THE EVALUATION OF A SELF-LEARN SCHEME IN APPLIED SCIENCE FOR STUDENTS OF HOTEL, CATERING AND INSTITUTIONAL MANAGEMENT AND HOME ECONOMICS, AND THE IDENTIFICATION OF FACTORS WHICH MAY BE ASSOCIATED WITH ASPECTS OF STUDENT PERFORMANCE

J. Horsey, B.Ed.,

A Thesis to be submitted for the Degree of Master of Philosophy.

This research was conducted in the Department of Hotel and Catering Studies and Home Economics, Sheffield City Polytechnic.

January, 1977.

ACKNOWLEDGEMENTS

This work was financed by a Grant from Sheffield Local Education Authority to whom I am grateful for support.

My thanks are due to Mr. A. Milson, Dr. A. G. Harding and Mrs. S. Campbell for their supervision, advice and encouragement.

I am indebted to the students of the Department of Hotel and Catering Studies and Home Economics at Sheffield City Polytechnic for their time and willing co-operation.

Finally, my thanks to Mrs. B. P. Wilson for typing and expert guidance on arrangement of the thesis.

INDEX

List of Tables

List of Tables (Contd.)

List of Tables (Contd.)

ABSTRACT OF CONTENTS

In introducing a new form of a course there is a need to evaluate its relevance towards students, to monitor the course in order to effect any necessary modifications, and to establish the nature of the relationship between performance and teaching method.

This Self-Learn Scheme in Applied Science was designed by A. Milson of the Department of Hotel and Catering Studies and Home Economics of Sheffield City Polytechnic (formerly Sheffield Polytechnic). It was first implemented in the academic year 1973/74 and was significantly modified at the end of the summar term 1974. A system of computer-marked multiple-choice weekly tests was introduced for use in the 1974/75 academic year.

This particular study was started in the 1974/75 academic year. In that year student response to each unit was sought by use of weekly questionnaires. The effects of the unit modifications made in 1974 were assessed by comparison of the student response survey of 1974/75 and a previous survey carried out by Milson in 1973/74, and further modifications to the text of the units were made. Response to the course was also sought by means of semi-structured interviews with a random sample of students in the Department, and the administration of the course and methods of feedback to the students were altered as a result of this information. The multiple-choice questions used in the 1974/75 course were evaluated by examining the computer analysis of the

marked tests, and were revised. These revised questions were used as the basis for the generation of a computer-bank of questions from which items could be randomly selected to form unit tests.

A student's performance on the self-learn course was assessed:

1) by marks gained on weekly unit tests and
2) by gains in knowledge calculated as the difference between scores obtained on a pre-test and on a post-test.

Student performance on the self-learn scheme varied considerably and various factors suggested in the literature to be related to the level of performance on self-learn schemes were examined with a view to establishing which factors were and which were not related to performance on the self-learn scheme in Applied Science. The data for the examination of these factors was obtained from unit test results, student response questionnaires, survey questionnaires, psychological tests and semi-structured interviews with a random sample of the students.

The results so far obtained give some indication of the factors which appear to relate to performance on the self-learn scheme. Academic and non-academic correlates of performance were examined. There was no significant relationship established between 'O' and 'A' level performance and performance on the self-learn scheme. Prior level of science knowledge was found to be related to performance on this self-learn course, but the relationship was not such that performance on the course could be predicted by knowledge of science background alone. Of the

non-academic factors investigated, measurable personality traits were not found to be related to any coherent, consistent way with performance on the self-learn scheme, and it is possible that the practical value of knowledge of the "personality" of the student (as defined by the tests in use at the present time), is very limited. Study habits and the level of motivation of the student seem to be of greatest significance in determining performance. It seems possible therefore that attention to these two factors could yield an improvement in student performance on the self-learn scheme.

INTRODUCTION

This study was concerned with a Self-learning Scheme in Applied Science (Physics and Chemistry) in operation in the Department of Hotel and Catering Studies and Home Economics at Sheffield City Polytechnic between 1974 and 1976.

This Self-learn Scheme in Applied Science (Physics and Chemistry) was devised by A. Milson of the Department of Hotel and Catering Studies and Home Economics of Sheffield City Polytechnic (formerly the Department of Hotel and Institutional Management of Sheffield Polytechnic) in 1973; students in the Department followed the Scheme in the academic year 1973/74 and the scheme was evaluated in the summer, 1974.

Milson (1975) perceived three factors to be particularly responsible for the introduction of this self-learn scheme; these are summarised below:-

1. The technological orientation of the Department which demanded that students have a knowledge of Physics and Chemistry as a basis for their concurrent and subsequent studies.
2. Entry requirements for courses in the Department did not specify any particular subject at 'A' level, nor were Physics or Chemistry specified at 'O' level. There was, therefore, a wide range of knowledge of Physics and Chemistry among students on enrolment.
3. Student numbers in the Department were large. Use of an efficient Self-learning Scheme would lead to a considerable

reduction in class contact time and allow a more efficient use to be made of staff time. Milson (1974) predicted a reduction in staff time for the teaching of basic Physics and Chemistry with a student intake of 150 from 20-24 hours/week to 5 hours/week if the teaching method was changed from teaching in small groups to a Self-learn approach.

It was felt that a self-learning scheme would be of value in these circumstances. It would provide a basic grounding in Physics and Chemistry for those students whose knowledge of these sciences was insufficient and provide a revision course for students who had received some instruction in sciences but perhaps had not studied it for some time. In addition, the course would give an indication of the application of such scientific knowledge to the catering and home economics fields. The course was designed to be of a standard approximating to G.C.E. 'O' level but containing only material appropriate to the Department's Courses. It was divided into fifteen units, each unit to contain the material which would have been covered in two hours of class contact time. The application of the material in the unit to the fields of catering and home economics was shown wherever possible.

It was felt that the wide range of background scientific knowledge could be more adequately catered for in a self-learning scheme, which is more self-paced than a lecture course. Certain constraints limited the degree to which this course could be 'self-paced'. It was felt to be essential that all students covered all fifteen units in order that a satisfactory level of knowledge of Physics and Chemistry be established as a basis for future

studies. The nature of the testing method employed necessitated the testing of all students at the same time. These circumstances meant that although the time allowed for study of the material presented was longer in the self-learn scheme than in a lecture, there was nonetheless a fairly rigid time schedule to which the student must adhere.

In introducing a new form of a course there is a need to monitor the course in order to effect any necessary modifications, to evaluate its relevance towards students, and to establish the nature of the relationships between performance and teaching method.

The subject of this study was such an evaluation of the self-learning scheme and the identification of factors which may be associated with aspects of student performance. Three questions were posed which formed major areas of investigation. These were:-

1. How can the course be improved to meet the needs of individual students or groups of students?
2. Does the design of this course affect the performance on it?
3. Can students who will not perform well on this course be selected out in advance, or very early in the course, so that they can be given additional help with the course?

Two complementary methodologies were utilised in order to arrive at answers to these questions. First, the correlation of student characteristics such as previous academic performance and personality traits with performance on the self-learn scheme. Second, semi-structured interviews with students to examine student attitudes to the self-learn scheme and to ascertain the effect of such factors as the current social environment and the learning milieu upon student performance.

Chapter 1

REVIEW OF THE LITERATURE

1.1 Introduction

Self-learning schemes of the type with which this study is concerned fall within a broad category of teaching strategies which are variously called programmed instruction courses, personalised instruction systems (P.S.I.), individualised teaching methods, and self-learning systems.

They comprise a category of teaching methods which are variously said to be 'individualised', 'independent' or 'personalised'. However, these terms cover a variety of strategies which even a brief investigation would show to be dissimilar in aims and in structure.

Hewton (1975) in his discussion of the meaning of independence in learning, states that "the difficulty centres around the fact that some teachers regard it (independent learning) solely as a method of learning, whilst others see it as a situation in which students are responsible for major decisions concerning their own education". There are various interpretations which can be taken of the term 'independence'. It could be that 'independence' means freedom from external constraints such as syllabus, curriculum, and examination. A review of 'independent' courses at present operating in Higher Education would suggest that independence, in this sense, is very rare. Similarly, the term 'individualised' or 'personalised' systems of instruction does not always describe a

system within which a student selects his own objectives and resources and works towards attainment of these objectives at his own pace. As Hewton (1975) has suggested, it might be helpful to describe systems which lay claim to one or other of these titles only by virtue of the fact that the lecturer is not physically present while the student masters the course material selected and prepared for him by some other title distinctly different from P.S.I. as such systems are, in fact, often extremely rigid and highly structured; this applies to most programmed learning schemes and to Keller Plan and Keller-type schemes.

The Self-learn Scheme in Applied Science is such a course. The objectives are stated, the content defined. There is some 'self-pacing' element but this is constrained within a time limit. All of the course must be studied, and the mastery is examined by a method (computer marked multiple-choice objective questions) which, although commonly used in such courses as this, certainly cannot be defined as 'independent'.

1.2 Programmed Learning in Higher Education in Britain

Independent learning schemes have been developing in Britain since the early 1960's. Various presentation media have been employed; tape/slide presentations, teaching machines, and programmed texts have all been used at different times and under varying circumstances. Although the media varies, all self-learn schemes have their base in Skinnerian psychology, with its emphasis upon behavioural conditioning and reinforcement. Teaching machines were the first programmed instruction method to be developed from these Skinnerian principles, but additional/alternative methods were soon developed.

The use of programmed instruction in Higher Education in Britain dates from the early 1960's. The Hale Committee (1964) noted that it was available as an alternative teaching strategy which seemed to be sound in principle. The Brymor Jones Committee (1965) surveyed the work in progress in April, 1963 and showed that little use was being made of the new approach at that time. Subsequent work has been published reporting on the use of programmed instruction in Higher Education in Britain, and those reports which are of some relevance to this thesis are summarised below. The programmed learning studies have to deal with the following areas:-

1.2.1. A comparison of the efficiency of self-learn schemes and traditional lecture courses in terms of measured student learning (Geller, 1963; Glynn, 1965; Hoare and Inglis, 1965; Poppleton and Austwick, 1964; Croxton and Martin, 1965; Hewlett and Bolton, 1970).

The findings of these research studies may be summarised as:

1) most students enjoyed the programmed learning.
2) learning was demonstrated to be as effective or more effective in groups using programmes.
3) weak students seemed especially to benefit from using a programmed course.

All these studies were (with the exception of the work by Hoare and Inglis) short in duration, and the experimental situation combined with the relatively short time involved in the study makes it possible that the results were modified by the Hawthorn Effect. Sutchett-Kaye (1972) has pointed out that because of this

experimental situation effect the value of studies in this category may be of limited value.

The best ratings, in terms of reliability and validity, would be those -

a) taken from studies over a long period of time

b) where programmed instruction is part of the normal learning situation and is less likely to be influenced by the experimental situation

1.2.2. A comparison of effectiveness of types of self-learn approach in terms of student achievement (Goldstein and Gotkin, 1962; Stones, 1966; Morris, Blank, McKie and Rankin, 1970). All studies concluded that machines and written texts were equally effective in promoting learning.

One of the claims advanced in favour of machine use has been that machines prevent students from 'cheating' on the in-text questions which form an essential part of many programmes, i.e. the student looks at the answer before attempting the question. The claim is a valid one only if it can be shown that such checking of answers in advance adversely affects the student's learning and performance.

Leith and Ghuman (1963) studied this question and found no differences between the post-test responses of groups who had had the answers to in-text questions made clear to them and groups who had had to construct their own responses from the test.

The authors concluded that:-

1) there is no need for complex machinery designed to prevent 'cheating' since there is no evidence that seeing the approved

response has any deleterious effect upon student learning.

2) in a written text, the format of the text need not be dictated by the need to cover up the response until the questions have been attempted.

1.2.3. The type of student response best employed (Leith and Buckle, 1966).

The authors concluded that the more difficult the task was to the learner, the greater the need for an overt response as a learning aid.

1.2.4. Programmed Courses as Revision Courses (Unwin and Spencer, 1966; Hogg, 1966).

Weaker students tended to rate the self-learn courses more highly than did other students, and there were no significant differences in the performance of students who worked on tests under supervision and those who worked unsupervised.

1.2.5. The adaptation and modification of traditional forms of programme

Hewlett (1969) used programmes with first and third year degree students. The first year course was revision and covered much ground which was familiar to the students. The students found these programmes boring, and also found it difficult to select out and learn the few unfamiliar items. The third year students to whom the material was new were happier with the programmes but found it difficult to establish a synoptic view of the topic. Hewlett therefore developed a new type of programme based on the following principles:-

a) the repetitious element of conventional linear programming was abandoned.

b) teaching points were grouped together so that a topic was dealt with as a whole. Questions related to that topic were also grouped together.

c) the individual questions were made more difficult.

Student reaction to the revised programme was favourable, but weaker students experienced more difficulty with the new type of programme.

The major conclusions from the published literature dealing with programmed learning in science in Higher Education are summarised as follows:-

1. Programmed instruction methods seem as adequate a method for the transmission of knowledge as any other.
2. The use of a written text is as acceptable a form of programmed instruction as any other , and within the text
   a) there is no need to make provision for overt responses by the student although this may be valuable in some cases
   b) the format of the text need not be dictated by the need to obscure the answers to in-text questions until the questions have been attempted.
3. Programmed courses which move away from the strict adherence to principles of linear programming still have validity, and the value of the course to the student may be increased.
4. An examination needs to be made of courses which are run on a long-term basis as non-experimental teaching methods.

1.3 The Development of P.S.I. Methods in Britain

The use of written texts in self-learn schemes was developed by Keller (1968) who devised a total self-learn system consisting of

information, assessment, and feedback to the student. Most self-learn schemes now in operation incorporate some of the elements of this system which Keller (1967) saw as most distinguishing the self-learn scheme from conventional teaching methods. These can be summarised as:

1) The pace of the work is determined by the individual student

2) The content of the course is divided into units and the mastery of one unit by any one student checked before there is progression to the next unit

3) Lectures and demonstrations may be incorporated in the course but they are not an essential part of it; they are used as "vehicles"rather than sources of information of motivation. The lecturer's role in this type of course is therefore different from what it would be in a conventional lecture course; his job becomes the facilitator of learning in others (Finger, 1962).

4) There is more stress laid upon the written word in teacher/student communication.

5) 'Proctors' are employed on the course. In his original work, Keller's 'proctors' were students who had previously followed the course. The use of proctors permitted "repeated testing, immediate scoring of test results, almost unavoidable tutoring, and a marked enhancement of the personal/social aspect of the educational process."

The relationship which P.S.I. courses or 'Keller-Plan' courses have with Keller's original work may be somewhat tenuous. Indeed, the term Keller-Plan may be used to describe teaching methods which incorporate so few of Keller's basic principles that they represent

quite a different method of teaching. In the context of the British educational system, certain factors can be delineated as being responsible for the modification of the Keller-Plan in a general way without examining particular courses. There are institutional constraints such as finding suitable rooms, and time-tabling for testing and feedback sessions. There are the problems of establishing criterion-based tests rather than ranking selection-based tests. and the related problem of removal of the end-of-course examination giving a normal curve of grades as the principal measure of assessment.

There are problems in establishing the proctor system. Although Farmer (1972) showed that greater opportunity for interaction with proctors increased the learning rate and motivation of the student, and Keller himself placed tremendous importance upon the role played by proctors, proctors are not usually a feature of British systems. Whitworth (1974) noted that the provision of proctors presented the greatest difficulty in mounting Keller courses in British Universities at the present time, while Donovan (1976) said that the major part played by student proctors under Keller is missing from the British scene.

Kulik, Kulik and Smith (1976) mention that the findings of Farmer (1972) could indicate the value of a prompt feedback system rather than the value of proctoring.

The reason for the development of courses in the U.K. which do not rely on proctoring appears to be economic. In the United States, salaried class assistants may be used, and student proctors may be salaried or allowed study credits. There has been

resistance to the use of both of these methods in the U.K. For financial reasons, paying students to act as proctors has not been approved and, for ethical reasons, the giving of study credits generally has not found favour in the educational climate of Britain. Boud, Bride and Willoughby (1975), in an examination of "P.S.I. Now", mention the problems of securing proctors and of ensuring that they are giving an adequate service. They also state that the most general trend in P.S.I. in Britain is towards diversification, with fewer of Keller's basic principles involved.

Keller Plan courses or Keller-type courses have also come to be used to cover a wide variety of subject areas. Keller's original work was with psychology students, and probably the first course of this type given outside the field of psychology was a physics course given by Green in 1969 (reported in the American Journal of Physics in July, 1971). A review of P.S.I courses in operation in 1972 indicated that the Keller Plan was most frequently used now in the teaching of psychology, physics, maths, engineering, chemistry and biology. There has been some reluctance to use this type of course in a field where the specification of detailed objectives may be thought to be very difficult - arts subjects, and 'creative' subjects.

1.4 The Self-Learn Scheme in Applied Science

The self-learn scheme in use at Sheffield City Polytechnic is a course consisting of fifteen units (sixteen in the original course, later modified). The course was written by Milson in 1973 and first implemented in the 1973/74 session. Student response to the course was monitored by the use of weekly questionnaires, and an analysis was made of these responses and of student performance on

the course. On the basis of the information so gained, the text of the course was radically altered in Summer, 1974, although the format was retained. The course, at the onset of this study, consisted of fifteen units. Each unit deals with a separate area of science knowledge and, in general, the units have no consecutive basis. Each unit consists of:-

1) A list of detailed behavioural objectives.

2) The text of the unit. This is divided into sections which are headed and numbered to correspond with the relevant objectives. In-text questions are provided so that the student can check upon progress made and understanding of one section before progressing to the next section.

3) A test upon the contents of the unit. In 1973/74 these tests were composed of short answer objective type questions. In the following sessions multiple-choice objective questions were used. This type of test was easier to mark which was important as student numbers were high and tests were given each week of term time. In addition. a wider spread of objectives, within the time limits available for marking, could be tested giving greater validity to the test results.

The students were given a specified time limit for the study of each unit. Usually, this was one week; in some cases it was longer. It was felt that students should attempt all of the units. Keller's original scheme meant that some students could procrastinate and this is a problem in many courses which are run on strict Keller lines.

Tutorials were made available for students who wished to attend, and in the 1975/76 session these were made compulsory for students

whose test marks indicated that they needed further assistance. The tutorials were given by the author of the course and another member of staff.

The course has now been in operation for three years (1973-1976). The text has been modified, the testing method changed, and the feedback system altered in that time. This development of the Self-Learn scheme will form one part of this study: the other area of investigation will be the factors associated with level of student performance on this course.

Chapter 2

EXPERIMENTAL PROCEDURES

In evaluating this self-learn scheme, two experimental procedures were used - correlation studies and interview data.

2.1 Statistical Evaluation

The first of these was a statistical analysis to show the degree of relationship between the following factors: to enable an evaluation of the scheme to be made in terms of its usefulness to various groups of students.

(i) student performance on unit tests

(ii) student performance on pre-test and post-test

(iii) student questionnaires giving reactions to the self-learn scheme

(iv) personality characteristics of students as measured by standardised tests

(v) entry qualifications of the students

This statistical evaluation of the self-learn scheme has, however, certain shortcomings which Parlett and Hamilton (1972) summarise briefly as follows:-

1) Educational situations are characterised by numerous relevant parameters. In statistical evaluation of a given situation, these parameters may be randomised or strictly controlled. Both of these approaches have serious limitations which detract from the value of the outcome of the study.

2) Before-and-after research design assumes that the scheme under

evaluation itself undergoes little or no change during the period of study. This premise is rarely upheld in practice and, indeed, to do so would be extremely difficult, and in some cases unethical with educational needs subordinated to the need to maintain the rigid distinctions necessary if a statistical analysis is to be carried out. It may also have a deleterious effect upon the programme itself by discouraging new developments and redefinitions mid-stream.

3) The methods used in traditional evaluations impose artificial and arbitrary restrictions on the scope of the study, factors which may be of relevance to the study being not taken account of in the study because they cannot be subjected to statistical evaluation.

4) Research which employs large samples and seeks to establish statistical generalisations tends to be insensitive to local effects. Typical results are seldom studied in detail when, in fact, they may have great relevance to the individuals and institutions concerned.

5) This type of evaluation often fails to articulate with the varied concerns and questions of participants, sponsors, and other interested parties. These studies rarely acknowledge the diversity of questions posed by different interest groups.

For these reasons it was suggested that a statistical evaluation of an innovatory course was not, of itself, sufficient to give a full and accurate evaluation. A second method of investigation was required.

2.2 Interview Data

The second methodology used was a series of semi-structured

interviews with students in order to seek to ascertain the effect of:

(i) previous social and educational background

(ii) current social environment

(iii) learning milieu

(iv) motivation

(v) study habits

on student performance in unit tests It was hoped that the use of these two techniques would provide information which would

1) show which factors did and which did not appear to be related to student performance on unit tests, and

2) detect those students who experienced exceptional difficulty with the course and delineate those factors which caused the difficulty.

A pilot study was conducted in the 1974/75 session in order to develop the interview technique and assess the value of interviews in adding depth to the statistical data. In the summer term of 1975 twenty students were interviewed, selected randomly from each of three course groups. The interview schedule was designed to take twenty minutes. In practice, the interviews ranged from fifteento forty-five minutes, depending upon the extent to which the student wished to pursue a particular point (for details on interviews see Appendix VI).

Half of the interviews were recorded on tape, the other half were recorded in brief note form at the time of the interview. Although the tape recorder provided the more accurate method of recording the data, it gave the interview a much more informal note. As the students did not seem unduly concerned about speaking in the

presence of the tape recorder, nor reticent when discussing the course, this seemed to be the more useful way of recording the data. The students were asked for permission before the recording was made and were assured that the interview was completely confidential. Since the self-learn scheme in applied science had finished two weeks before the first interview was held, the students were aware of their final grade for the course.

The interview started on an informal note with a few moments of conversation to let the student become accustomed to the interview room, and to the tape recorder or to having their comments noted. Students were then asked, as a lead-in, about their previous schooling and the differences in atmosphere and approach they found on entering the Polytechnic. They were then asked to talk in detail about their previous science background, and of what value this had been in relation tothe applied science course.

2.3 Introduction of the F.I.B.E.L. System

Apart from being useful as a pilot study to develop the interview technique and the interview schedule, the 1975 study also uncovered some useful data concerning response to the course. Feedback to students was clearly causing difficulties, and an improved system of feedback on test performance was needed.

It was suggested by the Polytechnic Computer Department that a variant of the FIBEL computer programme be used to provide feedback. This programme would mark the computer answer cards used by the students and provide each student with a feedback sheet. The feedback sheet could be designed to provide any amount of information for any answer. It was decided to give each correct answer the

comment "correct" and nothing more.

For each incorrect answer the comment would read "incorrect answer". "Read section (relevant section) of unit (relevant unit)." The correct answer would not be given. Students who fail to attain a set standard would then attend a tutorial where they could be given help with the unit, and with the following unit if needed.

2.4 Correction for Guessing

The problem of students who consistently guessed on unit tests was examined. All students interviewed stated that they did guess - some occasionally, some very regularly. All were insistent that they had a 'calculated guess' based on some knowledge and not a random guess.

In order to reduce marks given for guessing on the programme, a "correction for guessing" factor could be applied to the final total number of correct questions. This would reduce the marks of those students who consistently guessed. Handy and Johnstone (1973) found the correction of scores in this way to be of little value. However, it was thought that in a situation where the students took an objective test weekly and began to use the "calculated guess" frequently, this correction factor may have been valuable. A correction for guessing factor was applied randomly to three of the unit tests taken in the 1974/75 session; the scores were altered, but the rank order remained substantially the same with the rank correlation of 0.9 between corrected and in all three uncorrected score course groups. As this type of correction did not seem to differentiate between students who did and those who did not guess, or between those who had used calculated guess and those who guessed

randomly, it was not felt worthwhile to correct the scores in subsequent tests.

2.5 The Design of the 1975/76 Study

On the basis of the comments provided by this pilot study, a further study was designed to be carried out in the following two terms - the autumn and spring terms, 1975/76. All of these interviews were to be taped (unless the student objected) because this permitted much more accurate data analysis after the interview was concluded.

The interviews followed the schedule set out in Appendix VI. In most cases the order of questions and topics was not as it appears in the schedule, but all questions were covered at some time during the interview. Sometimes the information was volunteered, sometimes a direct question was asked.

Chapter 3

DESCRIPTION OF THE SAMPLE

This study deals with an examination of students over a two year period, beginning in the academic year September, 1974. The 'sample' for this study was all first-year students in the Department of Hotel and Catering Studies and Home Economics.

3.1 Size of the Sample

The numbers of students present at each phase of the study varied as some students enrolled late, or left their course, or transferred from one course to another. The numbers of students who were offered places on courses run by the Department, and who enrolled on the first day of their course, are shown in Table 1.

Table 1

Initial Size of the Sample

Course	Sex	Sept.1974 Entry	Sept.1975 Entry
B.Sc.Catering Systems	Male	16	9
	Female	10	21
H.N.D.Hotel, Catering and Inst. Man.	Male	19	10
	Female	21	28
Diploma in Home Economics	Male	-	-
	Female	26	34
Totals		92	102

3.2 The Educational Background of Students in the Sample

The academic qualifications of the students varied within courses and between courses. Some degree of similarity of educational qualification within courses was assured by specification of minimum acceptable entry qualifications. The minimum entry qualifications for the three courses offered by the Department are summarised in Table 2. The numbers of students qualifying for admission under each of the various ordinances are shown in brackets after that particular ordinance.

Most students entering the Department in the two years of this study qualified for admission by virtue of their 'O' and 'A' level performance and, as Table 3 indicates, many students, in fact, had entry qualifications above the minimum requirement.

'A' level passes are usually graded on an alphabetical scale; for the purposes of this study, the scale was converted to a numerical one in order to allow means to be calculated and correlations computed. The alphabetical scale was transformed so that Grade A was counted as 1, Grade B as 2, etc. An 'O' level pass on an 'A' level paper was rated as 6, and a failure to pass the examination as a 7. When calculating mean grades, all examination attempts were used, including fail grades.

'O' level passes are usually expressed numerically. Where the pass grade is expressed alphabetically, the grades were converted to a numerical scale in the same way as were the 'A' level grades. The method of grading 'O' level examinations was altered by the Examining Boards in 1974 and therefore, the level or grade expressed by a number was different before 1974 from what it was in/after 1974.

Table 2

Specified Minimum Entry Qualifications for

Courses in the Department

A) Bachelor of Science in Catering Systems

1. A General Certificate of Education with passes in four subjects including mathematics and a science subject, and with three of these passes at 'A' level (1974 - 0; 1975 - 0)

2. A General Certificate of Education with passes in five subjects including mathematics and a science subject, and with two of these passes at 'A' level (1974 - 26; 1975 - 29)

3. An O.N.C. or an O.N.D. with an overall theory mark of about 55% plus an 'O' level pass at the G.C.E. mathematics and science, or their equivalent obtained as part of the O.N.C. or O.N.D. course (1974 - 0; 1975 - 1)

B) Higher National Diploma in Hotel Catering and Institutional Management

1. A General Certificate of Education with passes in five subjects (one of which at 'O' level may be a craft subject and four of which must be on the list of approved subjects specified by the Joint Committee), one of which must be a pass at 'A' level (craft subjects excluded) (1974 - 39; 1975 - 35)

2. An approved O.N.D. (1974 - 1; 1975 - 2)

3. Any qualification deemed by the Joint Committee to be equivalent to the above. (1974 - 0; 1975 - 1)

C) The Diploma in Home Economics

The General Certificate of Education with passes in five subjects, one of which must be a pass at 'A' level. The passes must include English language and a science (preferably physics or chemistry) (1974 - 26; 1975 - 34)

Table 3

Summary of Educational Qualifications of Students in the Sample

(Students qualifying under ordinances which took account of O.N.D./O.N.C. qualifications were excluded from this analysis)

Intake Year		Mean Number of 'O' Levels Passed	Mean Grade of 'O' Levels Passed	Mean Number of 'A' Levels Passed	Mean Grade of 'A' Levels Passed
BSc	1974	7.1	4.2	2.2	3.9
	1975	7.9	4.0	2.6	4.0
HND	1974	7.0	4.2	1.9	4.8
	1975	7.4	4.1	1.7	4.7
DHE	1974	7.8	3.6	2.0	3.6
	1975	7.8	3.9	2.0	3.6

The mean number of 'O' and 'A' levels passed was calculated by:

$$\frac{\text{total number of passes in that group}}{\text{number of students in that group}}$$

The grades awarded under the revised marking scheme were amended to fit the old grading scheme; the means in Table 3 therefore represent a point on a scale of 1 - 9, with points 1 - 6 denoting various pass grades, 1 being the highest and 7, 8 and 9 representing a failure to pass the examination.

As can be seen from Table 3, the populations within each of the three courses offered did not discernibly change between 1974 and 1975 except that students enrolling on the BSc course in 1975 had slightly more 'O' and 'A' level passes than students enrolling on the BSc course in 1974.

There were some differences between the entry qualifications of students on the three courses, especially at 'A'level. The mean number of 'A' levels passed was greatest in the BSc group. The mean grade of 'A' levels taken was highest in the DHE group. The difference between the qualifications of the BSc and the DHE groups were slight in both years studied, but both groups were better qualified than the HND group on entry. These figures represent the mean performance of the groups; when one looks at the entry qualifications of individual students there is a large area of overlap in the qualifications of students in different groups.

The performance of the students at 'A' level was not predicted by performance at 'O' level. The number of 'O' level subject passes and the mean 'O' level grade of the three different courses were not sufficiently different to be able to predict from 'O' level performance alone, whether a student was more suited to a degree or non-degree course. The correlation between 'O' level grades and 'A' level grades for all three courses showed positive relationships in all cases but only two of the correlations were significant.

Table 4

Correlation Between G.C.E. Grades at 'O' and 'A' Levels

Course	Correlation Coefficients	
	1974 Entry	1975 Entry
B.Sc.	+ 0.59**	+0.27
H.N.C.	+ 0.10	+0.47*
D.H.E.	+ 0.20	+0.13

** significant at 0.01 level

* significant at 0.05 level

3.3 Academic Bias in the Sample

It was hoped that an examination of academic bias in the sample would provide information in two areas:-

1. Whether there was a relationship between 'divergent' thinking (Hudson, 1967) and performance on the self-learn scheme
2. Whether a science or arts orientation affected performance on the self-learn scheme.

It proved difficult to evaluate any relationship between divergent thinking and performance because too many of the students in the sample showed no academic bias. There is no Departmental specification of groups of subjects which must be studied prior to commencing courses in the Department (with the exceptions noted in Table 2). In 1974 the students who entered the Department had a very widespread of subject passes at 'O' level - 27 subjects were represented. The 'A' level subject passes were in 17 different areas. The general picture was the same with students who entered the Department in 1975. There was not, in any course run by the Department, a clearly

discernible pattern of subjects studied at 'O' and 'A' level in preparation for the course involved. The multi-disciplinary nature of the course appears, not unreasonably, to attract students who have an interest in both Arts and Science subjects. Out of the 185 students in the sample, 114 showed no particular bias towards arts or sciences in their choice of 'A' level subjects (see Table 5). These 114 students represent 61.6% of the sample.

Table 5

Academic Background of Students

Student Group	*** Arts 'A' Levels	*** Science 'A' Levels	*** No Bias
1974 Entry			
B.Sc.	9	2	10
H.N.D.	11	5	21
D.H.E.	3	-	23
1975 Entry			
B.Sc.	7	10	13
H.N.D.	10	3	24
D.H.E.	8	3	23
TOTALS	48	23	114

***NOTE

ARTS SUBJECTS: English, History, Modern/Classical Languages, Art, Religious Studies, Social Studies

(Contd.)

SCIENCE SUBJECTS: Physics, Chemistry, Physical Science, Mathematics, Statistics, Biology, Geography, Geology.

NO BIAS SUBJECTS: Home Economics, Crafts, General Studies.

Where there was doubt about the categorisation of a subject, the Syllabus of the relevant Examining Board was consulted. Where the student had more than one 'A' level, then the bias was taken as that of the total of subjects, e.g.:

English Literature, History, French	=	Arts Background
English Literature, History, Home Economics	=	Arts Background
Physics, Chemistry, Mathematics	=	Science Background
Physics, Home Economics, Mathematics	=	Science Background
Home Economics, General Studies, Biology	=	No Bias

The percentage of students having no fixed bias in their subject choice (61.6%) is much higher than the student average reported by the D.E.S. (Statistics of Education, Schools, Vol.1, D.E.S., 1973) which, in first year sixth forms in 1973, was 21.8%. The proportion of students in the sample having a background of science 'A' levels (12.4%) is lower than the national average (28.7%) according to the D.E.S. (1973) report.

3.4 Science Background of Students in the Sample

In order to determine the effect of prior knowledge upon attitude to the course and performance on the course, the students were grouped in terms of level of relevant science background. 'Relevant Sciences' were Physics, Chemistry, Physics with Chemistry or Physical Science.

In 1973 Milson categorised the students as S (having passed an

examination at 'O' or 'A' level in a relevant science subject) or NS (others), and found significant differences to exist between these two groups in terms of attitude and performance.

In the academic years beginning 1974 and 1975, this work was repeated with the categories modified. The categorisation used by Milson was felt to be rather inaccurate in that it did not distinguish between students with different levels of knowledge in physics and chemistry. Those who did not possess an 'O' level in a relevant science subject who were all classed as NS, e.g. students who had not studied any science since the third form at school, were placed in the same category as students who had studied science(s) to 'O' level standard but had not taken/had failed to pass the examination. A third category called MS was therefore introduced and students who fulfilled the following conditions were placed in that group:-

1. Had studied a relevant science subject to 'O' level standard but had not taken/had failed to pass the examination.
2. Had passed the 'O' level General Science paper.
3. Had passed Physics or Chemistry at C.S.E. level but not with a Grade 1 pass.

The number of students in each category are shown in Table 6. The numbers given for each category are the numbers as they were at enrollment; after this, the numbers changed. The majority of students in the 'S' category had 'O' level Science qualifications. The numbers of students with 'A' level Science passes are given in Table 7. The number of students with an 'A' level science background were 15 out of an S group of 100 students, i.e. 15% of the S group.

Table 6

Science Background of Students

Group	1974 Entry						1975 Entry					
	S		MS		NS		S		MS		NS	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
B.Sc.	14	53.8	4	15.4	8	30.8	25	83.3	2	6.7	3	10.0
H.N.D.	18	45.0	8	20.0	14	35.0	15	39.5	6	15.8	17	44.7
D.H.E.	11	44.0	4	16.0	11	40.0	17	50.0	6	17.6	11	32.4
Totals	43	46.7	16	17.4	33	35.9	57	55.9	14	13.7	31	30.4

Table 7

Numbers of Students with 'A' Level Science Passes

Group	1974 Entry	1975 Entry
B.Sc.	2	7
H.N.D.	2	2
D.H.E.	1	1
Totals	5	10

The science qualifications of the sample were different in the two years of the study. This difference was especially noticeable in the B.Sc. group. In 1974 53.0% of B.Sc. students had at least one 'O' level pass in a relevant science subject; in 1975 this had increased and 83.0% of the students entering the course had at least one relevant 'O' level science pass, and of these, 23.3% had passed an 'A' level in a relevant science subject. In 1975 therefore, the B.Sc. group had a much stronger science background than the other two groups (see Table 5).

3.5 Differences in Science Qualifications of Male and Female Students

There are more female than male students in this sample; this is partly because the Diploma in Home Economics course has only female students. The numbers of male and female students enrolling on courses in the Department in the two years of this study are shown in Table 8. These are the numbers at enrollment; numbers changed after this. The proportion of male/female students was different in 1974/75 and 1975/76, with a higher proportion of girls in the Department in 1975/76.

Table 8

Numbers of Male and Female Students in the Sample

Group	1974 Entry		1975 Entry	
	Males	Females	Males	Females
B.Sc.	15	9	9	21
H.N.D.	18	20	10	28
D.H.E.	-	25	-	34
Totals	35	57	19	83

The students on these courses are typical of the national picture in that more male than female students have studied physics and/or chemistry to examination standard. Table 9 summarises the science qualifications of male and female students.

In 1974, 34% of male students entering the Department had no 'O' level science qualifications, while the percentage of female students in this category was 63%. In 1975 the proportion of female students with no 'O' level science pass had dropped to 47% and the percentage of males in this category had risen to 42%. A greater number of males had passed both physics and chemistry at 'O' level, and a greater number of males had passed an 'A' level science examination. Among the female students who had taken an 'O' level examination in a science subject, chemistry seemed more usual than physics, with only a small proportion of female students having passed a physics examination. The numbers involved are shown in Table 10.

It seems possible that the female students take their science

Table 9

Science Qualifications - Differences Between Male and Female Students

Science Background	1974 Entry				1975 Entry			
	Males		Females		Males		Females	
	No.	%	No.	%	No.	%	No.	%
With no 'O' level science pass	12	34.3	36	63.2	8	42.1	39	46.9
'O' level physics only passed	7	20.0	2	3.5	2	10.5	2	3.8
'O' level chemistry only passed	1	2.9	13	22.8			24	28.9
Both physics and chemistry passed at 'O' level	10	28.6	1	1.8	3	15.8	6	7.2
'O' level physics-with-chemistry passed	2	5.7	3	5.3			8	9.6
'A' level physics only passed	2	5.7			2	10.5	2	2.4
'A' level chemistry only passed			2	3.5	2	10.5	1	1.2
Both physics and chemistry passed at 'A' level					2	10.5		
'A' level physical science only passed	1	2.9					1	1.2
Totals	35	100.0	57	100.0	19	100.0	83	100.0

The table shows the highest qualification of a student, e.g. a student who has passed 'O' level physics and 'A' level physics is counted in the 'A' level column but not the 'O' level column.

Table 10

Students Having Passed At Least an 'O' Level Physics Examination

	1974 Entry		1975 Entry	
	No.	%	No.	%
Males	22	62.9	9	47.4
Females	6	10.5	19	22.9

subject rather late in their school career. There are two distinct possibilities when assessing the relationship between previous school career and choice of higher education course:

1. That students having studied particular subject(s) at school seek a course for which their examination passes qualify them to apply.
2. That students seek a career/course, and then seek to meet the entry qualifications specifiec by that course.

Of these two options, the second seems more probable in the case of girls studying sciences, at least in this sample. This is supported by a) the fact that many course in food science/dietetics/food technology/catering, etc. specify a science subject passed at 'O' level, and often specify chemistry; b) many of the female students commented on this during structured interviews and said that they studied chemistry not because they had any special aptitude or liking for science but because it was a necessary qualification for their chosen career; c) the fact that many students, especially the females, took their 'relevant science subject' in the sixth form (after career choices had been made?) and not with their other 'O' levels supports this view.

Also, some schools, in an attempt to prevent too early specialisation, insist that at least one science subject is studied even among pupils who would rather not; in this situation female students may prefer chemistry,or physics with chemistry, to physics, as physics is traditionally a 'masculine' subject.

