.66624	-.35668	.72154	-1.54773	1.07247

Estimates for CRITICLM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.11745120	.39886	-.29447	.76857	-.90178	.66687
3	-1.3598795	.40000	-3.39967	.00075	-2.14645	-.57331
4	.537046151	.43262	1.24137	.21526	-.31367	1.38776
5	.816655939	.42064	1.94145	.05297	-.01050	1.64381

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.851134220	.20473	4.15740	.00004	.44855	1.25371

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.11970565	.39886	-.30012	.76425	-.90403	.66462
8	-.47075180	.40000	-1.17687	.24001	-1.25732	.31582
9	.351458373	.43262	.81239	.41709	-.49926	1.20217
10	-.30083660	.42064	-.71518	.47495	-1.12799	.52632

Appendix B-3.3 continued

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Estimates for ACTIVEM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.56739120	.66151	-.85772	.39160	-1.86819	.73341
3	.218034872	.66341	.32866	.74260	-1.08650	1.52257
4	.277238425	.71751	.38639	.69943	-1.13368	1.68815
5	.433303240	.69764	.62110	.53492	-.93854	1.80515

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	1.28748668	.33954	3.79184	.00017	.61981	1.95517

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	.529179986	.66151	.79996	.42425	-.77162	1.82998
8	-.65748066	.66341	-.99107	.32230	-1.96201	.64705
9	.749365171	.71751	1.04440	.29698	-.66155	2.16028
10	-.54790335	.69764	-.78537	.43274	-1.91975	.82394

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Estimates for COMPETVM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.18842243	.49402	-.38140	.70312	-1.15988	.78303
3	-.59850717	.49544	-1.20803	.22781	-1.57275	.37573
4	.457212494	.53584	.85326	.39407	-.59648	1.51090
5	1.12590297	.52100	2.16103	.03134	.10139	2.15041

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	1.09083185	.25357	4.30184	.00002	.59220	1.58946

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.04257788	.49402	-.08619	.93137	-1.01403	.92888
8	.184085345	.49544	.37156	.71043	-.79015	1.15832
9	1.15305704	.53584	2.15186	.03206	.09937	2.20675
10	-1.3073001	.52100	-2.50919	.01253	-2.33181	-.28279

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Estimates for ACHIEVGM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.172320026	.51872	.33220	.73993	-.84771	1.19235
3	-.86891798	.52021	-1.67032	.09570	-1.89187	.15403
4	.137954946	.56263	.24520	.80644	-.96842	1.24433
5	.641228756	.54705	1.17215	.24189	-.43450	1.71696

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	.510005594	.26625	1.91550	.05620	-.01356	1.03357

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.26619607	.51872	-.51317	.60814	-1.28622	.75383
8	.344706842	.52021	.66263	.50798	-.67824	1.36766
9	.081661072	.56263	.14514	.88468	-1.02471	1.18803
10	-.56744607	.54705	-1.03728	.30029	-1.64318	.50829

Appendix B-3.3 continued

Estimates for DECISIVM
--- Individual univariate .9500 confidence intervals

CATEGORY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.27437602	.59955	-.45764	.64748	-1.45334	.90458
3	.042002012	.60127	.06986	.94435	-1.14034	1.22434
4	-.33538131	.65030	-.51573	.60635	-1.61414	.94338
5	1.13223113	.63229	1.79068	.07416	-.11111	2.37558

SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
6	1.19714131	.30774	3.89014	.00012	.59200	1.80228

CATEGORY BY SEX

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
7	-.02872862	.59955	-.04792	.96181	-1.20769	1.15023
8	.325969194	.60127	.54214	.58805	-.85637	1.50831
9	.089154981	.65030	.13710	.89103	-1.18960	1.36791
10	-.31132782	.63229	-.49238	.62274	-1.55467	.93202

Appendix B-4.1 Multivariate Analysis of Variance of OPQ relationships with people scales by 'maturity'

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 3 1/2, N = 183 1/2)

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks             .91702    3.71018       9.00     369.00       .000
 Note.. F statistics are exact.

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 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 PERSUASM     49.30132 10713.0237   49.30132   28.41651    1.73495       .189
 CONTROLM     81.48960 13565.1601   81.48960   35.98186    2.26474       .133
 INDEPENM      4.53783 6498.79565    4.53783   17.23818     .26324       .608
 OUTGOM         .00022 18108.3664     .00022   48.03280     .00000       .998
 AFFILITM    203.06261 4649.70652  203.06261   12.33344   16.46439       .000
 SOCCONFM      4.17096 15257.0404    4.17096   40.46960     .10306       .748
 MODESTM      42.98300 10495.1860   42.98300   27.83869    1.54400       .215
 DEMOCRTM    137.51808 6006.50816  137.51808   15.93238    8.63136       .004
 CARINGM      95.29942 5609.58067   95.29942   14.87952    6.40474       .012

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 Estimates for PERSUASM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .537481962     .40806    1.31718     .18858    -.26487    1.33983

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 Estimates for CONTROLM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .691012162     .45917    1.50491     .13319    -.21185    1.59387

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for INDEPENM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .163064317     .31782     .51307     .60820    -.46186     .78799

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for OUTGOM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  -.00113894     .53052    -.00215     .99829   -1.04429    1.04201

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-4.1 continued

```
Estimates for AFFILITM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   1.09081117     .26883    4.05763     .00006     .56222    1.61940

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for SOCCONFM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   -.15633375     .48697    -.32104     .74836   -1.11384     .80118

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for MODESTM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   -.50186044     .40389   -1.24258     .21480   -1.29601     .29229

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for DEMOCRTM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .897665430     .30554    2.93792     .00351     .29688    1.49845

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for CARINGM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .747273758     .29528    2.53076     .01179     .16668    1.32787

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-4.2 Multivariate Analysis of Variance of OPQ thinking style scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 4 1/2, N = 182 1/2)

 Test Name         Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .95897    1.42766      11.00     367.00       .158
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

 PRACTICM     20.84551 15164.5997   20.84551   40.22440     .51823       .472
 DATARATM    137.97637 21442.0373  137.97637   56.87543    2.42594       .120
 ARTISTCM      6.65405 13243.5924    6.65405   35.12889     .18942       .664
 BEHAVRLM     29.88033 5782.41254   29.88033   15.33796    1.94813       .164
 TRADITLM       .20226 7341.52539     .20226   19.47354     .01039       .919
 CHANGORM     13.46891 6284.74745   13.46891   16.67042     .80795       .369
 CONCEPTM      9.00679 7063.75120    9.00679   18.73674     .48070       .489
 INNOVATM     51.35883 11355.7883   51.35883   30.12145    1.70506       .192
 FWDPLANM       .56249 5391.67732     .56249   14.30153     .03933       .843
 DETLCONM      2.10828 12373.3048    2.10828   32.82044     .06424       .800
 CONSCIEM       .39837 11248.8911     .39837   29.83791     .01335       .908

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for PRACTICM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   -.34949495     .48549    -.71988     .47204   -1.30410     .60511

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for DATARATM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .899159967     .57729    1.55754     .12018    -.23596    2.03428

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for ARTISTCM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .197459287     .45370     .43522     .66365    -.69464    1.08955

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for BEHAVRLM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter     Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2   .418434343     .29979    1.39575     .16361    -.17104    1.00791

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

Appendix B-4.2 continued

Estimates for TRADITLM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.034425892	.33780	.10191	.91888	-.62978	.69863

- -

Estimates for CHANGORM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.280931767	.31254	.89886	.36930	-.33361	.89547

- -

Estimates for CONCEPTM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.22973098	.33135	-.69333	.48853	-.88125	.42179

- -

Estimates for INNOVATM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.548582766	.42012	1.30578	.19242	-.27749	1.37465

- -

Estimates for FWDPLANM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.057410843	.28948	.19832	.84290	-.51180	.62662

- -

Estimates for DETLCONM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.11114719	.43854	-.25345	.80006	-.97343	.75114

- -

Estimates for CONSCIEM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.04831478	.41814	-.11555	.90807	-.87049	.77386

- -

Appendix B-4.3 Multivariate Analysis of Variance of OPQ Feelings and emotions scales by 'maturity'

```
* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

 EFFECT .. MATURITY
 Multivariate Tests of Significance (S = 1, M = 4 , N = 183 )

 Test Name         Value    Exact F Hypoth. DF   Error DF  Sig. of F

 Wilks            .95286    1.82075     10.00     368.00       .056
 Note.. F statistics are exact.

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EFFECT .. MATURITY (Cont.)
 Univariate F-tests with (1,377) D. F.

 Variable   Hypoth. SS    Error SS Hypoth. MS   Error MS          F  Sig. of F

 RELAXEDM     5.72285 15977.3957    5.72285   42.38036     .13504       .713
 WORRYIGM    30.22209 9124.68820   30.22209   24.20342    1.24867       .265
 TOUGHMDM    37.53536 15839.8493   37.53536   42.01552     .89337       .345
 EMOTCONM     5.96567 16135.8917    5.96567   42.80077     .13938       .709
 OPTIMISM   101.36459 12092.6329  101.36459   32.07595    3.16014       .076
 CRITICLM     2.62363 5155.51254    2.62363   13.67510     .19185       .662
 ACTIVEM    188.95098 13594.2487  188.95098   36.05902    5.24005       .023
 COMPETVM     9.42658 8013.16078    9.42658   21.25507     .44350       .506
 ACHIEVGM      .32663 8231.40277     .32663   21.83396     .01496       .903
 DECISIVM    53.25480 11282.6341   53.25480   29.92741    1.77947       .183

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for RELAXEDM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .183122037     .49833     .36747     .71347    -.79673    1.16298

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for WORRYIGM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .420820449     .37659    1.11744     .26452    -.31967    1.16131

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for TOUGHMDM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  -.46898062     .49618    -.94518     .34517   -1.44461     .50665

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Estimates for EMOTCONM
 --- Individual univariate .9500 confidence intervals

