AN INVESTIGATION INTO THE PERFORMANCE AND PROBLEMS OF FIRST-YEAR ENGINEERING STUDENTS AT THE UNIVERSITY OF CAPE TOWN

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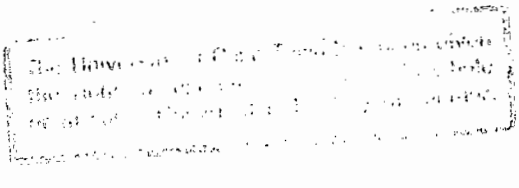
Presented for the Degree of M Phil (Eng)

1992

Faculty of Engineering

University of Cape Town



DECLARATION

I hereby declare that the work presented in this thesis is my own work and that no part of it has been submitted for a degree at any other university.

Signature.. Signed by candidate

ABSTRACT

The first- and second-year results of the 1989 engineering student intake were analysed and revealed that matriculants from Black Education Departments performed significantly worse in the first year than those from White Education Departments. Matric point scores were found to be good predictors for White Education Department matriculants, but less so for Black Education Department matriculants, with matric Physical Science a better predictor than matric Maths, for both first- and second- year courses.

Using interviews and a survey of students, a set of academic and non-academic problems experienced by first-year engineering students were identified with black students found to have experienced a particular set of problems to a greater degree than white students.

The data produced a portrait of the interaction between first-year engineering students and the academic and social systems of the university. The dominant feature that emerged was one of distance between the individual students and elements of the university environment, including staff, fellow students and the academic material. Factors from the student's personal and educational background that appeared to accentuate this experience of distance were identified.

Recommendations to the Engineering Faculty were compiled on the basis of this analysis together with student suggestions for improving the first-year engineering programme.

ACKNOWLEDGEMENTS

I would like to thank those friends and colleagues who encouraged me to undertake this study and, in some cases, had to bear the consequences. In particular, thanks goes to

my supervisors, Prof John Martin and Bill Cowan, for their advice and encouragement;

my wife, Wadeedah, for her support and for keeping house and home together without my help this past year;

my colleagues in the Academic Support Programme for Engineering in Cape Town (ASPECT) and the rest of Academic Support Programme at UCT for their help, especially Biddy Greene, who taught some of my classes when the going got tough and proof-read along the way, and Adrienne Shall for always being available to help me understand statistics, and

Jeremy Galvin and Anne Gordon of the Engineering Faculty for putting up with my never-ending requests for student records.

Finally this study would not have been possible without the students who gave of their time to talk to me about their experiences to help future generations of first-year engineering students.

The financial assistance of the Centre for Science Development towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the Centre for Science Development.

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ABBREVIATIONS

AED - African Education Departments, includes DET
ANOVA - Analysis of variance
ASPECT - Academic Support Programme for Engineering in Cape Town
BED - Black Education Departments (AED, CED and IED)
CED - Coloured Education Department
DET - Department of Education and Training
DP - Duly-Performed rating
IED - Indian Education Department
JMB - Joint Matriculation Board
K-W test - Kruskal Wallis one way analysis by ranks
MP - Matric Points
PROTEC - Programme for Technological Careers
UCT - University of Cape Town
WED - White Education Departments
Wits - University of the Witwatersrand

Performance variables

AVE - Average exam mark performance variable
C89 - First-year credit performance variable
C90 - Second-year credit performance variable

First-year course codes and abbreviations

AM - Refers to Applied Maths courses AM102W and AM104W
AM102W - Applied Maths for non-electrical engineers
AM104W - Applied Maths for electrical engineers
CEM100W - Chemistry full-course for chemical engineers
CEM108F - Chemistry half-course for non-chemical engineers
CIV101S - Water Chemistry for civil engineers
END102S - Introduction to Engineering
INTRO - Refers to the two half courses END102S and CIV101S
MEC102W - Engineering Drawing
MTH105W - Mathematics full-course
MTH101S - Mathematics half-course

PHY - Refers to Physics courses PHY102W and PHY104W.
PHY102W - Physics for non-electrical engineers
PHY104W - Physics for electrical engineers

Second-year course codes and abbreviations

CHE223 - Chemical Process Analysis
CIV213 - Continuum Mechanics
EEE205 - Electrical Engineering for non-electrical engineers
EEE206 - Electrical Circuits
EEE207 - Electronic Circuits
EEE208 - Electromechanical Energy Conversion
EEE209 - Electronics in Measurement
MAT204 - Materials Science and Engineering
SMS201 - Calculus and Vector Analysis
SMS202 - Linear Algebra
SMS203 - Engineering Statistics
SMS204 - Ordinary Differential Equations
SMS205 - Partial Differential Equations

CHAPTER 1

INTRODUCTION

1.1 ORIGINS OF THIS STUDY

In 1989 black[1] students accounted for approximately 38% of all students who registered for first-year Engineering at the University of Cape Town (UCT). This figure includes the 45 black students who registered for the first-year of the Academic Support Programme for Engineering in Cape Town (ASPECT).

The incorporation of such a large number of black students, many from disadvantaged backgrounds, posed an important challenge to the Engineering Faculty. Past experience at UCT, and elsewhere, had been one of high failure rates in first-year, and low graduation rates amongst black engineering students. This had led to several initiatives, the most recent of which was the ASPECT programme (see Sass, 1988) which the author joined as a Mathematics lecturer in 1988, its first year of operation.

Two limitations of the ASPECT programme gave rise to this study. Firstly, the programme provided support for only 50 students a year. The remaining black first-year students were offered no structured academic support. Secondly, ASPECT was seen as a transitional arrangement, albeit one planned to continue until the Engineering Faculty revised its curricula and teaching

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1 The word 'black' in the context of South Africa is used in this study to refer to persons classified as African, Coloured or Indian.

to take into account the needs of an increasingly heterogeneous student intake, as part of a university-wide academic review process.

This study aimed to contribute to this process by:

a) investigating the relationship between educational and personal background and academic performance in first-year Engineering, and identifying groups of students who performed significantly poorly;

b) investigating the relationship between performance in first-year and second-year courses, to assess whether or not the first year laid the foundation for success in subsequent years in Engineering;

c) identifying the academic and non-academic problems experienced by first-year engineering students, in particular black students and women, and the changes to the first-year programme that students felt would best assist them.

Previous studies of this kind involving engineering students at UCT have either been limited to a particular course such as Engineering Drawing, (Millroy, 1985; Honikman, 1982) or by an extremely small sample (Bestwick, 1987). The present study was designed to overcome both of these limitations by interviewing and surveying substantial numbers of students and monitoring the performance of the whole class over a two-year period.

Two secondary aims of this study were to collect data with which to compare the performance of students registered on the ASPECT programme, and to assess student attitudes towards an option for students who are not coping, namely to change to a 5-year curriculum during the first year.

It is hoped that this study will assist the Engineering Faculty in developing support systems for engineering students at UCT, to increase the retention of

black students and the overall effectiveness of the engineering degree programme.

1.2 RESEARCH DESIGN

From the outset there were no hypotheses being tested but rather a search for relationships with which to understand better the problems experienced by first-year engineering students and the factors affecting their performance. The study consisted of three components:

(a) The interviews

A group of first-year engineering students were interviewed to obtain a detailed picture of their experience and to generate suggestions for improving the first-year programme.

(b) The survey

A survey of the first-year class was undertaken using a questionnaire developed from the interviews. It enabled the author to verify the interview data and to canvass the views of the rest of the students on the suggestions made by the interviewees.

(c) The statistical investigation of results

The first- and second-year examination results were used to reflect on the performance of the interviewees, the survey respondents and the class as a whole, and to investigate factors affecting the academic success of engineering students.

The survey and exam result data were analysed using the STATGRAPHICS computer package.

The quantitative data collected using the survey and exam results were combined with the qualitative data obtained from the interviews and the

survey. The one added detail while the other has been used to provide factual support to trends and suggestions. All coding was undertaken by the author. Some categories, such as gender, population classification or education department were objective while others, such as types of problems and suggestions, were derived from the data.

While the study began with the interviews in September 1989, followed by the survey in October 1989 and the collection of results during 1990 and 1991, the presentation here follows a different order. The analysis of results is presented first to give an overall picture of performance and is followed by the interview and survey data providing details of the student experience.

As the study aimed to collect data on the kinds of support that would be of assistance to first-year Engineering students registered in the regular 4-year degree programme, students receiving academic support through the ASPECT programme were excluded. Foreign students were also excluded, as the study was investigating problems in the context of the South African education system.

This general orientation of the study led to the adoption of a dual-approach with respect to students who had not come to university directly from school, which included a large proportion of the African SA matriculants. These students were included in the interview and survey sample but excluded from the statistical investigation of results.

As more than half of the African sample who had come to university straight from school had matriculated from White Education Departments, population classification was not entirely appropriate as the main category of investigation. However, a black matriculant from a white school in South Africa would have had the benefit of better-resourced schooling but at the same time would have experienced many of the effects of apartheid.

In the investigation of the relationship between schooling and university performance, students were categorised in terms of their Education Department of matriculation, while in the survey and interview sections, population classification was used as the main category of investigation.

CHAPTER 2

THE CONTEXT OF THIS RESEARCH

A survey undertaken by the South African Engineering Association (SAVI) in 1988 found that there was an extreme shortage of engineers (Marcus, 1991). The insufficient numbers of engineers being trained in South Africa had caused concern amongst industry and the profession, and despite efforts to attract immigrants, there had been a net emigration of engineers since 1984, in many cases to avoid compulsory military service. At a conference at UCT in 1991, SAVI's president, Dr Roy Marcus, commented that

> there is no possibility of meeting the future skilled manpower demand from the white sector alone. Yet the output from the black education system is such that drastic steps will be necessary to make even a modest contribution to meeting the demand... Of over 100 000 standard ten students in the DET system throughout South Africa in 1988, only about 500 matriculated with results acceptable for entrance into University engineering study. (Marcus, 1991)

2.1 ENROLMENT IN ENGINEERING

While the white engineering enrolments for all years of study at South African universities went from 1836 to 7328 between the years 1952 and 1980, the combined enrolment for coloured, Indian and African engineering students increased from only 13 to 398 during the same period (Dreijmanis, 1988:116-119).

The number of white first-year engineering enrolments has remained relatively constant in the past ten years. However there has been a steady increase in black first-year engineering enrolments (Jawitz et al, 1992). During the latter half of the 1980's black enrolment in first-year Engineering at UCT increased dramatically (Fig 1).