There were twenty male students and seventy-five female students who did not have an 'O' level pass in a relevant science subject. Of the twenty male students, one had failed the physical sciences 'O' level, one had failed the physics 'O' level and one had passed the General Sciences 'O' level. Of the seventy-five female students, six had failed the 'O' level chemistry examination, one had failed the physics with chemistry 'O' level, and one had passed the 'O' level General Sciences paper. One student had failed the Malaysian Integrated Sciences course.

It would seem that in this sample:

1. Male students entering the Department are more likely to have studied sciences to 'O' level than the female students.
2. Among female students who take science subjects, chemistry is more likely to be chosen than physics.
3. The lack of physics qualifications among the female students is due to the fact that they have never studied the subject, not that they have studied it and failed the examination.

The problem of interesting girls in sciences at school level is a well documented one; the proportion of female students in this sample to have studied chemistry to 'O' level is higher than the national average which, in 1973, (according to the D.E.S.) was 17% of female school pupils. Presumably this is because of the need for a science subject pass at 'O' level in food industry/dietetics courses as outlined above.

Chapter 4

A COMPARISON OF PRE-TEST AND POST-TEST PERFORMANCE ON THE SELF-LEARN SCHEME.

4.1 Aims

1. To establish, by comparing scores obtained by students at pre-test with those obtained at post-test, whether some degree of learning had occurred in students following the self-learn scheme.
2. To see whether any gain in scores at post-test stage was retained over a period of months.
3. To see whether there is a different gain in scores between students following different courses.

4.2 Comparison of Mean Scores on Pre-Test and Post-Test

Method

In the first week of the self-learn scheme in Applied Science, when the students were given an introduction to the course, the students were asked to complete a pre-test consisting of thirty objective-type multiple-choice (MCQ) science questions. Thereafter, the students followed the self-learn scheme of 15 units, taking a fifteen item MCQ test after completing each unit. Usually the tests were at weekly intervals but, in some instances, there was more than one week between tests. After taking the last unit test the students took a post-test. This was the same thirty item MCQ test as the pre-test. The items in the pre-test and post-test were chosen from the weekly unit tests, two questions from each unit test being selected on a random basis.

The students were not warned in advance that they would be given the pre-test or the post-test. On both occasions they were told that the scores were to be used for the evaluation of the self-learn scheme and would not be used in any assessment of their performance on the self-learn scheme. In view of this, they were requested to answer only those questions which they were confident they understood and could answer, and not to guess blindly.

A lower number of students took the post-test; this was, in part, due to the fact that eleven students left the Department in the time between the pre- and post-tests.

Table 11

A Comparison of Mean Scores at Pre- and Post-test

	No.	No. Possible	Mean	S.D.	Range
Pre-test	99	(99)	21.4%	15.1%	0 - 50%
Post-test	79	(87)	56.0%	14.0%	13 - 83%

The standard deviation remained the same in the two tests. The post-test mean performance was 34.6% higher than the pre-test mean performance. The range of marks widened between pre- and post-test.

4.3 Comparison of Pre- and Post-test Performance of Students Following Different Courses

When classified according to course followed, there was no significant difference between the groups on pre-test (see Table 12). This is despite the fact that the proportions of students of S, MS and

NS background were not the same in the three groups.

Table 12

Performance on Pre- and Post-tests;

Students Grouped by Course Followed

	Course Followed		
	B.Sc. %	H.N.D. %	D.H.E. %
Pre-test Mean	22.4	21.4	20.7
Post-test Mean	61.1	49.0	58.0
Mean Gain	38.7	27.6	37.3
% Increase = Mean Gain X 100 / Pre-test Mean	172.8	128.9	179.9

At the post-test stage the B.Sc. group showed the highest mean performance and the highest mean gain in scores. The D.H.E. mean performance was slightly below this, and the mean gain in performance was almost the same as that of the B.Sc. students. The H.N.D. students showed a lower mean performance and a lower gain in scores. This lower performance of the H.N.D. group as compared to the other two groups may be partly explained by the different science backgrounds of the three groups (see Table 6). The H.N.D. group contains the greatest proportion of students who have never studied sciences beyond a third form level at school, and the B.Sc. group contains the greatest proportion of students who have passed at least one relevant science 'O' level examination.

4.4 Performance on a Delayed Post-Test

The students who entered the Department in 1974 completed their physics/chemistry self-learn scheme in April, 1975. In April, 1976 these students were asked to complete the 30 item M.C.Q. test described previously.

The test was presented at lecture sessions for which the students were already time-tabled. They were not told in advance that they were to be given this test. They were told on arrival at the lecture that completion of the test was voluntary and that the results of the test were for research purposes only. All students present at the lecture sessions completed the test. They were given the same instructions as students attending the first year pre- and post-tests. Fifty-five students took the test out of a total roll of seventy-eight. The results are given in Table 13.

Table 13

Performance on a Delayed Post-Test.

Mean	S.D.	Range
45.1%	15.5%	13 - 83%

The results confirm the pattern shown by the immediate post-test completed by the first year students (see Tables 11 and 12). The B.Sc. students had the highest mean score, the H.N.D. students the next highest and the D.H.E. students the lowest mean score. This possibly reflects the proportion of S students in each group (see Table 6) and the different numbers of students in each group who took

the test. It could be that the B.Sc., and H.N.D. students represented a more highly motivated section of their group, especially as the tests were given in the last week of term. The D.H.E. students were given their test at a practical session which nearly all the D.H.E. students attended.

When classified by science background, the S students had a higher mean score than the NS students, with the MS students midway between the two. The differences between the mean scores of the three groups were not as large after this test as were the differences between means on the immediate post-test. In the three test groups - S, MS, and NS - the mean score was lower at delayed post-test stage than at immediate post-test stage.

Table 14

Mean Performance on Delayed Post-Test:

Differences Between Courses

	S %	No.	MS %	No.	NS %	No.	Total %	No.
B.Sc.	63.6	7	51.0	3	45.5	4	55.7	14
* H.N.D.	58.7	7	40.0	1	37.6	8	48.3	19
*** D.H.E.	42.5	8	46.5	2	32.8	11	37.9	22
Total	54.9	22	45.8	6	38.6	23		

* Three H.N.D. students completed the test but did not identify themselves; their results are counted only in the H.N.D. group total.

***One D.H.E. student did not identify herself; her result is counted only in the D.H.E. group total.

Conclusions

1. There is a gain in the knowledge of the students, as measured by objective tests, by the end of the self-learn course (see Tables 7 and 8).

2. Some of this knowledge is retained for at least one year after the students completed the self-learn scheme (see Table 9). There is an average decline in scores on the measuring test of 10% between the post-test and the delayed post-test. The extent of the loss in score seems to be related, to some extent, to knowledge of sciences prior to following the self-learn scheme, and also to which course within the Department the student was following.

3. There appears to be a different rate of gain in scores between the three course groups, but again, this may partly rest upon previous science knowledge.

Chapter 5

ENTRY QUALIFICATIONS RELATED TO PERFORMANCE ON THE SELF-LEARN SCHEME

5.1 Introduction

Much attention has been focused on the nature of the relationship between entry qualifications - specifically 'O' and 'A' levels of the G.C.E. - and subsequent performance on courses at college or university. The main findings of research in this area seem to be:

1. That 'A' level grades remain the most widely used predictor of success in Higher Education.
2. 'A' level grades seem to be the most accurate predictor of performance in a given field, rather than 'O' level grades or any of the other various correlates of performance which have been explored, such as scholastic aptitude tests, intelligence tests, school assessments, etc. However, the correlation of 'A' level performance with final result at university is, on average, probably not more than +0.3 or +0.4, and some research places it much lower (Butcher, 1968).
3. The efficiency of 'A' levels as a predictor seems to vary from subject to subject. There appears to be evidence that 'A' levels are more accurately predictive of success on science courses than arts courses, but some work (e.g. Pilliner, 1960) conflicts with this view.

Nisbet and Welsh (1966), in their paper on the prediction of student performance, conclude that "It would appear that a substantial

part of the variation in student performance at University is basically unpredictable from evidence available at the time of entry to University", and that a more promising line of enquiry for the educationalist would be the early identification of weak students so that appropriate assistance can be given. Prevention of wastage would therefore be based upon identification of the needs of students already accepted into the institution and not upon improved selection methods.

This approach to the problem of student wastage has much in common with the approach of Keller - emphasis upon the tutoring and personal contact level with as much assistance as the individual student needs. The format of the Keller plan means that relationships between entry qualifications and performance on the Keller plan are difficult to establish; students either master the course or they do not, and distinctions can only be drawn between large categories such as 'those who completed the course' and 'procrastinators'. The limited and skewed distribution makes the calculation of correlation coefficients impossible.

The self-learn scheme in Applied Science has a skewed distribution of marks but the range of the distribution is much greater than that of Keller plan, and it is possible to compute correlations.

5.2 Aims of This Study

1. To see whether level of prior academic attainment (measured by mean grades awarded at G.C.E. 'A' and 'A' levels) was related to level of performance on the self-learn scheme.
2. To see whether this relationship between prior academic

attainment and performance was atypical.

3. To see whether the performance of students having a prior knowledge of sciences would differ from the performance of students who had not previously studied sciences and to evaluate the importance of such prior knowledge in relation to extent of learning.

4. To see if the performance of students on the self-learn scheme varied according to which course in the Department they were following.

5.3 Relationship Between Educational Background and Performance on the Self-Learn Scheme

Correlation coefficients were computed between the mean grade of a student's performance on the self-learn scheme ($= \frac{\text{sum scores on tests}}{\text{number of tests}}$) and mean performance at 'O' level and 'A' level. The resulting correlations are given in Table 15.

Table 15

Correlations Between 'O' and 'A' Level Grades and Mean Performance on the Self-Learn Scheme

Group	Correlation with 'O' Level Grades	Correlation with 'A' Level Grades
B.Sc.	0.25	0.13
H.N.D.	-0.03	0.29
D.H.E.	-0.07	0.15

None of the correlations were significant.

5.4 Relationship Between Educational Background and Performance On All Subject Areas

The correlation between entry qualifications and performance on the self-learn scheme was very low, and correlation coefficients were computed between the marks given for each subject area on each of the first year courses given by the Department and previous academic qualifications to see if this low correlation was atypical. The results are given in Appendix III.

In the H.N.D. group, none of the correlations are significant using 'O' levels as the correlate with either course work or examination success. 'A' level grade was significantly correlated with performance in nine out of the sixteen obtained correlations, but only with performance on examinations - none of the correlations between 'A' levels and course work were significant.

In the D.H.E. group, none of the correlations with 'O' levels were significant. Only one correlation was significant using 'A' levels as the correlate, and again, this was with performance on examination (Microbiology examination in this case) and not with course work. In the B.Sc. group, one correlation was significant using 'O' levels. This was a correlation between Technical Communications (Course Work) and 'O' levels. Two correlations were significant using 'A' levels, one in Technical Communications (Course Work) and the other in Psychology (Examination).

Conclusions

1. There was a low correlation between performance on the self-learn scheme and entry qualifications, but this was not atypical.
2. Entry qualifications were not highly correlated with

performance on the B.Sc., H.N.D. or D.H.E. first year courses; within these three courses there were more significant correlations between examination grades and 'O' and 'A' levels than between course work grades and 'O' and 'A' levels.

3. The current Departmental policy of not specifying precise grades of passes at 'O' and 'A' level would seem to be supported by these results.

5.5 Relationship Between Science Background and Performance on the Self-Learn Scheme.

Students were categorised as S, MS, or NS on the basis of their knowledge of science on entry to the Department, as described previously in Section 3.4.

All students on the course took the sameunit tests at the same time; the unit test marks gained are summarised in Table 16.

Results

The mean scores on unit tests cannot be compared from one session to another because 1) the tests were modified on the basis of information gained in the 1974/75 session; and 2) the test situation was altered in that in the 1975/76 session all students were tested at the same time whereas in 1974/75, the students were tested in their course groups. However, in both 1974/75 and 1975/76 sessions, the S students gained significantly higher scores than the NS students (0.01 level). In 1974/75, this difference, although statistically significant, was less than 5%. In the 1975/76 session the mean difference between S and NS students was 13.8%. Milson (1974), in an examination of differences in mean scores obtained by students of differing science background who were

Table 16

Science Background and Performance on the Self-Learn Scheme:

(i) 1974 Entry

Unit	Mean Scores %			Differences Between Means %		
	No.= 40 S	No.= 16 MS	No.= 29 NS	S/MS	MS/NS	S/NS
1	81.5	71.0	70.8	+ 10.5	+ 0.2	+ 10.7
2	80.2	80.6	80.4	- 0.4	+ 0.2	- 0.2
3	84.5	75.3	73.5	+ 9.2	+ 1.8	+ 11.0
4	89.3	76.3	82.3	+ 13.0	- 6.0	+ 7.0
5	84.2	84.1	83.0	+ 0.1	+ 1.1	+ 1.2
6	83.3	72.1	75.0	+ 11.2	- 2.9	+ 8.3
7	87.7	81.3	82.4	+ 6.4	- 1.1	+ 5.3
8	73.8	68.5	67.5	+ 5.3	+ 1.0	+ 6.3
9	90.2	81.0	78.6	+ 9.2	+ 2.4	+ 11.6
10	75.7	70.5	76.3	+ 5.2	- 5.8	- 0.6
11	89.1	81.1	86.0	+ 8.0	- 4.9	+ 3.1
12	79.4	76.9	77.7	+ 2.5	- 0.8	+ 1.7
13	79.4	73.1	78.6	+ 6.3	- 5.5	+ 0.8
14	82.2	75.5	81.4	+ 6.7	- 5.9	+ 0.8
15	83.1	72.8	76.6	+ 10.3	- 3.8	+ 6.5
Means	83.8	76.0	78.0	+ 6.9*	- 2.0	+ 4.8*

* Significant at 0.01 level.

Table 16

Science Background and Performance on the Self-Learn Scheme:

(ii) 1975 Entry

Unit	Mean Scores %			Differences Between Means %		
	No.= 54 S	No.= 14 MS	No.= 30 NS	S/MS	MS/NS	S/NS
1	81.9	77.3	60.2	+ 4.6	+ 17.1	+ 21.7
2	79.3	73.5	60.3	+ 5.8	+ 13.2	+ 19.0
3	80.3	74.8	57.5	+ 5.5	+ 17.3	+ 22.8
4	83.8	74.8	64.1	+ 9.0	+ 10.7	+ 19.7
5	83.2	84.5	74.6	- 1.3	+ 9.9	+ 8.6
6	74.6	69.5	64.9	+ 5.1	+ 4.6	+ 9.7
7	90.8	89.8	78.6	+ 1.0	+ 11.2	+ 12.2
8	70.4	69.5	57.7	+ 0.9	+ 11.8	+ 12.7
9	79.9	82.7	70.1	- 2.8	+ 12.6	+ 9.8
10	70.1	63.6	50.8	+ 6.5	+ 12.8	+ 19.3
11	69.7	75.8	60.9	- 6.1	+ 14.9	+ 8.8
12	67.8	64.8	56.8	+ 3.0	+ 8.0	+ 11.0
13	76.1	74.0	57.0	+ 2.1	+ 17.0	+ 19.1
14	71.8	69.8	65.1	+ 2.0	+ 4.7	+ 6.7
15	77.8	74.2	71.9	+ 3.6	+ 2.3	+ 5.9
Means	77.2	74.5	63.5	+ 2.6	+ 11.2*	+ 13.8*

* Significant at 0.01 level.

following the course in 1973/74, concluded that "in practice, the differences in performance between NS, S and AS (students with an 'A' level pass in a relevant science subject) students are not all that great even though they may sometimes be statistically significant" and that "the self-learn scheme does appear to bring the students, regardless of their previous science background, up to approximately the same level of achievement in the subject areas selected for the self-learn scheme."

In the 1974/75 session, the findings and conclusions would support those of Milson, but in the 1975/76 session, the differences between mean scores of S and NS students appear to be much greater. It is difficult to account for this increased difference in mean scores in 1975/76. The unit tests had been modified, but to a large extent, the questions were those used in the 1974/75 session. In fact, one would have hoped that the performance of NS students relative to that of S students would have improved as a result of improved feedback and more tutoring of weaker students. It may be that alteration of the testing situation prevented collusion which may have been occurring in earlier sessions, and that this would be particularly reflected in the scores of students with a weak science background. It may also be that the increased rigidity of the course resulted in a lowering of motivation among students of a weaker science background.

The introduction in the 1975/76 session of compulsory attendance at tutorials for students who did not appear to have mastered a particular unit (mastery here was the ability to gain at least 73% on a test of the unit's objectives), could be a factor. Among NS

students a large proportion were regularly requested to attend tutorials: out of 15 unit tests in thirteen instances, the NS group mean was below the 73% mark. Comments from students in structured interviews indicated that the students felt, in some cases, that they were attending tutorials so regularly they were singled out as failures which increased their conviction that sciences were beyond their grasp. Added to this, many students, on interview, said they felt the tutorials to be of little practical value; too many students attended for there to be much possibility of individual assistance, and problems of a general nature were often dealt with.

The performance of MS students is difficult to classify. In 1973/74, Milson did not distinguish this category and the results of the 1974/75 session would suggest that the distinction was perhaps not worth drawing. The MS students performed significantly less well on the unit tests than did the S students, and in fact, performed slightly less well than did the NS students although the difference was not statistically significant (see Table 16). In 1975/76, however, the position was different. Here there was a significant difference between the MS and NS students (0.01 level) but only a slight and not significant difference between S and MS students. In both sessions the size of the MS group was small compared to size of other groups (1974/75 = 16; 1975/76 = 14) and this may go some way towards explaining inconsistencies between the results of the two sessions. It may also be that the explanations offered above, e.g. the alteration of the testing arrangements - account, to some degree, for the differences.

5.6 Gains in Knowledge by Students of Differeng Science Background

Gains in knowledge for students of S, MS, or NS background were calculated as the difference between the pre-test and post-test score of a student. A summary of mean scores is given in Table 17. The level of performance at pre-test and post-test varied according to the science background of the student.

Table 17

Performance on Pre- and Post-Test;

Students Classified by Science Background

	Science Background		
	S% (No)	MS% (No)	NS% (No)
Pre-test Mean	24.6 (54)	18.4 (14)	17.3 (30)
Post-test Mean	66.2 (41)	52.0 (13)	43.7 (22)
Mean Gain	41.6	33.6	26.4
% Increase $\frac{\text{(Mean Gain)}}{\text{(Pre-test Mean)}}$	169.1	182.6	152.6

All three groups have low scores in the pre-test, and the differences between them are not significant. At the post-test stage, the differences in mean performance between the three groups have increased. The highest mean score is in the S group and the lowest in the NS group. The mean gain in score was greatest in the S group and significantly less in the NS group. The MS group falls midway in terms of gain in mean score. The highest percentage

increase was in the MS group, with the NS group having the least percentage increase and the S group falling midway between these two.

5.7 Conclusions

1. The level of prior knowledge of relevant science subjects is related to score on unit tests of the self-learn scheme. The results gained in the 1975/76 session in particular suggest that the self-learn scheme does not lead to all students having, at the end of the self-learn course, approximately the same level of achievement in the subject areas of the self-learn scheme.
2. This conclusion is substantiated by the finding that a comparison of pre- and post-test performance on the self-learn scheme shows differing levels of performance at the post-test stage, and the fact that the greatest gain in scores between pre- and post-testing is made by students with prior knowledge of sciences.

5.8 Differences in Performance on the Self-Learn Scheme Between Students Following Different Courses in the Department

Students were classified according to which course in the Department they were following - B.Sc., H.N.D. or D.H.E. Academic qualifications of the students varied according to which course they were following, but this was previously found not to be related to performance in the self-learn scheme.

Within each course group students were classified according to science background; this was necessary because the proportions of S, MS and NS students within each course group were not the same.

Results

The results are summarised in Table 18 (for full details see Appendix I, Student Performance on Unit Tests of the Self-Learn Scheme).

Table 18

Performance on the Self-Learn Scheme;

Student Marks on Unit Tests Classified by Course Followed

I. 1974/75 Session						
Science Background	Mean Scores All Units BSc % (No)	HND % (No)	DHE % (No)	Differences Between Mean Scores BSc/HND	HND/DHE	BSc/DHE
S	85.0 (13)	83.2(17)	79.7(10)	+ 1.8	+ 3.5	+ 5.3
MS	78.4 (4)	76.1(8)	73.6(4)	+ 2.3	+ 2.5	+ 4.8
NS	77.5 (6)	76.0(12)	80.5(11)	+ 1.5	- 4.5	- 3.0
Means	81.9 (23)	79.3(37)	79.1(25)	+ 1.9	+ 0.5	+ 2.4
II. 1975/76 Session						
S	80.5 (25)	75.4(13)	74.0(17)	+ 5.1*	+ 1.4	+ 6.5**
MS	79.5 (3)	75.6(7)	68.5(6)	+ 3.9	+ 7.1	+11.0
NS	74.9 (2)	59.8(16)	68.5(11)	+15.1	- 8.7*	+ 6.4
Means	78.3 (30)	70.3(36)	70.3(34)	+ 8.0	- 0.06	+ 8.0

* Significant at 0.05 level

** Significant at 0.01 level

1. There were differences between mean scores of groups. In 1974/75 none of these differences were significant, but in 1975/76 three out of the nine mean scores were significantly different.
2. Among the S group of students in 1975, there were differences between mean scores of the B.Sc., H.N.D. and D.H.E. course groups which are not explicable solely in terms of different science backgrounds.
3. Among the NS group of students, the D.H.E. students performed significantly better on unit tests than did B.Sc. or H.N.D. students. The difference between the mean scores of the B.Sc. students and the mean scores of the other groups is not possible to evaluate because the numbers involved are so small (B.Sc. NS No. = 2).
4. Among the MS group of students none of the differences between means for any of the course groups in either year of the study are significant.

The greatest differences between mean scores are in the 1975/76 session in the S group of students where the B.Sc. students performed much better on the unit tests than did the S students of the other two course groups. This could be due to a number of factors, possibly including expectations of performance by staff (not only on this self-learn scheme but over the range of subjects offered by each course), the nature of the other subjects on the course and the extent to which these reinforce or elaborate on information given in the self-learn course, and the attitude of the students towards their particular course, towards sciences, and towards private study. These matters will be the subject of future chapters.

Chapter 6

DIFFERENCES BETWEEN THE PERFORMANCE OF MALE AND FEMALE STUDENTS ON UNIT TESTS OF THE SELF-LEARN SCHEME

6.1 Aim

To see if there was a significant difference between the levels of performance of male and female students on the self-learn scheme.

6.2 Method

Students were grouped according to sex and science background, and mean performance for each of the unit tests by each of the groups was calculated. A summary of results is given in Table 19.

6.3 Results

Table 19

Performance on Unit Tests;

Difference in the Performance of Male and Female Students.

	1974 Entry			1975 Entry		
	S% (No)	MS% (No)	NS% (No)	S% (No)	MS% (No)	NS% (No)
Male Students	85.8(22)	84.6(3)	76.5(10)	82.2(11)	70.3(3)	71.2(5)
Female Students	80.2(21)	73.1(13)	78.4(23)	76.4(44)	76.4(14)	63.1(25)
Difference in Means Male/Female	+5.6*	+11.5	-1.9	+5.8**	-6.1	+8.1

* Significant at 0.05 level.
** Significant at 0.01 level.

(For complete table of results see Appendix II)

In the NS group of students there was no significant difference between the performance of male and female students in either year of study when account was taken of science background. Similarly, in the MS group there was no significant difference in the performance of male and female students in either year of study.

In both the MS and NS groups in both years, the numbers involved in some subgroupings were small, especially in the subgroupings of male students as the number of male students in the department is small compared to that of the female students. This may have partly contributed to the findings in the MS and NS groups.

In the S group of students there was a significant difference between the performance of male and female students in both years of study. However, the actual differences involved are small, under 6% in both years. Reference to Table 6 will show that this difference could be attributable to differing science backgrounds; although all students, male and female, in the S group had passed at least one 'O' level examination in a relevant science subject, the male students were more likely than the females to have studied both physics and chemistry to 'O' level or to have studied an 'A' level science subject. The difference may also be due, to some extent, to differences in attitude; even female students who had successfully passed an 'O' level examination were likely to comment, on interview, that sciences had been studied because it was necessary, and that the sciences still were incomprehensible.

Finally, the proportion of girls in the S group with science qualifications which include physics is much lower than the proportion of male students with a physics qualification; the self-

learn scheme contains units which deal with both physics and chemistry, but the weighting is such that more of the units are physics than chemistry.

Physics Units	Chemistry Units
4	1
5	2
6	3
7	11
8	
9	
10	
12	
13	
14	
15	

There are 11 physics units and 4 chemistry units. An analysis of the scores of female students compared to those of the male students in terms of whether the unit was a physics unit or a chemistry unit is given in Table 20 (S students only).

The differences between means scores are greatest for the physics units. This is particularly true of the 1976 entry students.

6.4 Conclusion

The difference between the performance of male and female students on unit tests can be explained in terms of prior relevant science knowledge.

Table 20

Marks on Unit Tests; Differences in Scores

on Physics and Chemistry Tests Between Male and Female Science Students

	Chemistry Units Mean Scores		Physics Units Mean Scores	
	1974 Entry	1975 Entry	1974 Entry	1975 Entry
Male Students	84.5	79.9	86.2	83.1
Female Students	81.4	79.4	79.6	75.8
Differences Between Mean Scores				
Male/Female	-3.1	+0.5	+6.6	+7.3

Chapter 7

STUDENT PERSONALITY FACTORS RELATED TO PERFORMANCE ON THE SELF-LEARN SCHEME

7.1 Aims

(1) To see if a relationship could be established between any of the personality factors measured by Cattelle 16 Personality Factor Questionnaire and performance on the Self-Learn Scheme.

(2) To see if such a relationship could be used as a predictive measure to select out or make alternate provision for students who were unlikely to perform well on the Self-Learn Scheme.

7.2 Introduction

Much of the work concerning student performance has focused upon the identification of specific personality traits which may be associated with various concepts of success in a given course. In spite of the large number of studies concerning the relationship of personality traits and performance on courses which have been published, it is difficult to draw from the results of these studies a conclusion which may have general application for Higher Education. Generally, problems arise because of the factors mentioned below.

First among these is the diversity of factors which have been investigated; and secondly, interwoven with the first, a lack of conceptual clarity as to the nature of the factor(s) under investigation. As an example of this problem one may look at the published literature dealing with the relationship of anxiety to test performance. Dunn,

(1964) found 'anxiety' among school-children to consist of at least three factors - Test anxiety, Generlised anxiety, and Task anxiety. Sassenrath (1964) found 'test anxiety' to be multi-dimensional in nature.

Much of the work on anxiety as a factor in learning is based on the Eysenckian model of personality in which neuroticism (measured on a scale termed N), has been seen as almost synonymous with anxiety. Eysenk (1972) has postulated a circumlinear relationship between neuroticism and achievement, extremely high and extremely low 'N' scores being equally incompatible with high achievement scores.

Several studies have supported this model (Lynn and Gordon, 1971; Savage, 1962; Kelvin, Lucas and Ojha, 1965). However, Greer (1969) using the junior EP1 found no consistent pattern between neuroticism, intelligence and achievement and Knight and Sassenrath (1966) found that while high anxiety students worked faster and made fewer errors than low anxiety students, they did not show superiority on a delayed post-test. Kline and Gale (1971) found no relationship between neuroticism and performance.

When different methods are used to assess the anxiety, the situation becomes even more complex, and one must not conclude that different tests measure precisely the same personality dimension even though the designers of the tests give the factors the same or similar names. Eysenck (1972) has suggested that research in the dimension of 'neuroticism' has been fogged because of this lack of clarification of terminology.

It has usually been assumed that a high score of 'N' predisposes a student to act in one particular way for a given situation, and

research has been focused on the types of academic behaviour which neurotic students most frequently display. Eysenck suggests that this is an over-simplification, that other personality traits and previous habits may determine how a student reacts to reduce the anxiety state once it is aroused.

Generally, a survey of the relevant literature shows a confused picture. Entwhistle (1973) points out that it is dangerous to assume wide generality in statements about the relationships between personality variables and academic attainment. Age, ability, class size and organisation, teaching method and teacher personality are some of the intervening variables which may affect the relationship to some extent.

The examination of the relationship of student personality factors and performance on a given course has therefore tended in more recent times to turn away from the isolation of specific personality traits which can be correlated with achievement towards the establishment of measures designed to assess the relationship of the student to his course taking into account his personality characteristics and relevant habit systems and their interaction with the learning environment.

7.3 Review of the Literature

7.3.1 General Review

The dimensions of neuroticism and extroversion have been the focus of attention for research into personality factors and their relationship with performance on a given course.

The two most widely quoted British studies, Furneaux (1962) and Kelvin, et al (1965) identified "unstable introverts" as the most

successful examinees at university level, in both cases using the Eysenck Personality Inventory (E.P.I.) as a definition and a measurement of instability and introversion. These two studies consolidated the earlier findings of Burgess (1956) and Davie (1961) in American universities. Eysenck (1947) has stated that at the tertiary stage of education, the successful student will be the "neurotic introvert". However, more recent evidence from America (Lavin, 1967) and Britain (Entwhistle and Wilson, 1970) challenge the generality of the finding. Lavin, (1967) concluded from his summary of all American work published at that time that the stable student is the most likely to be successful, although agreeing that introversion is more likely to be associated with success at university than is extroversion. Others do not confirm this finding. Rosenberg, McHenry and Rosenberg (1962) in a study of sociability as a predictor of academic success found high achievement to be related to social ease and popularity among peers. A fourteen-item sociometric questionnaire was administered to 86 students (before any academic grades were available) on three military courses. The authors noted that these sociometric ratings are much more accurate in the prediction of successful academic performance than they are at identifying the poor student.

In 1963 Cortis reached the same conclusion - that social ease was positively correlated with performance - in an examination of personality factors related to under-achievement in college.

Holland and Astin (1962) studied undergraduate achievement in scientific, social, aesthetic and academic areas. They

discovered differences among high achieving students in the arts and science fields and postulated personality differences between the "creative" student and the "academic" student.

1. Student leaders were found to be "self-confident, popular, sociable, enthusiastic, dominent and aggressive, responsible, conventional and extroverted.
2. The student artist possesses many of the stereotyped characteristics of the artist and, like the student leader, is sociable, self-confident, expressive and extroverted, though the qualities are less typical of the student artist than the student leader.
3. The findings were not as clear for scientific achievers because at the undergraduate level, there were few students who would fit this category. Mathematical aptitude and high creativity were common factors.
4. The academic achiever was different from all other groups in that high achievement was related to lack of creativity, insociableness, passivity and timidity.

This suggestion that personality differences were found between high-achieving students in different fields was echoed by Smithers and Batcock (1970) who found that stable introverts make the most successful examinees among social scientists in a technological university, but not among health scientists. This study indicates variations in personality traits between successful students taking different academic disciplines. Wankowski (1969) has suggested that it is stable introverts who dobest at university generally, but with many reservations depending upon the facility the students is

enrolled in, sex of student, etc. He found significant differences between personality 'types' of students in different faculties. He further suggested that a personality profile of a 'typical' student for every Department or Faculty could be drawn, and that students were more likely to fail their course when they were unlike their particular group personality profile. Wankowski further concluded from his data that there exists a "considerable degree of association" between extroversion and social class of student schools from which they enter university, and attainment at G.C.E. At the higher education level the relationship between personality factors of students and their performance on a course is not a simplistic one.

Beach (1961) examined the question of the personality/performance relationship in different learning situations. He showed that the more sociable students would achieve more under conditions allowing student participation.

Entwhistle and Entwhistle (1970) compared data on personality factors from two institutions as a pilot study for a larger-scale project which would examine data from three sections of Higher Education (now in progress). Using the EPI and first year marks, correlations of -0.25 (extroversion) and -0.11 (neuroticism) were found for universities; for a college of education sample the coefficients were -0.11 (extroversion) and -0.02 (neuroticism). In an analysis of half the data obtained in the follow-up sample, Nisbet, Percy and Entwhistle (1971) used data from 898 students from three universities, 562 students from four colleges of education and 190 students from five polytechnics. Students were given the EPI, the Eysenck scales of radicalism and tendermindness and the study

of values. The profiles of mean scores on these tests showed considerable differences between students taking different disciplines.

There were also differences within faculties. The greatest consistency in results occurred with the extroversion trait: on the whole, introverts tended to be more successful. No significant correlation was found between neuroticism and academic performance. Wilson (1971) found introversion and neuroticism to be linked to high performance. This latter finding contrasted with the findings of both Wankowsky (1968) who found neuroticism to be associated with failure, and Entwhistle and Entwhistle (1970) who found no relationships between neuroticism and performance.

The relationship of aspects of personality to performance is a complex one, with many other variables - such as sex of the students, teaching method, personality of the teacher, Department/Faculty involved - intervening and preventing the establishment of a simple casual relationship. Once having established some relationship, the resulting action has still to be decided. Beach (1961) suggested using personality profiles for deciding upon students who would be willing to benefit from a particular course or method of instruction i.e. selection. A similar suggestion has been put forward by Eysenck (1971). In contrast to this, Wankowski (1969) would use the data as a method of improving and widening teaching methods and styles, and points out the inherent dangers of recruiting to a Department on the basis of a personality profile which is associated with success in that Department. The data obtained indicated that it was not the personality of the student which predisposed him to failure, but the

influence of the educational treatments he receives throughout his learning years. Personality "does seem to play a part in the student's progress, but merely as a source of responses to a different educational media".

7.3.2. Personality Factors and Performance on Self-Learn Schemes

The data in this area are limited, and still restricted to the establishment of non-complex and possibly casual relationships between a given course and a measurable personality factor.

Swiris (1966) made a factorial study of students' variables relevant to a programmed learning situation. He investigated the effect of student variables on outcomes of learning using a linear maths programme in geometry. His subjects were twenty-five third-form grammer school pupils. The programme consisted of 180 frames covering thirty-three items. There were twelve variables under investigation including three personality factors.

Swiris concluded that most of the variance in post-programme scores could be attributed to initial level of achievement. Also, the abilities needed to succeed on a programmed learning course were not significantly different from those needed for success in other learning situations. A favourable attitude to programmed learning is associated with the absence of neuroticism and anxiety, and a high degree of adaptive flexibility is associated with slight hostility towards the rigid and highly structured nature of programmed instruction methods. Of these four major conclusions, two have been extensively investigated as personality factors affecting performance in programmed instruction courses: intelligence and anxiety.

(i) Intelligence Quotient as a Factor

There is general agreement in the literature that "poor ability", i.e. lower IQ students, take more time to complete a given programme (when self paced) than do higher ability students (Alter, 1963; Morris, et al, 1970; Underwood, 1954). Dick and Latta (1970) found that, although lower ability students took longer to complete the course, they obtained lower post-test scores.

Stolurow (1962) repeated an investigation by Detambel and Stolurow (1956) with, again, the finding that general intelligence did not correlate significantly with any of the scores reached after programmed instruction in logic, statistics and methametics. Traweek (1964), using a mathematics programme, found no correlation between intelligence and performance on the programme. Shay (1961) concluded that IQ did not serve as an adequate predictor of performance on programmed learning courses. Several explanations have been suggested to account for this lack of correlation between intelligence and performance; with regard to programmed learning:-

1) Several studies have pointed to the inadequacies of the intelligence test as an accurate predictor of success on any course. (Hiem, 1947; Himmelweit, 1961).

2) It has been suggested (Glaser, Homme and Evans, 1960; Homme and Glaser, (1959) that achievement scores from a programmed learning score tends to make learners more homogeneous, thus covering any real relationship between ability and achievement score. In direct contrast to this, Keisler (1959), Shay, (1961) and Morris, et al (1970) found that programmed instruction renders learners more variable on the achievement measure.

3) It is possible that restricted intelligence ranges used in most studies accounts for the apparent lack of relationship between ability and achievement scores. Tuel (1963) found that when the range of intelligence of the sample was restricted (in his survey IQ range was 95-115), correlation between IQ and achievement was zero. When a sample was used which included the full IQ range of a large public school (IQ range 70-140), a significant correlation was found.

Lambert, Miller and Willey (1962) established a positive relationship between IQ and performance on a programmed course, a finding supported by Creswell (1964), Larkin and Leith (1964), and Major (1970). Lewis and Gregson (1965) noted that a distinction must be made between immediate recall as measured by post-test on completion of the programme, and retention measured by delayed post-test. Lewis and Gregson found students with a higher IQ to perform better on both types of test, but Tuel (1963) and Larkin (1964) found that group differences in learning did not appear until the delayed post-test when it favoured the higher ability groups.

Alter (1963) did not find any significant difference in retention between students of high, middle or low intelligence. Alter concludes that the relationship of intelligence to delayed retention is explained in terms of the student's initial proficiency, a finding supported by the studies of Evans (1964), Eigen and Feldhusen (1963) and Bugelski (1956).

It appears that the IQ is a poor predictor of learning in the programmed learning situation, the exact relationship being difficult to assess. This may be indicative of differences in the test used to

measure performance on the courses, and the limited IQ range involved in many experiments, rather than the absence of any relationship between IQ and performance.

(ii) Anxiety as a Factor

In examining the interaction of teaching styles and student personality factors, Grimes and Allensmith (1961) found high anxiety pupils worked best in a highly structured situation. Since programmed instruction represents a very highly structured situation, it would seem plausible to expect anxious students to perform better than non-anxious students on a programmed course (but the possibility of a curvilinear relationship such as that postulated by Eysenck was not discussed in the study). Leith (1969) reports a series of experimental studies - an extension of those by Leith and Bosset (1967) - in which four learning situations were designed with a different amount of guidance given to the learner in each group. Leith used the Junior Maudsley Personality Inventory (M.P.I.) with a sample of children aged 10-11 years. He concluded that anxious children were better than non-anxious children when given complete guidance.

A replication with adult students gave a different pattern of results with non-anxious students performing very much better than anxious students in all areas. Within both groups of students there was an interaction between extroversion and learning method, such that extroverts were better in a highly structured situation than a non-structured one. A final follow-up study among student teachers again showed non-anxious students to be superior.

The fact that extroversion (Leith and Trown, 1970; Greer, 1969),

sex differences (Eysenck and Cookson, 1969; Long, 1964), and impulsiveness (Barratt and White, 1969) have all been found to interact with anxiety suggests that a multivariate examination of factors at work is likely to be of more value than concentration upon one single factor. From research already published, however, one may conclude that the extent to which anxiety will be an influencing factor on performance in the programmed learning situation will depend upon the extent to which the situation is anxiety or test-anxiety producing.

Sutchett-Kaye (1972), from a survey of the work done on the relationship of personality factors and self-instruction, concluded that the extent to which anxiety would be an influencing factor on performance would depend upon the nature of the learning situation, as follows:

1. High structured programmes result in less anxiety than do unstructured programmes which allow conflict situations to develop.
2. Programmes which stress success on the task, e.g. by including a large number of self-test exercises, that require the student to give constant feedback of his progress - are more likely to result in test anxiety being a significant factor in performance.
3. Programmes over which the student has control - self-paced programmes - generate less anxiety than programmes which are not self-controlled.
4. The amount of work presented at any one time may have an effect upon anxiety level. When a large amount of material is presented, anxious students would tend to do less well than non-anxious students. Thus, the effect of anxiety level upon performance would be greater with a large step programme than with a short step.