 MATURITY

  Parameter      Coeff.  Std. Err.    t-Value     Sig. t Lower -95%  CL- Upper

        2  .186966605     .50080     .37334     .70911    -.79774    1.17167
```

Appendix B-4.3 continued

Estimates for OPTIMISM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.770686456	.43354	1.77768	.07626	-.08176	1.62314

- -

Estimates for CRITICLM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.12398990	.28307	-.43801	.66163	-.68059	.43261

- -

Estimates for ACTIVEM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	1.05222635	.45967	2.28912	.02262	.14840	1.95605

- -

Estimates for COMPETVM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.23502371	.35291	-.66596	.50585	-.92895	.45890

- -

Estimates for ACHIEVGM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	.043748712	.35769	.12231	.90272	-.65956	.74706

- -

Estimates for DECISIVM
--- Individual univariate .9500 confidence intervals

MATURITY

Parameter	Coeff.	Std. Err.	t-Value	Sig. t	Lower -95%	CL- Upper
2	-.55861678	.41876	-1.33397	.18302	-1.38202	.26479

- -

Appendix B-5.1 - Homogeneity-of-variance tests for multivariate category x gender ANOVA

Univariate Homogeneity of Variance Tests for 'meaning orientation' ASI subscales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Deep approach	0.14863	0.217	1.67893	0.088
Relating ideas	0.14923	0.206	1.12549	0.340
Use of evidence	0.14406	0.320	1.17707	0.305
Intrinsic motivation	0.15376	0.138	0.82615	0.592

Multivariate Tests for Homogeneity of Dispersion Matrices for 'meaning orientation' ASI subscales

Box's M	115.92952	
F with (90,54583) DF	1.21675	P=0.080 (approx)
Chi-square with 90 DF	109.69893	P=0.078 (approx.)

Univariate Homogeneity of Variance Tests for 'reproducing orientation' ASI subscales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Surface approach	0.14315	0.345	0.77702	0.638
Syllabus-boundness	0.14466	0.305	0.93903	0.489
Fear of failure	0.14015	0.362	1.63816	0.098
Extrinsic motivation	0.14837	0.222	1.93413	0.103

Multivariate Tests for Homogeneity of Dispersion Matrices for 'reproducing orientation' ASI subscales

Box's M	121.77511	
F with (90,54583) DF	1.17811	P=0.081 (approx.)
Chi-square with 90 DF	105.69893	P=0.084 (approx.)

Univariate Homogeneity of Variance Tests for 'achievement orientation' ASI subscales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Strategic approach	0.14484	0.300	1.62625	0.101
Disorg. study methods	0.14410	0.319	1.19828	0.291
Neg. attitudes to study	0.15942	0.086	1.85151	0.094
Achievement motivation	0.14076	0.418	0.90465	0.520

Multivariate Tests for Homogeneity of Dispersion Matrices for 'achieving orientation' ASI subscales

Box's M	152.93346	
F with (90,54583) DF	1.16513	P=0.141 (approx.)
Chi-square with 90 DF	103.71411	P=0.104 (approx.)

Univariate Homogeneity of Variance Tests for 'styles and pathologies of learning' ASI subscales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Comprehension learning	0.11331	1.000	0.35205	0.957
Globetrotting	0.15674	0.105	0.68805	0.720
Operation learning	0.16922	0.310	1.51955	0.104
Improvidence	0.14298	0.350	0.82991	0.588

Multivariate Tests for Homogeneity of Dispersion Matrices for 'styles and pathologies of learning' ASI subscales

Box's M	107.94142	
F with (90,54583) DF	1.13291	P=0.183 (approx.)
Chi-square with 90 DF	102.14015	P=0.180 (approx.)

Appendix B-5.2 - Homogeneity-of-variance tests for multivariate category x gender ANOVA

Univariate Homogeniety of Variance Tests for 'relationships with people' OPQ scales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Persuasive	0.15671	0.088	0.77307	0.641
Controlling	0.14064	0.422	1.08872	0.367
Independent	0.13466	0.668	0.74932	0.664
Outgoing	0.13781	0.527	0.64762	0.757
Affiliative	0.15658	0.091	1.55055	0.124
Socially confident	0.15090	0.178	0.7712	0.643
Modest	0.15030	0.182	1.09269	0.364
Democratic	0.14149	0.253	1.64199	0.102
Caring	0.14982	0.212	1.75638	0.091

Multivariate Tests for Homogeneity of Dispersion Matrices for 'relationships with people' OPQ scales

Box's M	523.73711	
F with (405,47556) DF	1.03023	P=0.089 (approx)
Chi-square with 90 DF	462.20415	P=0.076 (approx.)

Univariate Homogeniety of Variance Tests for 'thinking style' OPQ scales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Practical	0.15386	0.137	0.71197	0.698
Data rational	0.12317	1.000	0.52843	0.855
Artistic	0.15081	0.180	1.42967	0.143
Behavioural	0.15762	0.095	1.67465	0.086
Traditional	0.13026	0.917	0.64162	0.762
Change oriented	0.15508	0.122	1.11408	0.348
Conceptual	0.15828	0.091	1.67153	0.090
Innovative	0.13451	0.676	0.58614	0.810
Forward planning	0.15865	0.090	1.53099	0.130
Detail conscious	0.13720	0.552	0.50789	0.870
Conscientious	0.15792	0.091	1.25249	0.257

Multivariate Tests for Homogeneity of Dispersion Matrices for 'thinking style' OPQ scales

Box's M	592.87034	
F with (594,47030) DF	1.00747	P=0.096 (approx)
Chi-square with 90 DF	482.73244	P=0.084 (approx.)

Univariate Homogeniety of Variance Tests for 'feelings and emotions' OPQ scales

	Cochran's C (37,10)	P (approx.)	Bartlett-Box F(9,70414)	P
Relaxed	0.13388	0.708	0.74135	0.671
Worrying	0.15716	0.103	0.95426	0.476
Tough-minded	0.16139	0.063	1.11696	0.346
Emotional control	0.11441	1.000	0.24323	0.988
Optimistic	0.16275	0.062	1.74910	0.072
Critical	0.16195	0.064	1.15475	0.320
Active	0.1344	0.681	0.42420	0.923
Competitive	0.15928	0.082	1.65248	0.078
Achieving	0.15907	0.084	0.86069	0.560
Decisive	0.14991	0.194	1.41760	0.174

Multivariate Tests for Homogeneity of Dispersion Matrices for 'feelings and emotions' OPQ scales

Box's M	642.05861	
F with (495,47253) DF	1.11475	P=0.070 (approx)
Chi-square with 90 DF	502.52638	P=0.065 (approx.)

Appendix B-5.3 - Homogeneity-of-variance tests for multivariate maturity x gender ANOVA

Univariate Homogeniety of Variance Tests for 'meaning orientation' ASI subscales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Deep approach	0.32148	0.060	0.56001	0.641
Relating ideas	0.46544	0.000*	4.08196	0.007*
Use of evidence	0.32277	0.054	0.78414	0.503
Intrinsic motivation	0.32752	0.038*	2.28680	0.077

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'meaning orientation' ASI subscales

Box's M	57.41703	
F with (30,14495) DF	1.81447	P=0.004* (approx)
Chi-square with 30 DF	54.55301	P=0.004* (approx.)

Univariate Homogeniety of Variance Tests for 'reproducing orientation' ASI subscales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Surface approach	0.26555	1.000	0.27193	0.846
Syllabus-boundness	0.34922	0.006*	2.97498	0.031*
Fear of failure	0.27990	0.684	0.26132	0.853
Extrinsic motivation	0.38944	0.000*	5.18704	0.001*

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'reproducing orientation' ASI subscales

Box's M	51.77389	
F with (30,14495)	1.63614	P=0.016* (approx.)
Chi-square with 30F	49.19136	P=0.015* (approx.)

Univariate Homogeniety of Variance Tests for 'achievement orientation' ASI subscales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Strategic approach	0.34060	0.013*	3.54984	0.014*
Disorg. study methods	0.39870	0.000*	3.39809	0.017*
Neg. attitudes to study	0.30793	0.150	1.28045	0.279
Achievement motivation	0.33656	0.019*	1.65840	0.174

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'achieving orientation' ASI subscales

Box's M	38.74061	
F with (30,14495) DF	1.22427	P=0.186 (approx.)
Chi-square with 30 DF	36.80819	P=0.183 (approx.)

Univariate Homogeniety of Variance Tests for 'styles and pathologies of learning' ASI subscales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Comprehension learning	0.27982	0.686	0.45928	0.711
Globetrotting	0.30262	0.208	1.24366	0.292
Operation learning	0.31231	0.113	1.17748	0.317
Improvidence	0.27336	0.904	0.16985	0.917

Multivariate Tests for Homogeneity of Dispersion Matrices for 'styles and pathologies of learning' ASI subscales

Box's M	25.10354	
F with (30,14495) DF	0.79331	P=0.781 (approx.)
Chi-square with 30 DF	23.85136	P=0.779 (approx.)

Appendix B-5.4 - Homogeneity-of-variance tests for multivariate maturity x gender ANOVA

Univariate Homogeniety of Variance Tests for 'relationships with people' OPQ scales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Persuasive	0.37375	0.001*	1.67389	0.171
Controlling	0.32416	0.049*	0.59558	0.618
Independent	0.30083	0.232	2.17164	0.089
Outgoing	0.32274	0.055	0.66891	0.571
Affiliative	0.40105	0.000*	2.40096	0.066
Socially confident	0.39566	0.000*	2.44217	0.063
Modest	0.31724	0.081	0.43140	0.731
Democratic	0.29765	0.278	3.64702	0.012*
Caring	0.34611	0.008*	3.52985	0.014*

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'relationships with people' OPQ scales

Box's M	170.46108	
F with (135,12379) DF	1.11122	P=0.180 (approx.)
Chi-square with 135 DF	151.87364	P=0.152 (approx.)

Univariate Homogeniety of Variance Tests for 'thinking style' OPQ scales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Practical	0.29574	0.310	1.35268	0.256
Data rational	0.30190	0.217	0.48690	0.691
Artistic	0.41427	0.000*	5.28383	0.001*
Behavioural	0.37156	0.001*	4.56799	0.003*
Traditional	0.27801	0.743	0.29113	0.832
Change oriented	0.26018	1.000	0.03496	0.991
Conceptual	0.34765	0.007*	0.99642	0.394
Innovative	0.32327	0.053	0.72889	0.535
Forward planning	0.32831	0.036*	1.61835	0.183
Detail conscious	0.29963	0.248	1.00093	0.391
Conscientious	0.34345	0.010*	2.13929	0.093

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'thinking style' OPQ scales

Box's M	303.40459	
F with (198,12214) DF	1.30457	P=0.003* (approx)
Chi-square with 198 DF	263.22294	P=0.001* (approx.)

Univariate Homogeniety of Variance Tests for 'feelings and emotions' OPQ scales

	Cochran's C (94,4)	P (approx.)	Bartlett-Box F(3,37157)	P
Relaxed	0.27611	0.807	0.17309	0.915
Worrying	0.29910	0.256	1.28445	0.278
Tough-minded	0.34442	0.010*	1.96147	0.118
Emotional control	0.28711	0.487	0.38812	0.762
Optimistic	0.34996	0.006	1.60534	0.186
Critical	0.33929	0.015*	1.73013	0.159
Active	0.27430	0.870	0.22811	0.877
Competitive	0.34053	0.013*	2.34157	0.071
Achieving	0.26613	1.000	0.07531	0.973
Decisive	0.32549	0.045*	1.29765	0.274

* p < 0.05

Multivariate Tests for Homogeneity of Dispersion Matrices for 'feelings and emotions' OPQ scales

Box's M	212.56450	
F with (165,12284) DF	1.11541	P=0.149 (approx)
Chi-square with 165 DF	186.89781	P=0.117 (approx.)

Appendix B-5.5 - Test Homogeneity-of-variance tests for multivariate category x maturity x gender analysis of variance

Univariate Homogeniety of Variance Tests for 'relationships with people' OPQ scales

	Cochran's C (18,20)	P (approx.)	Bartlett-Box F(3,37157)	P
Persuasive	0.11944	0.010*	-	-
Controlling	0.16256	0.000**	-	-
Independent	0.16317	0.000**	-	-
Outgoing	0.09776	0.141	-	-
Affiliative	0.20949	0.000**	-	-
Socially confident	0.17529	0.000**	-	-
Modest	0.12568	0.004**	-	-
Democratic	0.14378	0.000**	-	-
Caring	0.19896	0.000**	-	-

* p < 0.05 ** p < 0.01

NB, Since 2 cells contained only one observation, the Bartlett-Box test could not be performed. The celles were omitted from the Cochran test.

Multivariate Tests for Homogeneity of Dispersion Matrices for 'relationships with people' OPQ scales

Box's M	610.39371		
F with (450,22547) DF	1.10512	P=0.016*	(approx.)
Chi-square with 135 DF	509.48804	P=0.020*	(approx.)

* p < 0.05

Appendix C-1.1 Means of ASI scales according to gender and maturity status

	Sex		Maturity	
	Male	Female	21 or under (Non-mature)	22 or over (Mature)