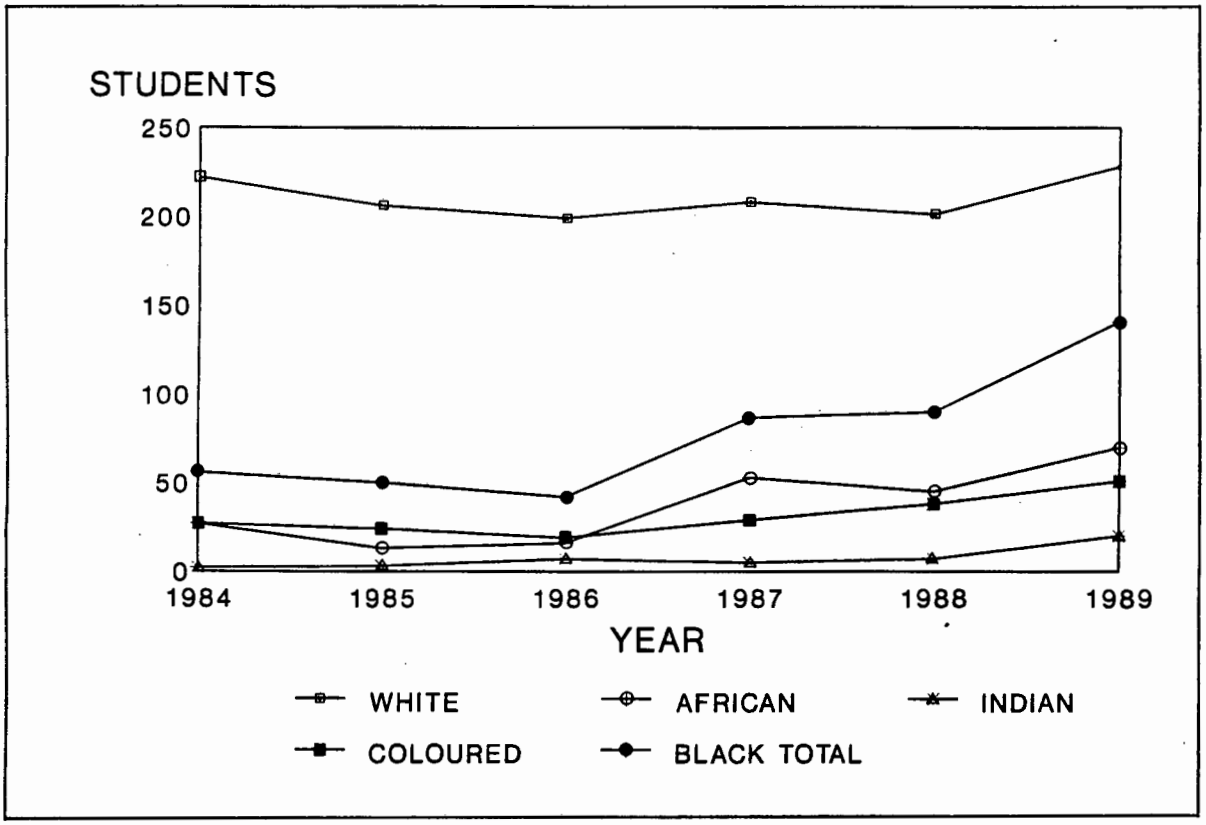

Fig 1: First-year Engineering enrolment at UCT 1984-1989

No comprehensive study has yet been undertaken of the success rates of black engineering students in SA. However it has been found that 69% of all students and 38% of African students who registered for first-year engineering between 1980 and 1983 at UCT graduated with an engineering degree. Between 1980 and 1986, 34% of all students and 9% of African

students graduated in Engineering in the minimum period of 4 years (Jawitz et al, 1992).

The number of white women who enrolled to study Engineering in South Africa grew slowly from 5 in 1952 to 162 in 1980 (Dreijmanis, 1988:59), while black women began enrolling only in the late 1970's. Chemical Engineering has been the most popular engineering discipline amongst women. By 1988 women made up about 5% of the engineering enrolment at UCT.

Between 1977 and 1984 an average of 4 women per year graduated in Engineering at UCT. The numbers increased slowly until in 1985 there were 14 women graduates (Davis 1987). By 1990 there had been only three black female engineering graduates at UCT. The first was an African student in 1984 while the other two black female students graduated in Engineering in 1990.

It has been found that society stereotypes professions such as Engineering as being unsuitable for women, while the Wiehahn Commission concluded that inadequate qualifications in Maths and Science, a lack of interest in technical work, and inadequate vocational guidance programmes were to blame for the small number of women entering technical occupations (Dreijmanis, 1988:80). In her article on women in Engineering at UCT, Davis (1987) wrote that women wanting to study Engineering were up against the prejudice of their teachers and parents.

While increasing numbers of women and black students have been registering for Engineering in recent years, they are not yet graduating in sufficient numbers to make up the shortfall referred to by Marcus (1991). In the case of black students, high failure rates must be understood against the background of the schooling system in South Africa.

2.2 EDUCATION UNDER APARTHEID

Although segregated education in South Africa dates from long before the policy of apartheid was legislated, the years between 1950 and 1970 saw the systematic separation of education into racially defined departments for African, coloured, Indian and white South Africans. Inequalities in funding (with the majority of resources being allocated for the education of white South Africans), and the increase in popular resistance to the apartheid education policy, resulted in the degradation and disruption of the education of almost two generations of black South Africans.

In 1959 the government took control of all black universities and modelled them into separate "tribal colleges", at the same time imposing controls on the admission of black students to the other universities which became de facto white universities.

The student uprising of 1976 challenged the government's ability to implement its policy of apartheid education, and, together with the increasing criticism of this policy from within the business community, led to the appointment of the De Lange Commission to investigate all aspects of education in the country. While rejecting some of the main recommendations of the Commission's report (such as a single Ministry of Education, and free and compulsory primary education for all), the government accepted most of the recommendations relating to the improvement of technical training for black workers, and the involvement of the private sector in training.

By that time there were 21 universities in South Africa of which ten catered for white students. The four English-medium universities were referred to as the "open universities" because of their admission of students of all races within the limits of the legislation, and their demand for an end to racial restriction on admissions. Despite this, a study by the University of the Witwatersrand (Wits) in 1984, found that a significant opinion within the

black community regarded the "open universities" in general, and Wits in particular, as representing the interests of the government and the white community. (Innes, 1988)

In December 1985 the government withdrew the requirement that students obtain official permission to attend a university other than the one to which they were assigned by virtue of their population classification. The racial quotas introduced in its place were abolished in 1991 after never being implemented.

The 1989 first-year university intake was made up of students who had begun their schooling in the aftermath of the 1976 uprising. They had been school students during the State of Emergency, and the national and regional school boycotts and stayaways which took place from 1984 onwards.

Most white schools were unaffected by these events. The participation in these national political events by students under the departments of Coloured and Indian education peaked with a boycott of classes and examinations in the Western Cape in 1985. Most of the first-year engineering intake of 1989 were in standard 7 or 8 in that year. At some schools, the entire school repeated the same standard in 1986 while at others all students were promoted to the next standard.

While events varied from region to region and between urban and rural centres, for students under the Department of Education and Training (DET) the general situation was described as follows by Eric Molobi of the National Education Crisis Committee:

> In June 1985 the regime declared a state of emergency... heavily armed South African Defence personnel stood at school entrances, identity documents were issued to students... The brief of the military was simple: to detain any school child who was found outside school

> premises or who failed to produce a pass on entering school. There have even been cases of armed soldiers who have refused to leave classrooms, while teachers have been manhandled by soldiers in front of their own students. There are presently teachers who have been expelled for "being political". Some teachers have been transferred to distant rural areas without any consultation and on short notice.
>
> In the Cape whole townships and other areas exist where there is not even one school in operation. In response to schools being closed by the authorities, students have demanded that they be re-opened... 73 schools... have been closed indefinitely. (Molobi, 1986)

Vusi Khanyile in his speech to the ASP conference in November 1986 described the implications of this situation for universities:

> It is the youth who have in the last decade laid down their lives to fight the evil that comes with education under apartheid. The reports of the last few weeks have shown that the current State of Emergency has made a frontal and concerted attack on the student sector, especially high school students. Commentators talk of up to 8000 students who have been detained...
>
> This struggle will have an ever increasing impact on the universities, not only because it is shaping the political consciousness of many prospective students, but because tertiary education will have to pay increasing attention to compensating these students for the educational sacrifices they have made in the course of their struggle and to providing the skills that the DET system... have failed to provide. (Khanyile, 1986)

More than ten years after the student uprising of 1976, large inequalities in the funding of black and white education were still evident. In 1987 the

government spent over five times more on the education of each white child than on each African child, and 87% of teachers in African schools were under-qualified. Classrooms in DET schools had an average pupil-teacher ratio of 41:1 compared to 16:1 in white schools (Hofmeyer and Spence, 1989).

For every 10 000 African children who started school at about the same time as the students under investigation in this study, only 113 passed the final school-leaving examination in 1988. Of these, only 27 passed with a matriculation exemption of whom only 1 passed with Mathematics and Physical Science (Kramer, 1990).

By 1988, black students accounted for 22,4% of the student population at UCT. As the student population at the white English-medium universities has become more heterogeneous in its composition, tensions have arisen around questions of admission to the universities, of curricula, and of control of decision-making structures (Innes, 1988). Major reviews of policy and programmes have been initiated and there has been a growing demand for affirmative action within the university to redress the inequalities of the secondary schooling systems. In its Mission Statement UCT committed itself

> to select students on merit while recognising that special criteria may be required to identify disadvantaged students who have potential;... [and] to ensure that students from a disadvantaged background are given special teaching assistance if needed after admission to UCT to ensure that they can succeed and meet the high degree standards UCT demands. (UCT, 1989)

As South African society entered a period of major transition, the challenge facing the universities was described by Khanyile:

> Mathematicians, Scientists, Engineers, Economists and Architects, amongst others, have a particular responsibility to show how their

disciplines can become part of the process of democratic transformation and relevant to the needs of the majority of South Africans. Already some of these disciplines are perceived by many student activists as elitist and divisive, exclusively serving entrenched establishment interests and resisting the forces of change. (Khanyile, 1986)

CHAPTER 3

A REVIEW OF RELATED STUDIES

3.1 INTRODUCTION

The present review focuses on studies undertaken in South Africa during the 1980s with a brief reference to recent studies involving "race" and academic performance in Engineering in the USA. The studies reviewed have been divided into those dealing with prediction of academic success at university (Section 3.3), and those on the problems experienced by students at university (Section 3.4). The findings of a review of studies on the prediction of academic performance in Engineering prior to 1980 (Potter, 1987a, 1987b) are presented in Section 3.2.

During the 1980s the retention and graduation of black students at white English-speaking universities was the focus of several studies and seminars. During the first half of the decade much of the discussion took place within Academic Support Programmes (ASPs) and at the ASP conferences held annually for several years until 1988 (see Hunter, 1989). Towards the end of the decade there was a shift away from the white English-speaking universities towards problems in the area of teaching and learning at tertiary institutions in general, but particularly at black universities.

During the same period several national seminars[2] were held on the need to increase the numbers of black students graduating with Science and Engineering degrees. Hofmeyr and Spence (1989) have described a range of

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2 Examples are the seminars hosted by the Institute for Educational Research of the HSRC in 1990, by Interbridge in June 1990 (see Moulder 1991), and by the Anglo-American Corporation in November 1991.

bridging and support programmes that have arisen to address this problem. (See also Sass, 1989; Reynolds, 1990; Bradbury, 1989; Kotecha and Rutherford, 1989).

3.2 A REVIEW OF RELATED STUDIES PRIOR TO 1980

Potter's review of literature on predicting academic performance in Engineering was divided into studies involving cognitive (Potter, 1987a) and non-cognitive variables (Potter, 1987b). It included studies from SA and elsewhere in the world. He found that studies on cognitive predictors revealed that:

* school performance, especially in Mathematics, was a significant predictor of performance in first-year Engineering;

* most of the variance in academic performance in Engineering could be accounted for by a combination of school results and psychometric test results;

* spatial perception was a good predictor of performance in Engineering Drawing;

* success in first-year Engineering and performance in subsequent years were based on different criteria as the first-year curriculum was similar to that in matric, while beyond first-year, the emphasis was on problem-solving;

* the best predictors of success in the final exams in first-year were likely to be first-semester tests, and success in first-year was likely to be the best predictor of performance in subsequent years of engineering study.

* black students encountered problems with engineering problem-solving due to their academic background, a lack of general knowledge about Engineering and minimal experience of language use in an Engineering context.

Potter concluded that any predictor set in South Africa would have to take into account the wide range of school systems and quality of education they provide. He commented that

> research based on case study methods, or research designs sensitive to the possibility that students from different backgrounds perform differently when exposed to the same academic environment are therefore promising to explore. (1987a:46)

In his review of studies using non-cognitive variables, Potter (1987b) found the literature on the use of personality tests inconclusive although in combination with other non-cognitive variables they appeared to provide better prediction than single non-cognitive variables. A low correlation was found between interest and academic performance in Engineering while factors measured by the study habits inventories overlapped with factors measured by other instruments. The research on study habits was inconclusive as study habits were found to be responsive to influences from the academic environment.