Bigelow and Egbert (1968) concluded that no significant personality differences existed between successful students following a traditional course and successful students on a self-learn course, a finding reported earlier by Koenig and McKeachie (1959).

Rasheed (1973) did find differences between successful students in a programmed learning situation and successful students on a more traditional course. Eighty-nine undergraduate students following a course in astronomy constituted this experimental group who took their course in a programmed text form over a period of nine days. The control group consisted of fifty-eight students matched as closely as possible to the experimental group; they followed the same course and were given the same subject matter but the course was lectured. A pre-test and post-test was given to both groups of students, and all students completed Cattell's 16P.F. personality inventory. In the self-learn group, Factor A (detachment) was the most highly correlated with performance, and B+ (high intelligence) was the next most highly correlated. In the control group no significant correlations emerged.

7.4 The 1974/75 Study

The study concerned eighty-six students following a self-learn course in Applied Sciences.

All students completed the Cattell 16P.F. form A, and the scores for each of the sixteen first-order personality factors and four second-order personality factors were correlated with mean performance on the fifteen unit tests of the Applied Sciences course.

The relationships between each of the personality factors and the test scores are shown graphically in Appendix IV.

The correlations for each of the three groups between the measured

personality factors and performance on unit tests are shown in Table 21. No consistent relationships between the measured personality factors and performance on the self-learn scheme emerged, but the following were significantly related to performance in at least one of the groups under investigation:-

1) Factor A (outward going) showed a significant correlation with performance in two out of the three groups; in one group the relationship was positive, in the other negative. The degree of reserve may influence performance, but it is unclear in what direction.

2) Factor B (high I.Q.) showed a positive correlation in all groups showing a relationship between general intelligence and attainment, but in only one group was the relationship statistically significant. Factor H showed a relationship between shyness and attainment in all groups, but in only one group was the relationship statistically significant.

3) Factor I showed a relationship between two out of three groups between tough-mindedness and attainment, but in only one case was the relationship statistically significant.

4) Factor Q1 showed a relationship between conservativeness and attainment, but in only one case was the relationship significant. No clear indication of the relationship of anxiety to test results emerged from this study. In one group the correlation was low and negative (-0.18) and in two groups the correlation was low and positive, the coefficients being +0.24 and +0.02 respectively. When plotted graphically, no curvilinear relationship could be seen.

5) The degree to which students were independent (Factor QIV) as

Table 21

Correlation Between 16 PF Scores/Marks on SL Scheme

Factor	BSc No. = 23	DHE No. = 25	HND No. = 37
A	-0.48**	+0.39*	+0.12
B	+0.32	+0.19	+0.38**
C	-0.34	+0.08	+0.04
E	-0.3	-0.18	-0.22
F	-0.12	+0.24	+0.06
G	-0.32	+0.18	-0.2
H	-0.53**	-0.26	-0.2
I	-0.15	-0.41**	+0.13
L	-0.17	-0.33	-0.11
M	+0.2	-0.04	-0.13
N	-0.04	+0.08	+0.11
O	+0.34	-0.12	+0.001
Q1	-0.19	-0.43**	-0.16
Q2	-0.07	+0.1	+0.04
Q3	-0.2	+0.11	+0.09
Q4	+0.17	-0.29	-0.02
QI	-0.22	+0.005	-0.07
QII	+0.24	-0.18	+0.02
QIII	+0.26	-0.31	-0.09
QIV	-0.34	-0.31	-0.13

* Significant at 0.10 level probability
** Significant at 0.05 level probability

assessed by the 16P.F. was negatively related to achievement in all three groups, but in no group was the correlation statistically significant.

6) Extraversion (Q1) and Anxiety (Q11) were not related to performance.

7.5 Conclusions

While some correlations could be seen between personality factors and performance on the self-learn scheme, the nature of the relationships was not clear. Factor A, for example, was significantly related to performance in two groups of students, but in one group the relationship was positive and in the other it was negative. In a third group, it was not significant at all and no non-linear relationship could be seen. This lack of generality in relationships makes it difficult to take much account at the planning stage of a learning course of the problems likely to be encountered by students because of differing personality types.

It may be that the practical importance of personality influences in learning, given the complexity of the interaction of these influences on the learning milieu, may be extremely limited.

Certainly the information presented in this study concerning student personality factors is not of great value either for selecting out students who are unlikely to benefit from the scheme, or of modifying the scheme so that it benefits more of the student population.

Chapter 8

STUDENT RESPONSE TO THE SELF-LEARN SCHEME

8.1 Introduction

The response of the students to an inovatory course has obvious implications for the success or failure of the course.

A great deal has been published concerning student reaction to a course, although the value of some of the material may be questioned. Because of the novelty value of new teaching methods and the commensurate Hawthorn effect, ratings of studies which have been of short duration may be of little value. The best ratings, in terms of reliability and validity, would be:

a) taken from studies over a long period of time

b) where the mew method has become a normal part of the learning situation and less likely to be affected by the experimental situation.

The student's view of the teaching he has received will reflect his own intellectual biases and emotional attachments. The authoritarian student personality, for example, seems to prefer and benefit from a high degree of departmental control (Vreeland and Bidwell, 1966) and to perform better when taught in a homogeneous group (Bendig and Hountras, 1959). Such a student will, for example, perceive an authoritarian teaching situation differently to his non-authoritarian peer. A study by Menges (1969) showed that when student and teacher are of a similar cognitive bias (authoritarian v. non-authoritarian), the student is more likely to rate the teacher as effective (although

as Menges also showed, this does not indicate that such a student would perform better on the course than a student with dissimilar cognitive bias).

A student's personality will be reflected in his assessment of the course he is following. People mould what they perceive into an existing framework (Anderson and Hunka, 1963) in order to impose some order over their world.

In an endeavour to obtain stable and orderly perceptions, people tend to see only the positive traits of those whom they like. Anxiety is likely to produce misperception, since the anxious person will tend to arrive at a decision quickly based on inadequate knowledge, in order to reduce anxiety caused by not knowing.

Finally, the student's rating of a course will incorporate his purposes in studying in general and his objectives in studying the particular course or the part of it in question. The disciplinary area to be evaluated may be central or peripheral in his perception of the situation. It is likely that students evaluate differently according to whether the class is compulsory or elective, undergraduate or graduate (Guthri, 1949; Riley, Ryan and Lifshitz, 1950).

Entwhistle (1972) states that student rating of a teaching method is likely to be adversely affected if the students were to come to feel that they were only being used as research "guinea-pigs".

8.2 Review of the Literature

Many inovatory programmed courses were assessed for student reaction, and in all cases the reports were favourable or, at worst, neutral (for example, Geller, 1963; Glynn, 1963; Hoare and Inglis, 1965; Owen, Hall, Anderson and Smart, 1965). However, many of the

limiting factors outlined in the Introduction apply especially to these early experiments, where the method was very revolutionary and the experimental situation effects likely to be correspondingly great.

In Keller-plan and Keller-type courses, the very favourable student reaction to this type of course has been a constant feature of published reports, and has been used as a strong argument for the introduction of this type of course. Reported complaints by students usually relate to the relatively large amount of work which they feel necessary compared to what they might do on a more conventional course. (For example, Born and Herbert, 1971; Nelson and Scott, 1972; Green, 1971; Koen, 1970).

Kulik, Kulik and Smith (1976) report that from a survey of published reports, only one or two students in a particular class of fifty would react negatively to Keller-type courses.

Most of the students' reactions were assessed by the collection of confidential questionnaires at the end of the course. Because of the often anonymous confidential nature of the responses, it has been difficult to do more than quantify them in terms of "I liked the course more than"..... followed by the percentage of students agreeing with the statement.

The fact that reaction to the method is usually measured at the end of the course may mean that early apprehension or doubts about the course may be overlooked (Knightly and Sayre, 1971).

Milson (prior to 1974) assessed the response to the self-learn scheme by means of questionnaires given in the 1973/74 session.

8.3 Aims of This Study

1) To see whether any of the variables under examination were related to performance on the Self-Learn Scheme.

   The variables examined were:

   a) Time spent on the unit

   b) Level of difficulty with the unit

   c) How interesting was the unit

   d) How useful was the unit in achieving the stated objectives

   e) How useful was the unit in achieving understanding of the subject

   f) Assess the quantity of information in the unit

2) To see whether there were significant differences on any of the variables between groups of students classified by course on which they were enrolled.

3) To see whether the modifications made by Milson to units reported as causing difficulty in 1973/74 led to a reduction in level of difficulty reported by students following the course in 1974/75.

4) To see whether the variables were related to one another.

5) To see whether student response to any of the variables was related to performance on unit tests.

6) To see whether student response to any of the variables was related to any of the personality factors of the students measured by Cattels 16PF.

8.4 Method

In the 1974/75 session, student responses to each unit were monitored by weekly response questionnaires based upon questionnaires used by Freeman and Penny (1972/73) in Sheffield Polytechnic. The responses to the questions were made on a computer-marked card and

the responses analysed by the APGRD computer programme. Each student was allocated a number which was then used to identify all future results on Unit tests of the Self-Learn Scheme and student response questionnaires. In this way it is hoped a degree of confidentiality could be secured while still enabling the response to the questionnaire variables to be related to other student variables on an individual rather than a group basis. Completion of questionnaires was voluntary, but because of the organisation of the test classes (all students were given a questionnaire along with a test paper, and a card for marking in the questionnaire response), the proportion returned was almost 100% of those taking a test. Over the whole course, eleven questionnaires were not returned by those who took a test, which represents less than 1% of the total of questionnaires.

All response variables were scored on a scale between 1 and 5 points, with 1 being the most favourable response and 5 the least favourable. Where quantities are involved (as in variable 1 - "How much time" and variable 5 - "Assess the quantity of the information"), 1 represents the least amount and 5 the most. (see Table 22)

Care is needed in interpreting the data on student responses. Two considerations are of particular importance:-

1) The distinction drawn between S and NS students is an arbitrary one. Included with the NS group are students who do have prior knowledge of sciences. However, the numbers of these "MS" students who have studied sciences but have not passed an 'O' level science examination, are too small to allow proper comparisons to be made if they are counted as a separate group (see Table 1).

2) The opinions of the students are based on subjective impressions and the number value is arbitrarily designated. The mean values (obtained from calculation of mean of all responses by a particular student to a particular variable combined with all other mean responses and divided by n) must be interpreted in this light.

Table 22

Performance on Self-Learn Scheme 1974/75:

Students Grouped by Science Background*

Student Group	S.Mean	N	MS.Mean	N	NS.Mean	N
BSc	85.0	12	78.4	4	77.5	7
HND	83.2	17	76.1	8	76.0	12
DHE	79.7	11	73.6	4	80.5	10
ALL	82.6	40	76.0	16	78.0	29

* For detailed analysis - Appendix 1

S = Students who have at least one GCE 'O' level pass in Physics, Chemistry, or Physics-with-Chemistry.

MS = Students who have studied Physics or Chemistry or a combination of these for examination purposes but not passed the examination.

NS = Students who have not studied Physics or Chemistry since a basic level at school, usually third form.

8.5 Results

1) Summary

Mean responses were calculated by

a) Taking the mean response to each variable for each student for all 15 units (90 means) and then

b) Taking the mean response to each variable for all students (1 mean).

Table 23 shows that response to the course was neutral to favourable, when the mean for each response was taken. The responses can be summarised as follows:-

Time Taken - the mean was 2.8, which represents an actual time commitment of one-and-a-half to two-and-a-half hours per week. This was felt to be a reasonable amount of time as the self-learn scheme replaced two hours of class contact time per week. The range covers all possible differences in amount of time spent, which is not unexpected in a course where a time limit is flexible to some extent and the degree of prior knowledge of the subject is varied.

Difficulty - the mean response was 3.3, which represents a point almost midway between "not particularly difficult" and "fairly difficult", with a wide range of individual responses.

Interest - the mean response fell between "fairly interesting" and "not particularly interesting". The wide range and the standard deviation of 0.45 indicate that there was a varied response to this question, but extreme responses were rare.

The Two "Understanding" Parameters - fell midway between

"fairly useful" and "not particularly useful" The range and standard deviation here suggest that individual student responses did not differ too far from the mean to be a cause for concern.

Quantity of Information - the mean response fell midway between "about right" and "rather a lot". Individual responses covered the whole range of possible responses.

Table 23

Mean Response to the Self-Learn Scheme

Variable	All Students Mean	S.D.	Maximum Average Response for any 1 Student	Minimum Average Response for any 1 Student	Range
Time	2.78	0.95	5.0	1.0	4.0
Difficulty	3.32	0.68	4.6	1.0	3.6
Interest	2.7	0.45	4.9	1.9	3.0
Understanding	2.3	0.3	3.3	1.4	1.9
Quantity	3.4	0.7	5.0	1.0	4.0

n = 85

All responses are scored on a scale of 1-5 points.

1 indicates the most favourable response and 5 the least favourable response. Where time and quantity of information are concerned, 1 = least and 5 = most time/quantity.

2) Means for Groups of Students

The mean responses for students grouped by science background are summarised in Tables 3-9. These tables show two comparisons:

a) Differences in responses between students following different courses in the Department, either B.Sc., H.N.D. or Dip.H.E.

b) Differences in response between students who had a relevant prior knowledge of sciences and students who did not. Students were designated S., MS., or NS. as described previously. The MS group of students was too small to allow any conclusions to be drawn from any differences which might have been observed, therefore the MS students were grouped with the NS students as they were by Milson in 1973/74. This also had the advantage of making some comparison between the findings inthe two sessions possible.

Time Taken to Complete the Unit (Table 24)

Comparison of the data for all units showed that there were no *significant differences between the HND, BSc. and DHE group means, although there were variations between these course groups for individual units.

On average, the NS students spent significantly more time on the units than did the S students. This trend was apparent for all units. The mean score for the S students was 2.2, and for the NS students, 3.3, representing a difference in actual time spent of 0.5 hours. This difference is significant at the 0.1 level. Units 2, 3, 4 and 5 showed a marked difference in time spent between S and NS students. Units which took longer than average for all groups were 2, 3 and 4.

*Significance, where mentioned in the text, refers to statistical significance. Where differences are held to be "not significant", they do not reach the 0.5 level.

Table 24

Summary Student Responses to Question

"How long did it take you to complete this unit?"

Unit	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc.		HND		All S-All NS	BSc-DHE	BSc-HND	DHE-HND
	N=11 S	N=14 NS	N=12 S	N=11 NS	N=17 S	N=20 NS				
1	2.4	3.6	2.3	3	2.4	3.8	-1.1	-0.7	-0.5	+0.2
2	2.4	4.3	2.4	3.5	2.4	4.1	-1.6	-0.5	-0.4	+0.1
3	3.3	4.7	3.4	4.7	3.5	4.7	-1.3	0.0	-0.1	-0.1
4	2.4	3.8	2.6	3.5	2.0	3.6	-1.3	-0.4	+0.3	+0.7
5	2.0	4.0	1.6	2.5	1.9	2.7	-1.3	-0.7	-0.2	+0.5
6	2.1	3.2	2.1	3.3	1.8	2.5	-1.0	+0.1	+0.5	+0.4
7	2.1	3.2	2.1	2.7	1.9	2.8	-0.9	-0.1	0	+0.1
8	2.0	2.9	2.4	2.5	2.2	3.1	-0.6	-0.1	-0.2	-0.1
9	2.3	3.3	2.1	2.3	1.7	3.1	-0.9	-0.7	-0.2	+0.5
10	1.9	2.8	2.6	2.5	2.0	3.7	-0.8	-0.4	-0.3	+0.1
11	2.4	3.5	2.2	2.4	1.8	3.1	-0.9	0.0	-0.1	-0.1
12	2.6	3.4	2.2	2.7	2.2	3.1	-0.8	-0.6	-0.2	+0.4
13	2.3	3.3	2.4	3.4	2.3	3.4	-1.1	0.0	0.0	0.0
14	2.3	4.1	2.6	3.7	1.9	2.6	-1.2	-0.2	+0.9	+1.1
15	2.2	2.9	1.7	2.8	1.5	2.6	-1.0	-0.4	+0.2	+0.6
Mean All Units	2.3	3.5	2.3	3.0	2.1	3.3	-1.1	-0.3	-0.02	+0.3

1 = under 1.5 hours

2 = between 1.5 and 2 hours

3 = between 2 and 2.5 hours

4 = between 2.5 and 3 hours

5 = over 3 hours

Degree of Difficulty (Table 25)

Comparison of the data showed negligable differences between the Dip.H.E., HND and BSc students. The NS students found the units 0.5 points more difficult than the S students, but this trend was not consistent from unit to unit. The S students found the unit just beyond "not particularly difficult" and the NS students found the units to be tending towards "fairly difficult". Units which students found particularly difficult were 8, 10, 12, 13 and 3 (especially for NS students).

Degree of Interest (Table 26)

Comparison of the data showed no significant differences between courses and no significant difference between S and NS students.

There was no significant difference between interest scores in the first term and those in the second term.

No individual units were particularly lacking in interest for all groups of students.

Usefulness in Achieving the Stated Objectives (Table 27)

Comparison of the data showed no significant differences between courses or between S and NS students.

Individual units which were not so useful in achieving the stated objectives were 3, 8 and 13, although not all groups agreed upon which units were less useful.

Usefulness in Understanding the Subject (Table 28)

Comparison of the data showed no significant differences between courses or between S and NS students.

Individual units which were not so useful in achieving understanding of the subject were 3, 8, 12 and 13, although not all

Table 25

Summary of Student Responses to Question

"How difficult did you find this Unit?"

Unit	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc.		HND		All S-All NS	BSc-DHE	BSc-HND	DHE-HND
	S	NS	S	NS	S	NS				
1	2.6	3.8	2.5	3.2	2.9	3.7	-0.9	-0.3	-0.4	-0.1
2	2.5	4.3	2.4	3.5	2.4	3.9	-1.5	-0.4	-0.2	+0.2
3	3.3	4.7	3.4	4.7	3.5	4.6	-1.3	0	0	0
4	3.5	3.6	2.7	3.3	3.2	3.3	-0.3	-0.6	-0.3	+0.3
5	3.1	3.1	2.8	2.9	2.3	2.7	-0.2	-0.3	+0.4	+0.7
6	3.0	3.1	2.8	3.4	2.7	3.4	-0.5	+0.1	0	-0.1
7	3.2	3.7	3.1	3.5	3.1	3.5	-0.5	-0.1	0	+0.1
8	4.4	4.4	3.6	4.2	3.6	4.1	-0.4	-0.5	+0.1	+0.6
9	3.2	3.3	2.8	3.2	2.9	3.4	-0.3	-0.1	-0.2	-0.1
10	3.8	3.9	4.2	4	4	3.4	+0.2	+0.3	+0.5	+0.2
11	3.2	2.9	2.9	3.7	2.9	3.6	-0.4	+0.3	0	-0.3
12	3.9	4.6	3.5	4.1	3.5	3.7	-0.5	-0.5	-0.2	+0.7
13	4.0	3.9	4	4.1	3.8	3.7	0.0	+0.2	+0.3	+0.1
14	3.9	4.1	3.4	4.2	2.9	3.4	-0.5	-0.2	+0.6	+0.8
15	3.8	3.1	3.1	3	2.8	3.1	+0.1	-0.2	+0.1	+0.3
Mean	3.4	3.8	3.1	3.6	3.1	3.6	-0.5	-0.2	+0.04	+0.2

1 = very easy

2 = fairly easy

3 = not particularly difficult

4 = fairly difficult

5 = very difficult

Table 26

Summary of Student Responses to Question

"How interesting did you find this Unit?"

Unit	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc.		HND		All S-All NS	BSc-DHE	BSc-HND	HND-DHE
	S	NS	S	NS	S	NS				
1	2.5	2.5	2.0	2.0	2.5	2.6	0	-0.5	-0.6	+0.1
2	2.5	2.0	2.0	2.7	3.0	2.6	+0.1	+0.1	-0.4	+0.5
3	3.1	3.0	2.3	2.9	3.6	3.4	-0.1	-0.4	-0.9	+0.5
4	3.5	2.7	3.1	3.2	2.8	2.5	+0.3	+0.1	+0.5	-0.4
5	2.8	2.8	2.7	2.7	2.9	2.7	+0.1	-0.1	-0.1	0
6	2.6	2.1	2.5	2.5	2.4	2.5	0	+0 2	0	+0.2
7	3.1	2.9	2.6	2.9	2.8	2.8	-0.1	-0.1	-	-0.1
8	3.5	3.7	2.4	3.2	3.2	3.2	-0.4	-0.8	-0.4	-0.4
9	2.7	2.6	2.2	2.6	2.4	2.7	-0.2	-0.2	-0.2	0
10	3.3	2.6	2.9	2.4	3.1	2.7	+0.5	-0.2	-0.2	0
11	2.1	2.1	2.5	2.3	3.1	2.6	+0.3	+0.3	-0.5	+0.8
12	3.3	3.3	2.8	2.9	3.0	2.8	0	-0.4	0	-0.4
13	3.6	2.6	2.8	3.0	3.2	2.9	+0.4	-0.1	-0.2	+0.1
14	3.4	3.1	2.8	2.5	2.7	2.7	+0.2	+0.3	0	+0.3
15	2.6	2.2	2.9	2.3	2.5	2.7	+0.3	+0.3	0	+0.3
Mean	3.0	2.7	2.6	2.7	2.9	2.8	+0.9	-0.2	-0.2	0.00

1 = very interesting

2 = fairly interesting

3 = not particularly interesting

4 = uninteresting

5 2 very boring

Table 27

Summary of Student Responses to Question

"How useful did you find the units in achieving the stated objectives?"

	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc.		HND		All S-	BSc-	BSc-	DHE-
Unit	S	NS	S	NS	S	NS	All NS	DHE	HND	HND
1	1.8	1.7	1.9	1.7	2.0	1.9	+0.1	+0.1	-0.1	-0.2
2	1.9	1.9	2.2	1.8	2.1	2.0	+0.2	+0.1	-0.1	-0.2
3	2.4	2.4	2.0	1.8	2.8	2.8	+0.1	-0.5	-0.9	-0.4
4	2.2	2.3	2.2	2.6	2.2	2.2	-0.2	+0.1	+0.2	+0.1
5	2.0	2.3	2.5	2.3	2.3	2.1	+0.1	+0.2	+0.2	0
6	1.9	2.3	1.6	2.4	2.1	2.3	-0.4	-0.1	-0.2	-0.1
7	2.1	2.2	1.9	2.2	2.5	2.7	-0.2	0	-0.5	-0.5
8	2.1	3.1	1.7	2.2	2.7	2.7	-0.5	-0.7	-0.7	0
9	2.2	2.2	2.0	2.3	2.2	2.2	-0.1	0	0	0
10	2.2	2.6	2.3	2.2	2.6	2.4	0	-0.2	-0.3	-0.1
11	1.6	2.1	2.1	2.3	2.3	2.5	-0.3	+0.1	-0.2	-0.5
12	2.4	2.6	2.3	2.6	2.6	2.6	-0.2	-0.1	-0.1	0
13	2.3	2.6	2.6	2.5	2.8	2.6	+0.1	+0.1	-0.1	-0.2
14	2.4	2.6	1.8	2.0	2.4	2.4	-0.1	-0.5	-0.4	+0.1
15	2.1	2.1	1.9	2.0	2.4	2.5	-0.1	-0.1	-0.5	-0.4
Mean	2.1	2.3	2.1	2.2	2.4	2.4	-0.1	-0.1	-0.2	-0.2

1 = very useful

2 = fairly useful

3 = not particularly useful

4 = useless

5 = a waste of time - knew them already

Table 28

Summary of Student Responses to Question

"How useful did you find the unit in

helping you understand the subject?"

Unit	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc		HND		All S-	BSc-	BSc-	DHE-
	S	NS	S	NS	S	NS	All NS	DHE	HND	HND
1	1.6	1.5	2.0	1.8	2.2	1.9	+0.2	+0.4	-0.2	-0.6
2	1.9	1.9	1.9	2.1	2.2	2.2	-0.1	-0.2	-0.2	-0.3
3	2.7	2.4	2.3	1.9	3.0	3.0	+0.3	-0.5	-0.9	-0.4
4	2.2	2.2	2.1	2.2	2.2	2.4	-0.1	0	-0.1	-0.1
5	1.8	2.0	2.2	2.4	2.3	2.2	-0.1	-0.4	0	-0.4
6	2.0	2.3	1.9	2.3	2.1	2.2	-0.3	-0.1	-0.1	0
7	2.2	2.5	2.3	2.4	2.6	2.7	-0.1	0	-0.3	-0.3
8	2.6	3.0	2.2	2.5	3.0	2.7	-0.1	-0.4	-0.5	-0.1
9	2.2	2.4	2.3	2.1	2.3	2.6	-0.1	-0.1	-0.3	-0.2
10	2.3	2.8	2.4	2.5	2.6	2.3	-0.1	-0.1	0	+0.1
11	1.8	2.1	2.4	1.9	2.8	2.6	+0.1	+0.1	-0.6	-0.7
12	2.6	2.8	2.5	3.2	2.6	2.7	-0.3	+0.1	+0.2	+0.1
13	2.6	2.5	2.1	2.7	2.9	2.8	-0.2	-0.1	-0.5	-0.4
14	2.6	2.5	2.0	2.6	2.7	2.5	-0.1	-0.2	-0.3	-0.1
15	2.3	2.1	2.4	2.1	2.5	2.5	+0.2	0	-0.3	-0.3
Mean	2.2	2.3	2.2	2.3	2.5	2.5	-0.05	-0.02	-0.3	-0.2

1 = very useful

2 = fairly useful

3 = not particularly useful

4 = useless

5 = a waste of time

groups agreed upon which units were least useful.

Quantity of Information in the Unit (Table 29)

Comparison of the data showed no significant differences between responses of different courses or between NS and S students. Individual units which were felt to contain too much information were 3, 8 and 13. Not all groups agreed upon which units contained too much information.

8.6 Effect of Modifying the Units

A comparison was made between the units which the students found difficult in 1973/74 and those which were difficult in 1974/75 session in order to assess whether the modifications made in 1974 were successful. A summary of the units with which the students had difficulty is given in Table 30. Responses to the units in 1973/74 and 1974/75 cannot be compared directly in some cases, as a unit in 1974/75 could consist of more than one unit of 1973/74.

Also, the proportions of students completing a response questionnaire varied between the two sessions: in 1973/74 it was an average 74.5% and in 1974/75 it was 100% of these students who took a test. No information is available as to whether there was a small population of students in 1973/74 who consistently did not fill in questionnaires: if this were the case, then one would expect differences in response to the same unit the following year, when all students always filled in questionnaires.

There is clearly some relationship between the units which caused difficulty in 1973/74 and in 1974/75. Comparison of the data from the two sessions showed:

1) That there was agreement between the two sessions as to which

Table 29

Summary of Student Responses to Question

"Assess the quantity of information in this unit"

Unit	MEANS						DIFFERENCES BETWEEN MEANS			
	Dip.H.E.		BSc		HND		All S-All NS	BSc-DHE	BSc-HND	DHE-HND
	S	NS	S	NS	S	NS				
1	3.3	3.5	3	2.9	3.1	3.4	-0.2	-0.4	-0.3	+0.1
2	3.1	3.1	2.9	3.1	3.2	3.4	-0.1	-0.1	-0.3	-0.2
3	3.8	4.1	3.7	3.7	3.8	4.4	-0.3	-0.3	-0.4	-0.1
4	3.1	3.1	3.3	3.2	3	3.1	0	+0.2	+0.2	0
5	3.0	3.3	3.1	3.2	2.9	3	-0.1	0	+0.2	+0.2
6	3.2	3.2	3.1	3	2.9	3	0	-0.1	+0.1	+0.2
7	2.8	2.9	2.5	2.9	3	3.4	-0.3	-0.1	-0.5	-0.4
8	3.8	4.6	3.7	3.2	3.7	3.5	-0.1	-0.7	-0.1	+0.6
9	3.2	3.3	2.9	3.2	2.9	3.4	-0.3	-0.2	-0.1	+0.1
10	3.3	3.6	3.9	3.8	3.5	3.4	0	+0.4	+0.4	0
11	3.3	3.4	3.4	3.4	3.8		0	+0.1	-0.4	-0.5
12	3.5	4.3	3.6	3.7	3.2	3.4	-0.4	-0.3	+0.4	+0.7
13	4.0	3.8	3.9	3.7	3.5	3.8	0	-0.1	+0.1	+0.2
14	4.0	4.3	3.2	4.1	3.2	3.3	-0.4	-0.5	+0.4	+0.9
15	3.7	3.2	3.2	3	3.4	3.4	+0.2	-0.3	-0.3	0
Mean	3.4	3.6	3.3	3.3	3.3	3.4	-0.3	-0.2	-0.04	-0.1

1 = too little

2 = rather tin

3 = about right

4 = rather a lot

5 = too much

Table 30

Summary of Units With Which Students

Had Difficulty in 1974/75

Student Response	Unit Number				
Excessive Time	2(11,12)	3(13)	4(1)		
Difficulty		3(13)	8(4)	12(7)	13(8)
Lack of Interest		----------			
Lack of Usefulness - objectives	3(13)	8(4)			13(8)
Lack of Usefulness - understanding	3(13)	8(4)		12(7)	13(8)
Excessive Quantity	3(13)	8(4)			13(8)

(The figure in brackets is the number the unit was designated in the 1973/74 session)

units were not difficult. No units were reported as difficult in 1974/75 which had not been reported as difficult in 1973/74.

2) In three units (unit 1, unit 5 and unit 6) which caused problems in the 1973/74 session, there were no difficulties reported in the 1974/75 session:

a) Unit 1 (unit 10,1973/74) was lacking in interest and did not help in achieving the objectives listed in 1973/74. In 1974/75 it was rated above average for both of these factors.

b) Unit 5 (unit 2, 1973/74) was rated poorly on the two "understanding"

parameters in 1973/74. In 1974/75, the responses of the groups varied slightly around the means response to the question. The only difficulty reported was by the DHE NS students who rate the unit as taking them more time than was usual.

c) Unit 6 (unit 3, 1973/74), was rated below average in 1973/74 for interest and usefulness in understanding the subject, was difficult, and contained too much information. In 1974/75, unit 6 was rated above average for interest and help in understanding the subject, was easier than average, and contained less information than other units.

3) In two other units, (unit 4 and unit 12) which caused problems in the 1973/74 session, the modifications resulted in a reduction of problems in the 1974/75 session, although a proportion of students still experienced difficulties:

a) Unit 4 (unit 1 of 1973/74), was rated below average for difficulty and interest in 1973/74 and took a long time to complete. In 1974/75, the unit still took longer than average to complete (except for HND S students) but was rated as about average difficulty. Three groups (Dip.H.E. S and B.Sc. S and NS) rated the unit below average for interest and three groups rated it as average or above average. There was no agreement between S or NS students as to the interest value of the unit.

b) Unit 12 (unit 7 of 1973/74) was rated in 1974/75 as being too long and taking above average time to complete. These factors were not mentioned in 1973/74, but instead, the unit was rated below average on difficulty and use in understanding a subject. It is difficult to account for this difference between the two sets of

responses except that unit 7 was slightly condensed for use as unit 12 in the 1974/75 session. It may also be that presenting the unit later in the course when students were becoming tired of the course had this effect.

4) In two units (units 3 and 8) the modifications appeared not to have improved the units from the viewpoint of the student.

a) Unit 3 (13 of 1973/74) was rated as being uninteresting, difficult and below average in helping to achieve objectives in 1973/74. In 1974/75 it was rated as below average on every factor except interest. Many students commented on the questionnaire that they found this unit (Organic Chemistry) very difficult to understand. In view of the extent of difficulties found with this unit, further modifications seem to be needed. Examination of the text reveals that few alterations could be made here, and it may be that the material in this unit is unsuitable for teaching by a self-learn scheme. Teaching the material by lecture/demonstration, or giving a tutorial/demonstration as well as the unit text, might overcome some of the difficulties.

b) Unit 8 (unit 4 of 1973/74) was rated below average on every factor except "achieving the stated objectives" in 1973/74. In 1973/74 the unit which dealt with Equilibrium, Energy and Machines was divided into two units (7 and 8) for use in 1974/75. Unit 7 dealt with Forces, and unit 8 with Work, Energy, Machines. No problems were reported in Unit 7, but Unit 8 was rated below average for difficulty and the two "understanding" parameters, and was felt to contain too much information. It would seem that the modifications had been unsuccessful. In mitigation of this

however, is the fact that unit 8 test was given on the last day of autumn term. The students had many assignments to complete by the end of term and were under pressure. The sample size was smaller than usual as many students were celebrating or had departed for home. Of those present, many were in a hurry to leave and filled in questionnaires carelessly. Bearing these facts in mind, however, it still seemed that unit 8 was difficult for many students.

As quantity of information was a problem, it may improve student understanding of the material if longer than a week could be given to read the unit and if it could be given at a time when work load in other subjects is known to be less. If the students could retain the unit over the vacation instead of being tested on the last day of term, understanding of the material might be facilitated. This could be checked at some future date.

8.7 Relationship Between Responses

All possible relationships between pairs of students responses for 1973/74 (Milson) and 1974/75 are plotted in Tables 1-15, Appendix V. A summary of correlation coefficients is given in Table 31.

The time taken to complete a unit was significantly related to the quantity of information contained in the unit. It was not related to how interesting or valuable (in terms of helping to understand the subject) the student perceived the unit to be, and although difficulty was positively correlated with time taken, the level of correlation did not reach significance. Interviews with a random sample of students supported these findings; most said

Table 31

Summary of Relationships Between Responses

Responses: 1 = time taken to complete the unit
2 = difficulty
3 = interest
4 = usefulness in achieving objectives
5 = usefulness in understanding subject
6 = quantity of information

Response		1	2	3	4	5	6
1	1973/74		0.73**	0.36	-0.06	0.14	0.68**
			0.76***	0.27	0.06	0.40	0.68**
	1974/75		0.43	0.28	-0.03	0.03	0.49*
2	1973/74			0.70**	0.47	0.55*	0.66**
				0.39	0.12	0.43	0.64**
	1974/75			0.61*			
3	1973/74			0.83***	0.72**	0.82***	0.85***
					0.73**	0.76***	0.53*
	1974/75				0.83***	0.83***	0.58*
4	1973/74					0.77***	0.28
	1974/75					0.91***	0.53*
5	1973/74						0.42
	1974/75						0.67**

Degree of difficulty was significantly raised to interest (especially for five students), understanding and quantity. Degree of difficulty increased as degree of interest decreased, the unit material became less useful for achieving the objectives and understanding the material, and the unit became longer. The same conclusions were reached by Milson in the 1973/74 session, and indeed are hardly surprising.

Interest in the unit became less as the material was less clear and useful to the student, and as the unit became longer. The same conclusions were reached in the 1973/74 session.

There was a very close positive correlation between the two "Usefulness" parameters, as one would hope. Usefulness in achieving objectives and in understanding the subject were also closely related to quantity of information. It would seem that too much information causes the student to perceive the unit as less useful.

These findings confirm, to a great extent, those found by Milson in 1973/74.

that they allowed themselves a fixed amount of time each week to study the SL. unit, which they would not/could not exceed unless the unit was exceptionally long. In 1973/74, time taken was significantly related to difficulty and to quantity of information. In both sessions, time taken depended upon quantity and difficulty rather than on intrinsic interest in the material.

8.8 Student Response and Performance on the Self-Learn Scheme

Student performance over all unit tests taken was correlated with responses to all units. A summary of the correlations obtained is given in Table 32.

Table 32

Correlation Between Student Response Variables and Performance on the Self-Learn Scheme

Response	Correlation with Performance
Time	-0.26*
Difficulty	-0.33**
Interest	-0.07
Usefulness Objs.	-0.10
Usefulness Subject	-0.18
Quantity	-0.16

n = 85

* = significant at 0.05 level

** = significant at 0.01 level

Only 'time' and 'difficulty' of the variables under investigation showed any significant correlation with performance, and in both cases the correlation was negative.

It seems that the more difficult a unit was, the longer the student spent in study of it and yet the poorer was the performance on the test of that unit (within limits). This is what might be expected - that students would experience difficulty and expend more time on more complex units and yet achieve less mastery of the unit material as assessed by tests than they would of simpler material.

8.9 Relationship Between Student Responses and Student Personality Factors

When considering the value of student response in evaluating the effectiveness of a course, it is important to recognise that the student's view of the teaching he receives will incorporate certain existing cognitive states and emotional attachments which cannot be ignored when an assessment of the course is required.

Much of the work done in this area has been centred upon students' views of lecturers, and a comparison of students who do and those who do not rate lecturers highly. Menges (1969) found that where student and instructor shared a similar cognitive structure, the student tended to rate the lecturer very highly in terms of efficiency. The second part of Menges' thesis, that such students would perform better in a course given by a lecturer of similar cognitive bias, was not substantiated.

Rayder (1968) and Foy (1969) both suggest that student evaluation of a course by using rating scales is a sound method of

evaluating a course, and of assessing lecturer performance.

Smithers (1970) found that a student's conception of the ideal lecturer to vary according to the personality of the student, but that the differences in this conception were comparatively few and comparatively slight. He concluded that opinions expressed by students were a valuable assessment of the course and not just an expression of a student's personality. Swiris (1966) found a favourable response to a programmed course to be associated with a lack of neuroticism and anxiety (see 7.3.1). However, this favourable attitude did not always ensure better performance on the programmed course compared with a non-favourable attitude.

The present study involved a sample of 85 students. The students completed the Cattell 16 Personality Factor Questionnaire (Form A) and the personality scores were correlated with the responses made by the students. A summary of the correlations is given in Table 33.

Few of the correlations were significant. Those personality factors which showed a significant correlation with responses were not significant for all groups. A favourable attitude was not found to be associated with the dimension of anxiety.

In the B.Sc. course, introversion was associated with a higher degree of interest in the units of the course. The more anxious students tended to spend more time on the units. However, introversion and high anxiety were not associated with high marks on the course.