	Mean	Mean	Mean	Mean
Deep approach 1	10.85	10.53	10.53	11.27
Deep approach 2	10.89	10.47	10.51	11.19
Deep approach 3	11.53	10.73	10.86	11.53
Relating ideas 1	10.61	10.41	10.32	11.48
Relating ideas 2	10.88	10.84	10.81	11.17
Relating ideas 3	10.86	11.22	11.09	11.29
Use of evidence 1	9.68	9.25	9.41	9.17
Use of evidence 2	10.36	9.44	9.71	9.50
Use of evidence 3	10.78	10.32	10.59	9.47
Intrinsic motivation 1	8.94	9.42	9.05	10.79
Intrinsic motivation 2	9.00	9.07	8.89	10.25
Intrinsic motivation 3	9.92	9.52	9.42	11.00
Surface approach 1	12.99	13.52	13.48	12.60
Surface approach 2	13.25	13.02	13.15	12.56
Surface approach 3	12.92	12.86	12.91	12.65
Syllabus boundness 1	7.40	7.45	7.48	7.12
Syllabus boundness 2	7.60	7.18	7.39	6.58
Syllabus boundness 3	6.92	7.18	7.18	6.65
Fear of failure 1	4.28	5.72	5.22	5.79
Fear of failure 2	4.49	5.81	5.42	5.64
Fear of failure 3	4.11	5.70	5.25	5.24
Extrinsic motivation 1	6.99	5.94	6.23	6.42
Extrinsic motivation 2	6.78	6.02	6.32	5.47
Extrinsic motivation 3	5.97	5.17	5.54	4.47
Strategic approach 1	10.66	10.80	10.76	10.77
Strategic approach 2	11.04	11.30	11.25	11.03
Strategic approach 3	11.39	11.63	11.62	11.18
Disorganized study methods 1	9.05	8.64	8.82	8.40
Disorganized study methods 2	8.91	8.71	8.72	9.08
Disorganized study methods 3	8.58	8.51	8.67	7.59
Negative attitudes to study 1	5.37	5.03	5.21	4.58
Negative attitudes to study 2	5.27	4.70	4.92	4.36
Negative attitudes to study 3	4.33	4.02	4.12	4.06
Acheivement motivation 1	9.35	8.79	8.93	9.08
Achievement motivation 2	9.04	8.87	8.97	8.47
Achievement motivation 3	9.03	8.79	8.91	8.53
Comprehension learning 1	10.44	9.59	9.87	9.67
Comprehension learning 2	10.04	9.20	9.39	9.69
Comprehension learning 3	10.94	9.15	9.71	9.29
Globetrotting 1	7.76	7.83	7.85	7.56
Globetrotting 2	8.00	7.59	7.76	7.31
Globetrotting 3	7.25	6.58	6.93	5.71
Operation learning 1	9.18	9.92	9.75	9.35
Operation learning 2	9.67	9.59	9.70	8.97
Operation learning 3	9.33	9.77	9.79	8.71
Improvidence 1	7.09	7.56	7.47	7.10
Improvidence 2	7.02	7.40	7.38	6.64
Improvidence 3	6.69	7.13	7.05	6.71

Appendix C-1.2 Means of ASI scales according to subject category

	Category of Study				
	Arts	Science	Broad-based	Vocational	Social science
	Mean	Mean	Mean	Mean	Mean
Deep approach 1	10.64	10.23	10.43	11.00	10.84
Deep approach 2	10.66	10.18	10.40	10.87	10.82
Deep approach 3	11.21	10.62	10.64	11.67	11.03
Relating ideas 1	10.18	10.26	11.01	10.42	10.58
Relating ideas 2	10.77	10.49	11.10	10.62	11.17
Relating ideas 3	10.75	10.12	11.71	11.67	11.42
Use of evidence 1	8.98	9.68	8.94	10.15	9.40
Use of evidence 2	9.32	9.56	9.21	10.71	9.96
Use of evidence 3	9.92	10.27	10.71	11.83	10.26
Intrinsic motivation 1	9.38	9.32	9.24	9.24	9.19
Intrinsic motivation 2	8.96	9.26	8.76	9.07	9.21
Intrinsic motivation 3	9.58	10.35	9.32	8.92	9.63
Surface approach 1	12.91	14.14	13.93	12.75	13.28
Surface approach 2	11.84	14.19	13.93	13.71	12.52
Surface approach 3	12.38	14.15	12.86	12.83	12.34
Syllabus boundness 1	7.00	7.79	7.95	7.03	7.54
Syllabus boundness 2	6.64	7.79	7.93	7.51	6.99
Syllabus boundness 3	6.63	6.79	7.46	7.92	7.16
Fear of failure 1	5.44	5.03	5.99	4.97	5.01
Fear of failure 2	5.39	5.42	5.64	5.33	5.46
Fear of failure 3	4.79	5.69	5.46	3.83	5.53
Extrinsic motivation 1	5.50	6.08	5.90	7.95	6.34
Extrinsic motivation 2	5.91	6.00	5.22	8.58	6.08
Extrinsic motivation 3	4.25	5.46	5.54	7.50	5.32
Strategic approach 1	10.36	10.67	11.13	10.66	11.06
Strategic approach 2	10.65	10.96	11.59	11.64	11.54
Strategic approach 3	11.08	11.23	11.96	11.83	11.71
Disorganized Study Methods 1	9.29	8.61	9.07	8.68	8.05
Disorganized Study Methods 2	8.98	8.63	9.24	9.02	8.08
Disorganized study methods 3	9.13	9.62	7.70	8.67	7.95
Negative attitudes to study 1	5.10	5.53	5.76	4.10	5.06
Negative attitudes to study 2	4.98	5.23	4.91	4.33	4.70
Negative attitudes to study 3	4.67	4.08	3.81	3.17	4.29
Achievement motivation 1	8.49	8.80	8.78	10.53	8.63
Achievement motivation 2	8.79	8.42	9.22	9.69	8.72
Achievement motivation 3	9.00	9.08	8.78	10.00	8.32
Comprehension learning 1	10.11	9.82	9.75	10.08	9.45
Comprehension learning 2	9.62	9.81	9.34	9.53	8.92
Comprehension learning 3	10.67	9.96	9.79	9.17	8.87
Globetrotting 1	7.66	8.82	7.69	7.69	7.35
Globetrotting 2	7.60	8.16	7.79	8.09	7.14
Globetrotting 3	6.29	7.92	6.29	7.17	6.50
Operation learning 1	9.19	9.68	10.06	9.81	9.94
Operation learning 2	9.11	10.02	9.62	9.69	9.82
Operation learning 3	8.88	9.81	9.86	9.25	10.00
Improvidence 1	6.91	8.02	7.52	7.41	7.49
Improvidence 2	6.63	7.42	7.60	7.96	7.28
Improvidence 3	6.25	7.73	6.86	7.25	7.03

Appendix C-1.3 Means of OPQ relationships with people scales according to subject category

	Category of Study				
	Arts	Science	Broad-based	Vocational	Social science
	Mean	Mean	Mean	Mean	Mean
Persuasive1	22.45	22.27	23.03	23.98	22.48
Persuasive2	22.49	22.39	22.88	23.57	22.38
Persuasive3	22.77	21.88	23.07	26.42	21.71
Controlling1	22.90	22.38	23.10	24.76	23.65
Controlling2	23.41	24.16	24.28	24.48	24.59
Controlling3	23.82	25.08	25.14	27.00	23.61
Independent1	26.81	25.41	25.66	27.10	26.01
Independent2	26.79	26.02	25.97	26.83	26.18
Independent3	25.73	27.38	24.89	28.25	26.18
Outgoing1	21.35	20.97	21.57	21.92	22.63
Outgoing2	22.06	21.58	22.03	22.28	22.62
Outgoing3	24.59	21.77	21.11	23.67	22.61
Affiliative1	28.50	27.95	28.84	28.37	28.75
Affiliative2	28.64	28.25	29.14	28.70	28.59
Affiliative3	29.05	27.31	28.71	27.08	28.50
Socially confident1	20.89	20.42	21.39	21.56	21.34
Socially confident2	21.46	21.75	21.31	22.67	21.66
Socially confident3	23.00	21.77	21.64	25.17	21.24
Modest1	17.80	17.88	18.49	18.53	18.76
Modest2	17.70	18.98	16.81	18.24	17.31
Modest3	16.27	17.65	17.82	17.58	18.16
Democratic1	23.92	25.09	23.61	23.15	24.41
Democratic2	24.77	25.51	23.71	23.52	24.79
Democratic3	25.55	25.08	24.75	22.75	24.50
Caring1	29.26	27.92	29.18	28.24	29.54
Caring2	29.17	27.88	28.67	28.17	29.34
Caring3	28.91	26.00	28.21	28.50	29.68

Appendix C-1.4 Means of OPQ thinking style scales according to subject category

	Category of Study				
	Arts	Science	Broad-based	Vocational	Social science
	Mean	Mean	Mean	Mean	Mean
Practical1	20.30	23.67	21.39	21.69	20.25
Practical2	20.57	24.14	21.41	21.48	20.51
Practical3	21.32	26.04	20.86	23.42	21.82
Data rational1	13.92	22.86	16.61	18.98	17.45
Data rational2	13.89	22.89	16.74	18.83	18.07
Data rational3	14.23	25.50	17.07	20.42	18.92
Artistic1	28.14	22.97	26.66	24.24	25.56
Artistic2	28.84	23.46	26.45	24.37	25.59
Artistic3	27.95	24.50	25.93	24.08	25.39
Behavioural1	28.97	27.52	29.93	28.69	29.38
Behavioural2	29.26	27.61	30.21	29.33	29.93
Behavioural3	29.27	25.85	29.71	30.83	31.29
Traditional1	18.19	18.17	18.87	20.41	17.74
Traditional2	18.44	18.35	18.76	19.98	17.70
Traditional3	19.45	19.42	19.79	19.67	18.34
Change oriented1	25.59	25.70	25.12	25.49	25.33
Change oriented2	25.68	25.61	24.86	25.50	24.85
Change oriented3	26.32	25.96	24.21	26.08	24.16
Conceptual1	24.61	24.26	24.27	23.61	24.31
Conceptual2	24.69	24.67	25.40	23.48	24.80
Conceptual3	24.59	25.92	24.50	24.58	25.03
Innovative1	23.84	21.94	22.37	23.32	22.65
Innovative2	24.12	22.58	23.14	22.87	21.79
Innovative3	24.45	23.08	24.11	22.83	21.32
Forward planning1	22.09	21.98	22.48	23.66	22.73
Forward planning2	22.95	22.72	22.24	23.80	22.87
Forward planning3	22.59	22.42	24.32	24.75	23.97
Detail conscious1	22.15	22.42	23.13	24.34	23.51
Detail conscious2	23.11	23.47	22.78	23.78	23.32
Detail conscious3	22.45	23.50	25.00	25.42	24.47
Conscientious1	24.25	25.32	24.82	25.49	26.23
Conscientious2	25.07	25.11	24.36	25.57	26.49
Conscientious3	25.95	24.58	26.43	23.50	27.97

Appendix C-1.5 Means of OPQ feelings and emotions scales according to subject category

	Category of Study				
	Arts	Science	Broad-based	Vocational	Social science
	Mean	Mean	Mean	Mean	Mean
Relaxed1	18.78	19.11	18.75	18.31	20.35
Relaxed2	18.89	20.05	19.21	17.59	19.39
Relaxed3	18.36	18.96	19.96	22.00	19.76
Worrying1	24.25	22.64	24.27	24.54	23.69
Worrying2	24.48	23.23	24.91	24.30	24.30
Worrying3	24.50	22.92	24.07	22.42	24.92
Tough minded1	14.86	17.85	13.78	14.36	15.15
Tough minded2	14.57	17.32	12.93	14.85	15.72
Tough minded3	14.23	17.08	15.71	17.33	14.50
Emotional control1	20.49	21.08	19.69	20.54	19.56
Emotional control2	19.26	19.74	18.78	19.76	19.23
Emotional control3	17.32	20.08	18.93	21.08	18.26
Optimistic1	26.65	25.03	24.87	25.73	25.56
Optimistic2	26.64	25.00	25.53	26.00	25.56
Optimistic3	26.91	26.12	26.57	27.67	26.16
Critical1	24.16	23.32	24.46	25.51	24.01
Critical2	23.60	23.02	24.53	24.74	23.72
Critical3	24.27	22.38	24.79	26.17	24.37
Active1	21.55	22.94	22.49	23.17	21.68
Active2	20.91	23.75	22.24	23.41	22.70
Active3	22.32	26.31	21.68	23.67	22.39
Competitive1	15.25	14.71	15.34	17.03	14.15
Competitive2	14.63	15.07	15.47	17.00	14.31
Competitive3	13.86	16.42	14.18	15.67	13.63
Achieving1	19.35	18.03	18.84	20.15	18.68
Achieving2	18.43	18.23	18.66	19.20	18.39
Achieving3	18.45	18.58	18.64	19.67	16.61
Decisive1	16.77	18.27	16.33	18.59	16.60
Decisive2	16.58	16.81	16.47	17.30	16.03
Decisive3	16.86	18.50	15.61	19.25	15.24
Social desirability1	15.08	15.70	15.22	14.69	15.51
Social desirability2	15.35	16.14	13.64	14.26	14.14
Social desirability3	14.86	15.08	15.75	14.75	14.68

Appendix C-1.6 Means of OPQ relationships with people scales according to gender and maturity status

	Sex		Maturity	
	Male	Female	21 or under (Non-mature)	22 or over (Mature)
	Mean	Mean	Mean	Mean
Persuasive1	24.06	22.23	22.88	22.08
Persuasive2	23.94	22.20	22.83	21.57
Persuasive3	23.94	22.20	22.97	20.82
Controlling1	24.01	23.01	23.50	22.02
Controlling2	25.22	23.72	24.41	22.03
Controlling3	26.74	23.79	24.73	23.82
Independent1	26.97	25.91	26.23	26.15
Independent2	26.91	26.16	26.37	26.30
Independent3	27.51	25.78	26.44	25.12
Outgoing1	22.35	21.41	21.58	22.42
Outgoing2	22.62	21.94	22.18	21.73
Outgoing3	22.83	22.44	22.64	21.94
Affiliative1	27.97	28.72	28.80	26.46
Affiliative2	28.59	28.68	28.95	26.49
Affiliative3	27.34	28.62	28.50	26.71
Socially confident1	22.24	20.62	21.01	21.69
Socially confident2	23.09	21.19	21.70	21.78
Socially confident3	24.51	21.20	22.24	21.35
Modest1	16.94	18.82	18.14	19.13
Modest2	17.05	18.03	17.67	18.46
Modest3	18.37	17.30	17.37	19.06
Democratic1	23.30	24.37	24.28	22.56
Democratic	23.40	24.96	24.80	22.46
Democratic3	22.89	25.38	25.04	22.47
Caring1	27.67	29.42	29.08	27.69
Caring2	27.79	29.09	28.93	27.24
Caring3	26.17	29.19	28.60	26.76

Appendix C-1.7 Means of OPQ thinking style scales according to gender and maturity status

	Sex		Maturity	
	Male	Female	21 or under (Non-mature)	22 or over (Mature)
	Mean	Mean	Mean	Mean
Practical1	22.68	20.74	21.14	22.48
Practical2	23.52	20.73	21.60	20.70
Practical3	26.20	21.13	22.94	19.94
Data rational1	20.50	16.37	17.83	16.02
Data rational2	20.23	16.78	18.01	15.68
Data rational3	21.74	18.21	19.54	16.94
Artistic1	23.74	26.60	25.79	25.52
Artistic2	24.38	26.64	26.08	25.57
Artistic3	24.31	26.16	26.07	22.94
Behavioural1	28.17	29.24	28.99	28.50
Behavioural2	28.21	29.71	29.44	28.24
Behavioural3	28.14	29.91	29.61	28.18
Traditional1	18.84	18.45	18.57	18.54
Traditional2	18.71	18.48	18.61	18.05
Traditional3	18.23	19.58	19.28	18.76
Change oriented1	25.58	25.40	25.50	25.13
Change oriented2	25.48	25.23	25.41	24.49
Change oriented3	26.69	24.49	25.07	25.29
Conceptual1	25.01	23.95	24.18	24.81
Conceptual2	25.60	24.31	24.64	24.81
Conceptual3	26.31	24.46	25.17	23.71
Innovative1	23.81	22.51	23.06	21.79
Innovative2	23.94	22.57	23.10	21.81
Innovative3	25.43	22.05	23.28	21.12