Potter concluded that while a variety of non-cognitive influences affected academic performance, these were likely to be specific to particular students and study environments.

> Contextual and institutional variables are of major importance as influences on academic success. Such factors may moderate the academic performance of university students in such a way as to affect both study

habits and attitudes. These in turn influence exhibited study behaviours, and academic performance. (1987b:77)

The appropriate research methods used in such studies would therefore have to be able to

> provide a holistic description of the wide variety of influences on academic performance in a particular academic environment, and of the responses of particular students to the environment. (1987b:30)

3.3 RECENT STUDIES ON PREDICTING STUDENT PERFORMANCE

3.3.1 Performance in non-engineering disciplines

The policy of apartheid education, comprising separate racial education departments with regional autonomy in White Education, together with the bantustan policy, has resulted in six matriculation (matric) examinations[3] administered by white education departments (WED) and four[4] administered by black education departments (BED). For admission to UCT the results in these examinations have been regarded as equal.

Most studies have used pass rates, average exam marks, or the number of courses passed to measure student performance at university, and aggregate

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3 These are the Cape, Natal, Orange Free State and Transvaal matric exams, the Joint Matriculation Board and the National Senior Certificate.

4 These are the Department of Education and Training (DET) and the Transkei Education Department examinations for African students, and the examinations of two Departments for coloured and Indian students.

symbol, individual subject symbols, or a combined matric point score[5] as indicators of success at school.

Several recent studies in South Africa have found an association between matric results and academic success at university which varies in strength for different education departments (Stoker et al, 1985; Morris, 1985; van Wyk and Crawford, 1984; Moran, 1987). In a study of medical students at Wits, Mitchell and Fridjhon (1987) found that not all of the WED examinations predicted equally well, and that

> the Joint Matriculation Board and Indian Senior Certificate examinations produced students better equipped for university study than do the Transvaal Senior Certificate and, in some circumstances, the Natal Senior Certificate. (1987)

These findings suggest that Indian matriculants need to be regarded as a special category amongst black matriculants. However, given the vast inequalities in schooling, it could be expected that black matriculants in general, and DET matriculants in particular, would perform worse than WED matriculants with equivalent matric results. Studies by Classen and Orkin (1983) and Morris (1985) suggest that this is not always the case.

Morris (1985) found a positive relationship between matric aggregate and Sociology I results at UCT. Although WED matriculants as a group obtained significantly better results than BED matriculants, WED and BED matriculants with similar matric aggregates obtained similar results in

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5 For an explanation of how matric points were calculated by the Engineering Faculty at UCT in 1989, see Section 4.1.2.

Sociology I. Most of the BED matriculants in the study were coloured matriculants who had attended schools under the Department of Education and Culture (Coloured Affairs). Morris found that the culture of the school and the home contributed to preparing a student for the requirements of the Sociology degree and presented evidence to suggest that social class also needs to be considered when investigating performance at university.

Classen and Orkin (1983) found the pass rate of African students in the Arts Faculty at Wits was not significantly different from that of white students. Furthermore the pass rate and number of subjects passed by black students was better than white students with comparable matric point scores. Unfortunately the sample of African students in the study was small (N=15) and no indication was given of the educational background of the students involved.

In contrast, Shochet (1985) found that the educational department of matric significantly affected all major predictor variables and their relationship with university performance for first-year Arts students at Wits. Matric point scores were found to be significant predictors of university performance for WED matriculants, but not for BED matriculants. Shochet also found that attendance at academic support programme activities was the best predictor of university performance of black students.

Two studies on academic performance were undertaken amongst non-engineering students at black universities (Penny, 1982; Fresen and Fresen, 1987). Penny (1982) found that the Human Sciences Research Council's Academic Aptitude Test, an aid for advising students on their choice of study, was a better predictor of success in first-year than the matriculation results in all faculties at the University of Fort Hare (attended mainly by DET matriculants). A lack of association was evident between matric results and academic success except amongst Science Faculty students, where a significant association was found between matric English, Maths, Science and

aggregate symbols and academic performance. Penny suggests that this exception was a result of the more stringent selection criteria used by the Science Faculty and based on matric symbols. Across all faculties, the matric English symbol showed the largest association with academic success. This would appear to support the view that language skills play an important part in the success of DET matriculants at university level.

At the University of the Western Cape, attended mainly by coloured matriculants, a strong association was found between matric point scores and success in a first-year Business Statistics course (Fresen and Fresen, 1987).

A work committee of the Committee of University Principals' investigation into macro aspects of the university in SA (CUP, 1987), reported that previous studies had found that

> the Matriculation Examination results seem to be a reasonable predictor of success for the White and Indian education departments and to a lesser extent for the Coloured Education Department. This examination was, however, found to be totally unreliable as a predictor of success for students writing examinations of the Department of Education and Training. (CUP, 1987:16)

Finally two studies at UCT confirm the usefulness of matric results as predictors of university performance, and provide evidence of the effect of other factors such as home language, domicile and population classification.

Moran (1987) found that matric point scores were good predictors of success in the Science Faculty, and that the majority of students with above 45 matric points passed at least two courses in first-year and hence gained readmission. Amongst 1988 Science graduates a statistically significant relationship was found between matric point scores and average exam marks achieved by students in all three years of study. Furthermore students who

had lived in residence for the duration of the degree performed better than the remaining graduates. No difference was found between the average exam marks of male and female students during the first three years of study but male students performed significantly better with respect to the number of first-class passes and other indicators of excellence.

The study by Bokhorst et al (1992) confirmed that matric aggregate was the best predictor of academic success in first-year psychology at UCT but also found that membership of the white population group and having English as a home language lowered the likelihood of failure. Bokhorst and his co-authors warned that

> quantitative analyses... run the danger of obscuring some of the non-academic factors experienced by black students at predominantly white universities - including subtle racism, feelings of alienation, socio-political influences and concrete problems regarding finances, transport and accommodation. (1992:64)

3.3.2 Performance in Engineering

A study of academic performance in Engineering at the University of Durban-Westville, the only Engineering Faculty at a black university in South Africa (at the time attended mainly by Indian matriculants), found low correlations between matric results and performance in the first year (Behr, 1982). This result appears to conflict with the findings of Mitchell and Fridjhon (1987) for medical students at Wits. Behr also found that psychometric tests were unable to predict academic performance in Engineering successfully. She suggested that rather than looking for tests to predict success, Engineering faculties should develop more effective selection methods and analyse the structure of their courses

> to discover the concepts that are to be mastered and the thought processes involved. (1982:94)

In a study of first-year Engineering students at Wits, Potter (1990) found a small significant correlation between the pre-matric and matric results of white students and their performance in first-year. For the small sample of African students (N=11), pre-matric results yielded a negative correlation with first-year results and matric results showed small positive correlations of very low significance. For all students the matric Maths result was the best predictor of academic performance in first-year Engineering subjects.

Potter defined educational disadvantage in terms of the number of subjects in which a student did not have a teacher at any stage during the last 3 years of school. In terms of this definition, African students in the sample fell into the most disadvantaged category. A relationship was found between the degree of educational disadvantage, and the degree to which the factors of assertiveness and extroversion, as measured by a personality inventory (FIROB), predicted first-year performance in Engineering.

The largest study of its kind during the period under review was undertaken by Stoker et al (1985) and involved students from all tertiary institutions in the country. The study investigated first-year and final achievement after three or four years in all major degrees for the student intake of 1980. The study team reported that most previous studies had found that success in the matriculation examinations extended to success at university, particularly in the first year.

Statistical analysis revealed different patterns of predictors for different fields of study, with gender not featuring at all. Matric aggregate, as indicator of school performance, appeared to be the best predictor of final achievement in all fields of study except Medicine, for which the university of study was found to have the most influence on success. Significant differences were found between the results of students from different matriculation bodies and at different tertiary institutions.

In the field of Engineering, the study revealed that the matric aggregate was the best single predictor of final achievement, with home language and university of study emerging as second-level predictors.

A regression analysis of final achievement in Engineering in terms of two categories, successful and unsuccessful, which included the results of individual matric subjects, found matric Maths and Physical Science to be the strongest predictor variables, and the differences between universities and examining authorities to be not significant.

A regression analysis of first-year achievement in Engineering with the average exam mark in first-year as criterion, found Maths, Physical Science and Biology to be the major explanatory variables. No statistically significant difference was found between universities, but in one case there was a highly significant difference between examining bodies.

3.3.3 Performance in Engineering Drawing

Several studies have reported that spatial tests provide the best predictors of performance in an Engineering Drawing course (Millroy, 1985; Millroy and Rochford, 1985; Potter et al, 1987). Spatial ability has been found to have almost no correlation with matric results (Potter, 1990; Taylor, 1980; Behr, 1982).

Millroy (1985) found a set of spatial ability tests to be the best predictors of performance in Engineering Drawing at UCT, irrespective of cultural groups. Her results revealed significant differences in performance in Engineering Drawing for students from different education departments and between English first- and second-language matriculants. She concluded that

> the implication of this finding underlines the huge disparities in the home background and/or quality of education offered by the different systems

and the problems faced by those students who are the products of an inferior and inadequate social system. (1985:122)

Rochford et al (1989) found a clear relationship between the spatial visualisation abilities of engineering students and their performance in Engineering Drawing, Astronomy and Chemistry. Approximately one-sixth of first-year engineering students at UCT were found to have 'spatial learning deficits' and performed significantly worse in these courses than the remaining first-year students.

3.4 RECENT STUDIES ON STUDENT PROBLEMS

Studies on the problems experienced by students at university, particularly in their first year, have attempted to answer the question: why do students fail? Most of the recent studies in this field have attempted to identify problems experienced by black students at white universities in South Africa.

3.4.1 Black students at predominantly white universities

After twenty years of desegregated education, studies in the USA reveal significant differences in the performance of minority[6] and majority students at university. While the national graduation rate for engineering students who registered in 1983-4 and graduated in 1987-8 in the USA was 63.9%, the graduation rate of minority engineering students during the same period was only 36.9% (Friedman and Kay, 1990).

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6 The word 'minority' in the context of the USA refers to persons regarded as Hispanic, Black American, American Indian and Alaskan Native, while 'majority' refers to white Americans.

The California Postsecondary Education Commission (1986) found that the retention of students in Engineering at 19 campuses in California varied for different ethnic groups, with Black American and Hispanic students displaying the lowest rates. It also found that minority students who participated in Minority Engineering Programmes (MEP) continued in Engineering at a higher rate than non-participants, and that the retention rates of male and female Engineering students were approximately equal. The Commission listed three components of the MEP's that helped minority students to succeed. These were a sense of community; academic support and professional and personal support.

The Commission found that the following factors affected the retention rate of minority students in Engineering:

a) inadequate school background in Mathematics and the Physical Sciences;
b) poor motivation toward Engineering as a career;
c) lack of financial resources;
d) lack of self-confidence;
e) ethnic isolation within the programme and institution;
f) excessive time spent on social and non-academic activities;
g) poor teaching and staff insensitivity to minority students;
h) inadequate counselling, tutoring and academic advising.

Tinto (1975) developed a model to explain the process by which a student reached the point of leaving university, either by voluntary withdrawal or because of academic failure.

Tinto describes the university as a closed system with its own values and social structure. A student's level of commitment to personal goals and to the institution changes as a result of the student's interaction with the academic and social sub-systems of the university. According to Tinto it is the student's perceptions and experience of this interaction that lead to a

re-evaluation of goal and institutional commitments and to the decision of whether to remain at university or to drop out. Decisions to withdraw voluntarily are not always associated with performance.