In the HND course "tough poise" was negatively related to time spent on the course, and to quantity of information contained in the

Table 33

Student Response to the Self-Learn Scheme and Personality Factors

Response	Correlation Coefficients			
	Extroversion	Anxiety	Tough Poise	Independence
Time:				
B.Sc.	0.39	0.41*	0.10	0.26
HND	-0.12	0.16	-0.33*	-0.16
DHE	-0.31	-0.02	-0.33	0.07
Difficulty:				
B.Sc.	0.21	0.38	0.08	-0.05
HND	-0.12	-0.01	-0.29	-0.27
DHE	-0.09	0.24	0.10	0.21
Interest:				
B.Sc.	-0.47*	0.06	-0.02	-0.18
HND	0.02	0.18	-0.26	-0.26
DHE	-0.07	-0.12	0.05	0.15
Understanding Objs:				
B.Sc.	-0.31	-0.31	-0.25	-0.01
HND	0.06	0.16	-0.19	-0.27
DHE	0.37	0.08	0.32	0.12
Understanding Subject:				
B.Sc.	-0.23	-0.20	-0.20	-0.07
HND	0.03	0.12	-0.16	-0.32*
DHE	0.36	0.21	0.32	-0.09
Quantity:				
B.Sc.	0.14	0.06	-0.01	0.26
HND	0.11	0.13	-0.32*	-0.19
DHE	0.07	-0.05	0.25	0.25

units, i.e. students with a high tough poise score found the units to contain too little information, and spent less time in studying the units. The tough poise factor was not significantly related to performance on the course. Independence in this group was related to how far the course had assisted the student to understand the subject. Those students with a high independence score felt that the units had helped them more in understanding the subject than did others of the group. The independence factor was not significantly related to performance on the course.

In the DHE course none of the correlation coefficients were significant. When the personality scores and student responses were plotted graphically, no relationships other than those outlined above could be seen.

8.10 Reaction to the Course, 1975/76

The type of monitoring of responses reported above was discontinued in 1975/76 for the following reasons:

(1) The students in the 1973/74 session became bored with the weekly chore of filling in the response questionnaires. This led to the questionnaires being filled in sometimes without a great deal of thought, to 'set responses', and to questions being omitted. This obviously affected the results to some extent.

(2) The main purpose of the weekly questionnaires was -

a. to assess the impact of modifications made in 1974.

b. to note differences between the main responses of groups of students.

As these aims had been satisfied, it seemed unnecessary to go on giving weekly questionnaires.

(3) The response questionnaires took time to administer and the results took time to assess: the time was well spent in 1973/75, but to repeat the assessment again was not thought to be profitable.

More time was spent in 1975/76 interviewing students personally and it was felt that this would provide much of the information which would have been collected from response questionnaires.

In addition to the interviews, however, it was thought valuable to collect, formally, some data on student response in 1975/76 since:-

1) not all students were interviewed
2) the data from interviews was not readily quantifiable
3) the course had been modified since 1974/75 and it was still necessary to assess student reaction.

The method of collecting response was different in 1975/76. Students were no longer given weekly questionnaires; instead they were asked to complete a questionnaire on three occasions - on 4th. November when they took the UNIT 3 test, on 27th. January on taking the UNIT 8 test, and finally, on 23rd. March on taking the UNIT 15 test. This method ensured that the students did not become too bored by the filling in of questionnaires, and yet changes in attitude over the duration of the course could be noted.

Numbers of students present on each response occasion varied, and the proportion of students present who completed the questionnaire varied. A questionnaire was placed at the seating place of each student, the students were told/reminded of the purpose of giving these questionnaires and were all requested to complete them.

Table 34

Numbers of Students Completing the

Response Questionnaire 1975/76

Date	Numbers
4th. Nov.	95 (100% of those present)
27th.Jan.	66 (79.5% " ")
23rd.March.	66 (75.6% " ")

Results

The results of the questionnaires are summarised in Table 35.

Question 1 ('I would like more courses run as self-learn courses')

Over the duration of the course, the percentage of students giving a neutral/favourable response barely altered. In November, 56.8% of students reported that they didn't mind, or were in favour of, more self-learn courses. In January and in March, the percentage giving a neutral/favourable response was 54.5. The proportion of students who disagreed to some extent was 41.0% in November, and 45.5% in January and March.

Question 2 ('How much have you learnt from the course compared with a conventional course?')

In November, 77.9% of the students felt that they had learnt at least as much (23.2%) or more (54.7%) physics and chemistry using the self-learn technique.

In January, 72.7% of the students gave a neutral favourable response. 28.8% felt that they had learnt the same amount using the self-learn technique, and 43.9% felt they had learnt more using the self-learn approach.

Table 35(1)

Student Response to the Course - 4th. Nov. 1975

	Agree Strongly	Agree	Do not mind	Disagree	Strongly Disagree	No Answer
1. I would like to see more courses run as self-learn courses.	1	19	34	37	2	2

	V.much more	Much more	Slightly more	Same	Slightly less	Much less	V.much less	No Answer
2. How much have you learnt from this course compared with a conventional course?	1	16	35	22	18	1	1	1
3. How much do you like this subject compared with when you started this course?		6	23	47	14	1	2	2
4. How much work have you done compared with what you might expect in a conventional course?	4	21	33	15	17	3	1	1
5. How rewarding has this course been compared with what you might expect from a conventional course?	1	14	35	24	15	3	1	2

	Yes	No	No Answer
6. Do you think all students should show they have mastered one unit before proceeding onto the next?	74	19	2

Table 35(2)

Student Response to the Course - 27th. Jan,1976

1. I would like to see more courses run as self-learn courses.

Agree Strongly	Agree	Do not mind	Disagree	Strongly Disagree	No Answer
4	9	23	28	2	

W.much more	Much more	Slightly more	Same	Slightly less	Much less	V.much less	No Answer
3	5	21	19	15	3		
	5	13	42	5		1	
1	11	12	13	20	8	1	
4	6	27	11	11	6		1

2. How much have you learnt from this course compared with a conventional course?

3. How much do you like this subject compared with when you started this course?

4. How much work have you done compared with what you might expect in a conventional course?

5. How rewarding has this course been compared with what you might expect from a conventional course?

Yes	No	No Answer
52	13	1

6. Do you think all students should show they have mastered one unit before proceeding onto the next?

Table 35(3)

Student Response to the Course - 23rd. March,1976

1. I would like to see more courses sun as self-learn courses.

Agree Strongly	Agree	Do not mind	Disagree	Strongly Disagree	No Answer
2	10	24	28	2	

	V.much more	Much more	Slightly more	Same	Slightly less	Much less	V.much less	No Answer
2. How much have you learnt from this course compared with a conventional course?	1	5	19	20	15	4	2	
3. How much do you like this subject compared with when you started this course?		2	22	35	5	3		
4. How much work have you done compared with what you might expect in a conventional course?	1	5	15	11	23	8	3	
5. How rewarding has this course been compared with what you might expect from a conventional course?	1	5	25	15	12	5	3	

6. Do you think all students should show they have mastered one unit before proceeding onto the next?	Yes	No	No Answer
	57	8	1

At the end of the course, 68.2% of students felt they had learnt as much (30.3%) or more (37.9%) using the self-learn approach. The proportion of students giving a neutral or favourable response declined between taking the first and last measurements.

Question 3 ('How much do you like the subject compared with when you started this course?')

In November, 80% of students gave a neutral/favourable response, 49.5% saying they liked the subject 'the same' and 30.5% saying they liked the subject more to some extent.

In January, 90.9% of the respondents said they liked the subject the same (63.6%) or more (27.3%) than when they started the course.

In March, 89.4% of respondents felt they liked the subject the same (53.0%) or more (36.4%) than when they started the course.

Question 4 ('How much work have you done compared with what you might expect in a conventional course?')

In November, 76.8% of respondents felt they had done the same amount or more work. In January this had declined to 56.1%, and in March, to 48.5%. The spread of responses was very wide, as is shown in Table 36.

As the course progressed, students increasingly reported that they did less work on the self-learn course than they would have done on a comparable lecture course. Thus, in November, 61.1% of respondents felt that they worked harder using the self-learn approach and only 22.1% felt they worked less hard. By March, only 31.8% felt that they did more work on the self-learn course and 51.5% felt they did less work.

Table 36

Response to the Question,

"How Much Work Have You Done ...."

	V.Much More %	Much More %	Slightly More %	Same %	Slightly Less %	Much Less %	V.Much Less %
Nov.	4.2	22.1	34.7	15.8	17.9	3.2	1.1
Jan.	1.5	16.6	18.2	19.7	30.3	12.1	1.5
March	1.5	7.6	22.7	16.6	34.8	12.1	4.5

Question 5 ('How rewarding has this course been compared with what you might expect from a conventional coures?')

In November, 77.9% respondents reported the self-learn scheme to be as rewarding (52.6%) as a conventional course.

By January, 72.7% of respondents reported the self-learn scheme to be as rewarding, (16.7%), or more rewarding (56.0%) than a conventional course.

In March, 69.7% of respondents reported the self-learn scheme to be as rewarding (22.7%) or more rewarding (47.0%) than a conventional course.

Question 6 ('Do you think all students should show they have mastered one unit before proceeding to the next?')

The majority of students felt that competence in one unt's subject matter ought to be demonstrated before progression to the next unit was made. The proportion of students feeling that competence ought to be demonstrated increased during the course, as Table 37 shows.

Table 37

Response to Question 6 (Mastery)

Over the Period of the Self-Learn Scheme

	Yes %	No %	No Answer %
Nov.	77.9	20.0	2.1
Jan.	78.8	19.7	1.5
March	86.4	12.1	1.5

This increase may be accounted for by two factors:

(i) that this represents a change in the attitude of the students brought about perhaps by a feeling that they had not, in fact, mastered the units of the course to their own satisfaction.

(ii) that this does not represent a shift in attitude, but the drop in the proportion of students completing the response questionnaire - by March, the proportion of the student population completing the form had declined to 75%.

8.11 Conclusions

1. The response to the course as measured by questionnaires in 1974/75 and 1975/76 was neutral to favourable. As time progressed, the students saw more disadvantages in the self-learn approach and were less willing to have other courses taught by this method. As far as physics and chemistry were concerned, however, the majority of students felt they had learnt at least as much and often more by using the self-learn approach, and now liked the subject as muchas,

or more than when they started the course. The course was felt to be more rewarding than the conventional lecture course. Most students were sure that they would not have preferred this course to be lectured. The amount of time spent in study of the units varied widely, as one would expect given the widely differing science backgrounds of the students.

2. There were no significant differences between the responses of students in different groups to the self-learn scheme, except that students with a good prior knowledge of sciences spent less time in study of the units.

3. Modifying the units in 1974 went some way towards correcting what the students saw as difficulties with the units. Two units in particular still present problems for students and an alternative/additional teaching method may be of value here.

4. Student response to the course was not significantly related to any student personality variables examined.

Chapter 9

STUDY HABITS AND PERFORMANCE ON THE SELF-LEARN SCHEME

9.1 Introduction

It has been suggested that the way in which the students divide their time between academic and non-academic effort may be a crucial factor in determining their success on a course. Similarly, the strategies that they adopt in learning new material may significantly affect their performance.

Where the course is a self-learn one, the extent to which a student learns a new body of material, and the way in which he controls his time, may be of even more importance.

9.2 Aims

An examination was made of the study habits of students who enrolled in 1974/75 as a pilot study for an examination of students entering the Department in 1975 in order to decide:

1. What was the relationship between study habits and performance on the self-learn scheme?
2. What study habits may be associated with relatively good performance on the self-learn scheme?
3. What assistance could be given to students to enable them to alter their study habits and thereby improve their performance on the self-learn scheme?

9.3 Review of the Literature

Whether students spend a great deal of time on outside affairs was, at one time, thought to be of less importance than time actually spent

in private study. Flecker (1959) showed that students who spent less time on study tended to perform less well in examintion. However, to estimate actual time spent in study may be an indication of level of motivation; it may not show all possible differences between different study methods. Also, there are probably ineffective students who spend too much time in study. Harris (1940) reported mixed findings from a review of studies on students time allocation: in one of these there was a correlation of +0.32 between time spent and grades achieved, but no relationship was shown in three other studies. Sinha (1966) found that in a survey of study habits, higher achievers began to study in earnest earlier than low achievers, and also their study was more regular and systematic. Himmelweit (1950) cites a number of studies which concur with Sinha's findings that a regular, systematic consistent approach to study is of more importance than actual hours spent in study. Even though this may be accepted, it is not easy to decide what the best study methods would be. Harris (1940) found conflicting evidence on what could be construed as good study habits, and Malleson (1958) found that students who failed to graduate did not appear to do fewer hours of work than those who were successful. Pond's study (1964) revealed some general patterns in study habits between high and low achievers. High achievers read more required references, did more preliminary reading, attended more lectures and tutorials, and were less inclined to neglect subjects in which they felt they might fail. Low achievers were more random in their study methods. Brown and Holtzman (1966) suggested from the findings of their research that attitudes towards study might be more important than study methods, the one tending to promote the other.

Entwhistle and Entwhistle (1970) found that number of hours worked was not significantly related to performance on a wide variety of courses at a University and a College of Education. Students with introverted personality types and students with good study habits tended to perform significantly better. Introverted students tended to show better study habits (although this only partially explained their academic superiority). However, the findings tend to be somewhat tautological; i.e. good study habits are associated with good performance, "good study habits" being implicitly defined as study habits which are associated with good performance.

Regularly spaced intervals of study appear to be one aspect, but other variables such as wide background reading vary from one discipline to another. It may also be that personality factors must be taken account of: what is a good study method for one student does not mean that it will work for all students. Entwhistle and Nisbet (1971) reported that the pattern of study habits researched by them suggested that Arts and Science students had a completely different experience of higher education, with correspondingly different study patterns. This is not to imply that the study methods of introverts could be successfully adopted by extroverts; possibly a different pattern of study altogether would be required, but insufficient evidence isavailable on this point. Entwhistle, Thompson and Wilson (1974) in an interview survey of motivation and study habits, found that motivational and study habit patterns could be varied and still lead to success. The impossibility of outlining a single set of study habits which would prove beneficial for all the students was emphasised.

9.4 The 1975/76 Study

9.4.1. The Design of the Study

The rationale behind the study is given in Chapter 2.2 and 2.3.

In the autumn and spring terms 1975/76, first-year students following any of the three courses in the department were told that there was an investigation under way into the usefulness of the self-learn scheme; their comment on the scheme would perhaps be sought, and if their name appeared on the notice list, to make an appointment for an interview which would last between ten minutes and half an hour.

Three students whose names appeared on the list did not attend for interview, even after repeated requests. Forty-three students who were requested to attend did so.

The students were interviewed usually for about twenty minutes. In some cases, the interviews were much longer if the student wished to elaborate on any point.

The attempt in 1973/74 and 1974/75 sessions to examine the relationship of study habits and performance was limited to an investigation into the amount of time spent on the study of the units. A negative relationship was found between these two factors (see 7.8). This is particularly explained by the fact that:

1. NS students spent more time in study of the units than did S students (see 7.5) but performed less well.
2. The degree of difficulty of the units was not uniform, and degree of difficulty itself was negatively related to performance (see 7.8), i.e. students spent more time on the more difficult units but performance on unit tests was lower.

In the 1975/76 session, the investigation of study habits and their relationship to performance was extended to include a large number of factors. Beard (1964) has pointed out that "it is notorious that by selective treatment of data, supporting evidence could be produced to sustain almost any hypothesis", and yet it would be impossible to reproduce here all the responses made by every student to every question. To classify the responses as being 'negative' or 'positive', 'favourable' or 'unfavourable', 'associated with higher performance' or 'not so associated' would:

1) remove all the individual shades of opinion which were thought to be so valuable to the survey
2) be wildly inaccurate.

Therefore, although the account must, of necessity, be somewhat generalised, there has been no attempt to tabulate and classify the responses made in interview.

In discussing which individuals or groups of students had "good" study methods, two clear groups emerged. First, a group who had studied all of the material beforehand - those with physics and chemistry to 'O' level standard and some science studied beyond 'O' level stage. For these students, only the application to Catering of the physics and chemistry was new - the basic principles were familiar. There were four students in this group; all were male and following the B.Sc. in Catering Systems course. All had studied physics and/or chemistry to Advanced level. All four students employed the same study methods - they read the unit through within two days of receiving it, then read it through again on the day of the test. They all passed every test. Two units were unfamiliar

to them - these were the units which dealt with S.I. units and measurement. They all enjoyed the course, especially as the alternative was, for them, rather boring. They did very much less work than they would have done in a conventional course, since they were not required to produce weekly essays, or be present at a lecture one hour out of every week. None of these four were ever referred for tutorial. They all stated that they learnt very little new material from this course, but it did refresh their memories and indicate the application of principles to the catering field.

The second group were the other thirty-nine interviewed. The range of prior science knowledge in this group was very wide, and included two students who had studied a science subject to 'A' level, twelve students who had not passed (or studied for) any examination in physics or chemistry, and twenty-five students who had studied at least one science subject for an examination.

9.4.2. Previous Knowledge of Science (Table 38)

The questions relating to this factor were:

11. Do you rely on previous knowledge to help you pass the tests? Do you rely on recall?

27. Did you expect much science in a Catering Course?

The answers to question 11 indicate that there is not necessarily a positive relationship between the amount of science aperson has studied and his perception of his own state of knowledge. Hence, one student, with one 'O' level Physics pass, claimed that it was "not really a disadvantage to have a poor science background, you could understand it O.K., form the units, but the chemistry is a bit difficult to follow", and another student with precisely the same

Table 38

Question Items in the 1975/76 Survey into Study Habits

4. Do you have a timetable for your study time, either on paper or a mental timetable?
5. Are your study conditions good, without distraction?
6. How much time do you spend in study of the unit? Do you always spend a fixed amount of time?
7. Do you ever study in the library? Do you use the books there to elaborate on what you have in the unit? Do you use the books there to check something you do not understand in the unit?
8. How soon after getting the unit do you read it? How many times do you read it?
9. Do you do as much work for the self-learn scheme as you do for other courses?
10. Do you read the unit on the day of the test? Is this the first time you have read it?
11. Do you rely on previous knowledge to help you pass the tests? Do you rely on recall?
12. Do you read the objectives sheet? Do you use it in reading the unit? Do you make notes on the unit? Do you answer the in-text questions?
13. Do you attend tutorials when required? Do you find them useful?
14. Would you rather have the course lectured to you?
15. Do you guess in tests? Wildly or an elimination guess?
16. Do you use the print-out sheet to see where you went wrong? Do you go through your wrong answers and re-check them? Do you keep the print-out?
17. Do you feel you learn much from this course?
27. Did you expect much science in a catering course?

qualifications stated that "it is all double-dutch, it is because I didn't do any science at school, only physics, and the physics is the worst part, it's all forces and angles and things and I never understood that at school." Similarly, most of the students interviewed commented, in answer to item 27, on the science and technology bias of their courses; some felt that the course was 'all science', that they had been misled at interview or by brochures into believing that the course was not science biased, or they simply had a misconception of what the course was about. Others welcomed the science bias, expected it and valued it. Two students commented that although they were not very good at science, "there isn't all that much anyway so it doesn't really matter". The student's perception of his course and the relative importance of science in that course varied considerably, and was not related to the student's own previous knowledge of science.

9.4.3. Allocation of Time

The questions relating to this area were:

4. Do you have a timetable for your study time, either on paper or a mental timetable?

The replies to question 4 showed varied patterns of study which could be associated with different levels of performance. There was no one pattern which emerged which could be clearly delineated as productive of good performance on this course. Some students reported that they had a very detailed study timetable, most had a flexible timetable but some structures could be discerned, and some students were chaotic in the extreme. Of the students who had a rigid timetabling system (5 students), this was done on the basis of

allocation of time, i.e. each evening and weekend a set amount of time was spent in study of some type. Usually this was associated with working in a set place - four out of five students worked in the library every evening. Their level of performance on this course varied; although none was very poor, four were referred for tutorial more than once. Of the students who had a flexible time-table, the study hours were allocated according to work set (or expected to be set) during the day so, some evenings were very full, others were 'free'. This appeared to work well for most students: some, however, admitted that long-term pieces of work (long essays, projects, reference reading, etc.,) tended to suffer as it was not allocated a weekly time and tended to be completed in a rush. To some extent, this was true of the self-learn scheme: students did not read it until the day before (or over the week-end) and so it was too late if any queries arose from their reading to attend the tutorial and get help or advice. This was true for many students interviewed - twenty-two out of the thirty-nine commented that the first time they read the unit was the week-end or the night before the test was due. The control which students exercised over this method of allocating study time varied. There were thirty-three students who allocated time on this basis, and their marks as unit tests varied considerably from extremely good to just satisfactory.

Six students had a method of time allocation which was irregular in the extreme and was usually associated with other factors which contributed to their lower than average performance on the self-learn scheme, such as discontent over accommodation, and a feeling of being overwhelmed by work.

9.4.4. Study Conditions

The questions relating to this section were:

5. Are your study conditions good, without distraction?

7. Do you ever study in the library? Do you use books there to elaborate on what you have read on the unit? Do you use books there to check something you do not understand in the unit?

The description of study conditions at the student's home suggested that the expectations of the student coloured his perceptions of his new surroundings and affected his ability to work in them. One student commented that conditions were very good - the emphasis being placed on the fact that the study bedroom was a single room whereas previously sleeping (and study) areas had been shared with a sibling. Other factors such as storage facilities for books, heating, etc. were subordinated to this. Other students in similar circumstances but with different expectations commented that their study facilities were very poor - here factors such as distance from the Polytechnic (travelling time) and library, heating, lighting, noise from outside the study area, were dwelt upon. However, it may be that the reaction of the student to his environment is not unimportant, even though an outside observer may consider study conditions to be satisfactory. When asked closely about their study conditions, most students worked in conditions which were satisfactory if not ideal (conditions were assessed in accordance with criteria specified by the accommodation officer).

Some students were experiencing difficulties with their lodgings but were not using other study facilities such as polytechnic premises or a library.

The six students who said they regularly studied in the library apparently used it merely because it was a quiet and comfortable place to work, as only two who did so had never used a book to check on something they did not understand and no one had read any item in a book or article to add depth to some aspect of the unit.

9.4.5. Study Organisation

The questions related to this section were:

8. How soon after receiving the unit do you read it? How many times do you read it?
9. Do you do as much work for the self-learn scheme as you do for other courses?
10. Do you read the unit on the day of the test? Is this the first time you have read it?
14. Would you rather have this course lectured to you?
17. Do you feel you learn much from this course?

The answers to these questions showed a distinction between study patterns which were more closely associated with success on the self-learn scheme and those which were not.

The answers to questions 8 and 10 showed that most of the students read the unit on the day of the test or the day before the test. The students who performed better on the unit tests, however, were those who also read the unit on at least one occasion prior to this "day-of-the-test" reading. The students involved claimed three main advantages for their method, which involved reading the unit in a cursory manner (on the bus on the way home for example) on the day it was given out, a detailed study on one evening during the week, and a brief read-through on the day of the test.

1. If the material was familiar, the read-through might be all that was necessary and further work later in the week need not be

time-tabled and allowed for.

2. If there were any serious problems there was the opportunity to attend a tutorial and discuss the problem, or to discuss it with other students.

3. Three separate sessions made learning more effective than one single 'slog' session. There were eight students who could be identified as using this method of studying, and all eight performed well on the unit tests, enjoyed the course, and felt that they were well in control of their studying. These eight, because of their study methods, also worked to a fairly rigid 'time-tabling' system of study hours. There was a wide variety of science background in these students.

9.4.6. In-Text Questions and Feedback

The questions relating to this section were:

12. Do you read the objectives sheet? Do you use the objectives sheet in reading the unit? Do you make notes on the unit? Do you use the in-text questions?

13. Do you attend tutorials (when required)? Do you find them useful?

15. Do you guess in tests? Wildly, or using an 'elimination' guess?

16. Do you use the print-out sheet to see where you went wrong? Do you go through your wrong answers and check them out? Do you keep the print-out?

The use of devices incorporated into the text to assist in study of the units was limited. In-text questions were more often read as part of the text than used as a self-test device.

The objectives sheet was rarely used as a guide to the text. In some instances it was used as a 'contents' guide, to give an indication

of the length of the unit and therefore the time which would be needed to master it: more commonly it was used as a check list after working through the unit to see if the subject matter had been mastered. Twelve students never used it at all. Only six students used the objectives sheet for the purpose for which it had been designed which was to relate the unit content to a specific detailed objective.

The tests were generally felt to be an essential part of the course, but some students commented that the emphasis on the tests was too heavy and that no test was made of the subject matter in a way which would assess understanding more than recall. The multiple choice tests were felt to be too inaccurate a measurement relying too heavily upon recall. Most students used some variation of elimination guessing if they did not know the answer; although wild, random guessing was very rare. However, the possibility of gaining a mark (which accounted for percentage score of 6.6%) by guessing made some students feel rather disillusioned, and less inclined to work at understanding the unit.

The feed-back sheets were felt to be useful, but the time-lag between taking the test and getting the feedback was too great for interest to be sustained to the point where students would check their wrong answers, and re-read the units. The feedback sheets were not therefore used fully, and few students retained them for future reference.

Tutorials were available for all students who wished to attend, but students were required to attend if they had not achieved the specified minimum score in the preceding test. Reaction to the tutorials was mixed but generally unfavourable, for the following

reasons:

1) They were perceived to be an indication of weakness - the same people attended every week.

2) Too many people attended for one lecturer to cope with individual problems.

3) Related to 2), problems were dealt with in a general way, and there was no opportunity for specific problems to be aired and dealt with.

Some students repeatedly did not attend tutorials, even when requested to do so. This was a problem as there were few sanctions which could be applied. The H.N.D. students and the Dip.H.E. students had an attendance requirement on their course, and if requested to attend a tutorial, lost their attendance mark if they did not appear (students who had gained a high enough pass mark in the test were excused the tutorial but were given their attendance mark). There was, however, no attendance requirement on the B.Sc. course.

The timing was unfortunate also in that the majority of students left their study until the weekend and the opportunity to attend the tutorial if they experienced any difficulties was not then available. Eleven students left their study of the unit until the morning of the test because:

1) They had two hours free then.

2) The material would be fresh in their memory for the test.

The performance of the students in this group as assessed by unit tests varied greatly. Some performed very well in tests. However, there was not in this group the satisfaction with the course experienced by the first group of students described here, above.

Particularly in this group, good performance on unit tests was not seen by students as expressing accurately their grasp of the material. They felt they had obtained high marks in thetest and yet did not understand the subject matter very thoroughly. The following were typical statements made in connection with this point:

"You don't get much out of it. I pass the tests O.K. though".

"I don't think I learnt it if you know what I mean. I just remembered it for that short part of time, then forgot it".

"If I had to take unit 1 or 2 test now I'd be sure to fail; the thing is, you just train for the test and then forget it all".

"I don't even try to think about it (the subject matter) now. I just learnt it parrott-fashion for a test; some of it stuck,of course, but not in any sensible way."

In view of the apparent discontent with the course, nevertheless, out of 43 students questioned, only two would have preferred the course to be lectured to them. Many, when asked directly if they would have preferred a lectured course, said that when they thought about it, they would probably have learnt less from a lectured course, an opinion expressed byone student as:- "I think it is because you have it all there in front of you. From a lecture you have only your notes, or a hand-out, or nothing at all. So it doesn't seem so much. If you kept a full text of every lecture and looked at them after a few months, you wouldn't remember it all".

9.5 Conclusions

9.5.1. What was the relationship between study habits and performance on the self-learn scheme

An overall relationship between study habits and performance was

not evident on the self-learn scheme. Certain indications do, however, emerge:

1. A distinction can be drawn between groups of students on the basis of their prior science knowledge, and to some extent, this will define which study will be more effective.
2. There is not necessarily a positive relationship between the prior level of knowledge of a student and his own perception of his state of knowledge. Confidence in knowledge is important.
3. The value the student places on the course he is following is of great importance in that the students who saw the value of sciences to their future careers - and their relevance to present studies-were more willing to spend time and effort in study of sciences.
4. Studying facilities are important - not only how acceptable these may be, but how the student perceives the facilities.

9.5.2. What study habits may be associated with relatively good performance on the self-learn scheme

The study habits which may be associated with relatively good performance on the self-learn scheme could be listed as follows:-

1) Some organised, disciplined use of the study hours.
2) More than one reading of the unit, with the separate readings separated by a few days.

9.5.3. What assistance could be given to students to enable them to alter their study habits

It was probable that many students questioned could have improved their performance on the self-learn scheme if they had so desired - a proposition with which most students agreed. The assistance which

could be offered to students to help improve their performance centres around the following areas:

1) Motivation. If interest, and regard, for sciences generally, but specially with regard to their role in catering, could be increased, performance would very likely be improved (see Chapter 10)

2) A guide to effective study of the units could be given. In 1975 this was, in fact, attempted and students were given a print-out outlining the course and describing how to work through the units. All except two of the students questioned had forgotten what was in the print-out, and most had never read it. An introductory lecture might be a better approach.

3) The computer print-out could be amended. In view of the time-lapse between being tested and receiving the print-out, it may be better if the print-out contained more than instructions to re-read certain sections of the previous unit, when the attention of the student is on the unit test he is about to take and the new unit he is about to receive. It may be more useful if the print-out could contain the wording of the question and the correct answer (with some reasoning, depending upon the erroneous answer chosen). The student might be more likely to read this than wait until after the test and go and look up the relevant unit, find the relevant test paper, and try to wade through it. Alternatively, the print-outs need to be returned to the students more quickly.

Chapter 10

MOTIVATION AND PERFORMANCE ON THE SELF-LEARN SCHEME

10.1 Introduction

The difficulty in assessing the relationship between motivation and performance on a given course is two-fold:-

1) A conceptual model of 'motivation' is lacking

2) Arising from this, existing 'tests of motivation',of necessity, lack validity except in a restricted sense.

Jones, MacIntosh and McPherson (1973) have described 'motivation' as a 'conceptual charlady' widely used for accounting for variance in academic performance unaccounted for by measured intellectual/social variables. Peters (1958) criticised the conceptual confusion surrounding the term 'motivation'. He found the mechanical model of motivation, defined in terms of underlying drives, to be in conflict with the goad-directed motivation which he perceived to be common to much human activity and the basis for much educational strategy. He also saw a need to distinguish between types of motivation - in particular, to distinguish between intrinsic and extrinsic motivation. Essentially, he saw intrinsic motivation as being derived from the task itself, the intellectual rewards of accomplishment, while extrinsic motivation was aroused by factors external to the learning situation, e.g. rewards to be gained from accomplishment. Hunt (1960) pointed out that this model assumes that all behaviour must be motivated or driven, or inertia results.

Extending Peters' analysis, Wilson (1972) distinguished between

intrinsic motivation which is clearly related to the task itself ("learning for learning's sake") and intrinsic motivation which is aroused by some need of the individual, which accomplishment of a task can satisfy, e.g. the need to increase self-esteem, to improve self-image.

Most educational research which has examined motivation as a variable affecting performance, has concentrated upon the factor analysis in defining and measuring motivation, using intuition and/or experience as a guide as to factors which may attribute. The conceptual confusion has largely been ignored, with the result that many such students lack real explanatory powers of the problem under investigation, and the measurement techniques lack real validity. However, the clarification of the terminology provides some framework for the examination of studies in motivation which have been published.

10.2 Review of the Literature

10.2.1. Goal Orientated Motivation

In this type of study, students are asked their reasons for embarking on a particular course of study. The results (in this country) have tended to show that unsuccessful students entered higher education for extrinsic reasons (such as parental pressure) rather than out of intrinsic interest in a particular discipline (Hopkins, Malleson and Sarnoff, 1958; Wankowski, 1969, 1970). Jones, et al., (1973) have pointed out that goal-orientated motivation may vary according to discipline. Wankowski (1969) showed that students who were progressing normally/well had clearer long-term and short-term goals than students who failed in their first year examinations.

10.2.2. Need Motivation

Studies which examine motivation as an underlying drive or need are most profusely represented by studies which examine "anxiety" or "need-for-Achievement" motivation. Higher levels of anxiety are often associated with improved performance on a course, but Eysenck (1972) has stressed that this is an unsimplified view. Anxiety may be a general personality trait, or be situation-specific. When anxiety is measured in a personality profile, it is general anxiety, the personality trait, which is assessed and not the situation-specific anxiety which may, in fact, be of more significance in the examination situation. Alpert and Haber (1960) identified two types of anxiety, one of which facilitated test performance and the other had the opposite effect. Lynn and Gordon (1961) identified a curvilinear relationship with both very high and very low anxiety scores being positively correlated with low performance. Speilberger (1962) suggested from his study that anxiety as a trait was fairly common but better performance was shown by more able students who utilised their anxiety more effectively than their less able peers. Atkinson and Feather (1966) distinguished "hope of success" from "fear of failure" as motivating forces, with the former facilitating performance and the latter affecting performance in a negative way. Birney, Burdick and Teevan (1969) elaborated on this theory, developing their "carrot and stick" model, whereby both hope of success and fear of failure were seen as facilitating performance, depending upon perception and personality of the student. In this study, achievement motivation was measured by the Thematic Aperception Test. In the T.A.T. the student is asked to describe/write stories

about vaguely drawn situations. The story is expected to show a projection of the student's personality, among them his need for achievement ('n' Ach), or fear of failure.

Other studies using the T.A.T. have, to date, produced inconsistent results (Lavin, 1967). This may be due to the 'n' Ach. being too general a drive, with academic achievement being only one among many goals which would satisfy it.

10.2.3. Academic Motivation

Academic motivation has been seen as the type of intrinsic motivation which links attainment with self-esteem. Some of the earlier studies in this area derived the factor of academic motivation from their analysis of general personality inveitones. Finger and Schlesser (1965) used their Personal Values Inventory to produce factors which were related to academic performance while remaining independent of scholastic aptitude test scores. In Britain, Specific Scales of academic motivation have been developed (Entwhistle, Nisbet, Entwhistle and Cowell, 1971) which show consistent relationships with degree results across different subject areas, although certain personality traits were found to interact with motivation factors.

10.2.4 Sylbs and Sylfs

Hudson (1968) has suggested that students adopt different styles of study according to their cognitive styles - whether they are convergent or divergent thinkers. He described 'sylbs' as those who were syllabus free. Syllabus bound students were characterised by a systematic and regular study-habit system, but this may become over-anxious and even obsessive in some students. Syllabus-free students

need independence in order to study and therefore may experience conflict with a teaching system which imposes rigidity in study habit upon them. Parlett (1969) devised a scale for measuring syllabus-boundness, expressed as a single score, and Biggs (1970) isolated six study dimensions which fit, to some extent, into Hudson's two categories. Factors included in the study were study organisation, intrinsic motivation, tolerance of ambiguity, and independence in studying. Although a follow-up study (1970), Biggs did not find considerably significant relationships with academic performance and his studying factors, other relationships of significance did emerge. Intrinsic motivation was found to be associated with introversion, while regularised study was associated with a high degree of autonomy and with convergent thinking.

A clear understanding of how study habits, personality factors and motivation interact is lacking, due largely to conceptual confusion in all three areas. The present emphasis on psychometry in the establishing of relationships may also confuse more than it illuminates, given the poor validity and reliability of the tests involved.

Parlett (1972) has suggested that the establishment of a different experimental model from the usual biology-paradgin might be of great value in illuminating some of the factors affecting student performance. Parlett (1972) described his approach as 'illuminative evaluation', and based upon an absorption of all factors related to the position of any particular student in the total learning environment. Entwhistle, Thompson and Wilson (1974) used a semi-structured interview schedule to assemble data with which to investigate

motivational factors. Data assembled in this way permits only very simple analysis which tends not to create definitive findings: as Parlett (1972) has stated, however, they may serve to support and especially amplify the findings identified in the literature, and to create a theoretical model in which further investigations can be carried out.

Entwhistle, et al., (1974) concluded from the results of their survey, taken in the context of published findings in the field, that "there are quite distinct motivational patterns which lead to academic success for different types of students". They distinguished between two groups of high-achieves, one of which was motivated by fear of failure and the other by hope of success. They further found that students of different personality types (who are therefore motivated in different ways) tackle their academic work in different ways, and have different perceptions of their learning environment.

Both of the largest studies into factors affecting student performances in Higher Education (Wankowski in Birmingham and Entwhistle in Lancaster) have subdivided their investigations concerning motivational factors into broadly similar categories. Entwhistle, et al., (1974) saw motivational factors to be related to:

(1) Pre-University Experience - incidence of pressure or encouragement from home and school to either Higher Education; preparation and guidance received; experience of academic success.

(2) Experience at University - difficulties in transition; satisfaction with intellectual demands of courses; relevance of courses to student's present interest; effort expended on study; contact with academic staff; extra-curricular activities; reactions to examinations.

(3) Anticipated part-University experience - perceived relevance of courses to student's future goals; plans for work; training; or further study.

These divisions relate very closely to Wankowski's "Dynamics of Success and Failure" Model, in which he perceived four areas of influence to contribute to success or failure.

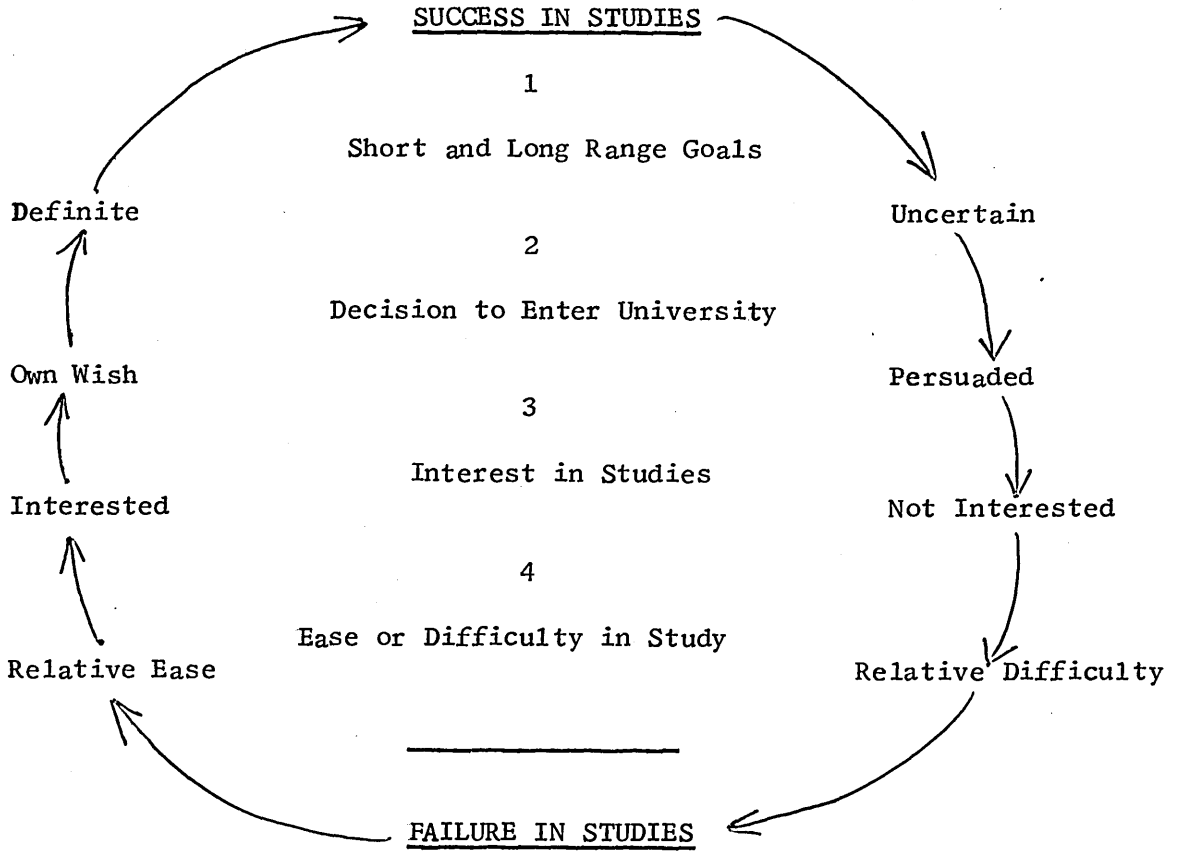
1) Decision to enter University - own wish or persuaded?