Forward planning1	22.28	22.64	22.57	22.27
Forward Planning2	22.63	22.98	22.97	22.27
Forward planning3	23.71	23.51	23.60	23.35
Detail conscious1	22.15	23.39	23.00	23.21
Detail conscious2	22.76	23.45	23.37	22.43
Detail conscious3	23.66	24.31	24.08	24.41
Conscientious1	23.83	25.74	25.16	25.25
Conscientious2	24.17	25.78	25.41	24.84
Conscientious3	25.23	26.51	26.06	26.71

Appendix C-1.8 Means of OPQ feelings and emotions scales according to gender and maturity status

	Sex		Maturity	
	Male	Female	21 or under (Non-mature)	22 or over (Mature)
	Mean	Mean	Mean	Mean
Relaxed1	21.61	18.04	19.13	18.92
Relaxed2	21.21	18.28	19.15	18.57
Relaxed3	23.37	18.16	19.62	19.53
Worrying1	21.99	24.69	23.94	23.52
Worrying2	22.29	25.01	24.43	23.03
Worrying3	20.57	25.33	23.87	24.88
Tough minded1	18.72	13.69	15.09	15.81
Tough minded2	18.23	13.87	15.03	15.32
Tough minded3	20.54	13.59	15.37	16.53
Emotional control1	21.65	19.67	20.38	19.46
Emotional control2	20.64	18.82	19.41	18.68
Emotional control3	18.83	18.91	18.81	19.41
Optimistic1	26.29	25.38	25.78	24.79
Optimistic2	26.30	25.61	25.99	24.38
Optimistic3	27.03	26.32	26.67	25.53
Critical1	25.07	23.90	24.24	24.27
Critical2	24.97	23.44	23.83	24.08
Critical3	26.40	23.36	24.01	25.47
Active1	24.33	21.39	22.50	20.63
Active2	24.35	21.73	22.73	20.35
Active3	26.11	22.01	23.65	19.94
Competitive1	16.59	14.64	15.16	15.58
Competitive2	16.84	14.50	15.08	15.59
Competitive3	16.91	13.66	14.47	15.18
Achieving1	19.61	18.75	19.03	18.81
Achieving2	19.34	18.24	18.54	18.57
Achieving3	19.71	17.45	18.26	16.94
Decisive1	18.92	16.50	17.08	18.13
Decisive2	18.81	15.74	16.40	17.92
Decisive3	19.09	15.73	16.61	17.00
Social desirability1	15.43	15.17	15.21	15.54
Social desirability2	15.34	14.52	14.68	15.16
Social desirability3	15.97	14.68	14.85	16.24

Appendix C-2.1 Repeated Measures Analysis of Variance Tables for OPQ relationships with people scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'PERSUASIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	3599.23	212	16.98		
YEAR	9.95	2	4.97	.29	.746
CATEGORY BY YEAR	35.80	8	4.48	.26	.977
SEX BY YEAR	1.77	2	.89	.05	.949
CATEGORY BY SEX BY YEAR	123.19	8	15.40	.91	.511

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CONTROLLING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1792.00	212	8.45		
YEAR	61.03	2	30.51	3.61	.029
CATEGORY BY YEAR	57.26	8	7.16	.85	.563
SEX BY YEAR	5.54	2	2.77	.33	.721
CATEGORY BY SEX BY YEAR	89.36	8	11.17	1.32	.234

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INDEPENDENT' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1441.39	212	6.80		
YEAR	14.41	2	7.20	1.06	.348
CATEGORY BY YEAR	47.14	8	5.89	.87	.545
SEX BY YEAR	5.96	2	2.98	.44	.646
CATEGORY BY SEX BY YEAR	40.03	8	5.00	.74	.660

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Appendix C-2.1 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OUTGOING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2205.99	212	10.41		
YEAR	90.07	2	45.03	4.33	.014
CATEGORY BY YEAR	85.91	8	10.74	1.03	.413
SEX BY YEAR	14.53	2	7.26	.70	.499
CATEGORY BY SEX BY YEAR	97.86	8	12.23	1.18	.315

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'AFFILIATIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1477.01	212	6.97		
YEAR	5.26	2	2.63	.38	.686
CATEGORY BY YEAR	50.15	8	6.27	.90	.518
SEX BY YEAR	.78	2	.39	.06	.946
CATEGORY BY SEX BY YEAR	82.71	8	10.34	1.48	.164

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SOCIAL CONFIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2334.70	212	11.01		
YEAR	122.54	2	61.27	5.56	.004
CATEGORY BY YEAR	24.42	8	3.05	.28	.973
SEX BY YEAR	10.07	2	5.03	.46	.634
CATEGORY BY SEX BY YEAR	39.91	8	4.99	.45	.888

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Appendix C-2.1 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'MODEST' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1889.90	212	8.91		
YEAR	8.29	2	4.14	.46	.629
CATEGORY BY YEAR	126.25	8	15.78	1.77	.084
SEX BY YEAR	49.36	2	24.68	2.77	.066
CATEGORY BY SEX BY YEAR	189.60	8	23.70	2.66	.071

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DEMOCRATIC' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1550.94	212	7.32		
YEAR	12.65	2	6.33	.86	.423
CATEGORY BY YEAR	34.23	8	4.28	.58	.790
SEX BY YEAR	39.98	2	19.99	2.73	.067
CATEGORY BY SEX BY YEAR	79.64	8	9.96	1.36	.215

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CARING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1794.32	212	8.46		
YEAR	46.96	2	23.48	2.77	.065
CATEGORY BY YEAR	31.01	8	3.88	.46	.884
SEX BY YEAR	31.89	2	15.94	1.88	.155
CATEGORY BY SEX BY YEAR	69.83	8	8.73	1.03	.413

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Appendix C-2.2 Repeated Measures Analysis of Variance for OPQ thinking style scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'PRACTICAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2332.27	212	11.00		
YEAR	60.46	2	30.23	2.75	.066
CATEGORY BY YEAR	131.60	8	16.45	1.50	.160
SEX BY YEAR	22.04	2	11.02	1.00	.369
CATEGORY BY SEX BY YEAR	67.96	8	8.49	.77	.628

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DATA RATIONAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2785.09	212	13.14		
YEAR	9.20	2	4.60	.35	.705
CATEGORY BY YEAR	179.95	8	22.49	1.71	.097
SEX BY YEAR	10.75	2	5.37	.41	.665
CATEGORY BY SEX BY YEAR	112.99	8	14.12	1.08	.382

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ARTISTIC' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1680.78	212	7.93		
YEAR	26.56	2	13.28	1.67	.190
CATEGORY BY YEAR	54.41	8	6.80	.86	.553
SEX BY YEAR	18.28	2	9.14	1.15	.318
CATEGORY BY SEX BY YEAR	67.74	8	8.47	1.07	.387

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'BEHAVIOURAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1455.34	212	6.86		
YEAR	13.67	2	6.83	1.00	.371
CATEGORY BY YEAR	93.88	8	11.74	1.71	.098
SEX BY YEAR	4.41	2	2.20	.32	.726
CATEGORY BY SEX BY YEAR	93.30	8	11.66	1.70	.096

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Appendix C-2.2 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'TRADITIONAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1691.05	212	7.98		
YEAR	8.49	2	4.24	.53	.588
CATEGORY BY YEAR	109.79	8	13.72	1.72	.095
SEX BY YEAR	18.86	2	9.43	1.18	.309
CATEGORY BY SEX BY YEAR	103.42	8	12.93	1.62	.081

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CHANGE ORIENTED' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1166.03	212	5.50		
YEAR	28.38	2	14.19	2.58	.063
CATEGORY BY YEAR	32.88	8	4.11	.75	.650
SEX BY YEAR	27.20	2	13.60	2.47	.087
CATEGORY BY SEX BY YEAR	62.74	8	7.84	1.43	.187

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CONCEPTUAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1417.78	212	6.69		
YEAR	23.59	2	11.80	1.76	.174
CATEGORY BY YEAR	61.13	8	7.64	1.14	.336
SEX BY YEAR	19.55	2	9.78	1.46	.234
CATEGORY BY SEX BY YEAR	97.38	8	12.17	1.82	.075

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INNOVATIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1921.44	212	9.06		
YEAR	43.67	2	21.83	2.41	.071
CATEGORY BY YEAR	121.96	8	15.25	1.68	.104
SEX BY YEAR	75.24	2	37.62	4.15	.017
CATEGORY BY SEX BY YEAR	112.48	8	14.06	1.55	.141

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Appendix C-2.2 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'FORWARD PLANNING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1164.24	212	5.49		
YEAR	14.35	2	7.18	1.31	.273
CATEGORY BY YEAR	45.07	8	5.63	1.03	.417
SEX BY YEAR	4.34	2	2.17	.40	.674
CATEGORY BY SEX BY YEAR	42.03	8	5.25	.96	.471

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DETAIL CONSCIOUS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1859.34	212	8.77		
YEAR	42.53	2	21.27	2.42	.091
CATEGORY BY YEAR	49.95	8	6.24	.71	.681
SEX BY YEAR	1.09	2	.54	.06	.940
CATEGORY BY SEX BY YEAR	80.70	8	10.09	1.15	.331

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CONSCIENTIOUS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	3151.76	212	14.87		
YEAR	4.25	2	2.13	.14	.867
CATEGORY BY YEAR	97.60	8	12.20	.82	.585
SEX BY YEAR	1.16	2	.58	.04	.962
CATEGORY BY SEX BY YEAR	82.60	8	10.33	.69	.696

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Appendix C-2.3 Repeated Measures Analysis of Variance for OPQ feelings and emotions scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'RELAXED' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2554.83	212	12.05		
YEAR	29.56	2	14.78	1.23	.295
CATEGORY BY YEAR	263.74	8	32.97	2.74	.007
SEX BY YEAR	13.74	2	6.87	.57	.566
CATEGORY BY SEX BY YEAR	153.13	8	19.14	1.59	.130

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'WORRYING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1786.41	212	8.43		
YEAR	13.50	2	6.75	.80	.450
CATEGORY BY YEAR	38.56	8	4.82	.57	.800
SEX BY YEAR	21.38	2	10.69	1.27	.283
CATEGORY BY SEX BY YEAR	81.66	8	10.21	1.21	.294

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'TOUGH MINDED' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2035.60	212	9.60		
YEAR	25.60	2	12.80	1.33	.266
CATEGORY BY YEAR	145.96	8	18.24	1.90	.061
SEX BY YEAR	34.74	2	17.37	1.81	.166
CATEGORY BY SEX BY YEAR	64.74	8	8.09	.84	.566

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'EMOTIONAL CONTROL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	3810.25	212	17.97		
YEAR	67.18	2	33.59	1.87	.157
CATEGORY BY YEAR	28.29	8	3.54	.20	.991
SEX BY YEAR	15.89	2	7.94	.44	.643
CATEGORY BY SEX BY YEAR	43.67	8	5.46	.30	.964

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Appendix C-2.3 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OPTIMISTIC' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2602.32	210	12.39		
YEAR	56.08	2	28.04	2.26	.107
CATEGORY BY YEAR	48.53	8	6.07	.49	.863
SEX BY YEAR	16.00	2	8.00	.65	.525
CATEGORY BY SEX BY YEAR	62.24	8	7.78	.63	.754

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CRITICAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1180.98	212	5.57		
YEAR	5.24	2	2.62	.47	.626
CATEGORY BY YEAR	65.98	8	8.25	1.48	.166
SEX BY YEAR	73.53	2	36.76	6.60	.002
CATEGORY BY SEX BY YEAR	60.57	8	7.57	1.36	.216

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACTIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1734.89	212	8.18		
YEAR	46.95	2	23.48	2.87	.053
CATEGORY BY YEAR	25.19	8	3.15	.38	.928
SEX BY YEAR	18.52	2	9.26	1.13	.324
CATEGORY BY SEX BY YEAR	57.62	8	7.20	.88	.534

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'COMPETITIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1422.16	212	6.71		
YEAR	16.60	2	8.30	1.24	.292
CATEGORY BY YEAR	55.35	8	6.92	1.03	.413
SEX BY YEAR	12.32	2	6.16	.92	.401
CATEGORY BY SEX BY YEAR	51.29	8	6.41	.96	.472

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACHIEVING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1329.87	212	6.27		
YEAR	4.66	2	2.33	.37	.690
CATEGORY BY YEAR	65.80	8	8.22	1.31	.239
SEX BY YEAR	7.41	2	3.70	.59	.555
CATEGORY BY SEX BY YEAR	38.18	8	4.77	.76	.638

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DECISIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1656.10	212	7.81		
YEAR	43.27	2	21.63	2.77	.065
CATEGORY BY YEAR	83.07	8	10.38	1.33	.230
SEX BY YEAR	28.50	2	14.25	1.82	.164
CATEGORY BY SEX BY YEAR	106.84	8	13.36	1.71	.097

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SOCIAL DESIRABILITY RESPONSE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1270.14	212	5.99		
YEAR	8.54	2	4.27	.71	.492
CATEGORY BY YEAR	68.19	8	8.52	1.42	.188
SEX BY YEAR	10.67	2	5.33	.89	.412