> Withdrawal... appears to relate to the lack of congruency between the individual and both the intellectual climate of the institution and the social system composed of his peers... Academic dismissals, on the other hand, are often lacking in both intellectual and social development or are socially integrated to an extreme... [so] that academic demands go unmet. (1975:117)

Loo and Rolison (1986) investigated the alienation experienced by minority students at predominantly white universities in the USA. They based their definition of alienation on Tinto's concept of 'malintegration', i.e the result of

> holding values highly divergent from those of the social collectivity and... insufficient personal interaction with other members of the collectivity. (Tinto, 1975:91)

They found that minority students at two Californian universities experienced a greater degree of alienation than white students. This alienation was felt mainly in the form of cultural domination and ethnic isolation. They also found that minority students could experience social alienation even if they were well-integrated academically. They suggested that minority students who were well-integrated into a peer-group of their own ethnic subculture were able to overcome problems caused by a failure to integrate into the university social system. Some of the institutional factors which helped to counter the experience of alienation included having a high proportion of minority students, the presence of a culturally supportive community, support services for minority students, the presence of supportive and accessible staff, in particular, minority staff.

The findings of a survey of 67 universities in the USA during 1988 and 1989 by Friedman and Kay (1990), generally supported Tinto's model applied to minority engineering students. Student commitment to the university was found to have a significant influence on academic performance. The presence of a substantial minority community of students or staff on campus, was also found to contribute significantly to the success of minority students.

A weakness of Tinto's model, in the South African context, is the assumption that the university forms a closed system.

Honikman (1982), in her study of problems experienced by first-year students at UCT, showed how many of these problems could be directly linked to the apartheid South African society and affected black and white students differently. As an example, while most white students in the study indicated that participating in sports and student societies had helped them find friends and integrate into the university system, the majority of black students at UCT did not take part in non-academic activities on campus in protest against segregated education and the government's university permit system. Honikman asserts that the structural violence of apartheid, the racism and paternalism at UCT, and the policy of non-participation resulted in most black students feeling alienated from white students, lecturers and the university administration and being isolated from the social system of the university.

Vilakazi and Tema (1985) argue that racism and the dominant white culture of white universities constitute a greater problem for black students than their inadequate schooling.

> It is this whiteness of the university which keeps the creative energies of the average black student in shackles, and make it tremendously difficult for the student to move quickly, or leap, over the educational

> deficiencies of his or her past. Such moves or leaps are possible given, among other things the right social atmosphere. (1985:21)

In their description of how white students viewed black students in the Engineering Faculty at Wits, Potter et al (1984) revealed that black engineering students were seen to be isolated from the

> informal student network operating among their white counterparts. As such they were not party to the hints and suggestions that circulated among the rest of the student body, nor did they have recourse to the other affective support systems (eg. consultation with peers, family, students in higher years of study, graduate students) which the majority of the white engineering students utilised. (1984:2)

Within a few years of Honikman's study, the permit system had ended, black students were allowed to live in university residences, and, in a major review of the non-participation strategy, black student organizations, and non-racial sports organisations were being established at most white English-speaking universities.

Despite these developments, Leon and Lea (1988) found that black students in the Arts and Social Science faculties at UCT in 1987 experienced greater alienation than white students. Unlike their white counterparts, black students found it difficult to separate the social and political aspects of their lives at UCT.

> The university was seen not to cater for their social and political needs and representing only the interests of whites. (1988:16)

> On a psychological level, many of the black students interviewed felt distanced from UCT, mainly because they felt they could not identify with the values of the institution. (1988:17)

On the material level black students experienced more problems with accommodation, transport and finances. Academically

> black students felt confident initially, due to poor academic performance this confidence was undermined... By contrast white students were performing better than they had expected and had gained confidence from this.
>
> [Specific problems] included language difficulties, study skills, perceived prejudice and difficulty with acclimatising to UCT. (1988:14)

The studies referred to above highlight the problems that black students experience with integrating into the social system of the white universities. Tinto's model helps to explain the relationship between this failure to integrate and consequent experience of alienation, and the retention of black students at these universities.

3.4.2 Problems experienced by non-engineering students

Penny (1981) investigated the students' experience of academic life at the University of Fort Hare and found that students only valued learning activities that they thought would help them to pass and believed that academic success could be achieved through rote-learning. Furthermore, academic success was more likely to be achieved if the teaching-learning situation matched the students' previous experience.

> Difficulties and failure appear more likely when the conditions of learning and teaching appear to the student to be, at best, different and unfamiliar, and at worst, alienating and bewildering. (1981:174)

A comprehensive investigation into the problems experienced by first-year students in three faculties at UCT, including the Engineering Faculty, was undertaken by Honikman (1982). She found that problems relating to university policy and procedures were experienced by black students to a greater extent than by white students. These included a lack of information about Engineering and UCT, the need for study permits, financial aid, accommodation and transport.

The main academic problems identified related to the transition from school to university. Amongst these were:

> the necessity of coping with different teaching styles and consequently different learning procedures; the generally impersonal environment with its consequences of big classes and little chance of contact with lecturers and other students; new and strange content... and the far more intense pace at which it is presented. (1982:248)

Academic problems were evident in the areas of study skills, communication skills and in specific subjects. Some students appeared to cope with the workload by working in groups and co-operating on assignments.

Honikman found that some of the academic problems experienced by students were the result of poor teaching at the university.

> Teachers...did not seem to possess an awareness of basic educational principles or communication skills. There was frequent evidence of inadequate preparation before classes, late handing back of assignments with poor feedback and general symptoms of lack of care. (1982:250)

Honikman's description of the experience of black students in the white UCT environment includes a wide range of social and emotional problems.

> [Black students] have... to struggle more than others to compensate for the gap between school and the university and between their socio-economic and cultural backgrounds and their new environment. (1982:253)

Agar (1990) interviewed students making use of the academic support programme at Wits in 1986 and found that the problems they experienced related to their academic background, to their past and present socio-economic and political backgrounds, and to the university environment and structure.

The following year Agar surveyed first-year students in Science, Arts and Commerce who were attending academic support tutorials as well as a group of students beyond first-year (ex-ASP), and found that of the most severe and most general problems, six fairly distinct categories could be identified:

a) academic cash and personal cash
b) workload and motivation
c) problems with teaching and learning styles
d) reading speed and expressing oneself in English
e) accommodation, transport and family problems
f) library-related problems

While students continued to experience most of these problems beyond first-year, Agar found a reduction in problems to do with teaching, learning and English language. He suggests that this could be due, in part, to the ASP programmes at Wits, which concentrated on these particular areas. While students are expected to adjust to the university environment, most of the set of problems identified are situated outside the individual student and cannot be dealt with by support programmes alone. Agar concludes that:

> it is only when policies and practices 'adjust' to meet the needs of the changing university demography, that student problems will diminish to a

level where the long term success of students will be influenced significantly. Since university policy and practice is to some extent determined by an apartheid society some of the changes which are necessary to ensure the long-term success of students and the quality of their experience at university can only be realised within the context of wider socio-economic and political change. (1990:454)

3.4.3 Problems experienced by engineering students

Granger (1980) reported that previous studies had found that only about 50% of all students who registered for Engineering in South Africa obtained the degree. To improve this pass rate he recommended better selection of students, special tutorials for weaker students and a fundamental re-organisation of curricula and teaching methods. He had found that student boredom with many courses was a serious problem and suggested that there be less formal instruction and greater use of educational technology, projects and design.

Potter, et al (1984) investigated the study habits and attitudes of 160 white engineering students in all four years of study at the University of Witwatersrand. Amongst their findings were the following:

a. The gap between school and university was a problem for most first-year students.
b. A foundation in matric Maths was essential for success in first-year while problem-solving ability was more important in later years.
c. The ability to interact and communicate with others was necessary for developing problem-solving skills and for obtaining help.
d. Many students complained about the quality of lecturing.
e. Black students were seen to experience particular problems such as poor academic background, language problems, conceptual difficulties with the work, lack of access to residence, transport and financial

problems. Furthermore, black students appeared to be distant from white students and lecturers.

f. Most students in all years of study experienced problems with the workload and pace of instruction. While white students developed effective closely-knit social networks to deal with these problems, black student networks, where they existed, did not appear to be as effective.

Bestwick (1987) undertook a needs assessment for a student- counsellor training programme in the Faculty of Engineering at UCT. He interviewed 6 students, amongst whom were black and white students as well as first-years and seniors. He concluded that

a) black and white students experienced problems of a different nature, as did first-year and senior students;
b) there was an urgent need for the early detection of poor academic performance;
c) the underlying cause of an academic problem was often a non-academic personal problem;
d) the relationship between students and lecturers needed to be improved.

Agar (1986) interviewed a group of black male engineering students attending academic support tutorials at Wits and concluded that black engineering students experienced many serious problems. The gap between school and university was evident in terms of language-related problems, workload and pace, the methods of teaching and the lack of individual attention. Other social problems included the "first experience of mixing with people of other race groups", and coping with political commitments and pressures. There was a shortage of adequate accommodation, and the time taken travelling to campus was a problem.

On a psychological level, Agar says,

> students are aware that blacks do not succeed in Engineering. This perception of high failure rate... felt at the outset of their studies, contributes to students feelings of inferiority, likely failure and extreme pressure. It is likely to contribute to a self-fulfilling prophecy syndrome. (1986:4)
>
> Most disastrously, in terms of improving black students pass rates is the perpetuated preconception that black students are not capable and unlikely to succeed in engineering. This conception is perpetuated both explicitly through individual lecturers actions and implicitly by insensitivity in general. (1986:5)

Agar found that the Faculty of Engineering had a racist reputation which was passed on from year to year, primarily through peer-groups, and suggested that some lecturers needed assistance in learning how to deal with the changing composition of the students in their classes.

3.5 SUMMARY

The following points emerge from the review:

a. Previous research indicates that matriculation results are significant predictors of first-year performance for WED and coloured matriculants but not for DET matriculants. The situation as regards Indian matriculants is less clear, with low correlations being found between school results and performance amongst Indian engineering students at UDW, but high correlations amongst Indian medical students at Wits. The highly selective criteria used in the case of the latter group of students may explain this difference.

b. There is evidence that factors such as living in residence, English as home language, and population classification affect academic performance, but gender was not found to be a significant factor.

c. Psychometric tests do not appear to be useful predictors, although results in spatial tests have been found to correlate well with performance in Engineering Drawing.

d. Black students attending white universities have a particular set of problems to cope with and experience a greater degree of alienation than do white students.

e. In many cases students perceive the standard of university teaching to be low and experience a lack of contact and communication between students and staff.

In the opinion of several of the researchers referred to in this review, it would appear that while legal restrictions on the admission of black students to white institutions have been removed, they are alienated from the university social system and are excluded from the social networks which appear to hold some of the keys to academic success. Some writers have suggested that racism forms part of the reason for this exclusion.

Several researchers have commented that less energy should be spent on the search for predictors of academic success and more on a closer investigation of the curriculum, the learning process, and contextual and environmental factors that inhibit learning.

Recent studies in the USA have adopted an approach that moves beyond the analysis of school marks and university results. Contextual and environmental factors are investigated more closely with the emphasis on how these can be altered to improve student learning and performance.

The present study has combined a statistical investigation into the relationship between personal and educational background and academic success, with an in-depth look at students' perceptions of the university environment and the problems they encountered. An attempt has been made to produce a holistic view of the factors influencing performance at university with a view to assisting the process of developing effective teaching and learning systems, and an university environment that is supportive to students from a range of backgrounds.

CHAPTER 4

AN INVESTIGATION INTO PERFORMANCE IN FIRST- AND SECOND-YEAR ENGINEERING

4.1 INTRODUCTION

4.1.1 Questions under investigation

The following set of questions were investigated for students who matriculated in South Africa in 1988 and registered for first-year Engineering at UCT for the first time in 1989:

A. Was there an association between Education Department of matriculation and performance in first-year Engineering?

B. Was there an association between gender and performance in first-year Engineering?

C. Did students who enrolled for Engineering straight after matriculation perform better than students with some post-matric experience?