2) Interest in Studies

3) Ease or difficulty in studies

4) Short or long-range goals - vague or definite?

The interaction of these factors Wankowski demonstrated diagramatically:-



Factors on the Right tend to pull towards failure (Wankowski, 1968)

Responses from a random sample showed that goal orientation was strongly associated with achievement. The possession of long-range goals has been associated previously with maturity (Allport, 1955), and maturity has recently been linked with early withdrawal from High Education courses (Steadman, 1973).

10.3 The Design of the 1975/76 Study

The interview procedure was that set out in Chapter 9.5. The questions relating to motivational items are given in Table 39.

10.4. Results of the 1975/76 Survey

10.4.1. Pre-University Experience

The questions relating to this section were:

20. Had you applied for other places in Higher Education? Were they for University/Polytechnic/Other? Were they for Catering courses?
21. What gave you the idea of applying for Catering courses?
22. Had you worked in the Catering Industry before coming to the Polytechnic?
23. How long ago did you decide to make a career in Catering?
24. What was the more important factor in deciding you to apply for this course-vocational training or some sort of Higher Education?

Out of the sample, the course (H.N.D., B.Sc., or D.H.E.) at this institution was first choice for 22 students. Out of the remaining 24 students, twelve had applied for a University place and had applied to the Sheffield Polytechnic as a back-up policy in case they did not achieve the grades needed for University, or after they had been turned down by the University. The other twelve students had previously applied for (and in some cases enrolled in) courses in other Polytechnics, or different courses in this Polytechnic, or colleges

Table 39

Question Items in the 1975/76 Survey into Motivation

18. Do you enjoy this B.Sc. (H.N.D./D.H.E.) course?

19. Is it what you expected?

20. Had you applied for other places in Higher Education? Were they for University or Polytechnic (or other)? Were they for catering courses?

21. What gave you the idea for applying for a catering course (parents, school careers guidance, advertisements)?

22. Had you worked in the Catering Industry before coming to the Polytechnic?

23. How long ago did you decide to make a career in Catering?

24. What was the more important factor in deciding on you coming on this course - vocational training or some sort of Higher Education?

25. What do you intend to do on leaving the Polytechnic? What sort of career do you envisage?

26. Is the level at which you pass your examinations important to you?

27. Did you expect very much science in a Catering course?

28. Is it important for you to do well in the B.Sc. (H.N.D./D.H.E.) course?

29. Does it matter to you if you fail the unit test?

30. Do you think sciences have much relevance in Catering and the sort of career you envisage?

31. Do you enjoy sciences here?

32. Did you find a change between methods of work at school and the Polytechnic?

33. Did you find this change bewildering? Exciting?

34. Did you feel you needed guidance in your use of time?

35. Did you feel you needed any guidance in your use of study methods?

36. What sort of accommodation do you have? Is it what you desired when you applied? Is it what you would wish now?

37. Do you enjoy the social life of the Polytechnic?

of Further Education. The number of students who had applied for a University place before coming to the Polytechnic (26% of the sample) was considerably lower than the proportions reported by Robinson (1975) in a study of Polytechnic degree students in twenty-eight Polytechnics, which was reported as over 50% in all Polytechnics and as high as 80% in some. The students who had applied for a University place as well as Polytechnic places did not appear, as a group, to differ on any other factors evaluated from students who had not applied for university places. There was no difference in level of performance on the self-learn scheme between the group who had not applied for university places nor was there a difference in expressed level of satisfaction with the course as a whole.

All of the students interviewed had worked in the catering industry, usually for a short period of time (during school holidays) and in four cases, for fairly long periods. This was apparently because students who, at interview for a place at the Polytechnic said that they had not previously worked in the Industry, were told that this was an experience they ought to have.

The answers to questions 23 and 24 showed that, in this sample, there was a relationship between determination in a career in Catering and satisfaction with the course (see Table 40).

Of the students who expressed dissatisfaction with their course (or said it was not as good as they had expected/they considered leaving/they felt it did not equip them for their future career), only one had apparently any determination upon a career in catering. In the other cases, the determination was upon some form of Higher Education, often associated with parental wishes for Higher Education,

Table 40

Pre-University Experience

	Polytechnic was First Choice	Also Applied for University	Decision to Apply Taken Long Ago	Intent on Course in Catering
Satisfied with Course	16	7	12	15
Dissatisfied with Course	6	5	3	1

and a decision to apply for a career in Catering had come rather late. However, as a predictive measure, the timing of a decision to apply for a Catering course (and therefore perhaps the timing of the application for a place on the course) would probably be unsuitable; many students who had made a late decision to make a career in the Catering Industry, and applied late for a place, were very satisfied with their course and were very highly motivated towards a career in catering. Satisfaction with the course was assessed directly by asking students if the course on which they were enrolled was as they expected (question 19) and if they enjoyed the course (question 18), and subjectively by their response to the interview schedule as a whole.

The answers to question 21 (factors which decided a student to apply for the course) showed that there was a wide variety of influence. For example, in four cases interest in Catering as a career rose out of other employment; in two cases no reason could be given; seven students cited career guidance at school. Parental influence was limited in the narrow sense - only one parent had actually suggested

a course in Hotel Management - but parental expectations of the interviewee undertaking some form of Higher Education were stated by twenty-eight of the students interviewed.

10.4.2. Experience at the Polytechnic

The questions to this section were:

29. Did you expect very much science in a Catering course?

30. Do you think sciences have much relevance to Catering and the sort of career you envisage?

31. Do you enjoy sciences here?

32. Do you find a change between methods of work at school and the Polytechnic?

33. Did you find the change bewildering? Exciting?

34. Did you feel you needed any guidance in your study methods?

35. Did you feel you needed guidance in your use of time?

The expectations of students regarding the science content of the course, and the value placed on science as an aspect of Catering varied widely. All students interviewed expected some science in their course; however, the nature and amount of expected science varied. Food science and microbiology were more expected and apparently more welcome than was physics and chemistry. Of the students interviewed, fourteen stated that the science and technology bias was stronger than they had anticipated, and that the bias was not very welcome. This did not in all cases mean that the students concerned were dissatisfied with their course, but that science was more of a problem than other areas of the course. Ten students of the fourteen mentioned above said that they could not see the relevance of physics and chemistry to their future career, or see that it had much relevance for their

current and subsequent studies at the Polytechnic. Nine of these ten were female, and none had a previous strong science background (science to 'O' level at least). Students who were dissatisfied with their course tended not to see any relevance to future career (eight students), not to have anticipated much science on their course (eight students), and not to enjoy sciences very much (six students).

Most students interviewed had anticipated a change in methods of work between school and University, and had experienced such a change. However, the change in style of work was less than the change in social setting, and this change in social setting emerged as a factor which influenced satisfaction with the Polytechnic course on which the student was enrolled.

Because of the relatively large number of hours devoted to class-contact time, the change in patterns of work (question 32) and the allocation of time (question 35) was not felt by the students to be especially important, and answers to these questions were not associated with level of satisfaction with the course. Students did comment that they would like more guidance on study methods, especially as the course was self-learn.

10.4.3. Social Factors

Questions relating to this aspect were:

36. What sort of accommodation do you have? Is it what you requested when you applied? Is it what you would like now?
37. Do you enjoy the social activities of the Polytechnic?

The students opinion had shifted greatly as regards choice of accommodation between applying for a place and the date of the interview

(some time in the second term of the first year). When applying, most students favoured Halls of Residence although Halls of Residence were available for only a few students or approved lodgings. By the date of interview, the majority of students favoured some sort of independent housing, with Halls of Residence being the choice of only three and approved lodgings the choice of only two students. Lodgings in someone's house was by far the most common type of accommodation among the students, although it was least popular.

Level of contentment with accommodation and social life was associated with expressed level of contentment regarding academic work. Distraction at lodgings and poor study facilities were often mentioned as being factors which contributed to a lower level of performance than might otherwise be the case (although in only two cases did the accommodation fail to meet the standards described by the Polytechnic Accommodation service) and fourteen of the students stated that they expected a change in their accommodation to favourably affect their work in the second year.

The way in which students regarded the social activities within the Polytechnic was also associated with level of contentment with the course. Although one could imagine a state in which students devoted so much energy and time to social activities that their studies suffered, there were no such students on this study. On the contrary, contentment with the social milieu generally was associated with contentment regarding the academic work of the Polytechnic. This can be illustrated by reviewing the reasons given by students who left the Department, September 1974-July, 1976. Of these, two had never enrolled. Of the remaining twenty-one students, ten left for reasons

which could possibly be construed as "academic" - two failed Part I examinations, three had originally entered the Department as a result of parental pressure and later realised they could not cope or preferred some other course, one transferred to a Degree course at another institution (having applied to Sheffield Polytechnic for an H.N.D. course and then getting better 'A' level results than anticipated), three found the course 'too difficult' and one gave her reason as 'did not like the course'. The other eleven students left for "non-academic" reasons. Of these, four left within four weeks of enrolling (they never settled and were homesick), one other student arranged to transfer to a University nearer her home, for similar reasons. One student who lived at the parental home never settled and found the Polytechnic course conflicted with his social life. A particular problem was that he never became involved in the social life within the Polytechnic; all his friends were involved in part-time courses and he wished to do the same. He eventually left the course with a view to enrolling on a part-time course in the next academic year. One student never settled, Industrial Placement proved the last straw. Two students did not know what they wanted to do, then never settled and had lost any interest in catering as a career; one left three months, and one five months after enrolling. Two further students left, one at the end of the first term and one at the beginning of the second term, on whom no information is available. They were coping satisfactorily with the course (from the point of view of performance), and did not discuss their reasons for leaving with anyone.

At least half the students who left the Department left for

reasons which were 'social' rather than 'academic', and the reasons involved discontent with social life rather than over-involvement. Similarly, students who were discontented with their social life (but not to such an extent that they wished to leave), many have been performing at well below their capacity on the course. From comments at this session of interviews and at the pilot study, a group of eight students (four from the present study) could be identified who were "extrinsically" motivated, in that they expressed little interest in the course or in an eventual career in catering, and were dissatisfied with their social life. The reasons they gave for continuing with the course included:

(1) The time investment in this course would prolong their education by a further year.

(2) A grant may not be available because they had been supported already for a time.

(3) They may find it difficult to get a place on another course because they had proved themselves to be "non-stayers".

(4) In most cases (all except one), they had no alternative interest or career which they wished to pursue.

10.4.4. Desire for Achievement on the Course

Questions relating to this area were:

26. Is the level at which you pass your examinations important to you?

28. Is it important for you to do well in the B.Sc. (H.N.D./D.H.E.) course?

29. Does it matter to you if you fail the unit test?

Worry about passing/failing examinations was mentioned by all students. However, it tended to be an either/or concern, rather than

concern with level of performance. In answer to the question 28, for most students (except nine), the answer was "No - just to get the qualification" (or variations like that). There was a feeling that level of work in the first year was not of great importance, that employers would not be concerned with level of performance but with possession of a relevant qualification, that the course was too fragmented for all assessments to be valid or important. As far as the self-learn scheme was concerned, the vast majority of students wished to avoid failing it in order to avoid being instructed to attend a tutorial. Only three students saw the unit test as being a valid measurement of their knowledge of the unit subject matter, which tended to decrease the valueplaced upon test performance.

10.4.5. Post-University Experience

Responses to the following question were collected:

25. What do you intend to do on leaving the Polytechnic? What sort of career do you envisage?

Only a small group of students were so unsure of their future career that they had no idea at all where they would look for their career, or contemplated a career outside the catering industry. There was a difference between courses in terms of career expectations. The students on the H.N.D. course tended to see themselves filling operative jobs for a great deal of their working life, perhaps specialising in one area, e.g. Head Waiter, Wine Waiter, Chef, etc. The students on the B.Sc. course tended to have -

(1) much longer term career plans.

(2) a much more precise idea of some development in this career.

The general pattern among the B.Sc. students was a short time in an

operational role (or several roles), then a move into a junior managerial pattern.

Students on the D.H.E. course (all female) had a wide range of career expectations: some saw themselves taking a further course (e.g. in Dietetics), some anticipated only a year or two of employment before marriage, and some planned long-term careers. Only three students fell into the latter category however: all other students mentioned the conflict they expected to arise between marriage and a career, and had decided that at certain stages of their marriage, career plans would need to be interrupted. Female students on the B.Sc. and H.N.D. courses mentioned these conflicts far less. It was not put to students as a direct question, and only two H.N.D. students and one B.Sc. student mentioned the matter spontaneously: in all cases it was a matter which they had not yet resolved for themselves.

Nine students stated that they had enrolled on their course with a career plan, but that the course had changed their minds and they were now not sure what to do or had formulated a different career plan.

Determinations upon a particular career were not associated with performance, nor were they associated with level of satisfaction with the course.

10.5. Conclusions

1) It is difficult to pick out motivational factors which apply equally to all students. Personality of the student, his expectations, parental influence, and study habits may all interact with the social and academic milieu to produce an individual situation for every student.

2) Social factors may be of great importance, especially in the

early weeks of the new institution. The effect of social factors may be important in only certain cases, depending upon the personality of the student. However, the availability of some form of counselling help may help some students who leave in the early weeks, or whose academic work in the early weeks may be seriously disrupted.

3) Relevance of the work to individual students needs to be improved and stressed in order to increase interest in the course content and reduce emphasis upon extrinsic motivation.

CONCLUSIONS

At the beginning of this study three questions were posed which formed major areas of investigation. These were:

1. How can the course be improved to meet the needs of individual students or groups of students?
2. Does the design of this course affect performance on it?
3. Can students who will not perform well on this course be selected out in advance or very early in the course so that they can be given additional help?

Improvement of the Course

The self-learn scheme was not a system of 'individualised' learning except in a very limited sense; improvements to the course therefore centred around the needs of groups of students.

The content and layout of the text had been determined by Milson before the onset of this study. Improvement to the course therefore centred around:

1. Improvement of the test items by removing items which computer analysis of test answers showed to be invalid or ambiguous, or which did not appear to discriminate satisfactorily between students.
2. Identification of areas of difficulty or ambiguity in the study unit by analysis of answers to tests of the study unit.
3. Improvement of the feed-back system. Self-learn schemes require a prompt and thorough feed-back system if the student is to benefit fully from the course (Goldstein and Gotkin, 1962). The feed-back

system in use with the self-learn course was modified in 1975 to include a computer printed sheet of comment on the answers the student had given, and tutorials were also available. There was evidence to suggest that the feed-back system required further modification (see p.123). The tutorial system did not seem to meet the needs of all students and some alteration in format was needed (see p.124).

Does the Design of the Course Affect Performance on it?

Most students commented that they enjoyed (initially) being taught by this method (p.106) and that they would not prefer to have the course lectured to them (p125). It may be that the novelty of the approach would encourage some students to study sciences again even though they commented that their experiences at school had led them to believe that they could not understand sciences and disliked study of sciences.

Some students expressed concern with their level of understanding after they had studied the course, and felt that the unit tests were too superficial and too reliant on recall (see p.125). The nature of the teaching method, and particularly the testing method, which aimed to cover a large number of the specified objectives of each unit made this, superficially, almost obligatory, and it was difficult to remove the superficiality without changing the nature of the course.

The impersonal nature and rigid structure of the course, together with this superficial testing of knowledge, was felt by students to be responsible for a gradual loss of interest in the course (see p.107). This was offset initially by the novelty of the teaching method, but liking for the course and for self-learn courses generally declin ed

as the course progressed (see p.106-107). Performance on unit tests did not decline as the course progressed, but attendance at tests and at tutorials declined. Students commented that their study of the unit material was, as the course progressed, increasingly directed by a fear of failing to pass the unit test (and compulsory attendance at tutorial) rather than a desire to learn from the unit material (see p.125). This may mean that the self-learn course is likely to decrease in efficiency, from the point of view of student learning, if the course is divided into more units or spread over a longer period of time.

The Prediction of Poor Performance on the Self-Learn Scheme

No prediction was possible from an examination of the prior general educational attainment of students (see Section 5.3) or from an examination of the personality profiles of the students (see Section 7.4). Prior level of attainment in science was related to performance on the self-learn scheme (see Section 5.5) and to gains in knowledge in sciences (see Section 5.6). Two groups emerged from this study: 1) those to whom the majority of the material was familiar; for these students, the self-learn scheme was revision of known material.

2) those to whom the majority of the material was unknown; for these students, the self-learn scheme was a remedial course.

It may be that a policy of grouping the students according to prior science knowledge would enable more attention to be paid to the group for whom this is new knowledge. The tutorial help, print-out from the computer and test items could be different for the two groups;

instead of treating the whole student entry to the Department as a homogeneous group, differences in prior knowledge could be recognised and the course adapted to them.

This self-learn scheme was designed for a specific student group; similarly, the research into the effectiveness of the scheme was restricted to a particular group of students in a particular institution. It may be that outside of the confines of the stated objectives, the value of the findings may be limited.

REFERENCES

ALLPORT, G. (1955): "Becoming", Yale.

ALPERT, R., and HABER, R.N. (1960): "Anxiety in academic achievement situations", Journal of Abnormal Social Psychology, 61, p207-215

ALTER, M. (1963): "Retention as a function of length of retention interval, intelligence and training time", Journal of Programmed Instruction, 2 (2), p7-17.

ANDERSON, C.C. and HUNKA, S.M. (1963): "Teacher education: Some problems and a proposal", Harvard Educational Review, 33, p.74-95.

ATKINSON, J.W. and FEATHER N.T., (1966): "A theory of achievement motivation", New York:, Wiley.

BARRETT, E.S. and WHITE, R. (1969): "Impulsiveness and anxiety related to medical students' performance and attitudes", Journal of Medical Education, 44, p.604-607.

BEACH, L.R. (1960): "Sociability and academic achievement in various types of learning situation", Journal of Educational Psychology, 51 (4), p.208-212.

BEARD, R.M., LEVY, P.M. and MADDOX, H. (1964): "Academic performance at University", Educational Review, 16 (3), p.169-174.

BENDIG A.N. and HOUNTRAS P.T. (1959): "Anxiety, authoritarianism and student attitude towards departmental control of college instruction" Journal of Educational Psychology, 50, p.501-508.

BIGELOW, G.S. and EGBERT, R.L. (1968): "Personality factors and indepent study", Journal of Educational Research, 62 (1), p.30-39.

BIGGS, J.B. (1970): "The relation of neuroticism and extraversion to intelligence and educational achievement", British Journal of Educational Psychology, 32, p.188-195.

BIRNEY, R.C., BURDWICK, H. and TEEVAN, R.C. (1969): "Fear of failure", New York: Van Nostraud.

BORM, and HERBERT, (1971): Journal of Experimental Education, 40,(1), p.6-11.

BOUD,D.H., BRIDGE, W.A. and WILLOUGHBY, L. (1975): "P.S.I. now - A review of progress and problems", British Journal of Education Technology, 6, (2), May, p.15-34.

BROWN, W.F. and HOLTZMAN,W.H. (1966): "Manual of the survey of study habits and attitudes", New York: The Psychological Corporation.

BUGELSKI, B.R. (1956): "The Psychology of learning", London: Methuen.

BURGESS, E. (1956): "Personality factors of over and under achievers in engineering", Journal of Educational Psychology, 47, p.89-99.

BUTCHER, H.J. (1968): "Educational research in Britain", University of London Press.

CATTELL R.B. (1963): "Manual for the 16PF Questionnaire Forms, A,B,C." IPAT, Champaign, Illinois.

CORTIS, L.B. (1963): "Personality factors related to under-achievement in college freshmen of high intellectual ability", Doctoral Dissertation, University of Florida.

CRESSWELL, S.W., (1964): "A study of the relationship between intelligence and performance in a programmed learning task", Educational Review, 16, p.137-144.

CROXTON, P.L.C. and MARTIN, L.H. (1965): "Away with notes", New Education, 1, p.25-27.

COWELL, M.D. and ENTWHISTLE, N.J. (1971): "Personality, study methods and academic performance in a technical college", British Journal of Educational Psychology, 41, p.85-89.

DAVIE, J.S. (1971): "Some observations on superior students", Journal of Educational Sociology, 35, p.172-177.

DETAMBEL, M.H. and STOLUROW, L.M. (1956): "Stimulus sequence and concept learning", Journal of Experimental Psychology, 51, p.34-40.

DICK, W. and LATTA, R. (1970): "Comparative effects of ability and presentation mode in computer assisted instruction and programmed instruction", A.V.Communication Review, 18 (1), p.33-45.

DOBSON, C.B. (1973): "Study habits and 'A' level performance", University of Bradford M.Sc. Thesis.

DONOVAN W. (1976): "The Keller Plan?", Self-Paced Study Bulltetin 4, Winter/Spring, Institute of Educational Technology, University of Surrey.

DUNN, J.A. (1964): "Factor structure of the test anxiety scale for children", Journal of Consulting Psychology, 28, p.92.

EIGEN L.D. and FELDHUSEN, J.F. (1963): "Inter-relationships among attitudes, achievement, reading, intelligence and transfer variables in programmed instruction", Paper presented at the Mid-Western Psychological Association.

ELTON, L.R.B., BOUD, D.J, NUTTAL J. and STACE, B.C. (1973): "Teach yourself Paradigm; The Keller Plan", Chemistry in Britain, 9, (4), p.164-168.

ENTWHISTLE, N.J. (1972): "Students and their academic performance in different types of institution" in Butcher, H.J. and Rudd, G., 'Contemporary problems in higher education', London: McGraw Hill, p.59-70.

ENTWHISTLE, N.J. (1973): "Complementary paradigms for research and development work in Higher Education", Paper presented to the Congress on Methodology of Research in Higher Education of the European Association for Research and Development in Higher Education, Rotterdam, 1973.

ENTWHISTLE, N.J. and ENTWHISTLE, D. (1970): "The relationships between personality, study methods and academic achievement", British Journal of Educational Psychology, 40, (2), p.132-141.

ENTWHISTLE, N.J. and NISBET, J.B. (1971): "Educational Research Methods", London: U.L.P.

ENTWHISTLE, N.J., NISBET, J., ENTWHISTLE, D. and COWELL, M.D. (1971): "The academic performance of students. 1. Prediction from scales of motivation and study methods", British Journal of Educational Psychology, 41, p.258-267.

ENTWHISTLE, N.J., THOMPSON, J. and WILSON, J.D. (1974): "Motivation and study habits", Higher Education, 3, p.379-396.

ENTWHISTLE, N.J. and WILSON, J.D. (1970): "Personality, study methods and academic performance", Universities Quarterly, 24, p.147-150.

EVANS, G.W. (1964): "Mode of presentation, pacing, knowledge of results and intellectual level in automated instruction", Dissertation Abstracts, 1317-1318.

EYSENCK, H.J. (1947): "Student selection by means of psychological tests", British Journal of Educational Psychology, 17, p.20-39.

EYSENCK, H.J. (1971): "Personality and attainment; An application of psychological principles to educational objectives", Higher Education, 1, p.39-52.

EYSENCK, H.J. and COOKSON, D. (1969): "Personality in primary school children: 1. Ability and achievement", British Journal of Educational Psychology, 39, p.109-122.

FARMER, J. (1972): "The role of proctoring in personalised instruction", Journal of Applied Behaviour Analysis, 5, p.43-47.

FINGER, F.W. (1962): "Psychologists in Colleges and Universities", in Webb, W.B. (Ed.) "The Profession of Psychology", New York: Holt, Reinhart and Winston, p.50-73.

FINGER, J.A. and SCHLESSER, G.E. (1965): "Non-intellective predictors of academic success in school and college", Sociological Review, 73, p.14-29.

FLECKER, R. (1959): "Characteristics of passing and failing students in first year University mathematics", The Educand, 3 (3), p.304-310.

FOY, J.M. (1969): "A note on lecturer evaluation by students", Universities Quarterly, 23, p.245-249.

FREEMAN, I.L. and PENNY, G.G. (1972/73): "A Keller-type course in physical chemistry for biologists" in L. J. Haynes, et al. (Eds.), "Alternatives to the lecture in chemistry", London: Chemical Society Education Division (personal communication).

FURNEAUX, W.D. (1962): "The psychologist and the University", Universities Quarterly, 17, p.36-46.

GELLER, M. (1963): "The measurement of the effectiveness of a teaching machine programme in the organic chemistry area of first year college chemistry", Journal of Research in Science Teaching, 1.

GLASER, R., HOMME, L.E. and EVANS, J.L. (1960): "An evaluation of textbooks in terms of learning principles", in Lumsdaine, A.A. and Glaser, R. (Eds.), "Teaching machines and programmed learning", Washington D.C., National Educational Association.

GLYNN, E. (1965): "Keys to chemistry (A personal effort in programmed)", New Education, 1, p.21-22.

GOLDSTEIN, L.A. and GOTKIN, L.C. (1962): "A review of research: Teaching machines V. Programmed textbooks as presentation modes", Journal of Programmed Instruction, 1, p.29-36.

GREEN, B.A. (1971): "Physics teaching by Keller plan at M.I.T.", American Journal of Physics, 39, (7), p.64-75.

GREER, A.F. (1969): "Personality and programmed learning", Unpublished M.Ed. Thesis, School of Education, University of Liverpool.

GRIMES, J.W. and ALLENSMITH, W. (1961): "compulsivity, Anxiety and school achievement", Merrill-Palmer Quarterly Review of Behaviour and Development, 7, p.247-269.

HALE COMMITTEE, (1964): Universities General Council, "Universities Teaching Methods", H.M.S.O.

HANDY, J. and JOHNSON, A.H. (1973): "Reproducibility in objective tests" Education in Chemistry, 10, (2), p.47-48.

HARRIS, D. (1940): "Factors affecting college grades: A review of the literature", Psychological Bulletin, 37.

HEIM, A.W. (1947): "An attempt to test high grade intelligence", British Journal of Educational Psychology, 37, p.70-81.

HEWLETT, G.H.K. (1969): "Programmed learning in electrical engineering degree courses", in "Aspects of Educational Technology II", London: Methuen.

HEWLETT, G.H.K. and BOLTON, B. (1970): "Experimental education methods in electrical engineering", in Bajpai, A.C. and Leedham, J.F. (Eds.) "Aspects of educational technology IV", London: Methuen.

HEWTON, E. (1975): "Initiating degrees of freedom", Times Higher Education Supplement, 25th.April, 1975.

HIMMELWEIT, H.T. (1950): "Student selection - An experimental investigation", British Journal of Sociology, 1, p.328-346.

HIMMELWEIT, H.T. (1961): "Student selection", Sociological Review Monograph, 7.

HOARE, D.E. and INGLIS, G.R. (1965): "Programmed learning in chemistry", Education in Chemistry, 2, p.32-35.

HOARE, D.E. and REVANS, M.M. (1969): "Measuring attainment of educational objectives in chemistry", Education in Chemistry, 6, (3), p.78-80.

HOGG, D.R. (1966): "The use of programmed learning with second year University students", The Proceedings of the Loughborough Programmed Learning Conference, Unwin, D., and Leedham J., (Eds.), "Aspects of Educational Technology", London:, Methuen, 1967.

HOLLAND, J.L. and ASTIN, A.W. (1962): "The prediction of the academic, artistic, scientific and social achievement of undergraduates of superior scholastic aptitude", Journal of Educational Psychology, 53, p.132-143.

HOMME, L E. and GLASER, R. (1959): "Relationships between the programmed textbook and teaching machines", in Galanter, E.H. (Ed.), "Automatic Teaching: The State of the Art",, New York: Wiley.

HOPKINS, J., MALLESON, N.B. and SARNOFF, I. (1958): "Some non-intellectual correlates of success and failure among University students", British Journal of Educational Psychology, 28, p.25-36.

HUDSON, L. (1967): "Contrary imaginations", London: Methuen.

HUNT, J.McV., (1960): "Experience and the development of motivation: Some re-interpretations", Child Development, 31, p.489-504.

JONES, C.L., MACINTOSH, H. and McPHERSON, A.F. (1973): "Questions of uncertainty: Non-cognitive predictors of achievement", in Page, C.F., and Gibson, J., "Motivation: Non-cognitive aspects of student performance", Papers presented at the Eighth Annual Conference of the S.R.H.E., p.35-54. London: S.R.H.E.

KEISLER, E.R. (1959): "Theoretical aspects of automated teaching". Paper presented at the Annual Convention of the Western Psychological Association.

KELLER, F.S. (1967): "Engineering personalised instruction in the classroom", Rev. Interamer de Psicol., 1, p.189-197.

KELLER, F.S. (1968): "Goodbye teacher", Journal of Applied Behaviour Analysis, 1, p.79-89.

KELVIN, R.P., LUCAS, C. and OJHA, A. (1965): "The relation between personality, mental health and academic performance of unversity students", British Journal of Social and Clinical Psychology, 4, p.244-253.

KLINE, P. and GALE, A. (1971): "Extraversion, neuroticism and performance in a psychology examination", British Journal of Educational Psychology, 41, p.90-93.

KNIGHT, H.R. and SASSENRATH, J.M. (1966): "Relation ofachievement motivation and test anxiety to performance in programmed instruction", Journal of Educational Psychology, 57, p.14.-17.

KNIGHTLY, J.J. and SAYERE, J.L. (1971): "Self-paced instruction for library science students", Journal of Education for Librarianship, 12, (3), p.193-198.

KOEN, B.V. (1970): "Self-paced instruction for engineering students", Journal of Engineering Education, 60, (7), p.735-736.

KOENIG, K. and McKEACHIE, W.T. (1959): "Personality and independent study", Journal of Educational Psychology, 50 (3), p.132-134.

KULIK, J.A., KULIK, C.C. and SMITH, B.B. (1976): "Research on the personalised system of instruction", Programmed Learning and Educational Technology, 13 (1), p.23-31.

LAMBERT, P., MILLER, D.M. and WILLEY, D.E. (1962): "Experimental folklore and experimentation: The study of programmed learning in the Wantwatosa Public Schools", Journal of Educational Research, 55, p.485-494.

LARKIN, T.C. (1964): "Electricity: A comparison between linear and branching methods of programming", Educational Review, 16, p.92-98.

LARKIN, T.C. and LEITH, G.O.M. (1964): "The effects of linear and branching methods of programmed instruction on learning and retention of a topic in elementary science", Programmed Learning and Educational Technology, 1, p.12-16.

LAVIN, D.E. (1967): "The prediction of academic performance", New York: John Wiley Science Editions.

LEITH, G.Om. (1969): "Learning and personality" in Dunn, W.R. and Holroyd, C. (Eds.), "Aspects of Educational Technology, II" London: Methuen.

LEITH, G.O.M. and BOSSET, R. (1967): "Mode of learning and personality", University of Birmingham: N.C.P.L.

LEITH, G.O.M. and BUCKLE, G.F. (1966): "Mode of response and non-specific background knowledge", National Centre for Research and Documentation of Programmed Learning, University of Birmingham.

LEITH, G.O.M. and GHUMAN, A.S. (1963): "The effects of prompting and confirmation on two methods of responding to a self-instructional program on co-ordinate geometry", Programmed Learning and Educational Technology, 4, p.15-19.

LEITH, G.O.M. and TROWN, E.A. (1970): "The influence of personality and task conditions on learning and transfer", Programmed Learning and Educational Technology, 7, (3), p.181-188.

LEWIS, D.G. and GREGSON, A. (1965): "The effect of frame size and intelligence on learning from a linear programme", Programmed Learning and Educational Technology, 2, (3), p.170-175.

LONG, J.M. (1964): "Sex differences in academic prediction based on scholastic, personality and interest factors", Journal of Experimental Education, 22, (3), p.239-248.

LYNN, R. and GORDON, I.E. (1961): "The relation of neuroticism and extraversion to educational attainment", British Journal of Educational Psychology, 31, p.194-203.

MAJOR, K. (1970): "Differential relationships between personality and performance under dissimilar modes of instruction", AV Communication Review, 18, (2), p.169-179.

MALLESON, N.B. (1958): "University student I profile, 1953: A study of one year's entry to University College, London", Universities Quarterly, 13 (3), p.23-28.

McCLELLAND, D.C., ATKINSON, J.W., CLARK, R.A. and LOWELL, E.L. (1953): "The achievement motive", New York: Appleton-Century-Crofts.

MENGES, R.J. (1969): "Student-instructor cognitive compatibility in the large lecture class", Journal of Personality, 37, p.444-459.

MILLER, G.W. (1970): "Success, failure and wastage in higher education: An over-view of the problems derived from research and theory" London: Harrap.

MILSON, A. (1975): "A self-learning scheme in applied science (physics and chemistry) for students of a widely varying background knowledge", Programmed Learning and Educational Technology, 12, (6), p.363-372.

MORRIS, V.A., BLANK, S.S., McKIE, D. and RANKINE' F.C. (1970): "Motivation, step size and selected learn variables in relation to performance with programmed instruction". Programmed Learning and Educational Technology, 7 (4), p.257-267.

NELSON, T.F. and SCOTT, T.W. (1972): Michigan Academician IV (3).

NISBET, J., PERCY, C. and ENTWHISTLE, J. (1970): In Nisbet J. and Entwhistle N.J. (1970), "Educational Research Methods", London: U.L.P.

NISBET, J. and WELSH, J. (1966): "Predicting student performance" Universities Quarterly, 20 (4), p.468-480.

OWEN, S.G., HALL R., ANDERSON, J. and SMART G.A. (1965): "A comparison of programmed learning instruction and lectures in the teaching of electrocardiography", Programmed Learning, 2, p.2-14.

PARLETT, M.R. (1969): "Undergraduate teaching observed", Nature, 223,p.5211.

PARLETT, M.R. and HAMILTON, D. (1972): "Evaluation as illumination: A new approach to the study of innovatory programmes", Centre for Research in the Educational Sciences, University of Edinburgh, Occasional Paper 9 (October).

PETERS, R.S. (1958): "The concept of motivation", London: Routledge.

PILLINER, A.E.G. (1960): "Note on the correlation coefficients between intelligence quotients and achievement quotients or ratios", British Journal of Educational Psychology, 31, p.95-98.

POND, L. (1964): "A study of high achieving and low achieving freshmen" Australian Journal of Higher Education, 2 (1), p.73-78.

POPPLETON, P.K. and AUSTWICK, K. (1964): "A comparison of programmed learning and note taking at two age levels", British Journal of Educational Psychology, 31 (2), p.128-137.

RASHEED, R. N. (1973): "The relationship between factors of personality and academic achievement in a programmed learning situation among college students", Doctoral Dissertation, Auburn University.

RAYDER, N.F. (1968): "College students ratings of instructors", Journal of Experimental Education, 37, p.76-81.

RILEY, J.W., RYAN, B.F. and LIFSHITZ, M. (1950): "The student looks at his teacher". An Enquiry into the Implications of Student Ratings at College Level. New Brunswick: Rutgers University Press.

ROBINSON, S. (1975): "Polytechnic places: Reward for merit or safety-net for the also-rans?" Times Higher Education Supplement, 21st. February, 1975.

ROSENBERG, L.A., McHENRY, T.B. and ROSENBERG, A.M. (1962): "Sociometric ratings as predictors of academic performance", Journal of Applied Psychology, 46, p.265-268.

SASSENRATH, J.M. (1964): "A factor analysis of rating scale items on the test-anxiety questionnaire". Journal of Consulting Psychology, 28, p.371-377.

SAVAGE, R.D. (1962): "Personality factors and academic performance" British Journal of Educational Psychology, 32, p.91-94.

SAVAGE, R.D. (1966): "Personality factors in academic attainment in junior school children", British Journal of Educational Psychology, 36, p.91-94.

SAYLES, P.C. (1972): "University of Bradford M.Sc. Thesis.

SHAY, C.B. (1961): "Relationship of intelligence to step size on a teaching machine program". Journal of Educational Psychology, 52 (2), p.98-103.

SINHA, D. (1966): "A psychological analysis of some factors associated with success and failure in University education", Indian Educational Review, 1 (1), p.33-38.

SMITHERS, A.G. and BATCOCK, A. (1970): "Success and failure among social scientists and health scientists at a technological University", British Journal of Educational Psychology, 40, p.144-153.

SMITHERS, C.A. (1970): "What do students expect of lectures?" Universities Quarterly, 24, (3), p.330-336.

SPEILBURGER C.D. (1962): "The effects of manifest anxiety upon the academic achievement of college students",Mental Hygiene", 46, p.420-426.

STEADMAN, S.D., (1973): "Immaturity: The common trait of early leavers" Times Higher Education Supplement, 23rd.March, 1973, p.13.

STOLUROW, L.M. (1961): "Teaching by machine", Coop. Res. Monograph No.6, Washington: U.S. Govenment Printing Office,

STOLUROW, L.M. (1962): "Social impact of programmed instruction: Aptitudes and abilities revisited". Paper presented at the American Psychological Association Annual Convention, Symposium on Programmed Instruction, St. Louis, Missouri.

STONES, E. (1966): "An experiment in the use of programming techniques in the training of student teachers", University of Nottingham Institute of Education, Occasional Paper 1.

STONES, E. (1966): "The effects of different conditions of working on student performance and attitudes", Programmed Learning, 3, (3), p.135-145.

SUNDERLAND, R.M. (1971): "Environmental and motivational factors associated with entrance and performance at University" University of Bradford M.Sc. Thesis.

SUTCHETT-KAYE, C.E. (1972): "Personality factors and self-instruction: A survey". Programmed Learning and Educational Technology, 9 (4), p.206-220.

SWIRIS, M.Y. (1966): "A factorial study of some variables relevant to a programmed learning situation", Programmed Learning, 3, p.30-34.

TRAWEEK, M.W. (1964): "The relationship between certain personality variables and achievement through programmed instruction", Californian Journal of Educational Research, 15 (5), p.215-220.

TUEL, J.K. (1963): "Overt versus covert responding in programmed instruction". Address delivered to the Annual Convention of the Californian Educational Guidance Association.

UNDERWOOD, B.J. (1954): "Speed of learning and amount retained - A consideration of methodology", Psychological Bulletin, 51, p.276-283.

Universities General Council, Department of Education and Science and the Science Educational Development Committee (1965): "Audio-visual aids in higher scientific education", H.M.S.O.

UNWIN, D. and SPENCER, A.J. (1966): Paper presented at the Loughborough Programmed Learning Conference in Unwin, D. and Leedham J. (Eds.), "Aspects of Educational Technology" (The proceedings of the Loughborough Programmed Learning Conference, 1966) London: Methuen.

VREELAND, R.S. and BIDWELL, C.E. (1966): "Classifying University Departments: An approach to the analysis of their effects upon undergraduates' values and attitudes", Sociology of Education, 40, (4), p.302-315.