CATEGORY BY SEX BY YEAR	26.43	8	3.30	.55	.817

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Appendix C-2.4 Repeated Measures Analysis of Variance for OPQ relationships with people scales by maturity and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'PERSUASIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	3746.34	228	16.43		
YEAR	8.38	2	4.19	.25	.775
MATURITY BY YEAR	8.31	2	4.15	.25	.777

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CONTROLLING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1955.38	228	8.58		
YEAR	65.44	2	32.72	3.82	.023
MATURITY BY YEAR	30.93	2	15.46	1.80	.167

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INDEPENDENT' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1552.83	228	6.81		
YEAR	15.47	2	7.74	1.14	.323
MATURITY BY YEAR	2.37	2	1.18	.17	.841

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Appendix C-2.4 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OUTGOING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2349.49	228	10.30		
YEAR	32.53	2	16.27	1.58	.209
MATURITY BY YEAR	48.01	2	24.00	2.33	.100

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'AFFILIATIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1578.96	228	6.93		
YEAR	8.95	2	4.47	.65	.525
MATURITY BY YEAR	23.73	2	11.86	1.71	.183

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SOCIAL CONFIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2413.12	228	10.58		
YEAR	29.13	2	14.57	1.38	.255
MATURITY BY YEAR	17.80	2	8.90	.84	.433

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Appendix C-2.4 continued

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'MODEST' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         2287.62     228     10.03
 YEAR                      25.89       2     12.95      1.29      .277
 MATURITY BY YEAR           2.72       2      1.36       .14      .873

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'DEMOCRATIC' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         1703.40     228      7.47
 YEAR                        .11       2       .05       .01      .993
 MATURITY BY YEAR           5.18       2      2.59       .35      .707

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'CARING' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         1935.60     228      8.49
 YEAR                      22.26       2     11.13      1.31      .272
 MATURITY BY YEAR           4.84       2      2.42       .29      .752

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Appendix C-2.5 Repeated Measures Analysis of Variance for OPQ thinking style scales by maturity and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'PRACTICAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2518.53	228	11.05		
YEAR	13.83	2	6.91	.63	.536
MATURITY BY YEAR	10.23	2	5.11	.46	.630

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DATA RATIONAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	3085.71	228	13.53		
YEAR	11.83	2	5.91	.44	.647
MATURITY BY YEAR	.65	2	.33	.02	.976

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ARTISTIC' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1777.00	228	7.79		
YEAR	11.15	2	5.58	.72	.490
MATURITY BY YEAR	10.82	2	5.41	.69	.501

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'BEHAVIOURAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1649.90	228	7.24		
YEAR	1.54	2	.77	.11	.899
MATURITY BY YEAR	2.01	2	1.01	.14	.870

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'TRADITIONAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1883.98	228	8.26		
YEAR	4.25	2	2.12	.26	.773
MATURITY BY YEAR	17.26	2	8.63	1.04	.354

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CHANGE ORIENTED' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1293.43	228	5.67		
YEAR	1.43	2	.71	.13	.882
MATURITY BY YEAR	2.97	2	1.48	.26	.770

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CONCEPTUAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1564.51	228	6.86		
YEAR	.57	2	.29	.04	.959
MATURITY BY YEAR	.57	2	.29	.04	.959

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INNOVATIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2227.45	228	9.77		
YEAR	18.90	2	9.45	.97	.382
MATURITY BY YEAR	2.11	2	1.06	.11	.898

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Appendix C-2.5 continued

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'FORWARD PLANNING' using UNIQUE sums of squares
 Source of Variation          SS      DF       MS        F  Sig of F

 WITHIN+RESIDUAL         1242.60     228     5.45
 YEAR                      13.19       2     6.59     1.21      .300
 MATURITY BY YEAR          10.84       2     5.42      .99      .371

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'DETAIL CONSCIOUS' using UNIQUE sums of squares
 Source of Variation          SS      DF       MS        F  Sig of F

 WITHIN+RESIDUAL         1974.35     228     8.66
 YEAR                      24.11       2    12.05     1.39      .251
 MATURITY BY YEAR           6.97       2     3.48      .40      .669

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design  1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'CONSCIENTIOUS' using UNIQUE sums of squares
 Source of Variation          SS      DF       MS        F  Sig of F

 WITHIN+RESIDUAL         3337.55     228    14.64
 YEAR                      20.22       2    10.11      .69      .502
 MATURITY BY YEAR           7.22       2     3.61      .25      .782

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Appendix C-2.6 Repeated Measures Analysis of Variance for OPQ feelings and emotions scales by maturity and year

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'RELAXED' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         2869.15     228     12.58
 YEAR                      15.41       2      7.70       .61      .543
 MATURITY BY YEAR          26.71       2     13.35      1.06      .348

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'WORRYING' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         1922.62     228      8.43
 YEAR                       3.91       2      1.96       .23      .793
 MATURITY BY YEAR          13.06       2      6.53       .77      .462

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'TOUGH MINDED' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         2306.80     228     10.12
 YEAR                      34.24       2     17.12      1.69      .186
 MATURITY BY YEAR          27.32       2     13.66      1.35      .261

 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

 AVERAGED Tests of Significance for 'EMOTIONAL CONTROL' using UNIQUE sums of squares
 Source of Variation          SS      DF        MS         F  Sig of F

 WITHIN+RESIDUAL         3933.10     228     17.25
 YEAR                      28.13       2     14.07       .82      .444
 MATURITY BY YEAR           7.34       2      3.67       .21      .808

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Appendix C-2.6 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OPTIMISTIC' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	2693.69	226	11.92		
YEAR	2.11	2	1.05	.09	.915
MATURITY BY YEAR	41.83	2	20.92	1.75	.175

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'CRITICAL' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1351.34	228	5.93		
YEAR	20.74	2	10.37	1.75	.176
MATURITY BY YEAR	23.07	2	11.53	1.95	.145

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACTIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1813.21	228	7.95		
YEAR	1.97	2	.99	.12	.883
MATURITY BY YEAR	12.42	2	6.21	.78	.459

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'COMPETITIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1531.30	228	6.72		
YEAR	11.44	2	5.72	.85	.428
MATURITY BY YEAR	8.72	2	4.36	.65	.524

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Appendix C-2.6 continued

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACHIEVING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1436.08	228	6.30		
YEAR	20.96	2	10.48	1.66	.192
MATURITY BY YEAR	18.83	2	9.41	1.49	.227

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DECISIVE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	6457.32	228	28.32		
YEAR	9.51	2	4.75	.17	.846
MATURITY BY YEAR	50.38	2	25.19	.89	.412

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SOCIAL DESIRABILITY RESPONSE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1427.70	228	6.26		
YEAR	9.85	2	4.92	.79	.457
MATURITY BY YEAR	7.34	2	3.67	.59	.557

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Appendix C-2.7 Repeated Measures Analysis of Variance of ASI meaning orientation scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DEEP APPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	636.70	216	2.95		
YEAR	2.94	2	1.47	.50	.608
CATEGORY BY YEAR	27.27	8	3.41	1.16	.327
SEX BY YEAR	2.83	2	1.41	.48	.620
CATEGORY BY SEX BY YEAR	32.33	8	4.04	1.37	.211

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'RELATING IDEAS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	571.25	216	2.64		
YEAR	17.20	2	8.60	3.25	.041
CATEGORY BY YEAR	17.03	8	2.13	.81	.599
SEX BY YEAR	1.69	2	.84	.32	.727
CATEGORY BY SEX BY YEAR	33.61	8	4.20	1.59	.129

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'USE OF EVIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	526.91	216	2.44		
YEAR	17.47	2	8.74	3.58	.030
CATEGORY BY YEAR	17.08	8	2.14	.88	.538
SEX BY YEAR	16.25	2	8.13	3.33	.039
CATEGORY BY SEX BY YEAR	5.85	8	.73	.30	.965

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INTRINSIC MOTIVATION' using
UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	758.81	216	3.51		
YEAR	21.12	2	10.56	3.01	.049
CATEGORY BY YEAR	59.81	8	7.48	2.13	.041
SEX BY YEAR	5.56	2	2.78	.79	.455
CATEGORY BY SEX BY YEAR	22.02	8	2.75	.78	.618

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Appendix C-2.8 Repeated Measures Analysis of Variance of ASI reproducing orientation scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SURFACE APPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1164.54	216	5.39		
YEAR	.40	2	.20	.04	.963
CATEGORY BY YEAR	25.16	8	3.14	.58	.791
SEX BY YEAR	.83	2	.41	.08	.926
CATEGORY BY SEX BY YEAR	58.29	8	7.29	1.35	.220

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SYLLABUS-BOUNDNESS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	382.10	216	1.77		
YEAR	8.58	2	4.29	2.43	.091
CATEGORY BY YEAR	28.35	8	3.54	2.00	.047
SEX BY YEAR	9.37	2	4.69	2.65	.073
CATEGORY BY SEX BY YEAR	16.90	8	2.11	1.19	.304

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'FEAR OF FAILURE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	444.92	216	2.06		
YEAR	.79	2	.40	.19	.825
CATEGORY BY YEAR	21.42	8	2.68	1.30	.245
SEX BY YEAR	1.36	2	.68	.33	.720
CATEGORY BY SEX BY YEAR	36.86	8	4.61	2.24	.026

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'EXTRINSIC MOTIVATION' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	708.89	216	3.28		
YEAR	22.21	2	11.10	3.38	.036
CATEGORY BY YEAR	22.07	8	2.76	.84	.568
SEX BY YEAR	5.82	2	2.91	.89	.413
CATEGORY BY SEX BY YEAR	40.73	8	5.09	1.55	.141

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Appendix C-2.9 Repeated Measures Analysis of Variance of ASI achieving orientation scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'STRATEGIC APPPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	444.54	214	2.08		