D. What was the relationship between matric points or symbols in matric Maths and Physical Science and performance in first-year Engineering?

E. Was there an association between Education Department of matriculation and performance in a selected set of second-year courses?

F. Was there an association between gender and performance in a selected set of second-year courses?

G. What was the relationship between matric points or symbols in matric Maths and Physical Science and performance in a selected set of second-year courses?

H. Was there a relationship between performance in first-year and performance in a selected set of second-year courses?

4.1.2 First-year Engineering intake of 1989

The students who registered for Engineering at UCT for the first time in 1989, excluding Surveying students, can be divided into several categories (Table 1).

Table 1: Categories of students in first-year Engineering 1989

Category		Population class. A	C	I	W	Total N	%
I. SA Matric(1988)	AED	5	0	0	0		
	CED	0	35	3	0		
	IED	0	0	14	0		
	WED	6	5	2	148		
	Total	11	40	19	148	218	59
II. SA matric (Pre-1988)		13	7	0	61	81	22
III.Foreign students		4	1	1	19	25	7
IV. ASPECT		42	3	0	0	45	12
Total intake	N	70	51	20	228	369	100
	%	19	14	5	62	100	

Key: WED -White Education Dept (Cape,Natal,OFS,Transvaal,JMB,NSC)
CED -Coloured Education Dept (House of Representatives)
IED -Indian Education Dept (House of Delegates)
AED -African Education Dept (DET and Transkei)
ASPECT - Academic Support Programme in Engineering at UCT
A - African C - Coloured
I - Indian W - White

This study investigated the performance of the 218 students in Category I who had matriculated in 1988 and registered for the regular Engineering programme in 1989. Surveying students were excluded as their curriculum differed substantially from that of the other Engineering Departments. Seven of the Category I students withdrew from UCT during the year leaving an effective sample of 211 students. As the majority of African students had either matriculated prior to 1988 or had registered for ASPECT, this sample included only 11 African students (Table 1).

The students in Category I had written 10 different South African matriculation examinations which, for the purpose of this study, were initially grouped into the four Education Departments reflected in Table 1. The majority, including 13 black students, were White Education Department (WED) matriculants, while only 5 students had matriculated from an African Education Department (AED). As a result of this variation in sample size the AED, CED and IED were combined into a single Black Education Department (BED) category for statistical analysis. The effect of grouping the departments in this way is discussed in Section 4.3.1.

Admission to the standard programmes of the Engineering Faculty was open to students with matriculation exemption and Higher Grade passes in matric Maths and Physical Science and was based on points allocated for matric symbols according to the following scheme:

Higher Grade:	A=8,	B=7,	C=6,	D=5,	E=4	F=3
Standard Grade:	A=6,	B=5,	C=4,	D=3,	E=2	F=1

A matric point score (MP) was calculated by doubling the points for Maths and Physical Science and adding them to the points obtained in four other subjects. The maximum possible number of matric points was 64.

In 1989 applicants with at least 44 points and not less than a C symbol for matric Maths and Physical Science were automatically admitted to the Engineering Faculty. Those with between 39 and 44 points were wait-listed with each Engineering Department deciding on the absolute minimum number of matric points required for admission. The average matric points for students registered in the Materials Department was significantly lower than for the other departments (Table 2).

The average matric points for female students was significantly higher than for male students while no significant difference was evident in the average

matric points across population classification. There appeared to be very little difference in the average matric points across the four different Education Departments but because of the variation in sample size this could not be confirmed statistically. However the difference in matric points between the two categories WED and BED was not found to be statistically significant.

Table 2: Average Matric Points (MP) of SA Matriculants 1988 (Category I)

		N	Ave MP	
Gender	Female	23	53.0	T-test = 1.98
	Male	188	50.5	p = 0.049
Population Classification(I)	African	11	48.9	
	Coloured	38	50.7	
	Indian	18	48.4	
Population Classification (II)	Black	67	49.8	T-test= 1.79
	White	144	51.3	p = 0.074
Education Department(I)	AED	5	47.4	
	CED	36	50.7	
	IED	13	48.5	
Education Department (II)	BED	54	49.9	T-test = -1.45
	WED	157	51.1	p = 0.150
Engineering Department	Chemical	44	52.5	F-ratio = 5.78
	Civil	25	50.9	p = 0.0002
	Electrical	66	50.9	
	Mechanical	64	50.7	
	Materials	12	44.2	
	Total	211	50.8	

4.1.3 First-year Engineering Curriculum and performance variables

In 1989 first-year engineering students registered for Physics, Mathematics, Applied Maths and Chemistry in the Science Faculty, and Engineering Drawing, Water Chemistry and Introduction to Engineering in the Engineering

Faculty. Each course had a credit-rating according to the number of lectures, practicals and assignments demanded by the course (Table 3) and reflecting the amount of work required of students. The total number of credits for the first-year curriculum ranged from 36 for Civil Engineering to 40 for Chemical Engineering (Table 4).

Table 3: First-year Courses for Engineering students 1989

Course	Lectures Per Week	Practicals Per Week	Credits
Mathematics MTH105W	5	1 hour	9
Applied Maths (AMA102W/AMA104W)	5	1 hour	8
Physics (PHY102W/PHY104W)	5	1 afternoon	9
Engineering Drawing (MEC102W)	1	1 afternoon	4
Chemistry Full-course (CEM100W)	5	1 afternoon	10
Chemistry Half-course (CEM108F)	4	1 afternoon	4
Intro to Engineering (END102S)	3		3
Water Chemistry (CIV101S)	2		2

Table 4: First-year curriculum by Engineering Department

Course	Engineering Department			
	Chemical	Civil	Electrical	Mechanical & Material
Maths	MTH105W	MTH105W	MTH105W	MTH105W
Applied Maths	AMA102W	AMA102W	AMA104W	AMA102W
Physics	PHY102W	PHY102W	PHY104W	PHY102W
Chemistry	CEM100W	CEM108F	CEM108F	CEM108F
Engineering Drawing	MEC102W	MEC102W	MEC102W	MEC102W
Introduction to Engineer	-	CIV101S	END102S	END102S
Total credits	40	36	37	37

Students who obtained fewer than 14 credits in any one year, or who failed after first year to maintain an average of 18 credits per year, were excluded

and not allowed to re-register in the Engineering Faculty the following year. To graduate in Engineering a student had to accumulate 144 credits over a minimum of 4 and a maximum of 8 years.

The first-year engineering curriculum was regarded as a very demanding one. While Science students were not allowed to register for more than 4 full courses in first year, all Engineering students registered for the equivalent of four-and-a-half full courses. They had lectures during 4 of the 5 periods each morning, practicals or tutorials on 4 afternoons a week, and were expected to find time to learn computing, a self-taught component of the Mathematics course. Only the 5th period each day and one afternoon a week were available to attend any other tutorials that were offered.

This situation continues to date and the concern amongst some engineering educators was reflected at a conference entitled "Unjam the Curriculum! Teach Less - But Teach it Better!" organised by the Society for Electrical and Electronic Engineering Educators and the SA Institute of Electrical Engineers at UCT in 1991.

This study used the results of all first-year courses with the following pairs of courses being treated as single courses and referred to by the abbreviations below:
PHY - the Physics courses, PHY102W and PHY104W,
AM - the Applied Maths courses, AMA104W and AMA102W, and
INTRO - Introduction to Engineering (END102S) and Water Chemistry (CIV101S)

The performance variables used for this study were the credits performance variables containing the number of credits obtained by each student in first year (C89), and in second year (C90), and the average exam mark performance variable (AVE) for first year.

Courses passed in November and the supplementary exams were included in the calculation of C89 and C90. As these performance variables did not produce normal distributions (Fig 2a and 2b), they were investigated in terms of the following categories:

I. < 14 credits - which defined exclusion,
II. 14 to 35 credits - passed some courses
III. > 35 credits - passed all courses

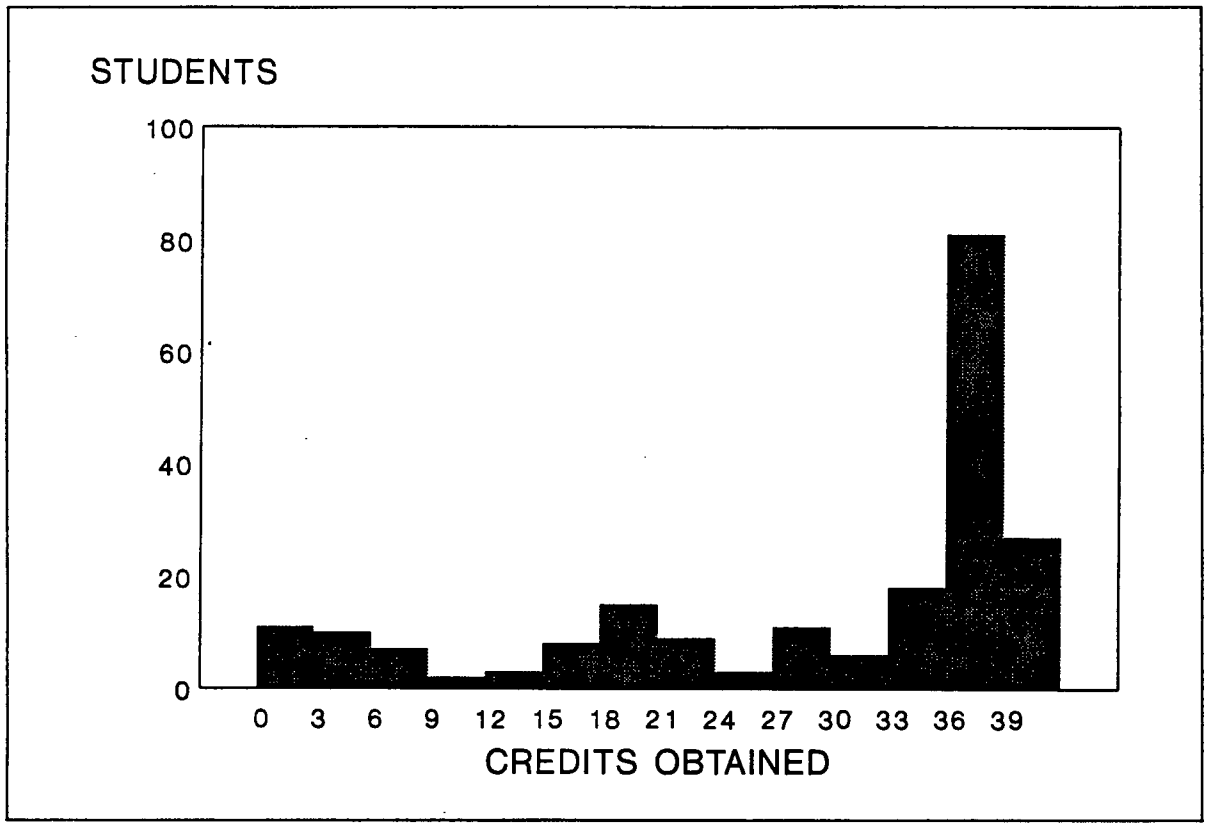

Fig 2a: Distribution of first-year credits performance variable (C89)

The AVE performance variable was calculated by doubling the marks obtained for full-courses, adding together the marks of all final exams, and dividing by the number of half-course equivalent units written. The result of the first sitting of an exam, including a deferred exam but not a supplementary exam, was used and no result was entered where a student was absent from an

exam, had withdrawn from a course, or had not been allowed to write the exam.