WANKOWSKI, J.A. (1969): "Some aspects of motivation in success and failure at University" in "Research Into Higher Education",1968 the Proceedings of the 4th. Annual Conference of the Society for Research into Higher Education. London: S.R.H.E. p.1-39.

WANKOWSKI, J.A. (1970): "Random sample analysis: Motives and Goals in University studies" (2 volumes). Birmingham: University of Birmingham Educational Survey.

WHITWORTH, M. (1974): "More learning - less teaching", Physics Education, 9, p.16-18.

WILSON, J. (1972): "Philosophy and educational research", Slough: NFER.

WILSON, J.D.(1971): "Predicting levels of first year University performance", British Journal of Educational Psychology, 41, p.163-170.

APPENDIX 1

Marks on Unit Tests of the Self-Learn Scheme in Applied Science 1974-1976: Student Marks Grouped by Science Background and by Course Followed:

1. Science Groupings

'S' students are those who have passed at least one 'O' level examination in Physics, Chemistry, or Physics with Chemistry, or who have passed an 'A' level in Physics, Chemistry or Physical Sciences.

'MS' students are those who have studied the subjects detailed above to at least G.C.E. 'O' level stage but have not taken, or have failed to pass, the relevant examination; students who have studied Physics or Chemistry to C.S.E. level and have passed the examination but not at scale 1: students who have passed the 'O' level General Science paper.

'NS' students are those who have not studied Physics or Chemistry or any combination of them to examination level.

2. Course Groupings

'B.Sc.' students are those students following the course which leads to the award of Bachelor of Science (Catering Systems).

2. Course Groupings (Contd.)

'H.N.D.' students are those students following a course leading to the award of a Higher National Diploma in Hotel, Catering and Institutional Management.

'D.H.E.' students are those students following a course leading to the award of Diploma in Home Economics.

Marks on Unit Tests by Students with 'S' Background

1a. 1974/75

Group Unit	B.Sc./S	H.N.D./S	D.H.E./S	Mean all S
1.	85.8	80.2	78.4	81.5
2.	79.2	80.3	81.0	80.2
3.	88.0	77.3	76.0	84.5
4.	86.9	90.6	90.5	89.3
5.	81.1	90.6	81.0	84.2
6.	84.6	83.8	81.5	83.3
7.	90.9	89.7	82.5	87.7
8.	79.5	71.9	70.0	73.8
9.	90.5	94.4	85.6	90.2
10.	85.3	74.3	67.6	75.7
11.	88.2	88.6	90.4	89.1
12.	79.6	81.5	77.1	79.4
13.	87.0	77.2	74.3	79.5
14.	82.4	83.4	80.9	82.2
15.	86.5	84.7	78.1	83.1
All Units	85.0	83.2	79.7	83.8

B. Sc. n = 13

H.N.D. n = 17

D.H.E. n = 10

Marks on Unit Tests by Students with 'MS' Background

1b. 1974/75

Group Unit	B.Sc./MS	H.N.D./MS	D.H.E./MS	Mean all MS
1.	78.0	70.0	65.0	71.0
2.	75.0	81.9	85.0	80.6
3.	86.6	75.6	63.8	75.3
4.	81.2	79.4	68.8	76.5
5.	87.5	93.6	72.5	84.5
6.	75.0	70.0	71.3	72.1
7.	81.5	79.0	83.3	81.3
8.	67.5	60.6	77.5	68.5
9.	81.5	87.1	74.5	81.0
10.	76.2	67.3	68.0	70.5
11.	88.0	75.5	79.8	81.1
12.	71.2	82.1	77.3	76.9
13.	77.5	71.9	70.0	73.1
14.	73.0	78.9	74.5	75.5
15.	76.0	69.3	73.0	72.8
All Units	78.4	76.1	73.6	76.0

B. Sc. n = 4

H.N.D. n = 8

D.H.E. n = 4

Marks on Unit Tests by Students with 'NS' Background

1c. 1974/75

Group Unit	B.Sc./NS	H.N.D./MS	D.H.E./NS	Mean all NS
1.	66.6	66.8	78.9	70.8
2.	75.8	78.7	86.7	80.4
3.	73.3	68.2	79.0	73.5
4.	77.5	81.2	88.2	82.3
5.	82.5	85.0	81.4	83.0
6.	73.3	74.5	77.3	75.0
7.	83.2	79.0	84.9	82.4
8.	69.2	62.7	70.6	67.5
9.	80.5	84.2	71.1	78.6
10.	75.2	71.7	81.9	76.3
11.	85.2	83.3	89.5	86.0
12.	78.5	76.5	78.2	77.7
13.	85.0	72.7	78.1	78.6
14.	79.6	82.4	82.3	81.4
15.	77.2	73.7	79.0	76.6
All Units	77.5	76.0	80.5	78.0

B. Sc. n = 66

H.N.D. n = 12

D.H.E. n = 11

Marks on Unit Tests by Students with 'S' Background

1d. 1975/76

Group Unit	B.Sc./S	H.N.D./s	D.H.E./s	Mean all S
1.	84.0	80.8	79.7	81.9
2.	78.2	79.0	81.5	79.3
3.	83.7	76.4	78.1	80.3
4.	86.7	80.8=	82.5	83.8
5.	84.0	80.3	84.5	83.2
6.	77.4	74.2	71.2	74.6
7.	91.8	90.4	89.8	90.8
8.	76.2	65.1	66.9	70.4
9.	86.9	79.7	69.9	79.9
10.	72.6	72.2	65.9	70.1
11.	72.3	68.7	67.2	69.7
12.	75.3	63.0	59.6	67.8
13.	81.3	73.0	70.9	76.1
14.	76.5	75.1	65.6	71.8
15.	81.1	73.0	76.1	77.8
All Units	80.5	75.4	74.0	

B. Sc. n = 25

H.N.D. n = 13

D.H.E. n = 17

Marks on Unit Tests by Students with 'MS' Background

1e. 1975/76

Group Unit	B.Sc./MS	H.N.D./MS	D.H.E./MS	Mean all MS
1.	70.0	79.0	82.9	77.3
2.	77.8	73.3	69.4	73.5
3.	82.2	65.7	76.5	74.8
4.	93.3	80.0	68.5	74.3
5.	84.4	81.9	87.2	84.5
6.	60.0	75.6	72.9	69.5
7.	96.7	90.5	82.2	89.8
8.	71.4	75.0	62.1	69.5
9.	86.6	82.2	79.3	82.7
10.	72.7	70.8	46.3	63.6
11.	80.0	74.6	72.8	75.8
12.	73.4	62.2	58.8	64.8
13.	90.0	73.3	58.7	74.0
14.	73.3	70.0	66.1	69.8
15.	73.8	74.3	74.5	74.2
All Units	79.5	75.6	68.5	

B. Sc. n = 3

H.N.D. n = 7

D.H.E. n = 6

Marks on Unit Tests by Students with 'NS' Background

1f. 1975/76

Group Unit	B.Sc./NS	H.N.D./NS	D.H.E./NS	Mean all NS
1.	76.5	53.1	67.7	60.2
2.	79.5	62.7	66.1	65.4
3.	73.0	47.3	67.0	57.5
4.	86.5	65.9	77.0	64.1
5.	83.0	69.5	81.2	74.6
6.	66.5	62.5	67.5	64.9
7.	89.5	69.4	89.4	78.6
8.	78.0	51.3	63.8	57.7
9.	80.0	65.8	74.9	70.1
10.	63.0	45.9	57.5	50.8
11.	70.0	60.8	58.9	60.9
12.	60.0	51.6	63.1	56.8
13.	70.0	54.0	58.8	57.0
14.	66.5	63.0	68.1	65.1
15.	81.5	73.8	66.6	71.9
All Units	74.9	59.8	68.5	

B. Sc. n = 2

H.N.D. n = 16

D.H.E. n = 11

1g. Marks on Self-Learn Scheme 1974/75

Grouped by Courses

Course Unit	B.Sc.	H.N.D.	D.H.E.	Mean all Courses
1.	79.3	74.1	76.5	76.6
2.	77.4	80.1	84.2	80.6
3.	83.2	74.2	75.4	77.6
4.	83.4	84.9	86.0	84.8
5.	85.5	88.8	79.8	84.7
6.	80.0	77.9	78.0	78.6
7.	87.1	83.9	83.6	84.9
8.	74.0	65.9	71.1	70.3
9.	86.3	89.2	80.8	85.4
10.	80.7	71.9	73.3	75.3
11.	87.3	83.4	87.4	86.0
12.	77.9	80.1	77.7	78.6
13.	84.5	74.7	74.2	77.8
14.	80.0	81.9	78.5	80.1
15.	82.0	75.7	75.8	77.8
Mean	81.9	79.1	78.8	

N

B. Sc. = 23

H.N.D. = 37

D.H.E. = 25

1h. Marks on the Self-Learn Scheme 1975/76

Grouped by Courses

Course Unit	B.Sc.	H.N.D.	D.H.E.	Mean for all Students
1.	82.7	68.1	76.9	75.9
2.	78.2	68.6	72.5	73.1
3.	81.0	61.2	75.1	72.4
4.	87.7	69.5	77.4	78.2
5.	83.9	75.5	84.3	81.2
6.=	76.1	68.3	69.1	71.2
7.	92.0	80.8	89.2	87.3
8.	72.2	59.0	63.1	64.8
9.	86.3	74.4	72.7	77.8
10.	71.8	60.1	61.1	64.3
11.	73.0	66.8	65.5	68.4
12.	74.0	58.1	61.7	64.6
13.	80.8	64.4	67.5	70.9
14.	76.6	68.7	65.4	69.8
15.	79.4	70.9	71.3	72.9
Mean	79.4	67.6	71.5	

N

B. Sc. = 30

H.N.D. = 36

D.H.E. = 34

APPENDIX II

Marks on Unit Tests of the Self-Learn Scheme in Applied Science, 1974-1976: Differences Between the Scores of Male and Female Students

1974-75

		Male Students		Female Students		
	S(22)	MS(3)	NS(10)	S(21)	MS(13)	NS(23)
1.	84.6	80.0	64.0	79.6	66.7	74.5
2.	82.1	80.0	77.8	79.0	80.8	80.9
3.	82.5	90.0	70.6	79.5	67.7	76.6
4.	91.3	90.0	77.2	87.5	73.2	83.9
5.	87.8	88.3	91.1	85.3	83.2	81.4
6.	87.2	90.0	77.8	81.5	60.8	75.7
7.	90.4	95.3	85.8	86.4	71.5	83.0
8.	77.6	61.7	63.8	70.4	66.5	66.0
9.	94.5	91.0	84.1	86.7	80.2	80.2
10.	82.3	82.0	64.0	68.2	73.5	75.5
11.	88.6	93.3	76.3	89.4	77.2	88.7
12.	81.3	86.3	77.4	79.2	75.4	76.9
13.	82.4	81.7	77.5	75.3	72.5	77.1
14.	87.1	83.8	81.4	74.0	74.7	80.3
15.	86.8	76.0	78.9	81.7	71.9	74.6
Mean	85.8	84.6	76.5	80.2	73.1	78.4

N ** Male Students S = 22 MS = 3 NS = 10 Female Students S = 21 MS = 13 NS = 23

	Male Students			Female Students		
	S	MS	NS	S	MS	NS
1.	83.0	76.0	61.5	81.9	81.0	59.6
2.	79.4	56.5	60.3	79.6	76.1	65.0
3.	88.3	63.5	58.5	80.4	80.4	57.1
4.	90.0	83.0	82.0	82.2	80.0	70.4
5.	84.5	83.0	82.3	83.9	84.7	74.0
6.	82.1	60.0	82.3	73.7	70.8	61.4
7.	90.8	96.5	89.0	91.2	89.2	77.0
8.	75.3	67.5	78.7	69.7	70.4	53.8
9.	84.7	76.5	73.3	79.2	83.8	70.0
10.	80.2	46.5	57.7	68.0	68.2	50.0
11.	68.9	73.0	66.7	69.7	74.3	60.7
12.	80.5	56.5	60.0	64.5	66.7	56.5
13.	80.7	67.0	71.0	74.2	76.9	56.2
14.	81.7	63.0	63.5	69.5	71.5	65.2
15.	83.3	86.0	81.7	78.0	72.7	70.0
Mean	82.2	70.3	71.2	76.4	76.4	63.1

N ** Male Students S = 11 Female Students S = 44

MS = 3 MS = 14

NS = 5 NS = 25

** at enrolment. After this numbers varied, e.g. Female S group (n = 44), by the time students began taking unit tests, n was 41. This was reduced by the end of the 15 units to 40. Absenteeism meant that for any one test, n varied between 33 and 40, with a mean n of 37.5.

APPENDIX III

Correlation Coefficients Between Areas of Study on the B.Sc., H.N.D., and Dip.H.E. Courses and Performance at 'O' and 'A' Level of the G.C.E.

H.N.D.Course 1974 Entry

Subject Area	Correlation with 'O' Level Grades		Correlation with 'A' Level Grades	
	Exam.	Course	Exam.	Course
Self-Learn Scheme	-0.03		+0.29	
Statistics	+0.17	-0.03	+0.33*	+0.24
Economics	-0.02	+0.10	+0.35*	+0.05
Accommodation	+0.20	+0.24	+0.34*	+0.25
Work Study	+0.14	+0.20	+0.09	+0.15
Communication	+0.08		+0.10	
Microbiology	+0.06		+0.36*	
Nutrition	+0.20		+0.54***	
Rest. Management	+0.16		+0.26	
Food Service	-0.05	+0.08	+0.17	+0.03
Food Presentation	+0.17	+0.11	+0.22	+0.31

n = 36

B.Sc. Course 1974 Entry

Subject Area	Correlation with 'O' Level Grades		Correlation with 'A' Level Grades	
	Exam.	Course	Exam.	Course
Self-Learn Scheme	+0.25		+0.13	
Applied Science	+0.06	-0.30	+0.21	-0.02
Food Preparation	+0.38	+0.24	+0.35	-0.03
Q.M.I.	+0.08		+0.35	
Economics	-0.22		+0.18	
C.C.O.A.		+0.07		+0.11
Tech. Comm.		+0.49*		+0.66**
Psychology	+0.31		+0.64**	

n = 22

* significant at 0.05 level
** significant at 0.01 level
*** significant at 0.001 level

Dip.H.E. Course 1974 Entry

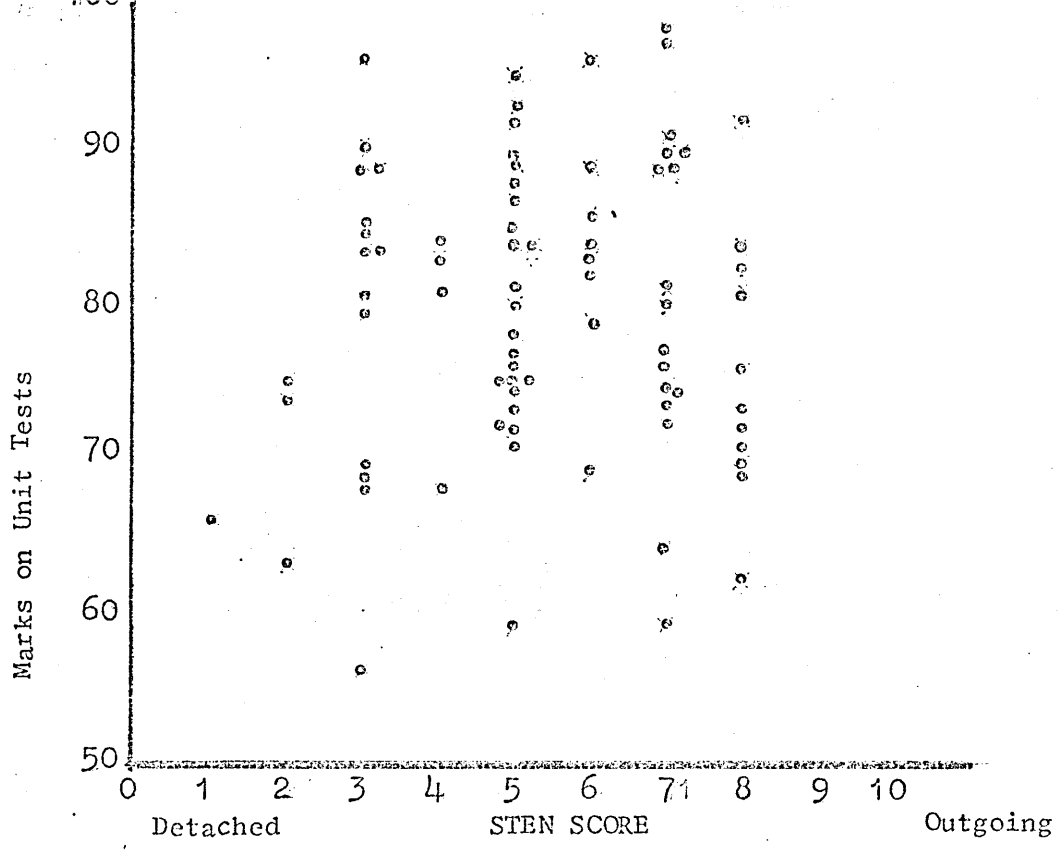
Subject Area	Correlation with 'O' Level Grades		Correlation with 'A' Level Grades	
	Exam.	Course	Exam.	Course
Self-Learn Scheme	+0.07		+0.15	
Food Studies	+0.04	-0.19	+0.32	-0.10
Food Science	+0.04	-0.02	+0.32	+0.32
Microbiology	+0.02	-0.17	+0.59**	+0.10
Social Studies	+0.06	+0.10	-0.04	+0.22
Housing	+0.23	-0.18	+0.02	+0.22
Consumer/Equip.	-0.19		+0.19	
Psychology	-0.06	-0.03	-0.21	+0.27

n = 25

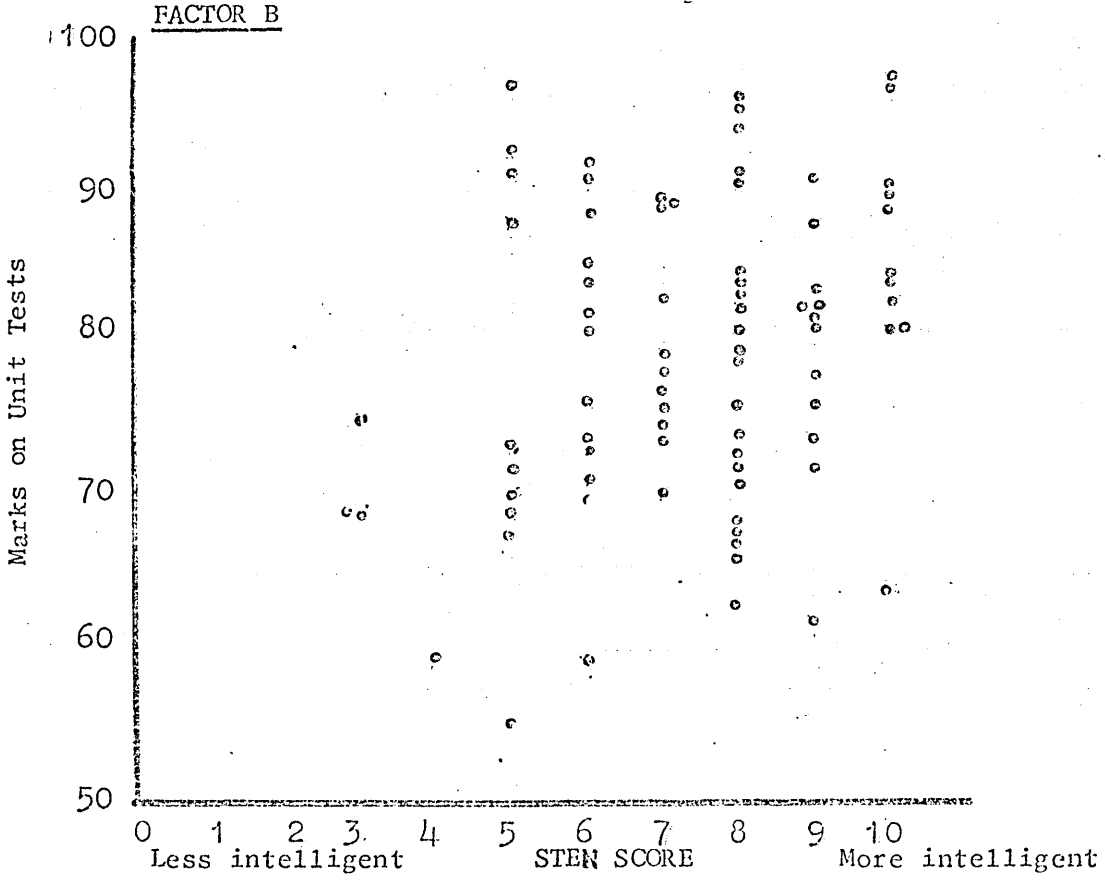
** significant at 0.01 level

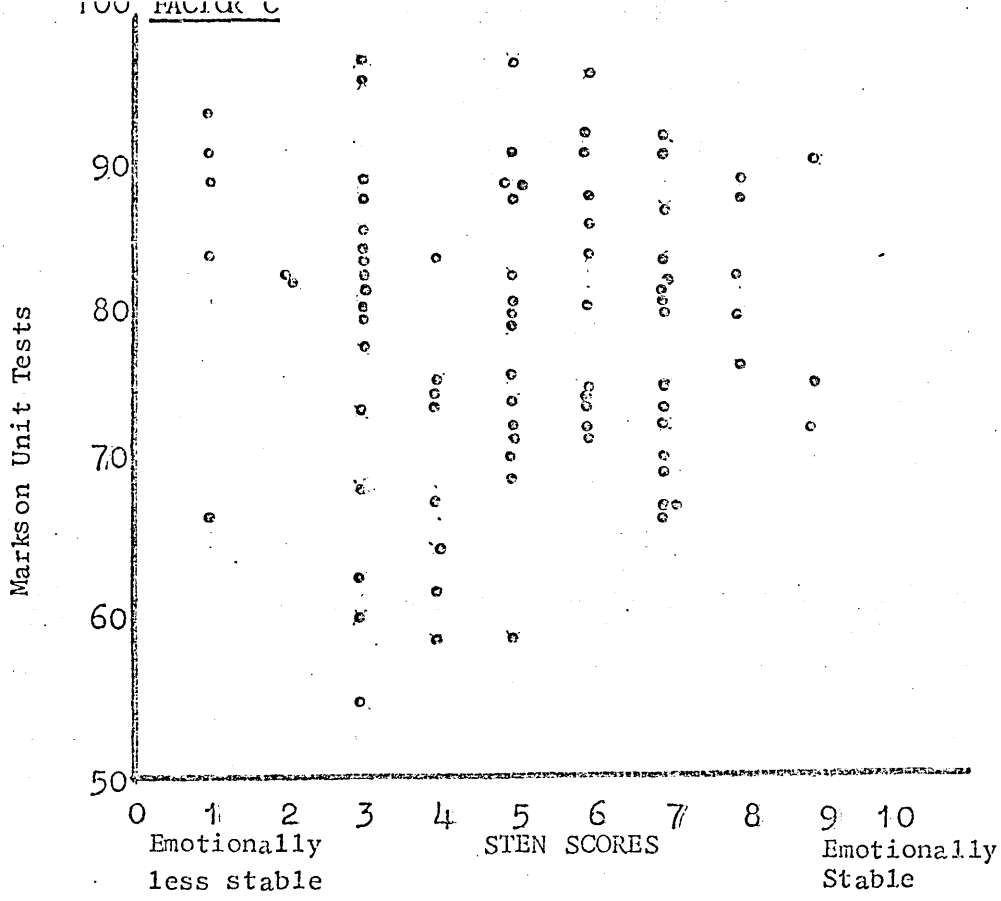
Appendix IV

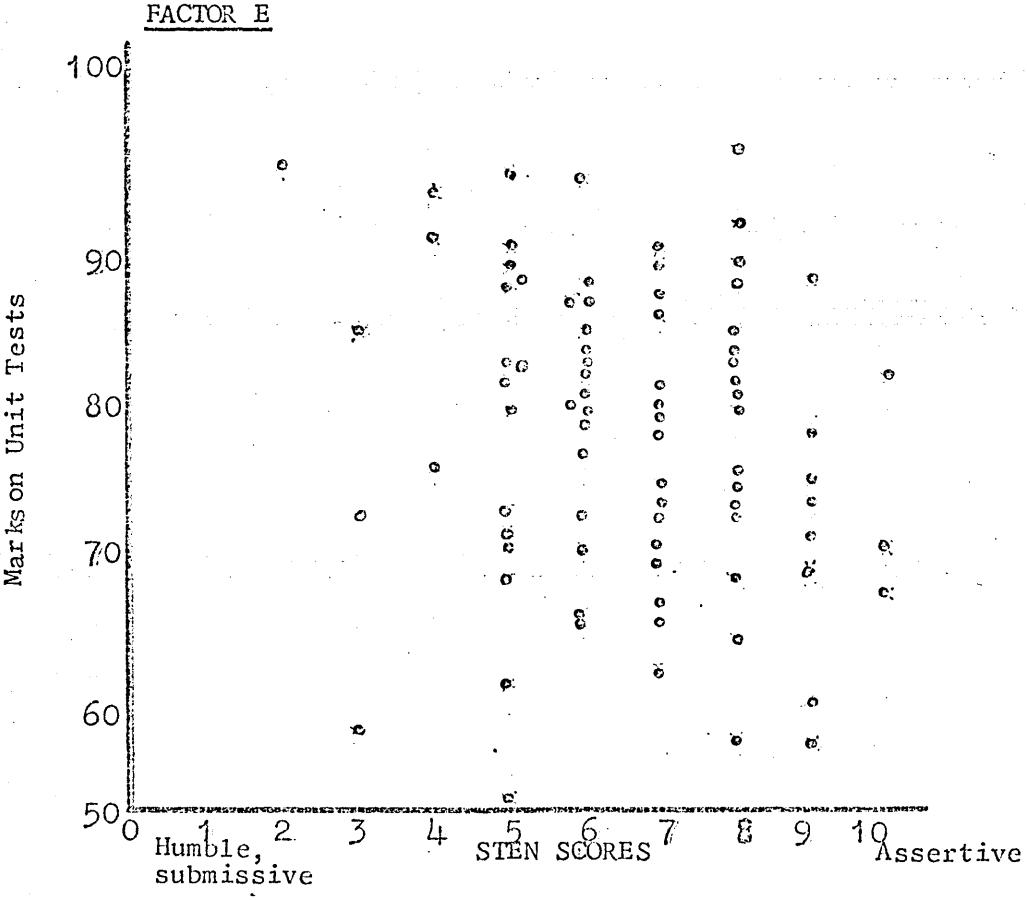
Relationships Between Scores on the 16PF and Unit Test Marks

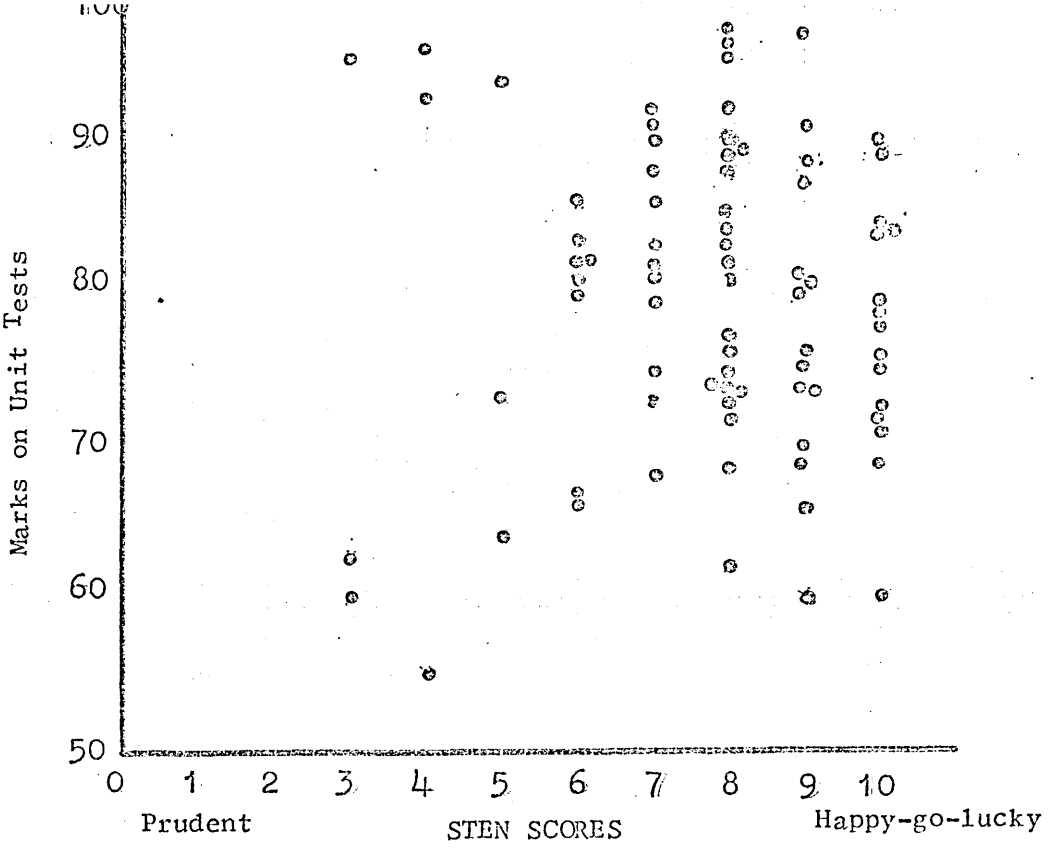

Marks on Unit Tests
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Detached
STEN SCORE
Outgoing

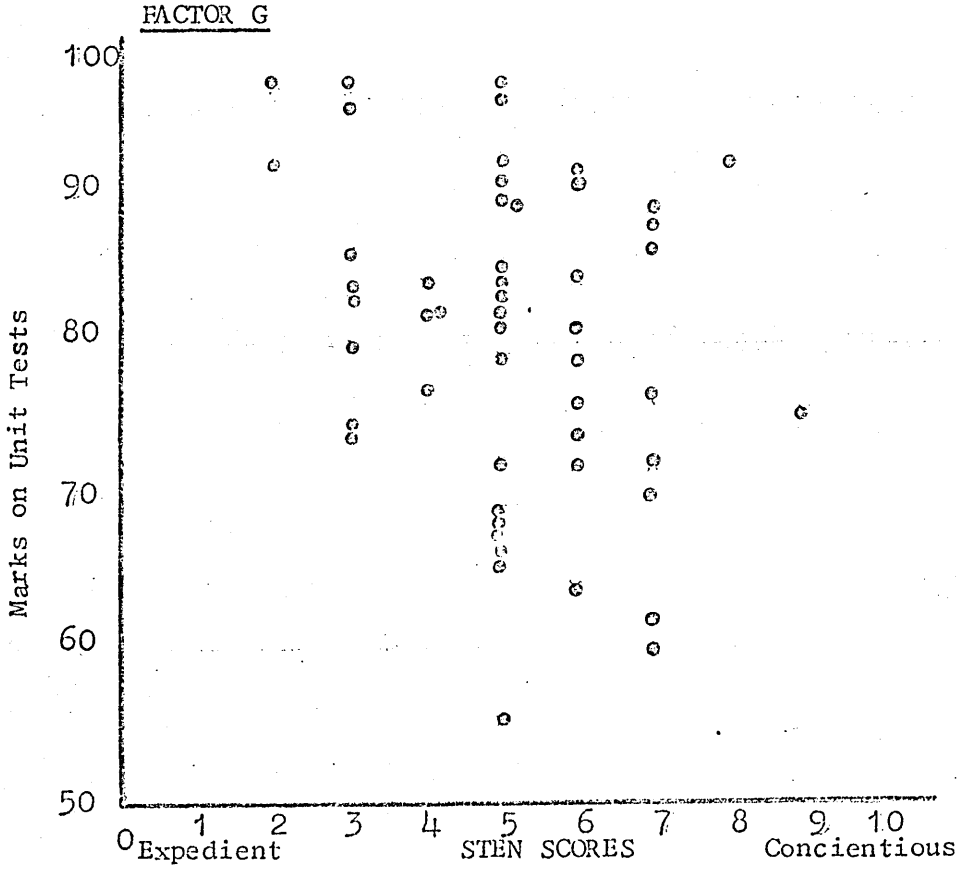
FACTOR B

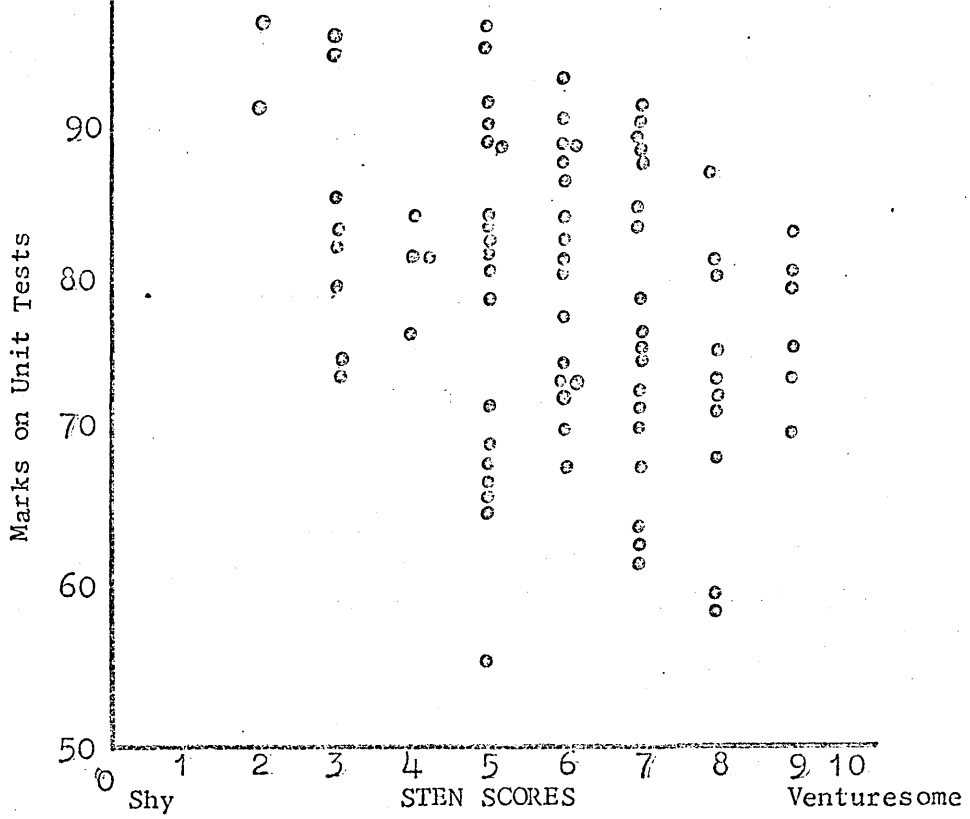

Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Less intelligent
STEN SCORE
More intelligent

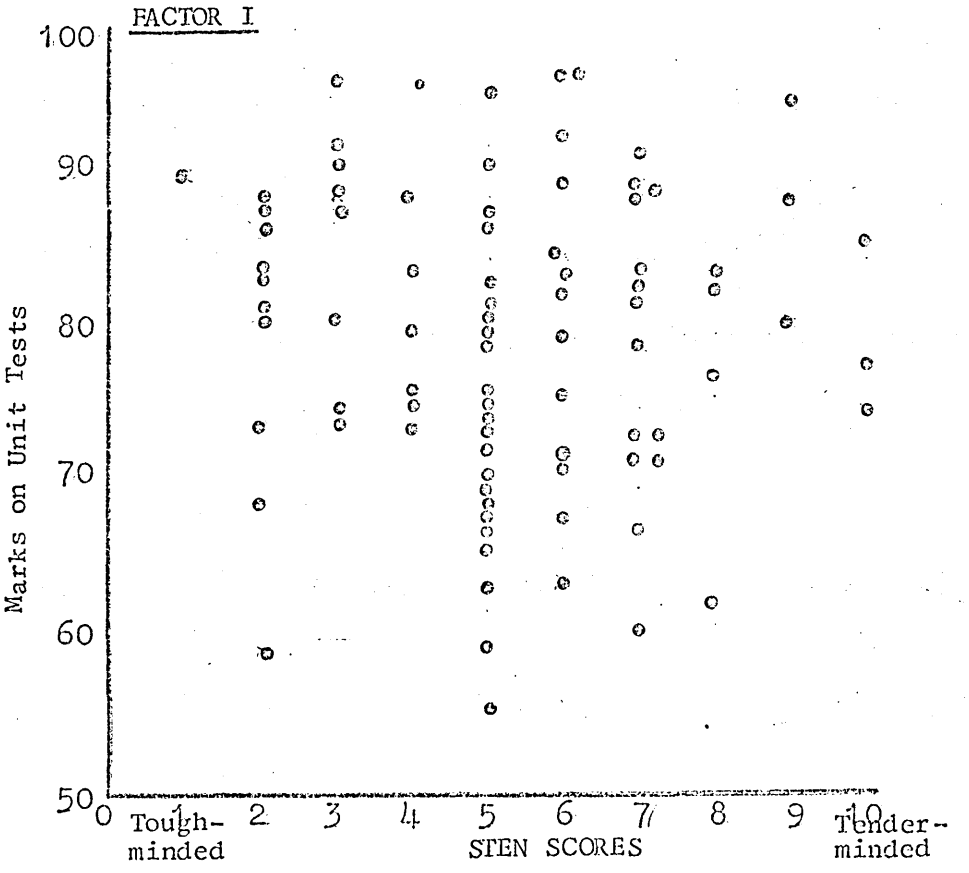

FACTOR C
100
90
80
70
60
50
Marks on Unit Tests
0 1 2 3 4 5 6 7 8 9 10
Emotionally less stable
STEN SCORES
Emotionally Stable