YEAR	19.96	2	9.98	4.81	.009
CATEGORY BY YEAR	17.16	8	2.15	1.03	.412
SEX BY YEAR	.11	2	.05	.03	.974
CATEGORY BY SEX BY YEAR	8.70	8	1.09	.52	.838

- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DISORGANIZED STUDY METHODS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	992.42	214	4.64		
YEAR	.91	2	.46	.10	.906
CATEGORY BY YEAR	34.32	8	4.29	.93	.497
SEX BY YEAR	.90	2	.45	.10	.908
CATEGORY BY SEX BY YEAR	33.29	8	4.16	.90	.520

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'NEGATIVE ATTITUDES TO STUDY' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	773.47	214	3.61		
YEAR	44.46	2	22.23	6.15	.003
CATEGORY BY YEAR	33.31	8	4.16	1.15	.330
SEX BY YEAR	5.20	2	2.60	.72	.489
CATEGORY BY SEX BY YEAR	15.42	8	1.93	.53	.831

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACHIEVMENT MOTIVATION' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	741.27	214	3.46		
YEAR	1.02	2	.51	.15	.863
CATEGORY BY YEAR	45.14	8	5.64	1.63	.118
SEX BY YEAR	1.61	2	.81	.23	.793
CATEGORY BY SEX BY YEAR	47.00	8	5.88	1.70	.101

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Appendix C-3.0 Repeated Measures Analysis of Variance of ASI styles and pathologies of learning scales by category, sex and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'COMPREHENSION LEARNING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	793.01	216	3.67		
YEAR	5.46	2	2.73	.74	.476
CATEGORY BY YEAR	76.67	8	9.58	2.61	.010
SEX BY YEAR	9.67	2	4.83	1.32	.270
CATEGORY BY SEX BY YEAR	29.01	8	3.63	.99	.447

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'GLOBETROTTING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	589.17	216	2.73		
YEAR	28.43	2	14.21	5.21	.006
CATEGORY BY YEAR	16.87	8	2.11	.77	.627
SEX BY YEAR	10.09	2	5.04	1.85	.160
CATEGORY BY SEX BY YEAR	43.84	8	5.48	2.01	.047

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OPERATION LEARNING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	476.16	216	2.20		
YEAR	1.04	2	.52	.24	.789
CATEGORY BY YEAR	6.12	8	.77	.35	.946
SEX BY YEAR	14.98	2	7.49	3.40	.035
CATEGORY BY SEX BY YEAR	30.96	8	3.87	1.76	.087

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'IMPROVIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	617.55	216	2.86		
YEAR	10.99	2	5.50	1.92	.149
CATEGORY BY YEAR	8.88	8	1.11	.39	.926
SEX BY YEAR	5.42	2	2.71	.95	.389
CATEGORY BY SEX BY YEAR	31.61	8	3.95	1.38	.206

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Appendix C-3.1 Repeated Measures Analysis of Variance of ASI meaning orientation scales by maturity and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DEEP APPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	693.02	232	2.99		
YEAR	5.39	2	2.70	.90	.407
MATURITY BY YEAR	.51	2	.25	.09	.918

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'RELATING IDEAS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	616.99	232	2.66		
YEAR	2.40	2	1.20	.45	.637
MATURITY BY YEAR	3.72	2	1.86	.70	.498

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'USE OF EVIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	560.52	232	2.42		
YEAR	12.72	2	6.36	2.63	.074
MATURITY BY YEAR	6.08	2	3.04	1.26	.286

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'INTRINSIC MOTIVATION' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	831.14	232	3.58		
YEAR	11.92	2	5.96	1.66	.192
MATURITY BY YEAR	1.76	2	.88	.24	.783

\- -

Appendix C-3.2 Repeated Measures Analysis of Variance of ASI reproducing orientation scales by maturity and year

* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SURFACE APPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1250.21	232	5.39		
YEAR	1.00	2	.50	.09	.911
MATURITY BY YEAR	2.62	2	1.31	.24	.785

\- -

* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'SYLLABUS-BOUNDNESS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	435.56	232	1.88		
YEAR	3.16	2	1.58	.84	.433
MATURITY BY YEAR	.58	2	.29	.15	.857

\- -

* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'FEAR OF FAILURE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	509.85	232	2.20		
YEAR	1.37	2	.69	.31	.732
MATURITY BY YEAR	1.26	2	.63	.29	.750

\- -

* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'EXTRINSIC MOTIVATION' using
UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	768.92	232	3.31		
YEAR	16.14	2	8.07	2.43	.090
MATURITY BY YEAR	13.63	2	6.81	2.06	.130

\- -

Appendix C-3.3 Repeated Measures Analysis of Variance of ASI achieving orientation scales by maturity and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'STRATEGIC APPPROACH' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	470.22	230	2.04		
YEAR	13.42	2	6.71	3.28	.039
MATURITY BY YEAR	.01	2	.01	.00	.997

\- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'DISORGANIZED STUDY METHODS' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	1059.71	230	4.61		
YEAR	7.71	2	3.85	.84	.435
MATURITY BY YEAR	8.79	2	4.39	.95	.387

\- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'NEGATIVE ATTITUDES TO STUDY' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	823.56	230	3.58		
YEAR	22.18	2	11.09	3.10	.047
MATURITY BY YEAR	1.60	2	.80	.22	.800

\- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'ACHIEVEMENT MOTIVATION' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	804.30	230	3.50		
YEAR	4.19	2	2.09	.60	.550
MATURITY BY YEAR	24.49	2	10.75	8.07	.048

\- -

Appendix C-3.4 Repeated Measures Analysis of Variance of ASI styles and pathologies of learning scales by maturity and year

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'COMPREHENSION LEARNING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	892.84	232	3.85		
YEAR	1.04	2	.52	.13	.874
MATURITY BY YEAR	3.99	2	1.99	.52	.596

\- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'GLOBETROTTING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	642.04	232	2.77		
YEAR	55.42	2	27.71	10.01	.000
MATURITY BY YEAR	20.48	2	10.24	3.70	.026

\- -

* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'OPERATION LEARNING' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	531.52	232	2.29		
YEAR	1.95	2	.98	.43	.653
MATURITY BY YEAR	1.88	2	.94	.41	.665

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design 1 * * * * * *

Tests involving 'YEAR' Within-Subject Effect.

AVERAGED Tests of Significance for 'IMPROVIDENCE' using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	654.71	232	2.82		
YEAR	11.28	2	5.64	2.00	.138
MATURITY BY YEAR	1.67	2	.84	.30	.744

\- -

Appendix C-4.1 Table of test-retest reliability values for the OPQ scales

Trait	Year 1 vs Year 2 *r*	Year 1 vs Year 3 *r*	Year 2 vs Year3 *r*
Persuasive	0.79	0.56	0.55
Controlling	0.78	0.75	0.78
Independent	0.69	0.69	0.60
Outgoing	0.83	0.76	0.81
Affiliative	0.69	0.54	0.61
Socially confident	0.79	0.73	0.75
Modest	0.70	0.64	0.69
Democratic	0.64	0.69	0.69
Caring	0.68	0.59	0.62
Practical	0.81	0.72	0.80
Data rational	0.82	0.77	0.81
Artistic	0.85	0.74	0.80
Behavioural	0.66	0.61	0.70
Traditional	0.70	0.53	0.69
Change oriented	0.76	0.69	0.70
Conceptual	0.68	0.68	0.69
Innovative	0.77	0.71	0.74
Forward planning	0.66	0.67	0.71
Detail conscious	0.72	0.69	0.78
Conscientious	0.66	0.45	0.64
Relaxed	0.78	0.75	0.78
Worrying	0.75	0.71	0.74
Tough-minded	0.77	0.79	0.80
Emotional control	0.70	0.70	0.70
Optimistic	0.77	0.57	0.72
Critical	0.56	0.64	0.70
Active	0.82	0.81	0.83
Competitive	0.72	0.69	0.73
Achieving	0.73	0.70	0.79
Decisive	0.73	0.50	0.42
Social Desirability	0.61	0.58	0.69

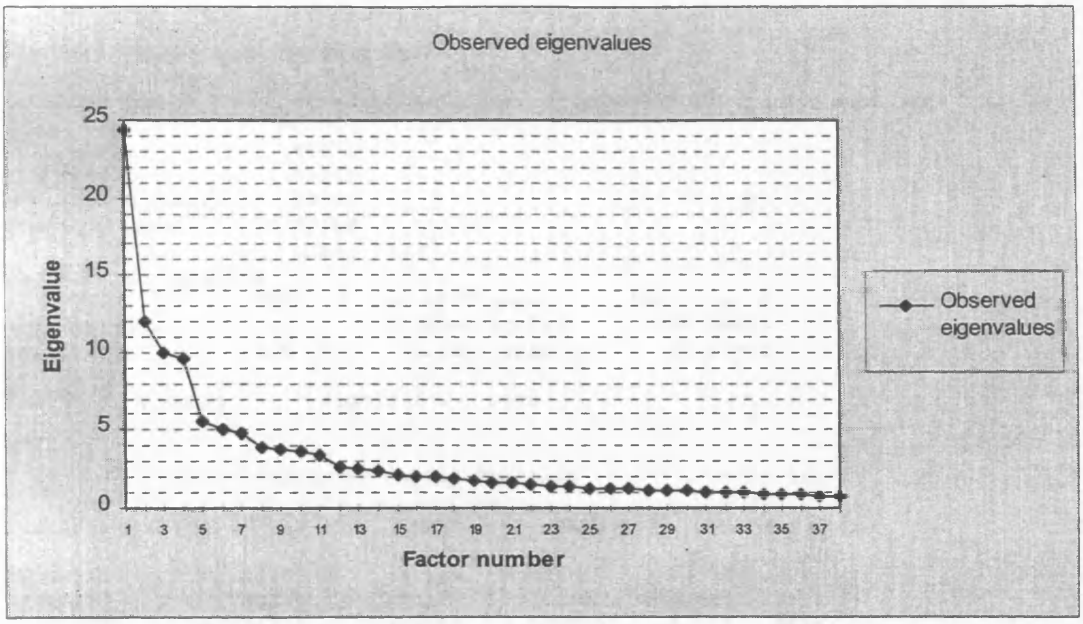
All correlation coefficients significant at $p<0.001$

Appendix C-4.2 Table of test-retest reliability values for the ASI scales

Scale	Year 1 vs Year 2 *r*	Year 1 vs Year 3 *r*	Year 2 vs Year3 *r*
Deep approach	0.61	0.56	0.46
Use of evidence	0.42	0.51	0.44
Relating ideas	0.60	0.52	0.67
Intrinsic motivation	0.65	0.63	0.63
Surface approach	0.50	0.49	0.61
Syllabus boundness	0.56	0.57	0.60
Fear of failure	0.66	0.62	0.72
Extrinsic motivation	0.67	0.62	0.72
Strategic approach	0.55	0.49	0.42
Disorganised study methods	0.64	0.62	0.76
Negative attitudes to study	0.68	0.51	0.65
Achievement motivation	0.65	0.59	0.67
Comprehension learning	0.64	0.55	0.49
Globetrotting	0.60	0.54	0.65
Operation learning	0.53	0.49	0.43
Improvidence	0.57	0.54	0.52

All correlation coefficients significant at $p<0.001$

Appendix C-4.3 Scree chart of pooled dispersion matrix of three years administrations.



Appendix D-1.1 Multiple regression of eleven factors for prediction of academic performance in non-mature students

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             * * * *   M U L T I P L E   R E G R E S S I O N   * * * *

Listwise Deletion of Missing Data

Equation Number 1    Dependent Variable..   MEANMARK First year mean mark

Multiple R           .45973
R Square             .21135
Adjusted R Square    .17296
Standard Error      7.08986

Analysis of Variance
                    DF      Sum of Squares      Mean Square
Regression          11          3044.38836        276.76258
Residual           226         11360.15292         50.26616

F =       5.50594       Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable              B          SE B        Beta          T  Sig T

EMOTSTAB       -.470109       .471339    -.059643      -.997  .3196
ASSERTIV       -.764230       .462170    -.098600     -1.654  .0996
REPRODOR      -2.294435       .454153    -.302272     -5.052  .0000
CONSCIEN       1.900399       .472769     .241265      4.020  .0001
MEANIGOR        .483877       .481088     .059684      1.006  .3156
AMBITIUS       -.674593       .465965    -.086247     -1.448  .1491
ABSTRTOR       -.959189       .472065    -.122141     -2.032  .0433
SELFCONC       -.817359       .463706    -.105949     -1.763  .0793
CONCRTOR       -.433111       .458499    -.056598      -.945  .3459
SENSSEEK       -.953469       .478821    -.118055     -1.991  .0477
CONSERVT        .321399       .463908     .041453       .693  .4891
(Constant)    56.074180       .468463               119.698  .0000


Listwise Deletion of Missing Data

Equation Number 1    Dependent Variable..   FINAL   Final degree class

Multiple R           .34330
R Square             .11785
Adjusted R Square    .08151
Standard Error      1.30804

Analysis of Variance
                    DF      Sum of Squares      Mean Square
Regression          11            61.03107          5.54828
Residual           267           456.82556          1.71096

F =       3.24279       Signif F =  .0004

------------------ Variables in the Equation ------------------

Variable              B          SE B        Beta          T  Sig T

EMOTSTAB       -.104130       .077713    -.077336     -1.340  .1814
ASSERTIV       -.108618       .079534    -.078934     -1.366  .1732
REPRODOR       -.146433       .078102    -.108816     -1.875  .0619
CONSCIEN        .265079       .082411     .187157      3.217  .0015
MEANIGOR        .032907       .081387     .023467       .404  .6863
AMBITIUS       -.199599       .078364    -.147559     -2.547  .0114
ABSTRTOR       -.096887       .080156    -.069916     -1.209  .2278
SELFCONC       -.108689       .077311    -.081624     -1.406  .1609
CONCRTOR       -.223874       .077405    -.168802     -2.892  .0041
SENSSEEK        .003585       .081671     .002542       .044  .9650
CONSERVT       -.030672       .078243    -.022689      -.392  .6954
(Constant)     3.232778       .079202                40.817  .0000
```