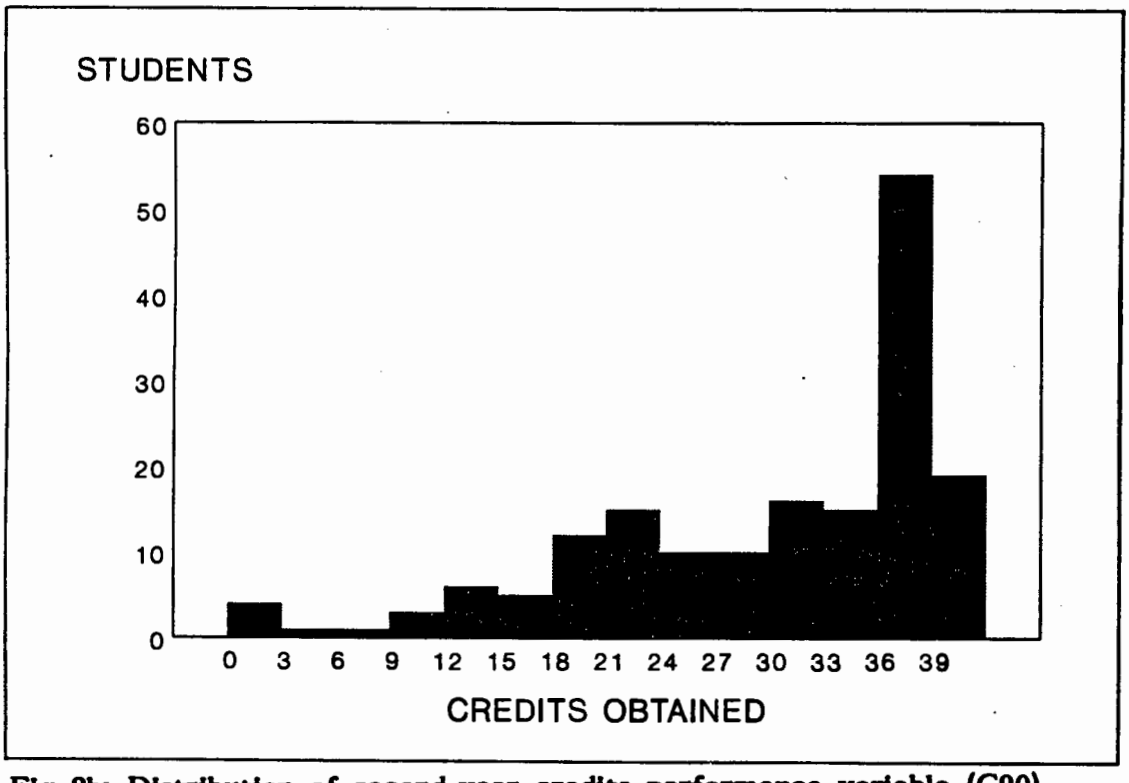

Fig 2b: Distribution of second-year credits performance variable (C90)

The AVE performance variable could be misleading where a student had not written all the first-year examinations. As all students began the year registered for the same number of courses, it could be argued that a student who wrote all exams and obtained a 60% average exam mark performed better than a student who obtained the same average exam mark but wrote only two examinations. This difference would not be reflected by the AVE performance variable.

A Chi-square test revealed that a significantly greater proportion of BED matriculants did not write all exams at the end of first year (Table 5). Five BED matriculants, including three of the five AED matriculants, did not

write exams in more than four half-course units. To minimise the effect of these extreme cases, the results of these five students were removed from all calculations involving the AVE performance variable. This excluded 9.2% of the BED matriculants leaving a total sample size of 206 students. The distribution of the AVE performance variable for this sample was regarded as normal (Fig 3).

Table 5: Students who did not write all examinations

Education Department	N	Wrote all exams	Did not write all exams	Number of half-course units not written 1	2	3	4	5	6	7	8
WED	157	140	17	9	5	2	1	0	0	0	0
BED	54	35	19	8	3	2	1	2	1	1	1
Total	211	175	36	17	8	4	2	2	1	1	1
	Chi-squ = 15.17 p = 9.8E-5										

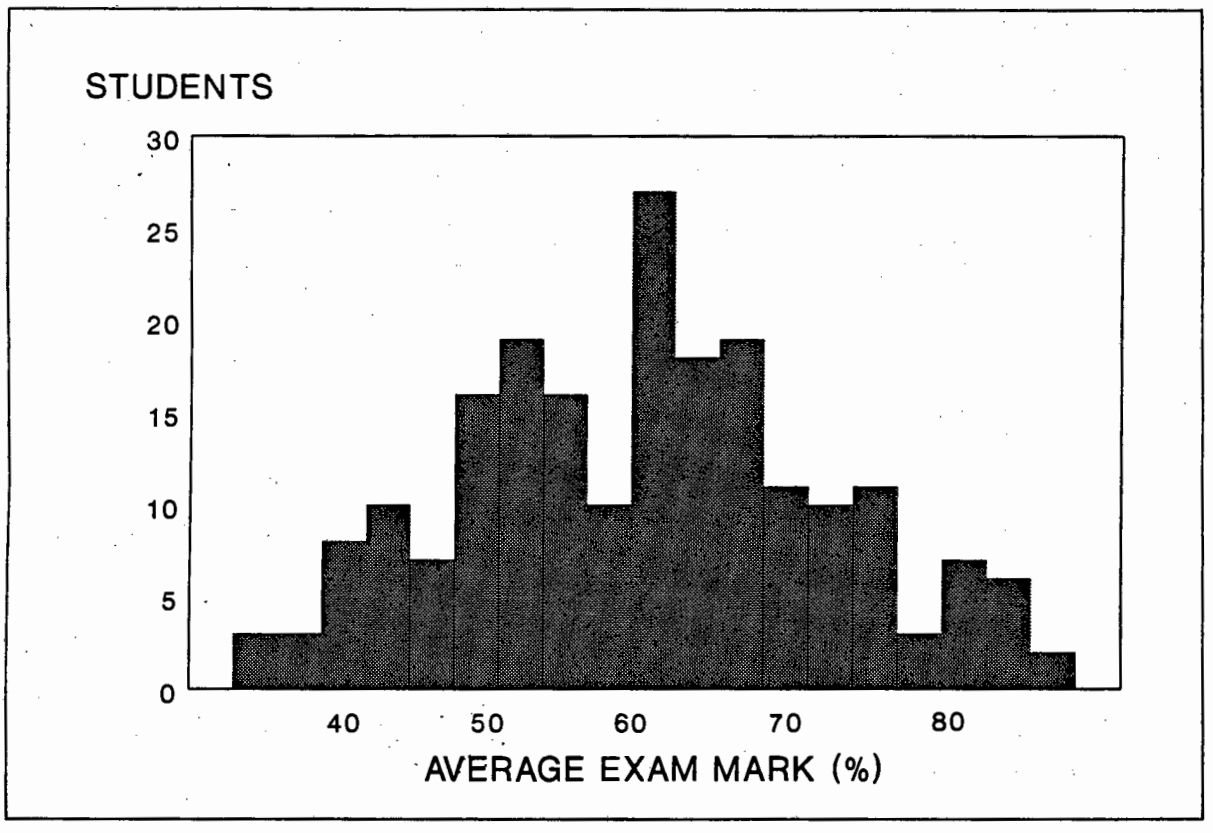

Fig 3: Distribution of first-year average exam mark performance variable (AVE)

4.2 A SUMMARY OF FINDINGS

A summary of the findings of the statistical investigation of results is presented below. The detailed results and analysis follows in the remainder of this chapter.

Question A : WED matriculants performed significantly better in all first-year courses and performance variables. A significantly larger proportion of BED matriculants were excluded and significantly more WED matriculants passed all courses.

Question B : Male and female Engineering students showed no significant difference in performance in first-year courses.

Question C : No significant difference was found in the performance of 1988 matriculants and students with post-matric experience in first-year Engineering.

Question D : All first-year results correlated strongly with WED matric results with the matric Physical Science symbol in general displaying a stronger correlation than the matric Maths symbol. Correlations with BED matric results were generally lower than those for WED matriculants with no significant correlation between BED matric results and Engineering Drawing (MEC102W) and the Introduction to Engineering courses (END102S and CIV101S).

Secondary findings related to this question were :
1) Most WED matriculants in all matric point categories obtained above 14 credits while the majority with 47 points or more passed all courses. Most BED matriculants with below 50 points obtained less than 14 credits while the majority of those with 56 points or more passed all courses.
2) Most BED matriculants with a C or D symbol for matric Maths or Physical Science obtained less than 14 credits, while the majority of BED matriculants with an A for matric Physical Science passed all courses. Most WED matriculants with D symbols for matric Maths or Physical Science did not pass all courses.
3) The mean average exam mark for all students with a D for matric Physical Science and for BED matriculants with either C or D symbols for matric Maths or Physical Science was below 50%.

Question E : The differences between BED and WED matriculants with respect to credits obtained and course results in the second year were much

less than in the first year, with second-year BED matriculants performing almost as well as their WED counterparts.

Question F :Male and female students showed no significant difference in performance in a selected set of second-year courses nor in the credit performance variable for second-year.

Question G : A subset of the second-year courses under investigation, the maths course SMS205 and three electrical engineering courses EEE206, EEE207 and EEE208, revealed no significant correlation with matric results. For the remaining courses, matric points and the matric Physical Science symbol displayed significant correlations, with the matric Maths symbol displaying lower or non-significant correlations.

Question H : Performance in the first-year Maths, Physics and Applied Maths courses correlated significantly with most of the second-year courses under investigation. A subset of the second-year courses, including SMS205 and several electrical engineering courses, correlated poorly with remaining first-year courses.

4.3 BIOGRAPHICAL FACTORS AND PERFORMANCE IN FIRST YEAR

The results of an investigation into first-year performance with respect to three biographical variables, Education Department, gender, and year of matriculation, are presented in this section.

4.3.1 Education Department of Matriculation

Apartheid education ensured that the majority of South Africans were schooled in racially segregated systems of education and wrote separate matriculation examinations. The majority of students in this study were schooled according to this design (Table 1).

While population classification is a major factor in every aspect of South African society, the focus of this research was on the relationship between the type of schooling a student had received and academic performance. For this reason students were categorised according to the Education Department of their matriculation rather than by population classification. Sample size limitations necessitated using only two categories, namely BED and WED.

Of the matric results, only the mean Physical Science symbol obtained by WED matriculants was found to be significantly higher than that of BED matriculants (Table 6). It must be remembered that these matric results do not reflect performance in the same examination. As explained earlier, students in different Education Departments wrote different examinations.

Table 6: Mean matric results by Education Department

	WED	BED	T-stat	p value
N	157	54		
Mean Matric Points	51.1	49.9	1.45	0.150
Mean Maths symbol*	6.8	6.7	0.59	0.559
Mean Phy Sc symbol*	6.7	6.1	3.84	1.7E-4

* B-symbol = 7 points
C-symbol = 6 points

A two-sample T-test was used to compare the mean performance of BED and WED matriculants in each first-year course. Despite no significant difference in matric points, BED matriculants performed significantly worse than WED matriculants in every first-year engineering course and the AVE performance variables (Table 7 and Fig 4).