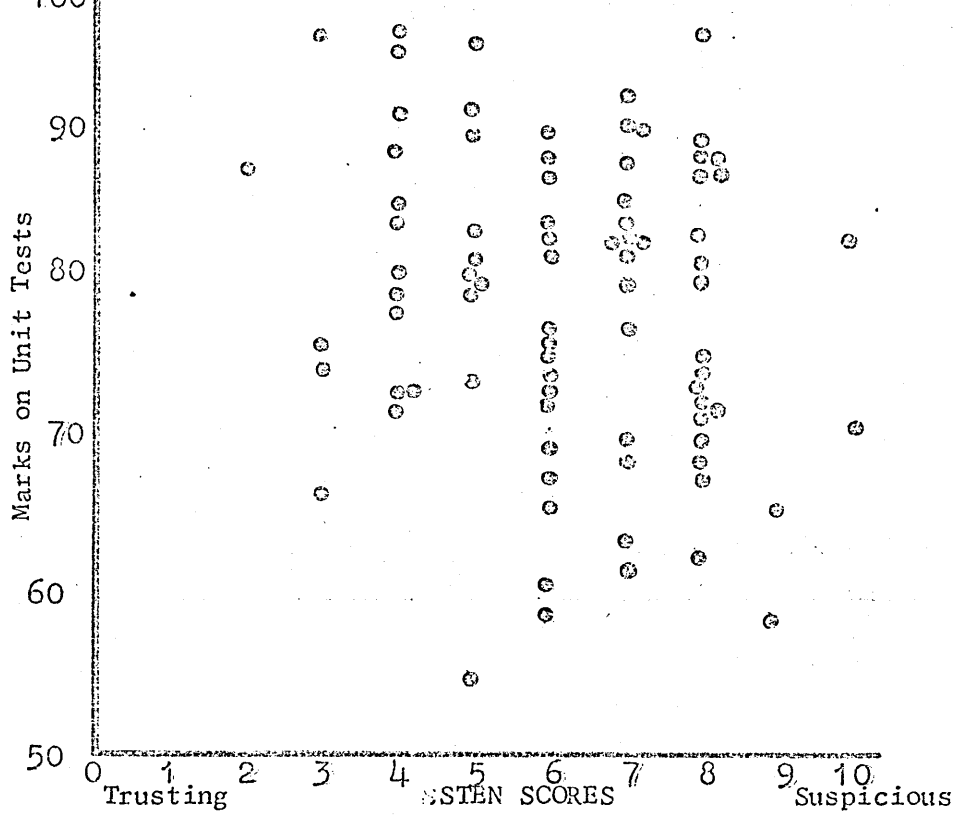

FACTOR E
100
90
80
70
60
50
Marks on Unit Tests
0 1 2 3 4 5 6 7 8 9 10
Humble, submissive
STEN SCORES
Assertive

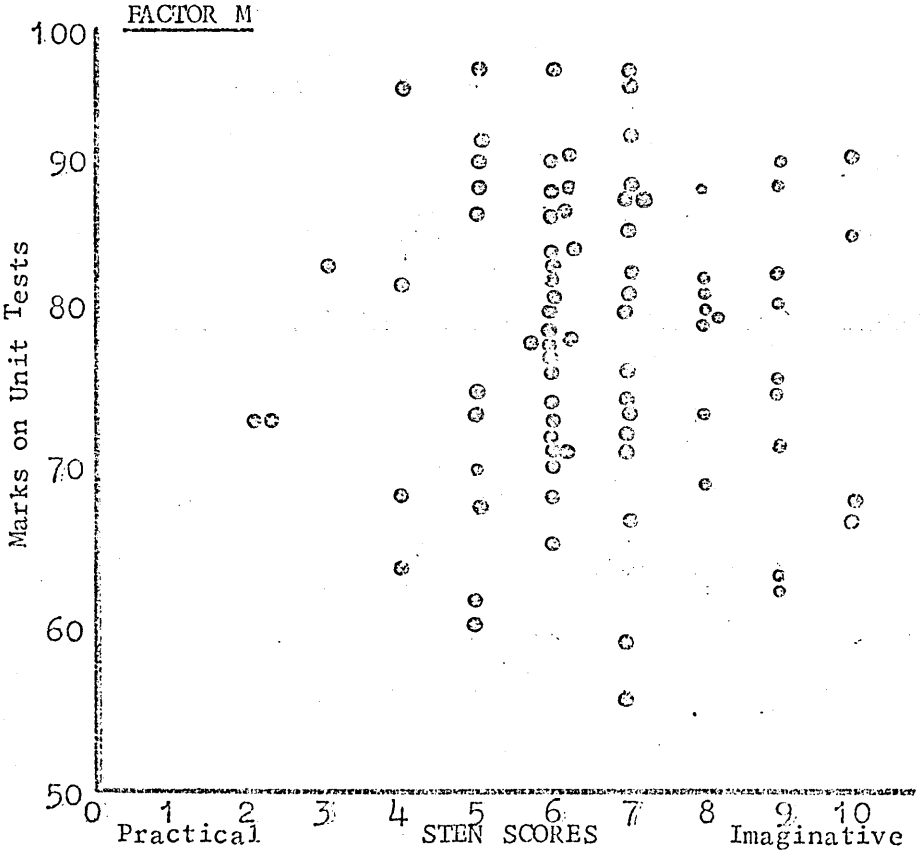

Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Prudent
STEN SCORES
Happy-go-lucky

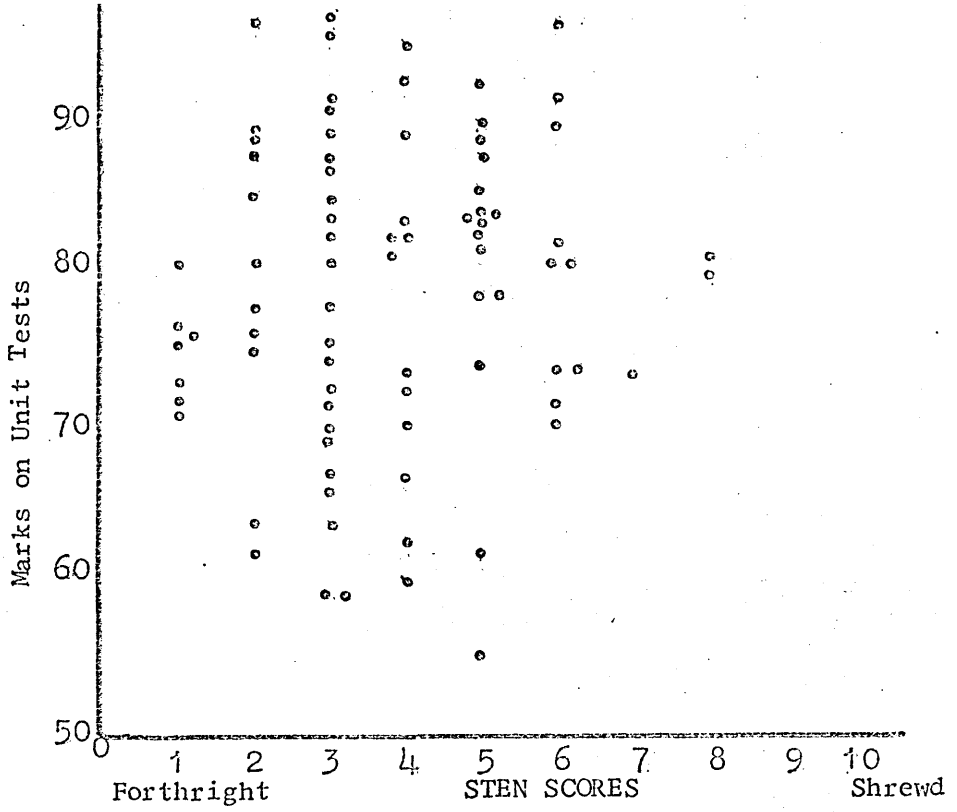

FACTOR G
Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Expedient
STEN SCORES
Concientious

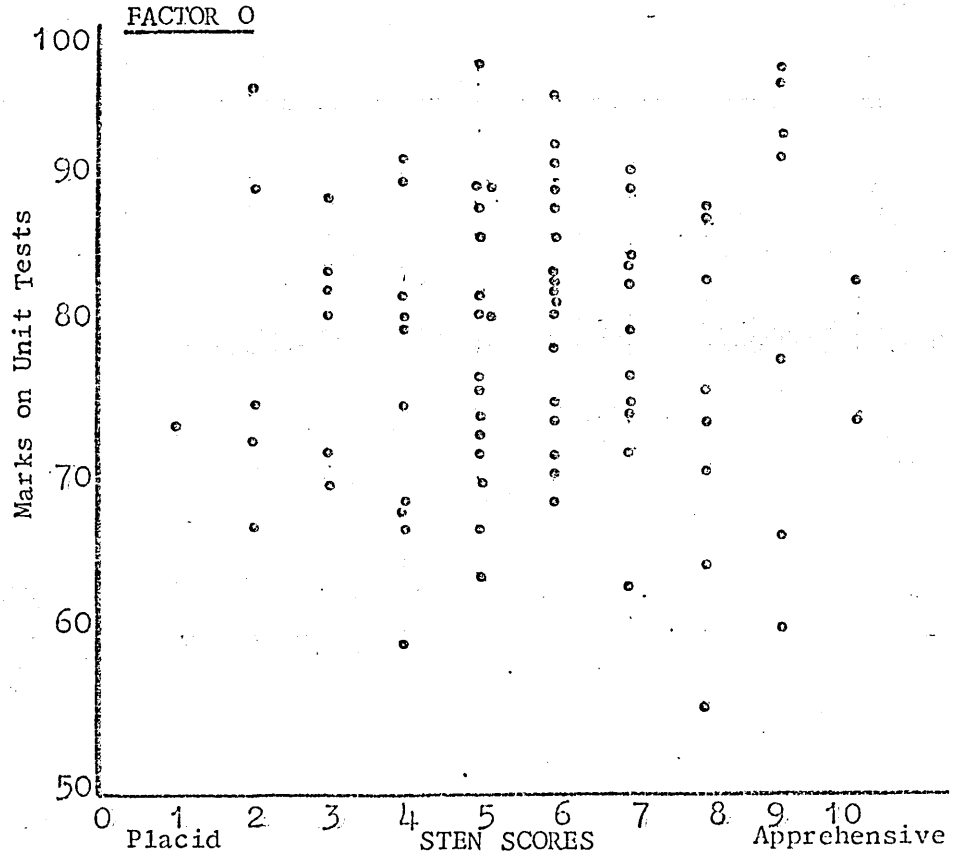

Marks on Unit Tests
100
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Shy
STEN SCORES
Venturesome

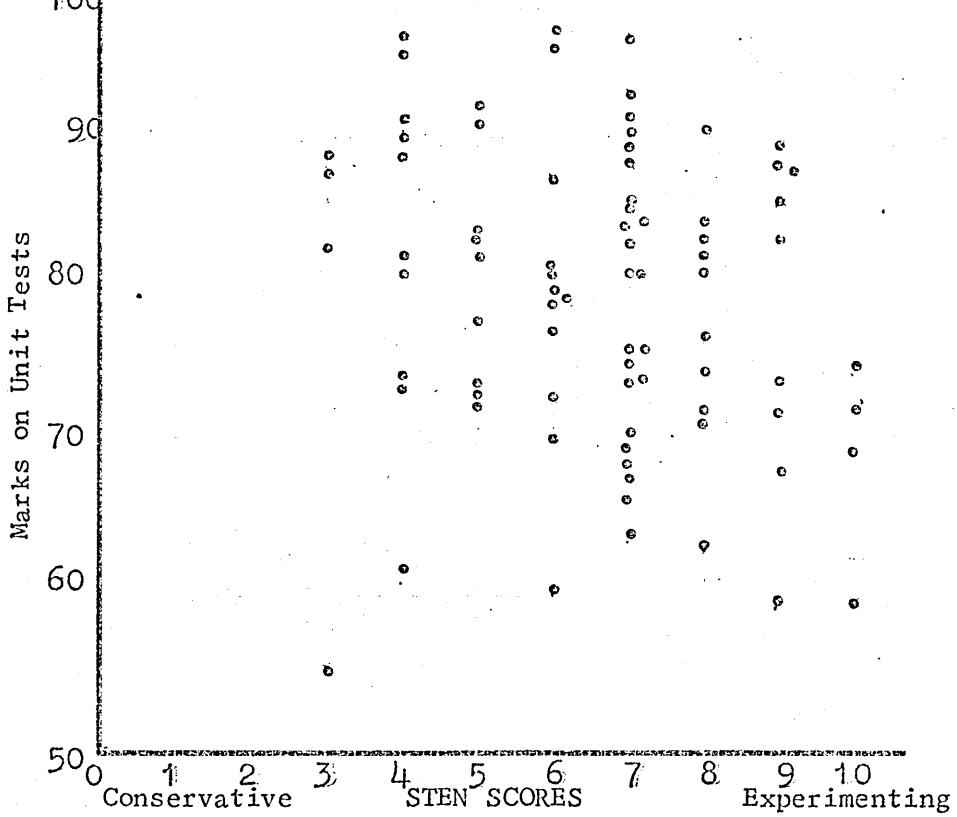

FACTOR I
Marks on Unit Tests
100
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Tough-minded
STEN SCORES
Tender-minded

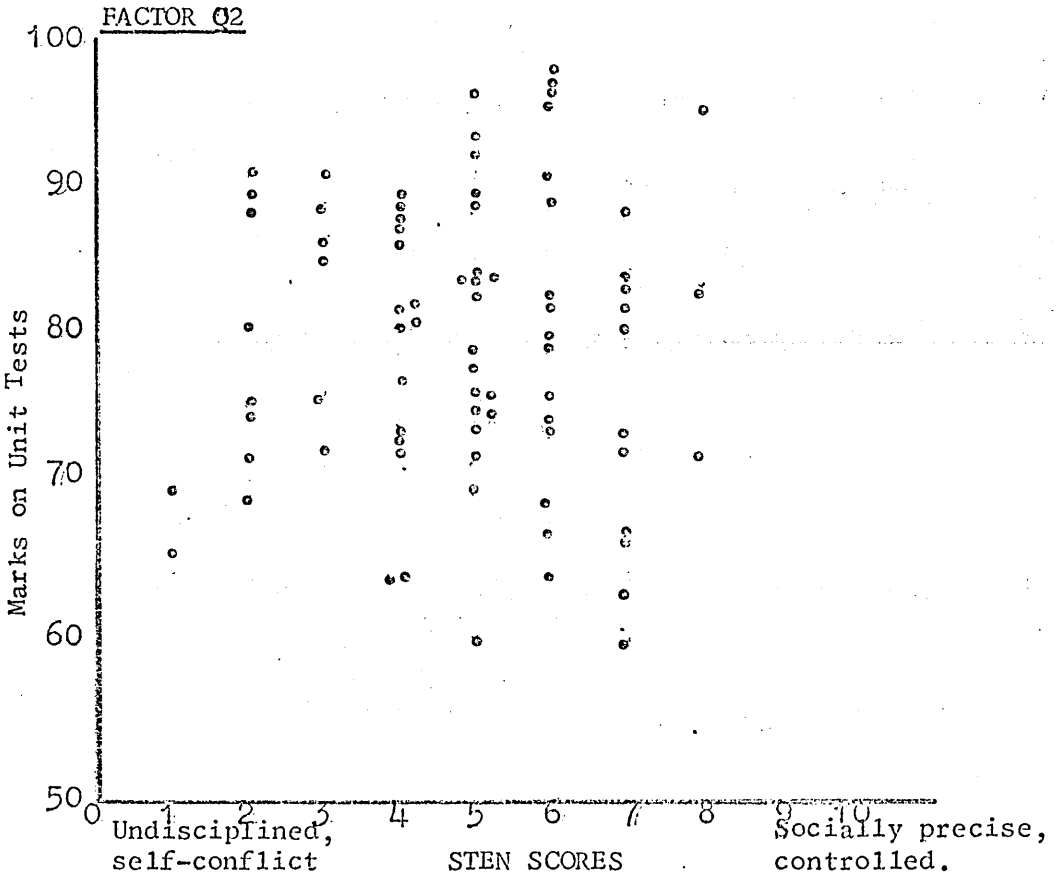

Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Trusting
STEN SCORES
Suspicious

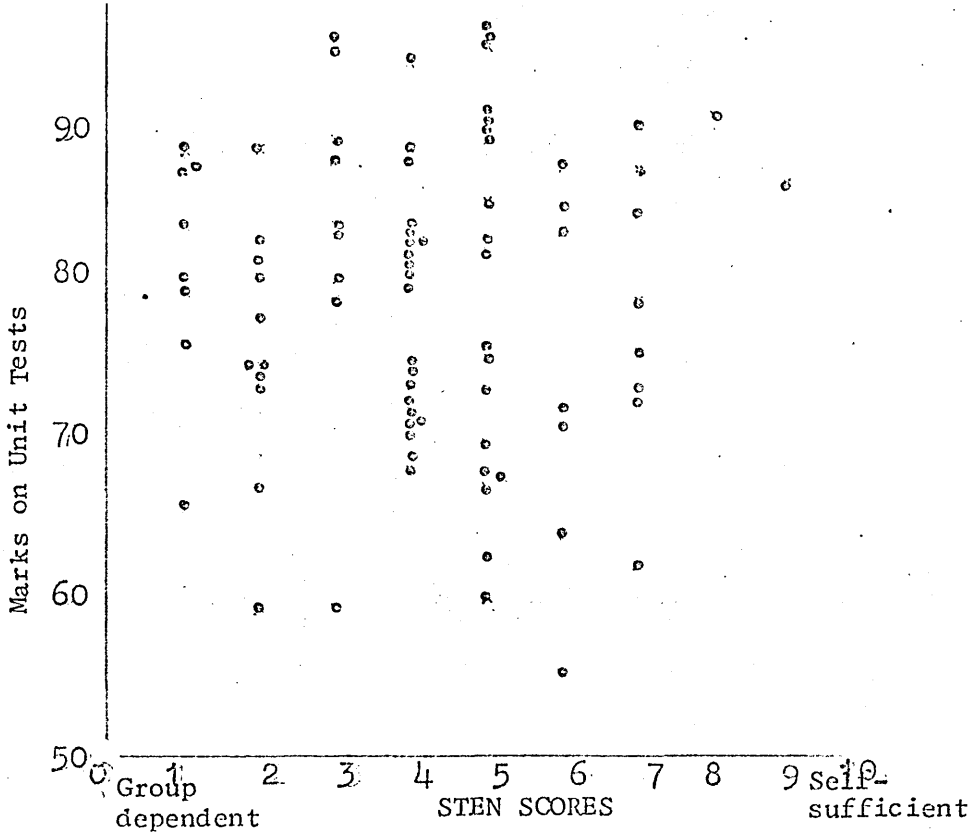

FACTOR M
Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Practical
STEN SCORES
Imaginative

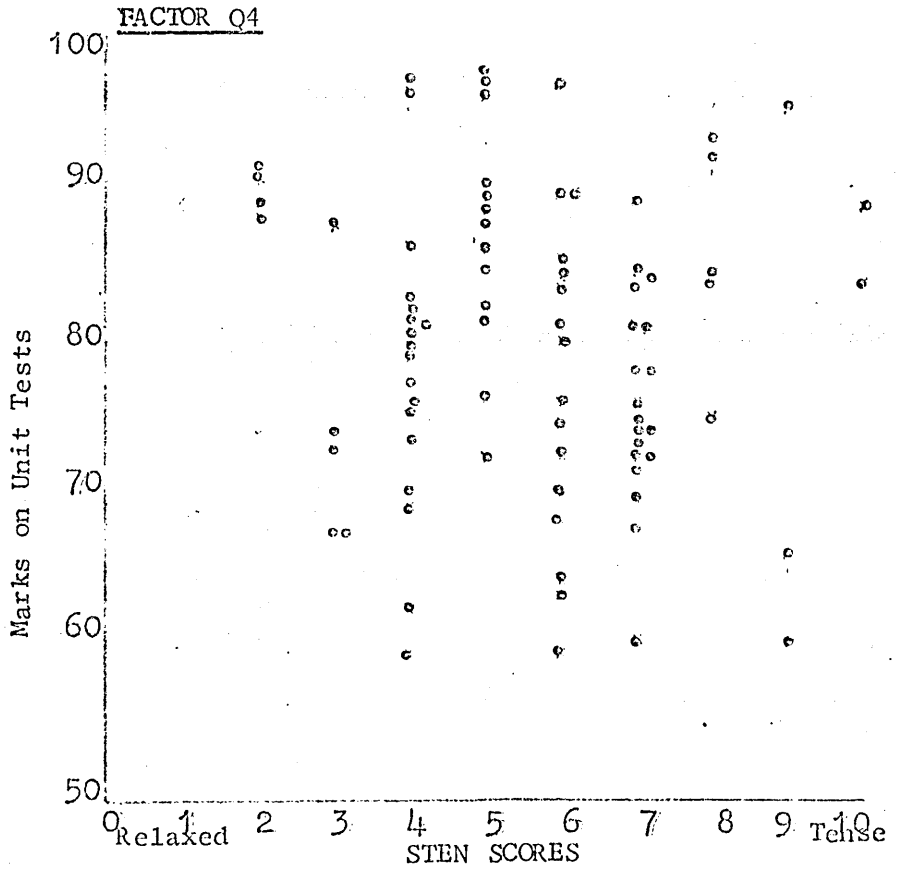

Marks on Unit Tests
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Forthright
STEN SCORES
Shrewd

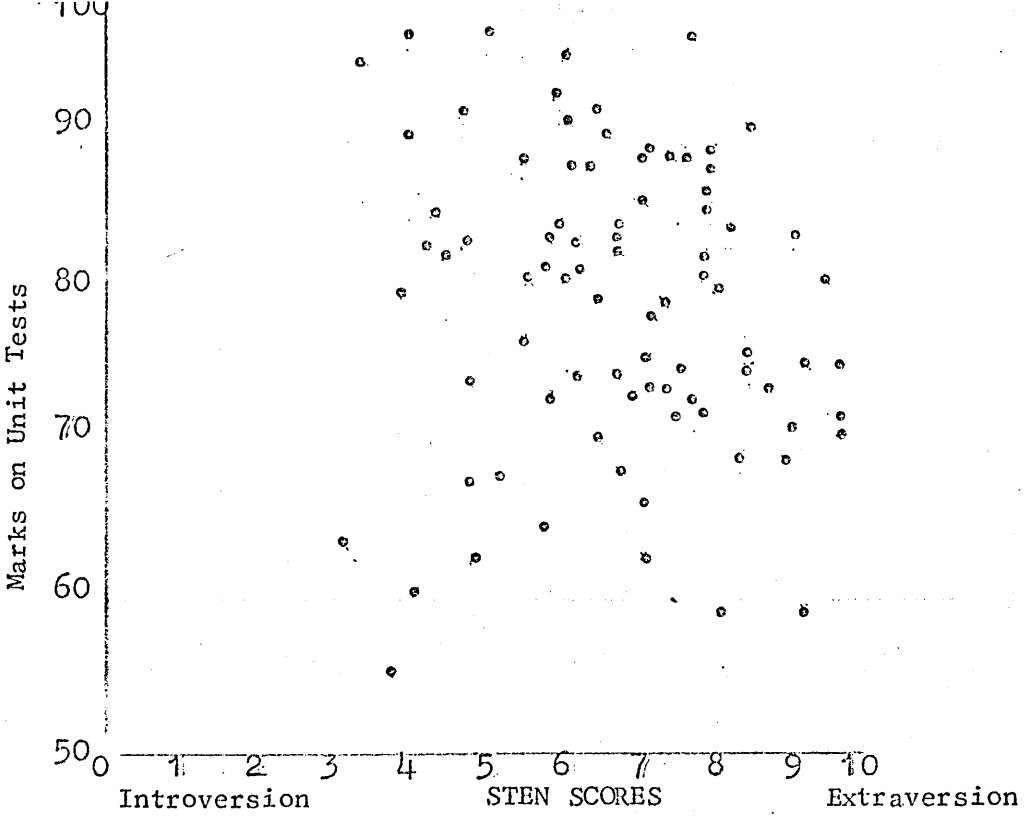

FACTOR O
Marks on Unit Tests
100
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Placid
STEN SCORES
Apprehensive

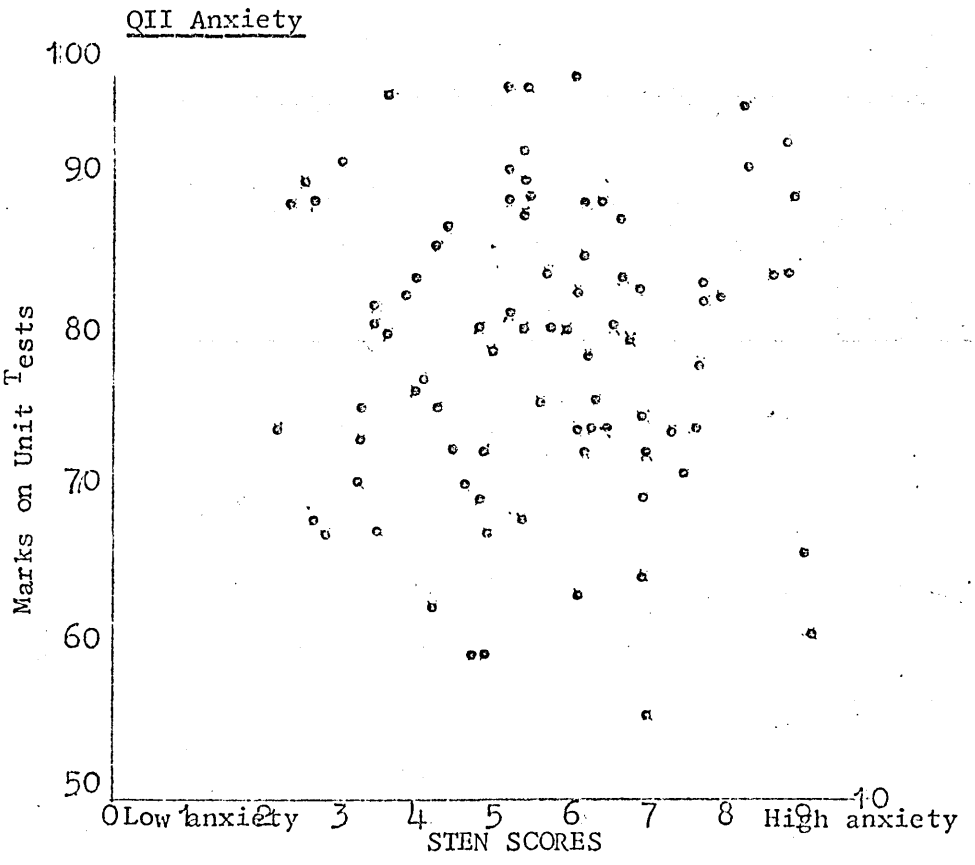

Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Conservative
STEN SCORES
Experimenting

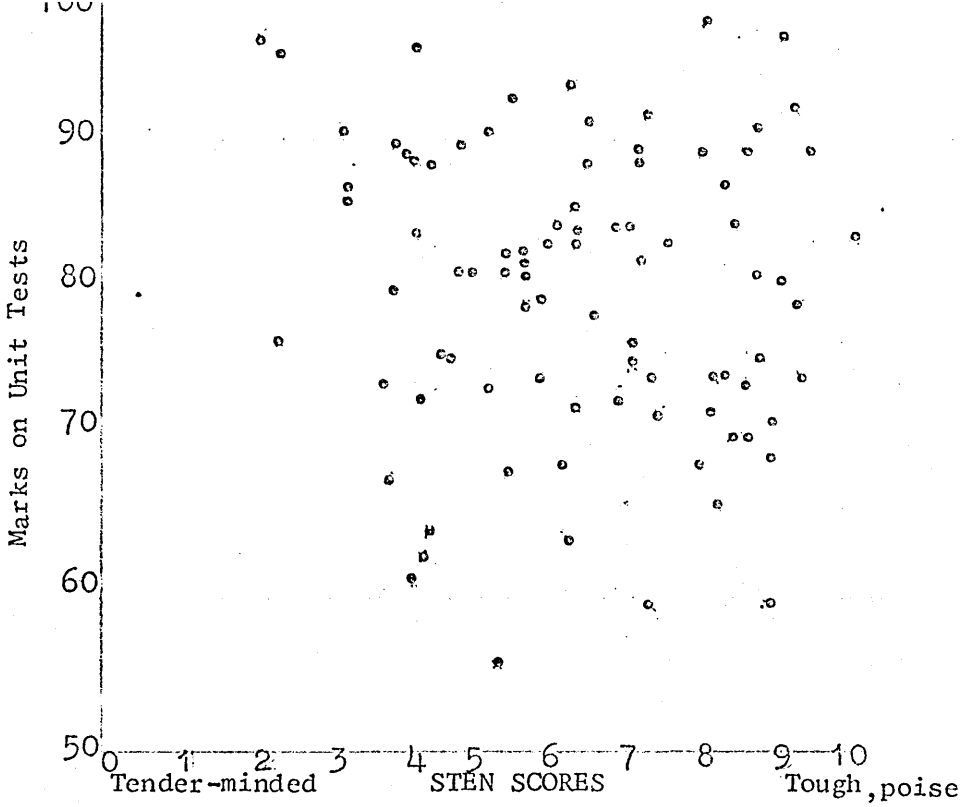

FACTOR Q2
Marks on Unit Tests
100
90
80
70
60
50
0 1 2 3 4 5 6 7 8 9 10
Undisciplined, self-conflict
STEN SCORES
Socially precise, controlled.


Marks on Unit Tests
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Group dependent
STEN SCORES
Self-sufficient

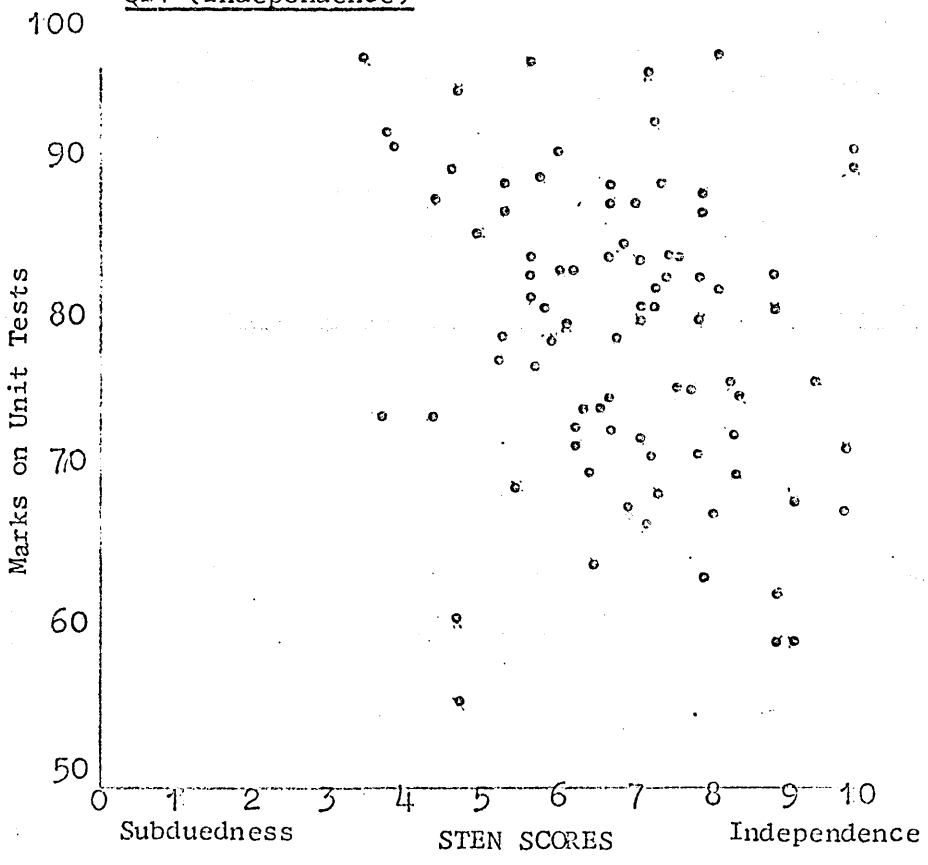

FACTOR Q4
Marks on Unit Tests
100
90
80
70
60
50
0
1
2
3
4
5
6
7
8
9
10
Relaxed
STEN SCORES
Tense


100
90
80
70
60
50
Marks on Unit Tests
0 1 2 3 4 5 6 7 8 9 10
Introversion
STEN SCORES
Extraversion


QII Anxiety
100
90
80
70
60
50
Marks on Unit Tests
0 Low anxiety 1 2 3 4 5 6 7 8 9 10 High anxiety
STEN SCORES



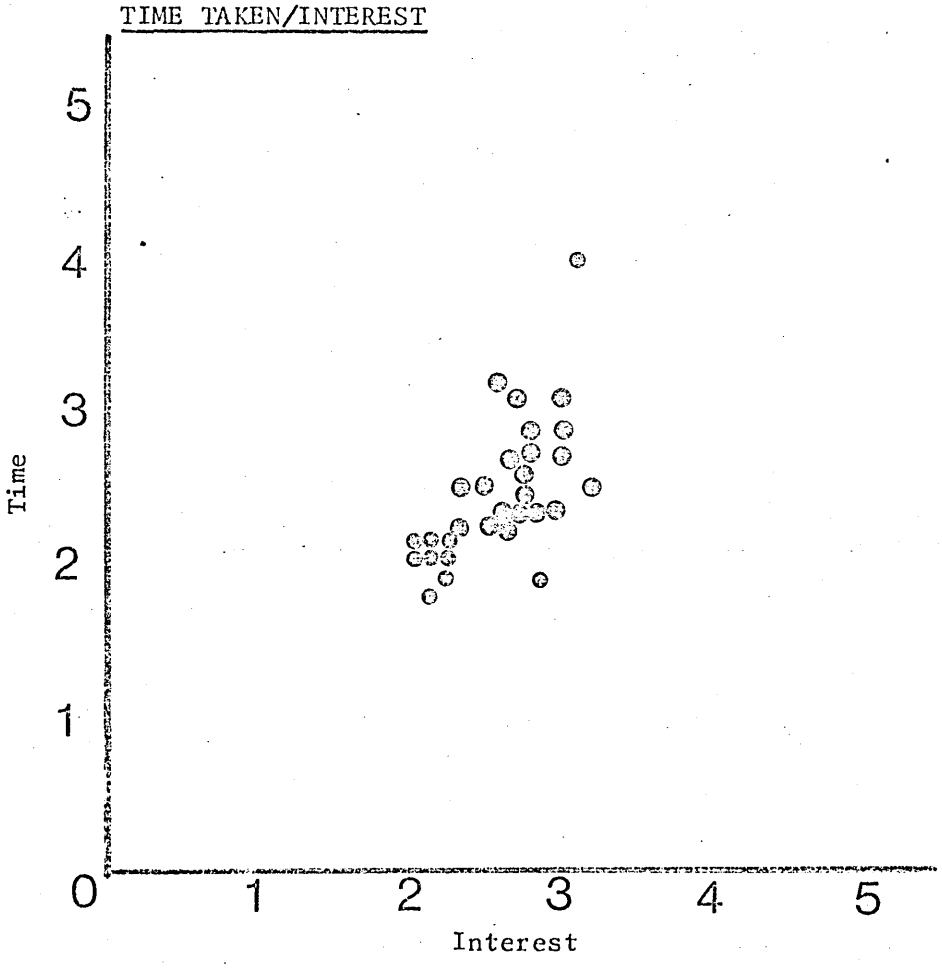
QIV (Independence)



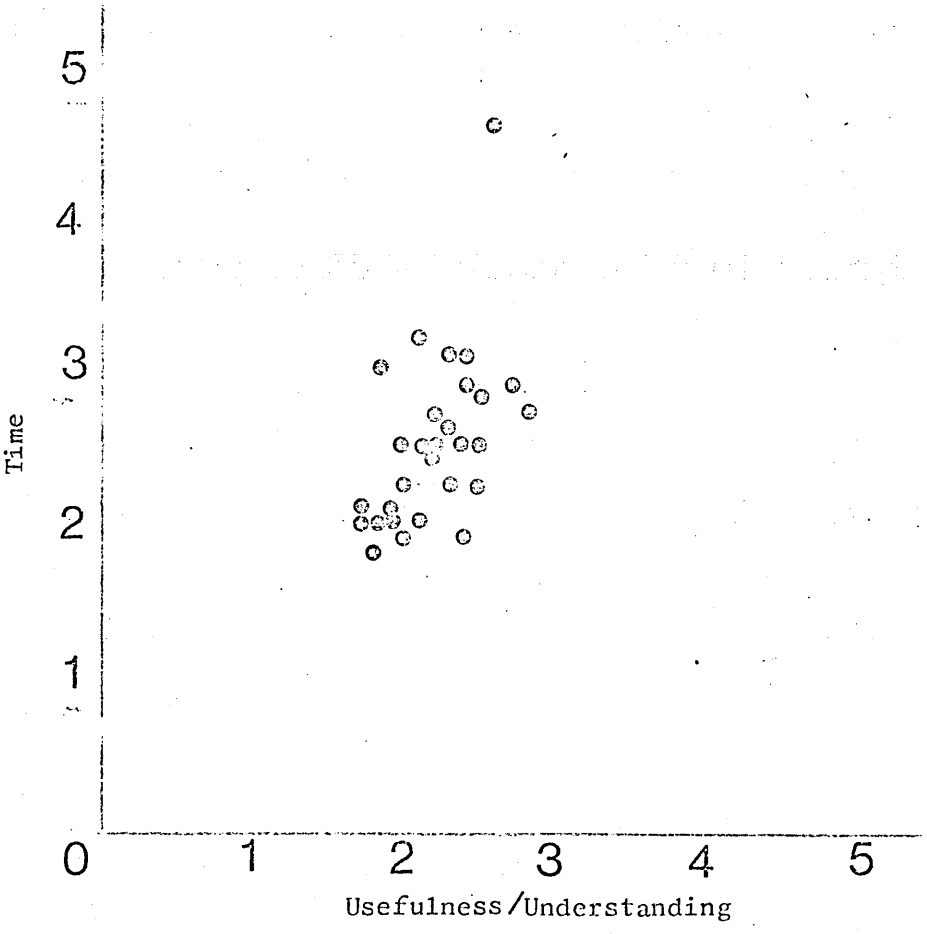
Appendix V

Relationships Between Student Responses

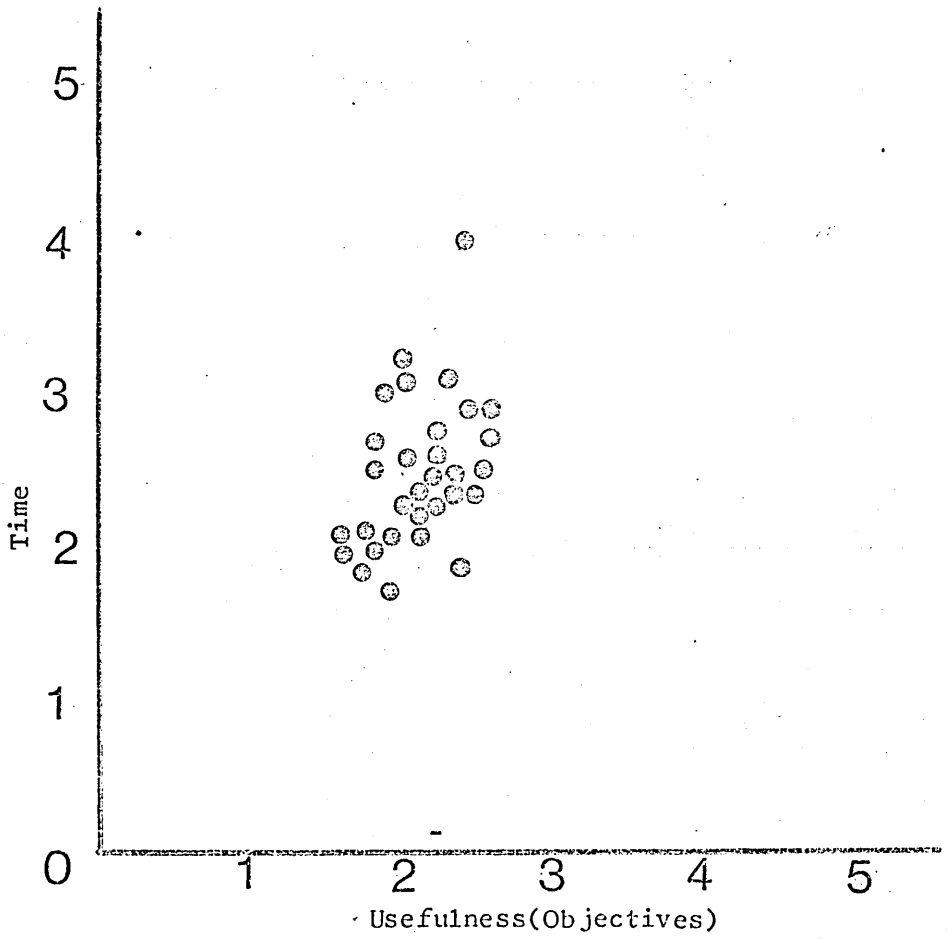
TIME TAKEN/INTEREST



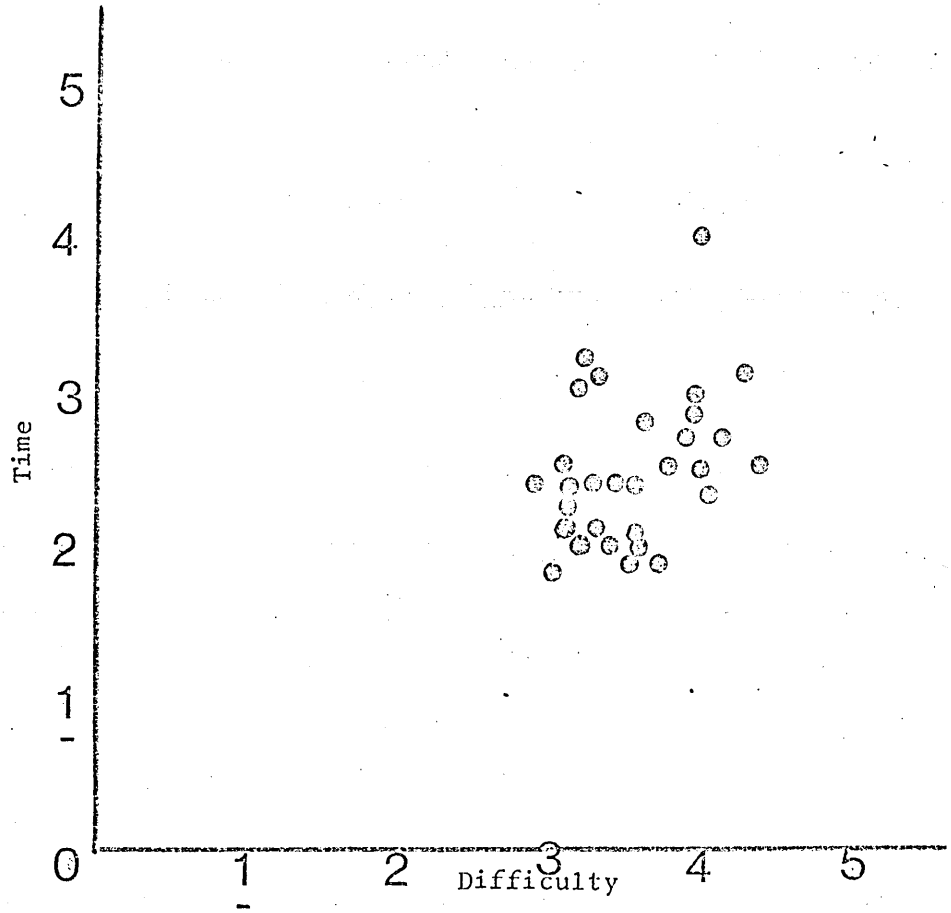
TIME TAKEN/USEFULNESS (UNDERSTANDING)