Appendix D-1.2 Multiple regression of eleven factors for prediction of academic performance in mature students

* * * * M U L T I P L E   R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   MEANMARK First year mean mark

Multiple R	.68565
R Square	.47011
Adjusted R Square	.22725
Standard Error	7.17997

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	1097.68423	99.78948
Residual	24	1237.24794	51.55200

F =   1.93571   Signif F = .0854

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-3.054938	1.331783	-.407680	-2.294	.0309
ASSERTIV	2.040724	1.619104	.218040	1.260	.2196
REPRODOR	-3.690470	1.591917	-.522862	-2.318	.0293
CONSCIEN	3.358125	1.314370	.464566	2.555	.0174
MEANIGOR	1.222720	1.116336	.191001	1.095	.2843
AMBITIUS	-1.510216	1.623538	-.192534	-.930	.3615
ABSTRTOR	-.980878	1.439741	-.129350	-.681	.5022
SELFCONC	-.613664	1.267489	-.088401	-.484	.6327
CONCRTOR	3.788656	1.966168	.407793	1.927	.0659
SENSSEEK	.149129	1.459344	.018630	.102	.9195
CONSERVT	2.106034	1.791965	.236288	1.175	.2514
(Constant)	56.026694	1.755324		31.918	.0000

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   FINAL   Final degree class

Multiple R	.50431
R Square	.25433
Adjusted R Square	.01309
Standard Error	1.62301

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	30.54767	2.77706
Residual	34	89.56103	2.63415

F =   1.05425   Signif F = .4243

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.149440	.268151	-.091981	-.557	.5810
ASSERTIV	-.149212	.299924	-.083201	-.498	.6220
REPRODOR	.262338	.279003	.182845	.940	.3537
CONSCIEN	.748072	.283091	.497679	2.643	.0124
MEANIGOR	.257026	.234945	.188038	1.094	.2817
AMBITIUS	.374720	.294330	.230434	1.273	.2116
ABSTRTOR	-.739696	.280043	-.493130	-2.641	.0124
SELFCONC	-.339170	.261348	-.225862	-1.298	.2031
CONCRTOR	-.168764	.348904	-.090257	-.484	.6317
SENSSEEK	-.084154	.247794	-.058170	-.340	.7362
CONSERVT	-.164724	.329807	-.087570	-.499	.6207
(Constant)	2.584285	.307247		8.411	.0000

Appendix D-1.3 Multiple regression of eleven factors for prediction of academic performance in male students

* * * * M U L T I P L E   R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   MEANMARK First year mean mark

Multiple R	.58173
R Square	.33841
Adjusted R Square	.22814
Standard Error	8.85547

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	2647.38239	240.67113
Residual	66	5175.67833	78.41937

F =   3.06903   Signif F = .0022

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.257533	1.108833	-.026261	-.232	.8171
ASSERTIV	-.769004	1.078370	-.074480	-.713	.4783
REPRODOR	-3.399245	.961169	-.379292	-3.537	.0007
CONSCIEN	3.158301	.915879	.360783	3.448	.0010
MEANIGOR	-.351985	1.041792	-.035563	-.338	.7365
AMBITIUS	-1.395286	1.094034	-.135883	-1.275	.2067
ABSTRTOR	-.793024	.924448	-.089102	-.858	.3941
SELFCONC	-1.754056	1.141393	-.168579	-1.537	.1291
CONCRTOR	.243147	1.174025	.023713	.207	.8366
SENSSEEK	-.923122	1.048537	-.092259	-.880	.3818
CONSERVT	1.281156	1.189474	.116042	1.077	.2854
(Constant)	55.257585	1.259663		43.867	.0000

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   FINAL   Final degree class

B

Multiple R	.53523
R Square	.28648
Adjusted R Square	.19729
Standard Error	1.50295

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	79.80935	7.25540
Residual	88	198.78065	2.25887

F =   3.21196   Signif F = .0010

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	.238837	.148318	.151292	1.610	.1109
ASSERTIV	.015420	.160975	.008744	.096	.9239
REPRODOR	-.091968	.142130	-.060608	-.647	.5193
CONSCIEN	.311736	.141043	.206917	2.210	.0297
MEANIGOR	.013790	.154064	.008431	.090	.9289
AMBITIUS	-.452171	.155926	-.273024	-2.900	.0047
ABSTRTOR	-.082317	.139650	-.053832	-.589	.5571
SELFCONC	-.444960	.162089	-.263326	-2.745	.0073
CONCRTOR	-.595286	.163000	-.348883	-3.652	.0004
SENSSEEK	.090811	.149282	.056578	.608	.5445
CONSERVT	-.098896	.167262	-.055017	-.591	.5559
(Constant)	3.183473	.193870		16.421	.0000

Appendix D-1.4 Multiple regression of eleven factors for prediction of academic performance in female students

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. MEANMARK First year mean mark

Multiple R	.37194
R Square	.13834
Adjusted R Square	.08683
Standard Error	6.39961

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	1209.85230	109.98657
Residual	184	7535.72070	40.95500

F = 2.68555 Signif F = .0032

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.894206	.508268	-.125121	-1.759	.0802
ASSERTIV	-.362972	.463664	-.054306	-.783	.4347
REPRODOR	-1.581296	.461995	-.238536	-3.423	.0008
CONSCIEN	1.221522	.499082	.170416	2.448	.0153
MEANIGOR	.515428	.462006	.077467	1.116	.2660
AMBITIUS	-.601612	.474567	-.090040	-1.268	.2065
ABSTRTOR	-.937779	.487494	-.133181	-1.924	.0559
SELFCONC	-.529864	.440226	-.083596	-1.204	.2303
CONCRTOR	-.066862	.508783	-.009438	-.131	.8956
SENSSEEK	-.652616	.465912	-.097253	-1.401	.1630
CONSERVT	.185733	.455452	.028372	.408	.6839
(Constant)	56.090193	.507259		110.575	.0000

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. FINAL Final degree class

Multiple R	.26983
R Square	.07281
Adjusted R Square	.02493
Standard Error	1.22238

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	24.99271	2.27206
Residual	213	318.26952	1.49422

F = 1.52057 Signif F = .1256

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.149405	.088041	-.114567	-1.697	.0912
ASSERTIV	-.108580	.082474	-.087617	-1.317	.1894
REPRODOR	-.030991	.082593	-.025111	-.375	.7079
CONSCIEN	.216360	.092055	.157776	2.350	.0197
MEANIGOR	-.040615	.082705	-.032789	-.491	.6239
AMBITIUS	-.023123	.085174	-.018384	-.271	.7863
ABSTRTOR	-.189182	.086384	-.145918	-2.190	.0296
SELFCONC	.013960	.078911	.011826	.177	.8597
CONCRTOR	.036172	.090369	.027604	.400	.6894
SENSSEEK	.017816	.082912	.014342	.215	.8301
CONSERVT	-.062793	.081145	-.051500	-.774	.4399
(Constant)	3.292779	.088260		37.308	.0000