Table 7: First-year results by Education Department

	WED mean	N	BED mean	N	T-stat	p value
AVE perf. var.	62.5	157	47.4	49	8.27	6.3E-8
MTH105W	58.7	145	47.1	44	4.49	1.2E-5
AM	60.0	155	43.9	49	6.93	5.5E-11
PHY	65.4	154	52.5	46	5.94	1.3E-8
CEM100W	58.2	29	43.3	14	3.78	5.0E-4
CEM108W	59.7	128	51.8	37	4.73	4.9E-6
MEC102W	72.7	154	53.8	44	8.22	6.7E-14
INTRO	65.1	126	53.9	37	5.13	8.1E-7

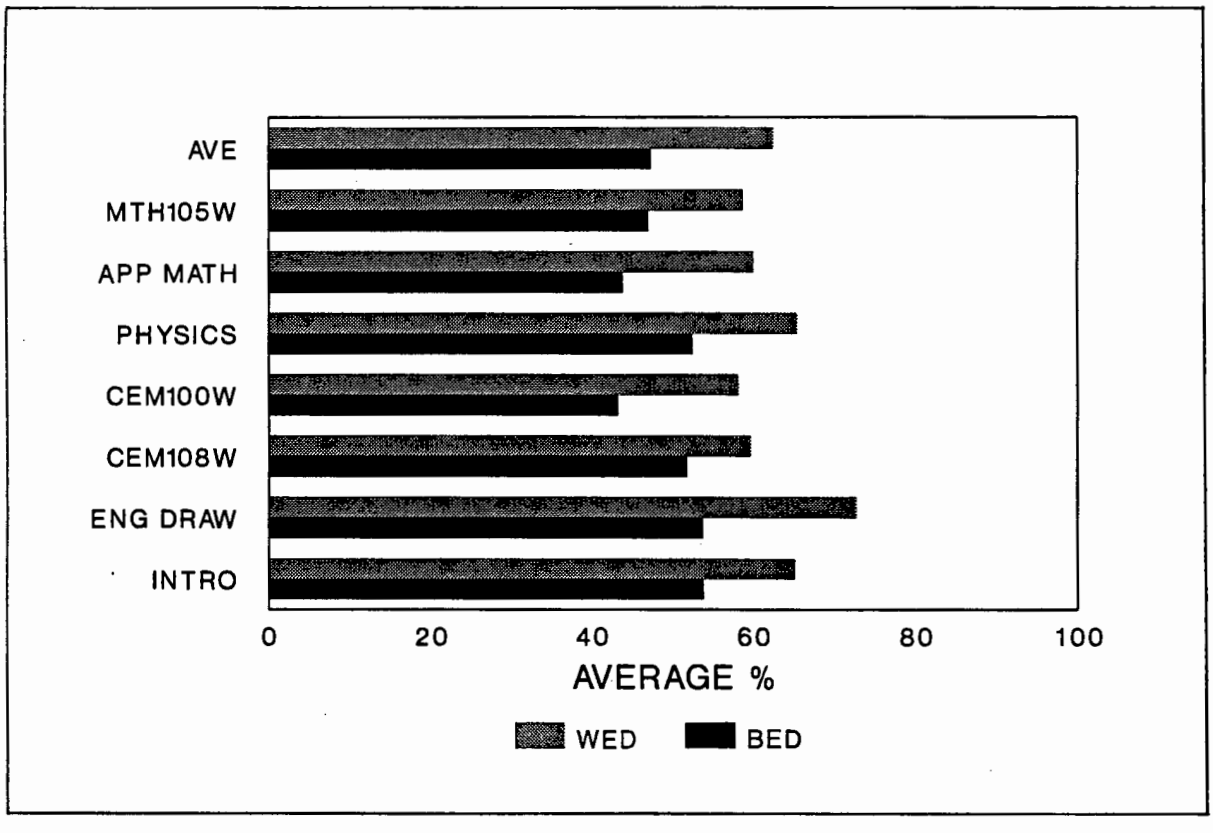

Fig 4: First-year results by Education Department

The non-parametric Kruskal-Wallis (K-W) test revealed that BED matriculants obtained significantly fewer credits than WED matriculants in performance variable C89 (Table 8). Furthermore a highly significant association was found between credit category and Education Department with a significantly larger proportion of BED matriculants obtaining fewer than 14 credits and WED matriculants passing all courses.

Table 8: First-year credits performance (C89) by Education Department

	WED		BED		
N	157		54		
Mean C89	32.5		18.7		
K-W ave rank C89	120.2		64.7		Test stat = 35.28 p = 2.9E-7
Credits	N	%	N	%	
< 14	9	6	23	43	Chi-squ=48.6;p=2.8E-11
14-35	38	24	16	30	
> 35	110	70	15	28	G=-0.72;p<0.01
Totals	157	100	54	101*	

* In several tables in this study totals do not add up to 100% due to rounding error

The difference in performance between BED and WED matriculants is not unexpected as the disparity in the quality of education and schooling provided by the WED compared to the other Education Departments is widely acknowledged. However the grouping of Education Departments into only two categories conceals differences within categories.

While the sample size does not allow a full statistical investigation into the relative performance of AED, IED and CED students, the information in Table 9 reveals large differences in pass rates at the end of first-year. All 1988 AED matriculants were excluded at the end of first year, and the pass rate for IED matriculants was only 38.5%. In Table 10, significant differences

are evident in both the C89 and AVE performance variables, with AED and IED matriculants performing significantly worse than CED matriculants.

Table 9: Pass rates by Education Department

Educ Dept	N	With-drew	Wrote exams	EX	Allowed to cont	Pass rate %
WED	161	4	157	9	148	94.3
CED	38	2	36	10	26	72.2
IED	14	1	13	8	5	38.5
AED	5	0	5	5	0	0.0
Total	218	7	211	32	179	84.8

Key: EX - excluded/obtained fewer than 14 credits

Table 10: Performance of AED, IED and CED matriculants

Educ Dept	Mean C89	K-W test N	K-W test Ave rank C89	ANOVA N	ANOVA mean AVE
AED	3.8	5	12.3	2	42.5
CED	23.1	36	32.5	36	51.4
IED	12.5	13	19.6	11	43.7
Total	18.7	54		49	49.3
		Test stat = 11.70 p=2.9E-3		F ratio = 3.37 p = 0.043	

The poor results of the comparatively small sample of IED matriculants in the present study appears to contradict the findings of Mitchell and Fridjohn (1987). One possible explanation for this might be that IED matriculants who registered for Engineering at UCT in 1989 had poorer matric results and hence were weaker students than those who registered for Medicine at Wits.

A great deal of attention has been paid by the Engineering Faculty to providing academic support for AED and other black matriculants by, for

example, establishing the ASPECT programme. The pass rates of the AED matriculants reflected in Table 9 would appear to justify this concern. It has been assumed that in general the performance of IED and CED matriculants has not been significantly worse than WED matriculants. The evidence of this study is that this assumption was not valid for the Engineering student intake of 1989 especially with respect to IED matriculants.

Before leaving this section a few comments need to be made about the performance of the 13 black WED matriculants and their results compared with that of white WED matriculants and black BED matriculants.

A Kruskal-Wallis (K-W) test revealed significant differences in the credit performance variable C89 between these three groups of students (Table 11). The average rank of credits obtained by black WED matriculants was closer to the average rank of white WED matriculants than of black BED matriculants. This would suggest that the performance of black WED matriculants more closely resembled that of white WED matriculants than black BED matriculants.

Table 11: Performance of black WED matriculants

Matriculant	Mean C89	K-W test N	Ave rank C89	ANOVA N	mean AVE
Black BED	18.7	54	64.7	49	49.3
Black WED	28.4	13	110.0	13	56.7
White WED	32.9	144	121.1	144	63.0
		Test stat = 35.7 p = 1.8E-8		F-ratio=28.10 p = 0.0000	

An analysis of the variance (ANOVA) of the AVE performance variable also revealed significant differences in the performance of these three groups. However in this case the average exam mark of black WED matriculants lay midway between that of white WED matriculants and black BED matriculants.

It is clear however that black WED matriculants performed significantly better than BED matriculants but not as well as white WED matriculants. The fact that the performance of black WED matriculants is distinguishable from that of white WED matriculants is one of the factors that is concealed by the use of only two Education Department categories, BED and WED, in this study.

4.3.2 Gender

Sixteen percent of the black students were female compared to 8% of white students (Table 12). Despite the fact that female students had significantly higher matric points than male students (Table 13), no significant differences were found in the results of any first-year courses or in the AVE performance variables (Table 14 and Fig 5). However the difference in performance in Engineering Drawing was almost significant (p=0.078).

The K-W test and chi-square test also revealed no significant difference in the mean credit performance variable (C89) or credit categories for first-year male and female students (Table 15). However all 5 female students who obtained fewer than 14 credits were black, 4 being BED matriculants, and one a black WED matriculant.

The results indicate that there was no significant difference in the performance of male and female students in first-year Engineering and support the findings in similar studies (Moran 1987, Stoker et al 1985).

Table 12: Gender composition of 1988 matriculants

	Black		White		Total	
	N	%	N	%	N	%
Male	56	84	132	92	188	90
Female	11	16	12	8	23	11
Totals	67	32	144	68	211	100

Table 13: Matric results by gender

	Female	Male	T-stat	p value
Mean Matric Points	53.0	50.5	1.98	0.049
Mean Maths symbol	6.9	6.7	0.83	0.405
Mean Phy Sc symbol	6.7	6.6	0.86	0.389

Table 14: First-year results by gender

	Female mean	N	Male mean	N	T-stat	p value
AVE perf var	55.8	22	59.8	184	-1.41	0.161
MTH105W	52.2	21	56.5	168	-1.18	0.241
AM	54.0	22	56.4	182	-0.68	0.498
PHY	58.9	22	62.7	178	-1.25	0.213
CEM100W	49.6	8	54.2	35	-0.83	0.410
CEM108F	55.6	14	58.1	151	-0.99	0.326
MEC102W	62.9	21	69.2	177	-1.77	0.078
INTRO	58.8	14	62.3	149	-1.17	0.245

Table 15: First-year Credit performance (C89) by gender

	Female		Male		
N	23		188		
Mean C89	27.1		29.1		
K-W ave rank C89	106.5		105.9		Test stat = 1.7E-3 p = 0.967
Credits	N	%	N	%	
<14	5	22	27	14	Chi-squ=0.96;p=0.620
14-35	6	26	48	26	
>35	12	52	113	60	G=0.17;p>0.05
Total	23	100	188	100	

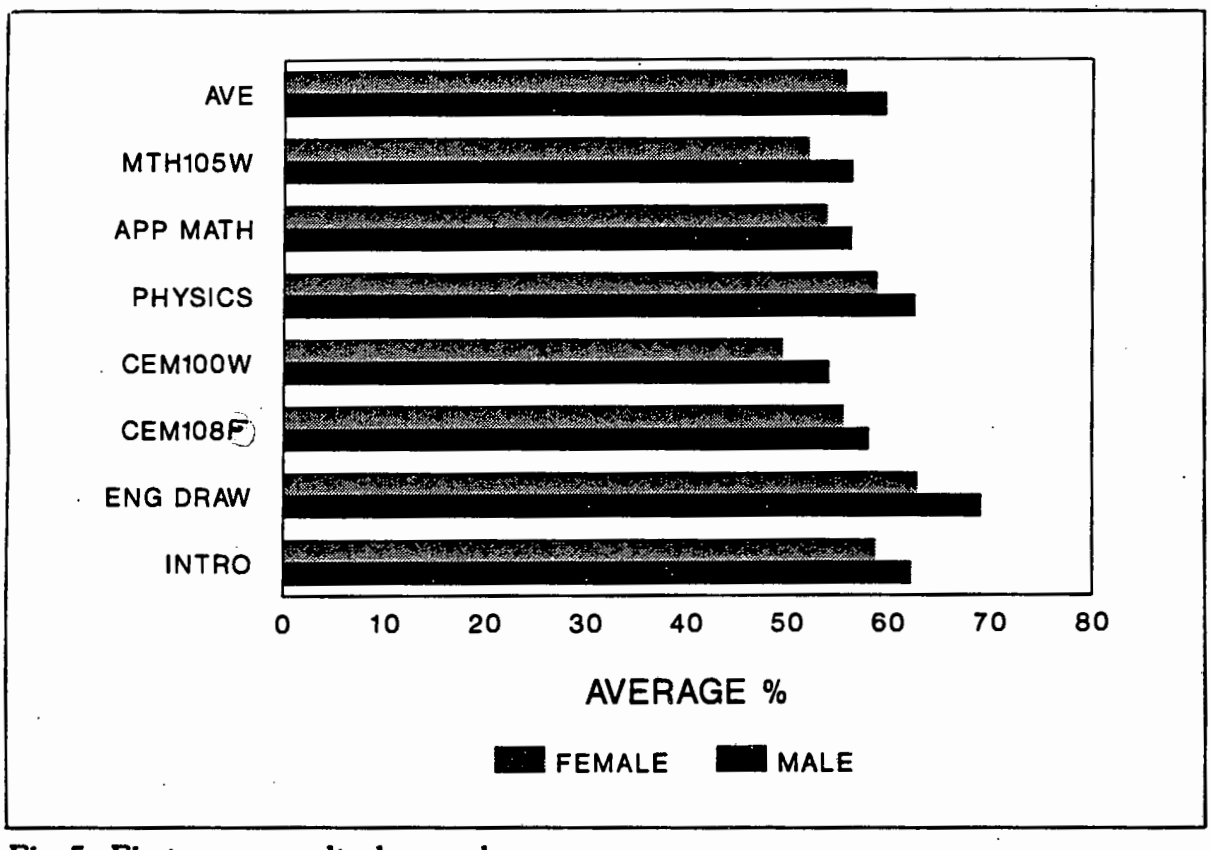

Fig 5: First-year results by gender.