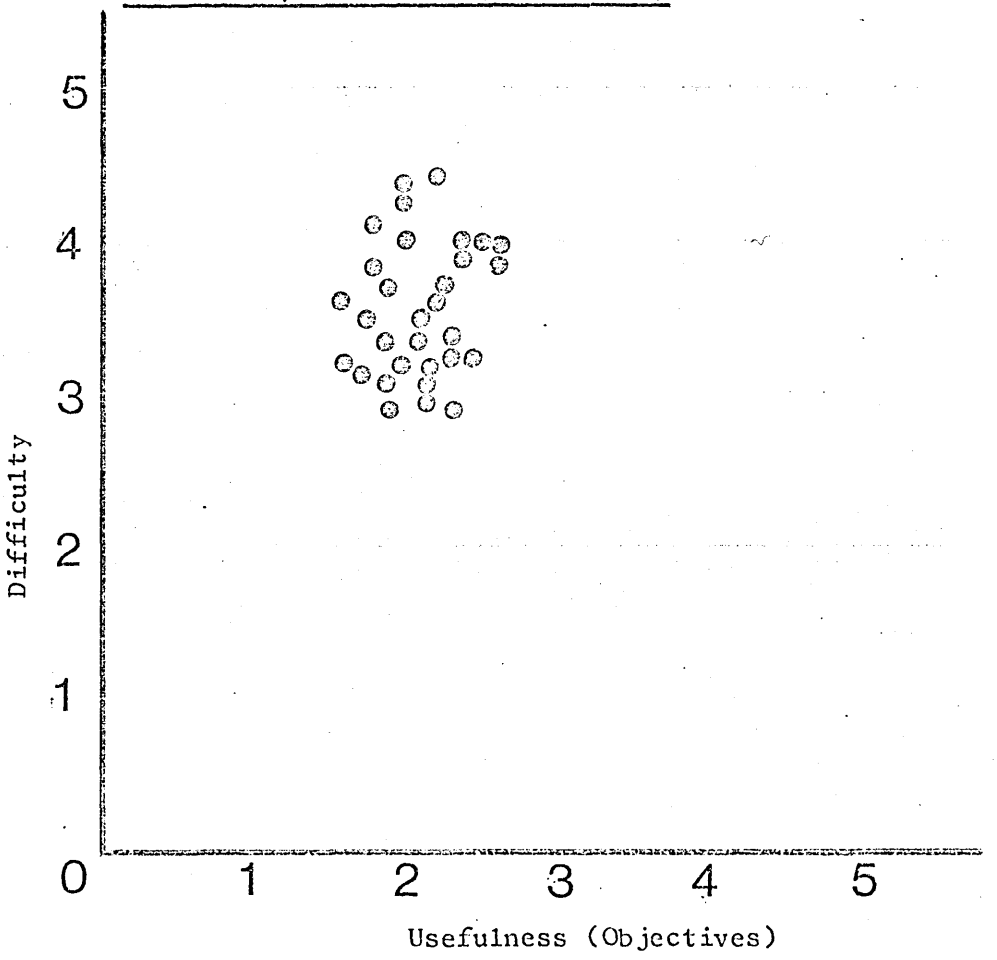
TIME TAKEN/USEFULNESS (OBJECTIVES)



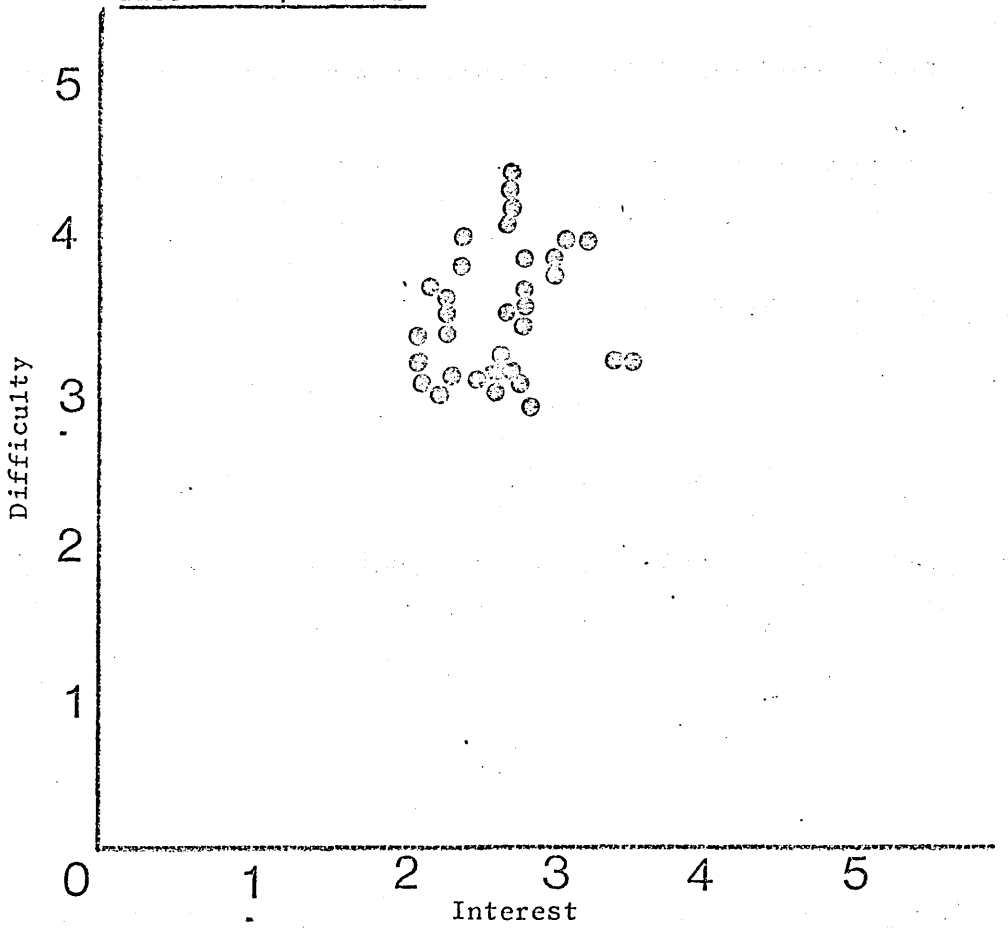
TIME TAKEN/DIFFICULTY



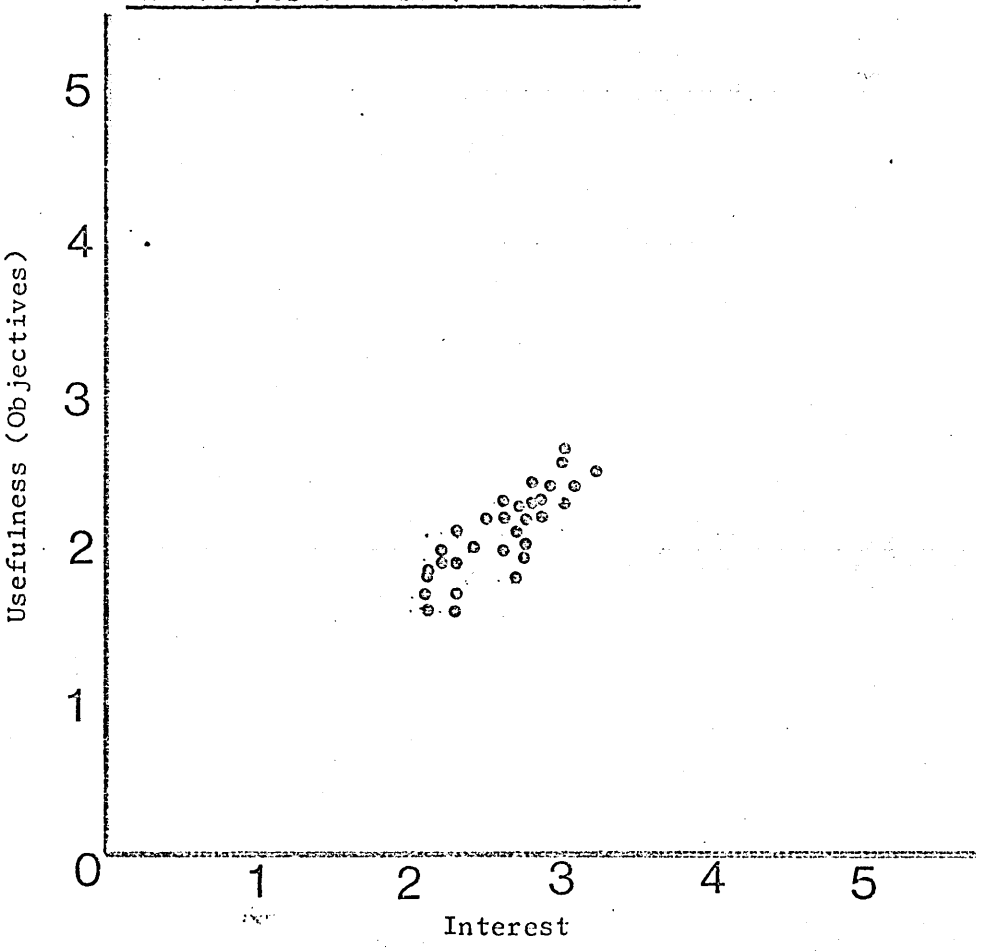
DIFFICULTY/USEFULNESS (OBJECTIVES)



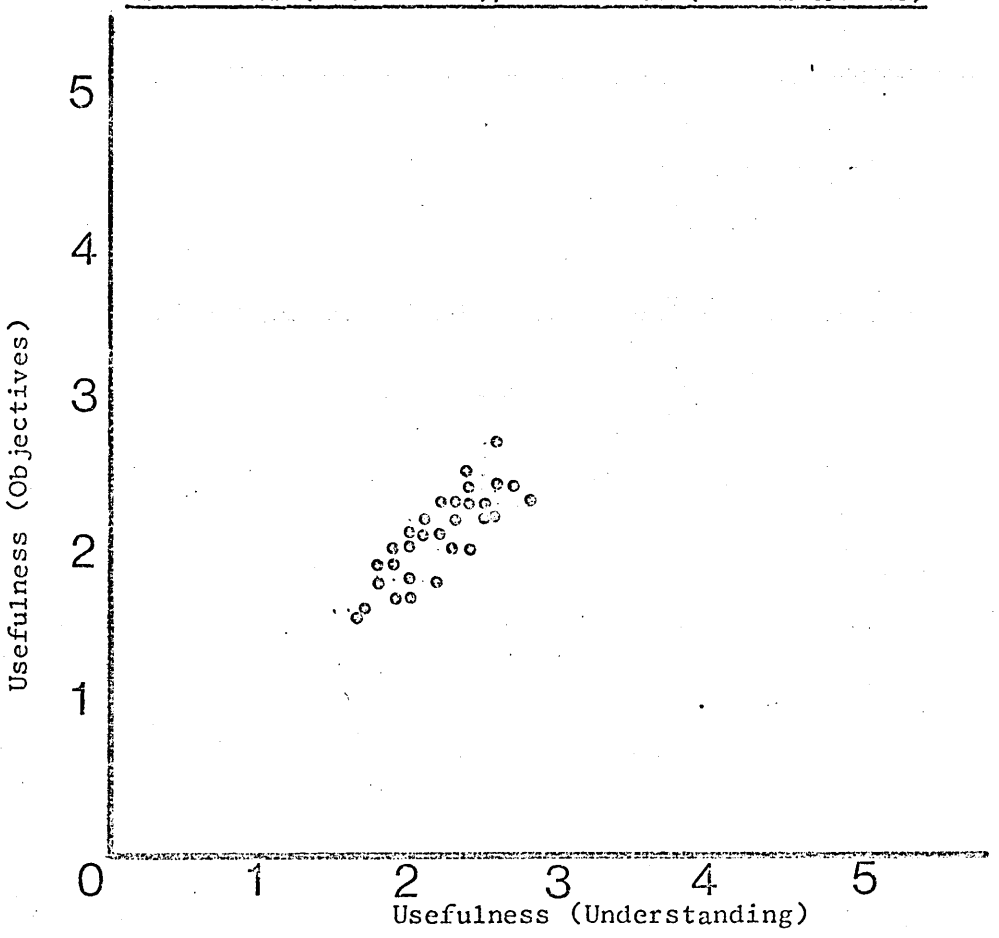
DIFFICULTY/INTEREST



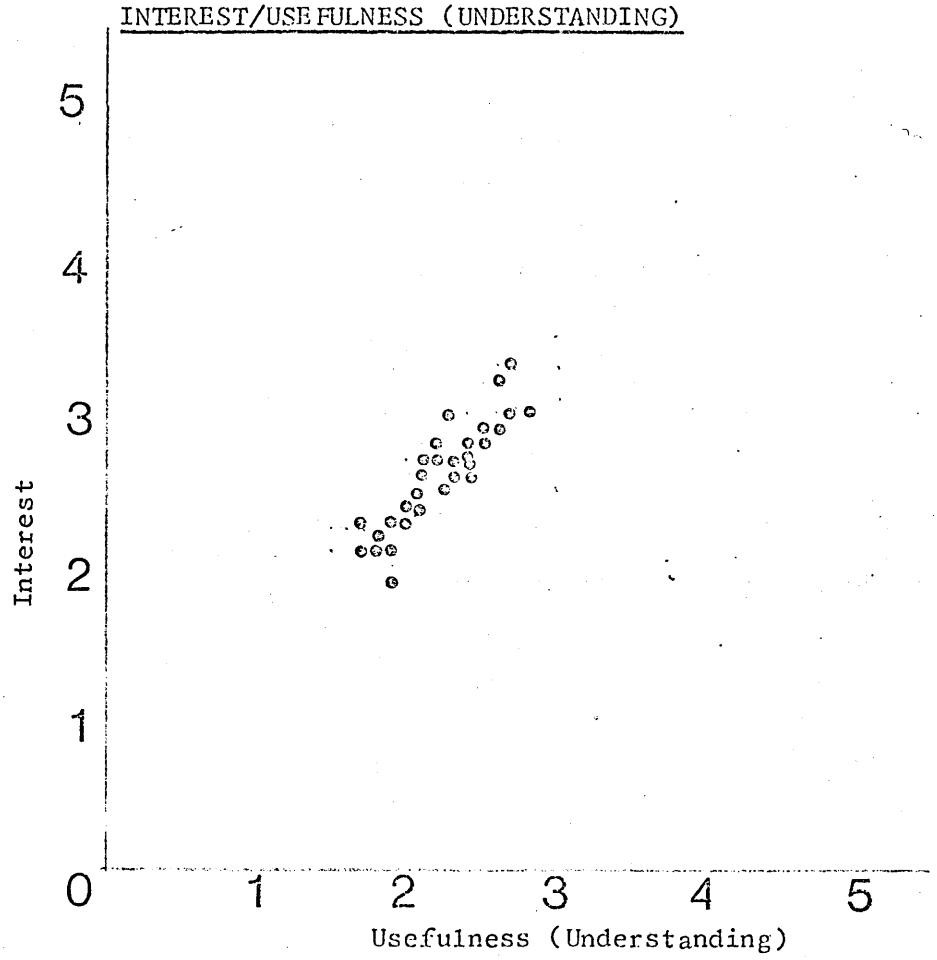
INTEREST/USEFULNESS (OBJECTIVES)



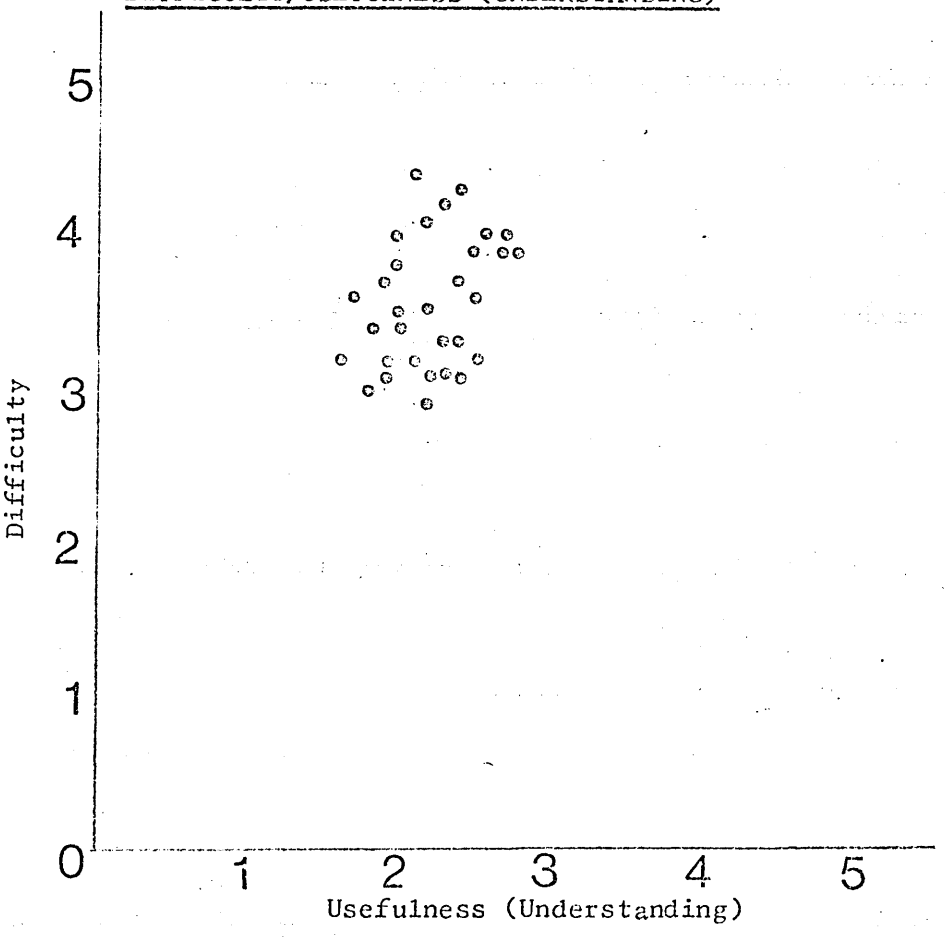
USEFULNESS (OBJECTIVES)/USEFULNESS (UNDERSTANDING)



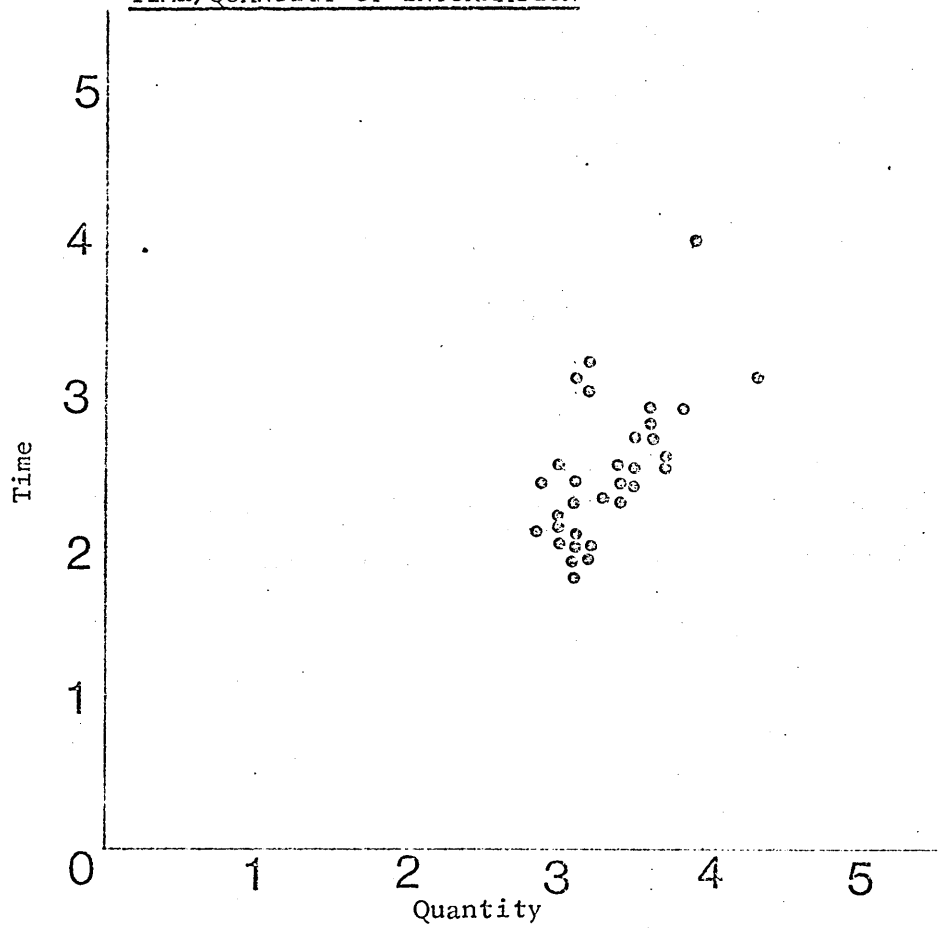
INTEREST/USEFULNESS (UNDERSTANDING)



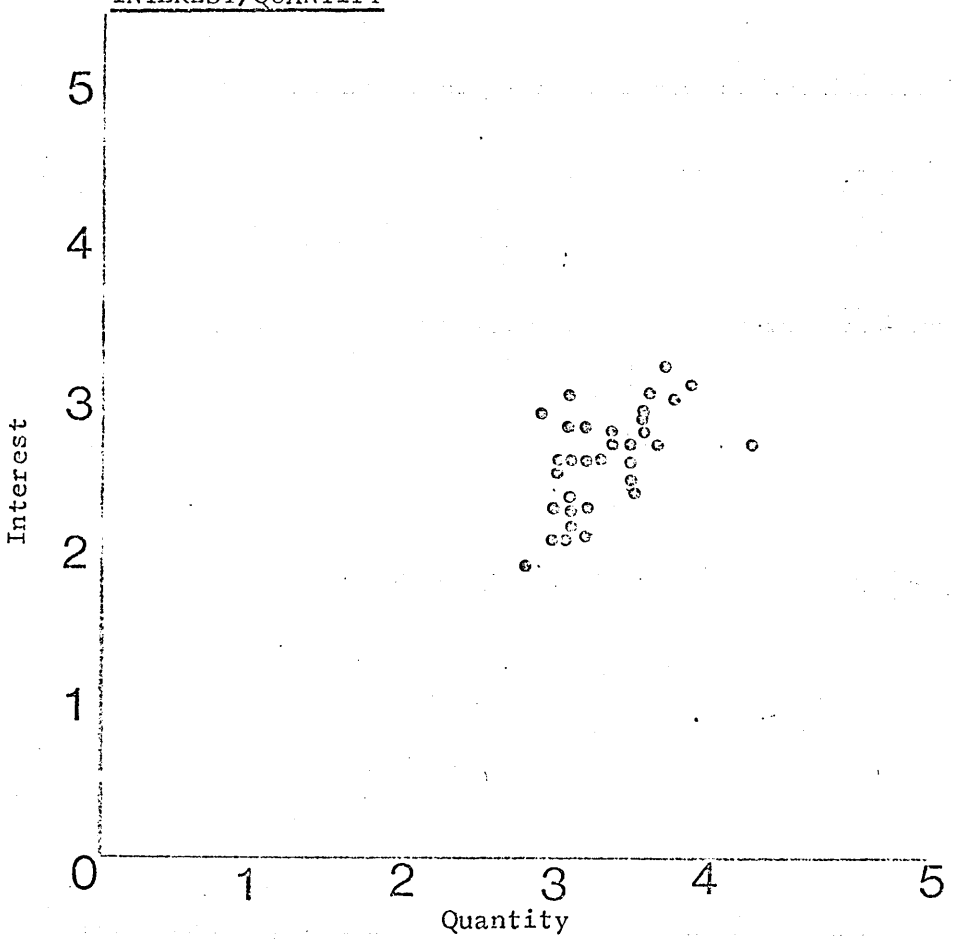
DIFFICULTY/USEFULNESS (UNDERSTANDING)



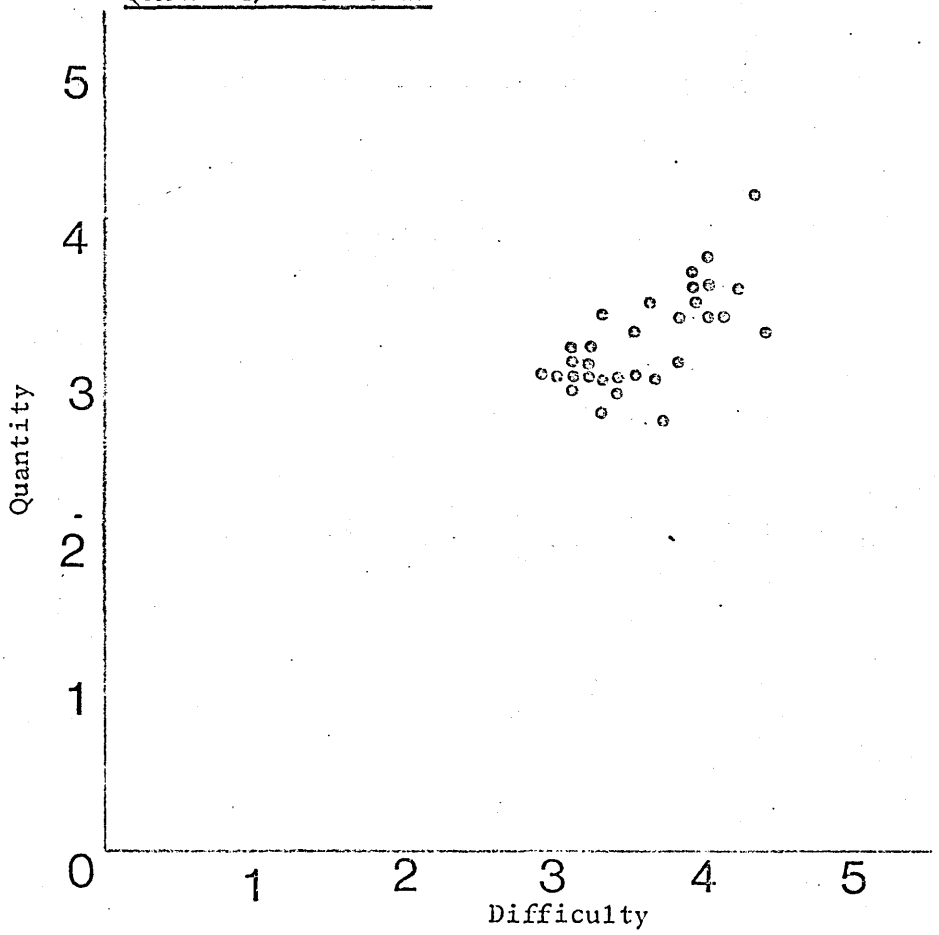
TIME/QUANTITY OF INFORMATION



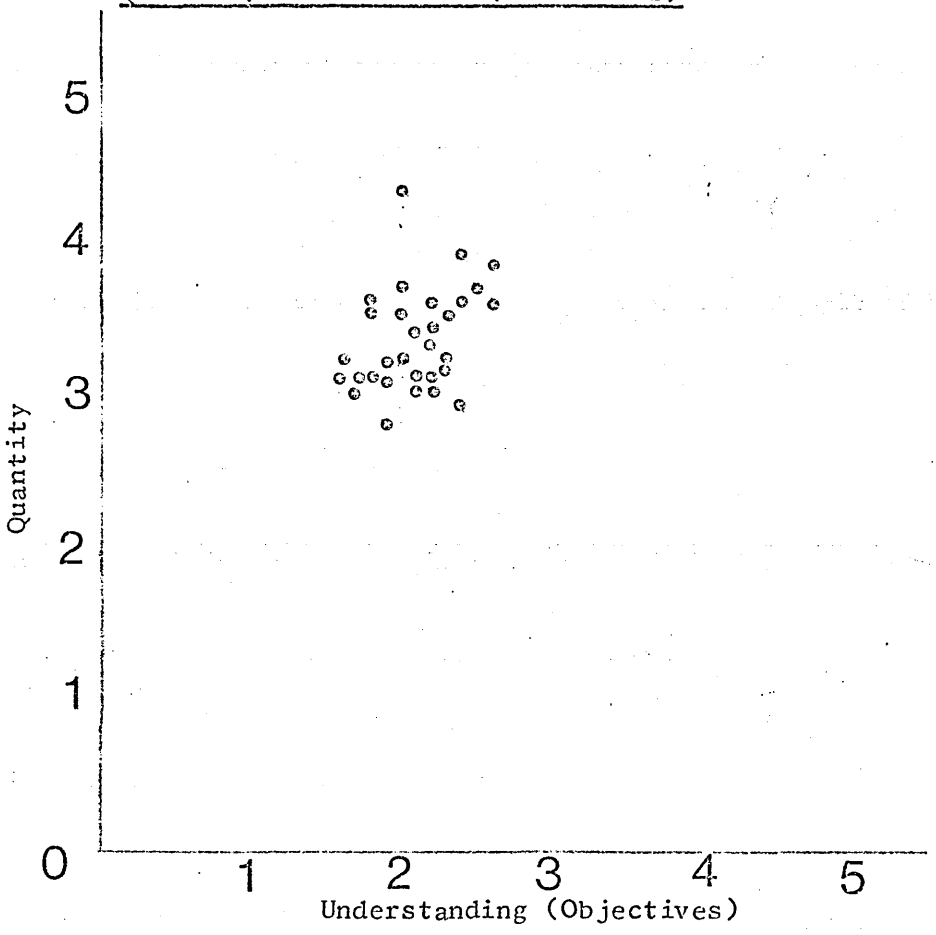
INTEREST/QUANTITY



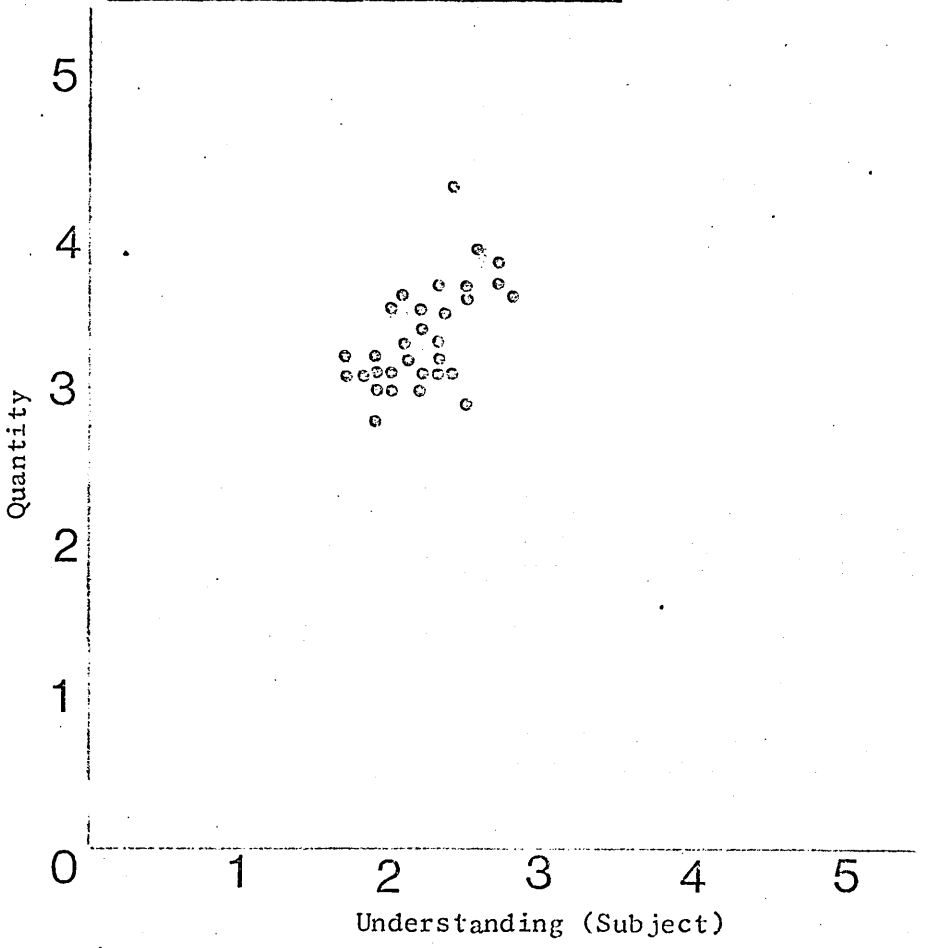
QUANTITY/DIFFICULTY



QUANTITY/UNDERSTANDING (OBJECTIVES)



QUANTITY/UNDERSTANDING (SUBJECT)



APPENDIX VI

Semi-Structured Interview Schedule

1. What level had you previously studied science?
2. Did you enjoy sciences at school?
3. Have you any previous knowledge of self-learn schemes?

These first three items were always used in the same order. Other items were used as they arose but all were covered.

4. Do you have a timetable for your study time either on paper or a mental timetable?
5. Are your study conditions good, with distraction?
6. How much time do you spend in study of the unit? Do you always spend a fixed amount of time?
7. Do you ever study in the library? Do you use library books to elaborate on points in the unit? Do you use library books to check on something you have not understood in the unit?
8. How soon after getting the new unit do you read it. How many times do you read it?
9. Do you do as much work for this self-learn scheme as you do for other courses?
10. Do you read the unit on the day of the test? Is this the first time you have read it?
11. Do you rely on previous knowledge to help you pass the tests? Do you rely on recall?

12. Do you read the objectives sheet? Do you use it in reading the unit? Do you answer the in-text questions? Do you make notes on the unit?

13. Do you attend tutorials when required? Do you find the tutorials useful?

14. Would you rather have this course lectured to you?

15. Do you guess in tests? Randomly? On an elimination basis?

16. Do you use the print-out sheet to see where you have made mistakes? Do you go through your incorrect answers and re-check them? Do you keep the print-out?

17. Do you feel you learn much from this course?

18. Do you enjoy your course (B.Sc., H.N.D. or Dip.H.E.)?

19. Is your course was you expected?

20. Had you applied for other places in Higher Education? Were they for University or Polytechnic places? Were they for catering courses?

21. Where did you get the idea of applying for catering training? (parents, relatives, school careers, etc.)

22. Had you worked in the catering industry before coming to the Polytechnic?

23. How long ago did you decide to make a career in catering?

24. What was the more important factor in deciding you to come on this course - vocational training or some sort of Higher Education?

25. What do you intend to do on leaving the Polytechnic? What sort of career do you envisage?

26. Is the level at which you pass your course examinations important to you?

27. Did you expect much science in a catering course?

28. Is it important for you to do well in your course here?

29. Does it matter to you if you fail the unit test?

30. Do you think sciences have much relevance in catering and the sort of career you envisage?

31. Do you enjoy sciences here?

32. Do you find a change between methods of work at school and those at the polytechnic?

33. How do you find this change (exciting, bewildering)?

34. Do you feel you needed guidance in your use of time?

35. Do you feel you need guidance in your study methods?

36. What sort of accommodation do you have? Is it what you desired when you applied to the Polytechnic? Is it what you would wish for now?

37. Do you enjoy the social life of the Polytechnic?