Appendix D-1.5 Multiple regression of eleven factors for prediction of academic performance in arts students

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. MEANMARK First year mean mark

Multiple R	.53627
R Square	.28759
Adjusted R Square	.14511
Standard Error	5.23699

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	608.92670	55.35697
Residual	55	1508.43182	27.42603

F = 2.01841 Signif F = .0439

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.379811	.818403	-.064208	-.464	.6444
ASSERTIV	-1.049596	.702996	-.201663	-1.493	.1411
REPRODOR	-.958005	.812335	-.170756	-1.179	.2433
CONSCIEN	1.157136	.590149	.232225	1.961	.0550
MEANIGOR	-.162311	.696991	-.028036	-.233	.8167
AMBITIUS	-1.277698	.770190	-.199527	-1.659	.1028
ABSTRTOR	.633169	.653008	.118472	.970	.3365
SELFCONC	-.694721	.616633	-.131046	-1.127	.2648
CONCRTOR	-.831001	.873203	-.122455	-.952	.3454
SENSSEEK	-.828588	.708763	-.137693	-1.169	.2474
CONSERVT	.690132	.643620	.133334	1.072	.2883
(Constant)	54.616658	.878062		62.201	.0000

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. FINAL Final degree class

Multiple R	.40257
R Square	.16206
Adjusted R Square	-.02605
Standard Error	1.24578

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	14.70758	1.33705
Residual	49	76.04652	1.55197

F = .86152 Signif F = .5821

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.320090	.199238	-.250196	-1.607	.1146
ASSERTIV	-.002002	.163059	-.001758	-.012	.9903
REPRODOR	-.202020	.200124	-.170904	-1.009	.3177
CONSCIEN	.019802	.172615	.016113	.115	.9091
MEANIGOR	-.094635	.164894	-.079128	-.574	.5686
AMBITIUS	-.166392	.185694	-.126443	-.896	.3746
ABSTRTOR	.215401	.153508	.196205	1.403	.1669
SELFCONC	-.095158	.156917	-.082526	-.606	.5470
CONCRTOR	-.060140	.213644	-.041819	-.281	.7795
SENSSEEK	.152581	.166195	.123619	.918	.3631
CONSERVT	.062446	.158755	.056220	.393	.6958
(Constant)	3.262902	.225917		14.443	.0000

Appendix D-1.6 Multiple regression of eleven factors for prediction of academic performance in science students

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. MEANMARK First year mean mark

B

Multiple R	.67737
R Square	.45883
Adjusted R Square	.31001
Standard Error	10.13165

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	3481.25272	316.47752
Residual	40	4106.01482	102.65037

F = 3.08306 Signif F = .0044

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	.197093	1.350835	.018921	.146	.8847
ASSERTIV	1.725462	1.570222	.140485	1.099	.2784
REPRODOR	-5.359945	1.542310	-.435584	-3.475	.0012
CONSCIEN	3.855583	1.727799	.274194	2.231	.0313
MEANIGOR	.707732	1.367703	.063751	.517	.6077
AMBITIUS	.582761	1.475874	.051533	.395	.6950
ABSTRTOR	-3.261199	1.602480	-.270071	-2.035	.0485
SELFCONC	-.730054	1.514412	-.061341	-.482	.6324
CONCRTOR	.570558	1.417113	.052411	.403	.6894
SENSSEEK	-1.640078	1.496476	-.136273	-1.096	.2797
CONSERVT	2.266332	1.796565	.158522	1.261	.2144
(Constant)	56.571116	1.921524		29.441	.0000

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. FINAL Final degree class

Multiple R	.62262
R Square	.38765
Adjusted R Square	.26518
Standard Error	1.30789

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	59.55980	5.41453
Residual	55	94.08199	1.71058

F = 3.16531 Signif F = .0022

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.145824	.142006	-.112895	-1.027	.3090
ASSERTIV	-.050452	.172681	-.032169	-.292	.7713
REPRODOR	-.417353	.184068	-.259879	-2.267	.0273
CONSCIEN	.477830	.188393	.282396	2.536	.0141
MEANIGOR	.257372	.165603	.180185	1.554	.1259
AMBITIUS	.100844	.170692	.067659	.591	.5571
ABSTRTOR	-.334674	.183657	-.214667	-1.822	.0739
SELFCONC	-.188320	.167088	-.128426	-1.127	.2646
CONCRTOR	-.149065	.166255	-.104340	-.897	.3738
SENSSEEK	.196729	.178146	.124063	1.104	.2743
CONSERVT	.261633	.185302	.160647	1.412	.1636
(Constant)	3.042715	.225272		13.507	.0000

Appendix D-1.7 Multiple regression of eleven factors for prediction of academic performance in broad-based students

* * * * M U L T I P L E   R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   MEANMARK First year mean mark

Multiple R	.76018
R Square	.57787
Adjusted R Square	.41203
Standard Error	7.06534

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	1913.38727	173.94430
Residual	28	1397.73356	49.91906

F = 3.48453   Signif F = .0037

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-3.604811	1.343147	-.381649	-2.684	.0121
ASSERTIV	.214453	1.565154	.019094	.137	.8920
REPRODOR	-2.739743	1.382555	-.300497	-1.982	.0574
CONSCIEN	5.184252	1.308908	.535465	3.961	.0005
MEANIGOR	.196337	1.294093	.021975	.152	.8805
AMBITIUS	.704542	1.263262	.077233	.558	.5815
ABSTRTOR	-2.661514	1.468520	-.250848	-1.812	.0807
SELFCONC	.389061	1.354151	.038151	.287	.7760
CONCRTOR	-.355352	1.388804	-.037667	-.256	.7999
SENSSEEK	-.424804	1.177805	-.048533	-.361	.7210
CONSERVT	-1.012674	1.248955	-.114487	-.811	.4243
(Constant)	55.200960	1.340290		41.186	.0000

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   FINAL   Final degree class

Multiple R	.51132
R Square	.26145
Adjusted R Square	.11374
Standard Error	1.59930

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	49.79999	4.52727
Residual	55	140.67762	2.55777

F = 1.77000   Signif F = .0822

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.106192	.207708	-.063139	-.511	.6112
ASSERTIV	-.175162	.222124	-.095410	-.789	.4337
REPRODOR	.063502	.235038	.036813	.270	.7880
CONSCIEN	.573978	.221810	.327108	2.588	.0123
MEANIGOR	.075307	.202231	.044704	.372	.7110
AMBITIUS	-.512743	.206266	-.311983	-2.486	.0160
ABSTRTOR	-.319499	.230666	-.172632	-1.385	.1716
SELFCONC	-.185994	.217655	-.103897	-.855	.3965
CONCRTOR	-.413050	.225426	-.239262	-1.832	.0723
SENSSEEK	.095728	.213229	.054578	.449	.6552
CONSERVT	.202362	.219509	.113901	.922	.3606
(Constant)	2.761071	.214709		12.860	.0000

Appendix D-1.8 Multiple regression of eleven factors for prediction of academic performance in law students

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. MEANMARK First year mean mark

Multiple R	.53858
R Square	.29006
Adjusted R Square	.02976
Standard Error	4.31335

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	228.04780	20.73162
Residual	30	558.14863	18.60495

F = 1.11431 Signif F = .3846

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.119047	.932884	-.025801	-.128	.8993
ASSERTIV	1.068327	.931163	.220187	1.147	.2603
REPRODOR	-.036284	.845111	-.009404	-.043	.9660
CONSCIEN	.378515	.870978	.079487	.435	.6670
MEANIGOR	-.409351	.798033	-.092437	-.513	.6117
AMBITIUS	.406602	.711200	.106433	.572	.5718
ABSTRTOR	-.011709	.872188	-.002649	-.013	.9894
SELFCONC	-1.581841	.660047	-.437083	-2.397	.0230
CONCRTOR	.324992	.862992	.066997	.377	.7091
SENSSEEK	.133810	.826785	.029972	.162	.8725
CONSERVT	-.093892	.718043	-.023962	-.131	.8968
(Constant)	52.685076	1.049659		50.193	.0000

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. FINAL Final degree class

Multiple R	.67745
R Square	.45894
Adjusted R Square	.26055
Standard Error	1.22454

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	38.15759	3.46887
Residual	30	44.98527	1.49951

F = 2.31334 Signif F = .0338

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	.142808	.254580	.095742	.561	.5790
ASSERTIV	.020573	.262778	.013009	.078	.9381
REPRODOR	.374354	.233367	.304151	1.604	.1192
CONSCIEN	.757369	.246592	.488998	3.071	.0045
MEANIGOR	-.147977	.226585	-.102654	-.653	.5187
AMBITIUS	.077596	.197517	.062672	.393	.6972
ABSTRTOR	-.630628	.252725	-.435520	-2.495	.0183
SELFCONC	.077076	.187915	.065680	.410	.6846
CONCRTOR	-.566444	.251563	-.355496	-2.252	.0318
SENSSEEK	-.267886	.222510	-.198767	-1.204	.2380
CONSERVT	-.374593	.202101	-.295628	-1.853	.0737
(Constant)	2.306901	.274872		8.393	.0000

Appendix D-1.9 Multiple regression of eleven factors for prediction of academic performance in social science students

* * * * M U L T I P L E   R E G R E S S I O N * * * *

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   MEANMARK First year mean mark

Multiple R	.42905
R Square	.18408
Adjusted R Square	.03695
Standard Error	5.21207

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	373.86540	33.98776
Residual	61	1657.10560	27.16567

F = 1.25113   Signif F = .2745

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	-.156262	.766616	-.027469	-.204	.8392
ASSERTIV	-.413321	.648806	-.076444	-.637	.5265
REPRODOR	-.687451	.648714	-.136049	-1.060	.2935
CONSCIEN	.392025	.641398	.075753	.611	.5433
MEANIGOR	.321374	.711894	.057818	.451	.6533
AMBITIUS	-.159672	.728297	-.026682	-.219	.8272
ABSTRTOR	-.864327	.701802	-.161870	-1.232	.2228
SELFCONC	-.937253	.684627	-.171209	-1.369	.1760
CONCRTOR	1.062673	.812279	.178127	1.308	.1957
SENSSEEK	-.518033	.667272	-.099261	-.776	.4405
CONSERVT	-.342676	.732096	-.055537	-.468	.6414
(Constant)	58.267635	.658484		88.488	.0000

Listwise Deletion of Missing Data

Equation Number 1   Dependent Variable..   FINAL   Final degree class

Multiple R	.32826
R Square	.10776
Adjusted R Square	-.02138
Standard Error	.98976

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	11	8.99154	.81741
Residual	76	74.45164	.97963

F = .83441   Signif F = .6065

------------------ Variables in the Equation ------------------

Variable	B	SE B	Beta	T	Sig T
EMOTSTAB	.037074	.132809	.034818	.279	.7809
ASSERTIV	-.036812	.115806	-.035725	-.318	.7515
REPRODOR	-.096474	.115089	-.099846	-.838	.4045
CONSCIEN	-.133380	.110888	-.138422	-1.203	.2328
MEANIGOR	-.138882	.120331	-.134340	-1.154	.2520
AMBITIUS	-.157708	.121381	-.145700	-1.299	.1978
ABSTRTOR	-.163169	.117089	-.165722	-1.394	.1675
SELFCONC	.036571	.114601	.036614	.319	.7505
CONCRTOR	.133777	.135181	.124296	.990	.3255
SENSSEEK	.031680	.107950	.034339	.293	.7700
CONSERVT	.014270	.126037	.012719	.113	.9102
(Constant)	3.649269	.113596		32.125	.0000