4.3.3 Year of Matriculation

No statistically significant difference was found in both first-year performance variables (Table 16) nor in the first-year credit categories (Table 17) between 1988 matriculants and pre-1988 matriculants.

Table 16: First-year performance by year of matriculation

Matric year	Mean C89	K-W test N	Ave rank C89	Two-sample T test N	mean AVE
pre 1988	29.3	79	137.7	78	60.5
1988	29.0	211	148.4	206	59.3
		Test stat = 1.00 p = 0.318		T stat = 0.73 p = 0.469	

Table 17: First-year credit category (C89) and year of matriculation

	Year of Matriculation pre-1988		1988		
Credits (C89)	N	%	N	%	
<14	10	13	32	15	Chi-squ=0.29;p=0.864
14-35	21	27	54	26	
>35	48	61	125	59	G=-0.04;p>0.05
Total	79	101	211	100	

A problem with grouping students in this way is that it does not distinguish between the different post-matric activities that students were engaged in prior to coming to university. Such a distinction is beyond the scope of this study and needs to be the subject of further research. However, a brief analysis of the post-matric activities of students who had matriculated prior to 1988, and their continuation rates after first and second year revealed the following (Table 18):

a. High continuation rates at the end of first-year were evident amongst students who had done military service and those who had attended university previously. All except one of these students were WED matriculants.

b. Students who had studied at Technikon and Technical Colleges had similar continuation rates by the end of second-year.

c. Very low continuation rates were apparent for students who had repeated matric. Despite the small sample size this appears to suggest that matriculants who repeat their matric, to improve their results and ensure admission to UCT, do not perform well in Engineering.

d. The majority of black pre-1988 matriculants, including six African students, had spent a postmatric year at a private school. The pass-rate of this group at the end of first-year was almost equal to that of WED 1988 matriculants (see Table 9), and remained high at the end of second year.

Table 18: Post-matric activities of pre-1988 matriculants and their continuation rates

	A	C	I	W	Total	WD	EX	Cont 1 N	Cont 1 %	Cont 2 N	Cont 2 %
1.Technikon	4	1	0	23	28	0	6	22	79	21	75
2.Military service	0	1	0	12	13	0	0	13	100	11	85
3.Private school	6	2	0	5	13	1	0	12	92	10	79
4.Technical College	2	1	0	5	8	1	0	7	88	6	75
5.University	0	0	0	7	7	0	1	6	86	6	86
6.Repeat matric	0	1	0	6	7	0	3	4	57	2	29
7.Travel,work,other	1	1	0	3	5	0	0	5	100	4	80
Total	13	7	0	61	81	2	10	69	85	60	74

Key: A - African; C - Coloured; I - Indian; W - White
WD - Withdrew during first year
EX - Excluded at end of first-year
Cont 1 - Continued at end of first year
Cont 2 - Continued at end of second year

4.4 MATRIC RESULTS AND PERFORMANCE IN FIRST YEAR

4.4.1 Correlations between matric and first-year results

There are several problems with the use of matric results in studies of this kind. The variation in the standards of examination papers and marking, both within departments and between the different Education Departments casts doubt on the reliability of the matric result as an indicator of ability. The matric results could be said to reflect a student's ability to remember and reproduce large amounts of information, as there is little emphasis on analysis and problem-solving at the matriculation level. A limitation on the statistical analysis of matric results is caused by the fact that as raw scores are not available, matric symbols have to be used and are converted into numeric indicators. Despite these problems, matric results are the main criteria for university entrance, and, with the exception of DET matriculants, have been shown to correlate well with success at university, particularly at first-year level.

Spearman's rank correlation coefficients were calculated between matric results and the first-year performance variables and course results (Table 19).

The matric results of WED matriculants displayed significant correlations with all first-year performance variables and courses. Strongest correlations were with the half-course in Chemistry (CEM108F) and the weakest with Engineering Drawing (MEC102W). Across all first-year courses and variables, the highest correlations were with matric points, while correlations with matric Physical Science were generally higher than those with matric Maths, except for MEC102W. This is inconsistent with Potter (1990) who found matric Maths to be the strongest predictor in first-year engineering courses. In general, there were higher correlations between matric results and AVE performance variable than with the C89 credit performance variable.

Table 19: Rank Correlations between Matric and first-year results

	WED Matric Results			BED Matric Results		
	Points	Math	Phy Sc	Points	Math	Phy Sc
Performance variables						
AVE	.667***	.536***	.572***	.503**	.513**	.405*
C89	.509***	.372***	.421***	.590***	.544***	.505**
First-year courses						
MTH105W	.634***	.553***	.558***	.453*	.620***	.313
PHY	.605***	.434***	.520***	.618***	.451*	.593***
AM	.606***	.454***	.526***	.536**	.461*	.465*
CEM100W	.630**	.431	.562*	.663		.595
CEM108F	.690***	.571***	.660***	.460		.496*
MEC102W	.379***	.340***	.254*			
INTRO	.495***	.338**	.460***			

Notes: 1. Correlations with p >.05 have been left blank
2. *** significant at .0001 level
** significant at .001 level
* significant at .01 level
significant at .05 level

The correlations for BED matriculants were generally lower than for WED matriculants with no significant correlation found between any matric results and MEC102W or INTRO. A similar result was found by Potter (1990) for African students at Wits registered for an equivalent Engineering Analysis and Design course. No significant correlation was found between matric Maths symbol and either of the Chemistry courses CEM100W or CEM108F. In contrast with WED matriculants there were higher correlations between school results and C89 than AVE.

The existence of a strong correlation between the results of two courses means that the levels of performance achieved by students in the first course are reflected in the second course. Students who did well in the first course generally performed well in the second course. The performance in

the first course could therefore be said to be a fair predictor of the performance in the second course.

If no significant correlation exists, or if a low correlation exists between two courses, one would not be able to rely on the results of the first course to predict performance in the second course. Students who performed poorly in the first course would not necessarily perform poorly in the second course, while students who did well in the first course would not necessarily perform well in the second course.

Such correlations could be interpreted in several ways. One reason could be that the content and skills tested in the first course bore no relation to the contents and skills tested in the second course. This could explain why the matric results in general displayed their lowest correlations with the Engineering Drawing course (MEC102W) and the Introduction to Engineering course (INTRO). These two courses were based on concepts, skills and information which most students were introduced to for the first time in first-year. The remaining courses were essentially continuations of the school syllabus.

Another reason could be that significant changes occurred, between the two tests, in the learning behaviour of the students involved. The effect of a good teacher, a remedial programme, a generally more productive, hard-working and competitive environment, or a supportive peer-group could all contribute to change the learning behaviour of a student for the better and lead to accelerated learning. On the other hand, personal problems, a hectic social life, or an alienating and hostile learning environment could be expected to change the learning behaviour of the student for the worse and affect academic performance negatively.

In the interviews conducted as part of this research, black students in first-year Engineering at UCT referred to many of the negative factors listed

above in describing their experiences during their first-year. These probably form part of the explanation for the difference in correlation patterns of BED and WED matriculants in Table 19.

4.4.2 Performance by Matric points and symbols

While the majority of WED matriculants in all matric point categories obtained more than 14 credits, this was only the case for BED matriculants with more than 50 points (Tables 20 and 21). BED matriculants with fewer than 50 matric points were at risk of being excluded. This result was confirmed by the mean performance variables by matric point category for BED and WED matriculants (Table 22 and Fig 6). A linear relationship was evident between both performance variables, C89 and AVE, and matric point categories for WED matriculants. The relationship for BED matriculants appeared to be complicated by the poor performance of students in the 53-55 matric point category.

Table 21 indicates that 59% of all students obtained more than 35 credits. While most WED matriculants with 47 points or above passed all courses, this was only the case for the majority of BED matriculants with 56 points or more. The table indicates that there was a high probability that BED matriculants with fewer than 56 matric points, equivalent to a B aggregate in matric, would not pass all their courses in first-year with the result that they would be unlikely to complete the Engineering degree in 4 years.

The distribution of students by matric Maths and Physical Science symbols by credits categories and Education Department is reflected in Tables 23 and 24. As has already been shown BED matriculants obtained significantly lower Physical Science symbols in matric than their WED counterparts.

Table 20: Number of students in credit categories by matric points and Education Department

Credit Category		Matric Points 40-43	44-46	47-49	50-52	53-55	56-58	59-64	Total
WED	<14	3	2	2	0	2	0	0	9
	14-35	9	15	5	6	2	1	0	38
	>35	1	11	18	21	20	20	19	110
	Total	13	28	25	27	24	21	19	157
	%	8	18	16	17	15	13	12	74
BED	<14	4	8	6	3	2	0	0	23
	14-35	1	3	2	5	4	1	0	16
	>35	0	1	2	4	1	5	2	15
	Total	5	12	10	12	7	6	2	54
	%	9	22	19	22	13	11	4	26

Table 21: Percentage of students in credit categories by matric points and Education Department

Credit Category		Matric Points 40-43	44-46	47-49	50-52	53-55	56-58	59-64	Total
WED	<14	23	7	8	0	8	0	0	6
	14-35	69	54	20	22	8	5	0	24
	>35	8	39	72	78	83	95	100	70
BED	<14	80	67	60	25	29	0	0	43
	14-35	20	25	20	42	57	17	0	30
	>35	0	8	20	33	14	84	100	28
ALL	<14	39	25	23	8	13	0	0	15
	14-35	56	45	20	28	19	7	0	26
	>35	6	30	57	64	68	93	100	59

Table 22: Mean performance variables by matric points and Education Department

	Mean Average exam mark (AVE)		Mean credits obtained (C89).	
	WED	BED	WED	BED
Sample size	157	49	157	54
Matric Points				
40-43	48.8	43.8	19.8	9.0
44-46	55.3	42.6	27.7	8.4
47-49	59.6	45.8	32.2	12.1
50-52	62.4	53.4	35.0	26.8
53-55	62.7	45.9	34.0	19.4
56-58	71.2	58.8	36.8	34.5
59-64	76.3	67.5	38.5	38.5
F-ratio	20.56	5.94		
p-value	.0000	.0001		

More that 80% of WED matriculants with A or B symbols in matric Maths or Physical Science passed all courses while the majority with D symbols in either matric subject did not pass all courses. The majority of BED matriculants with either C or D symbols in matric Maths or Physical Science did not obtain 14 credits and were excluded. Seventy-one percent of BED matriculants with A symbols in matric Physical Science and 50% of those with A symbols in matric Maths or B symbols in matric Physical Science passed all courses. Only 7% of all students with a D symbol in matric Physical Science passed all courses.

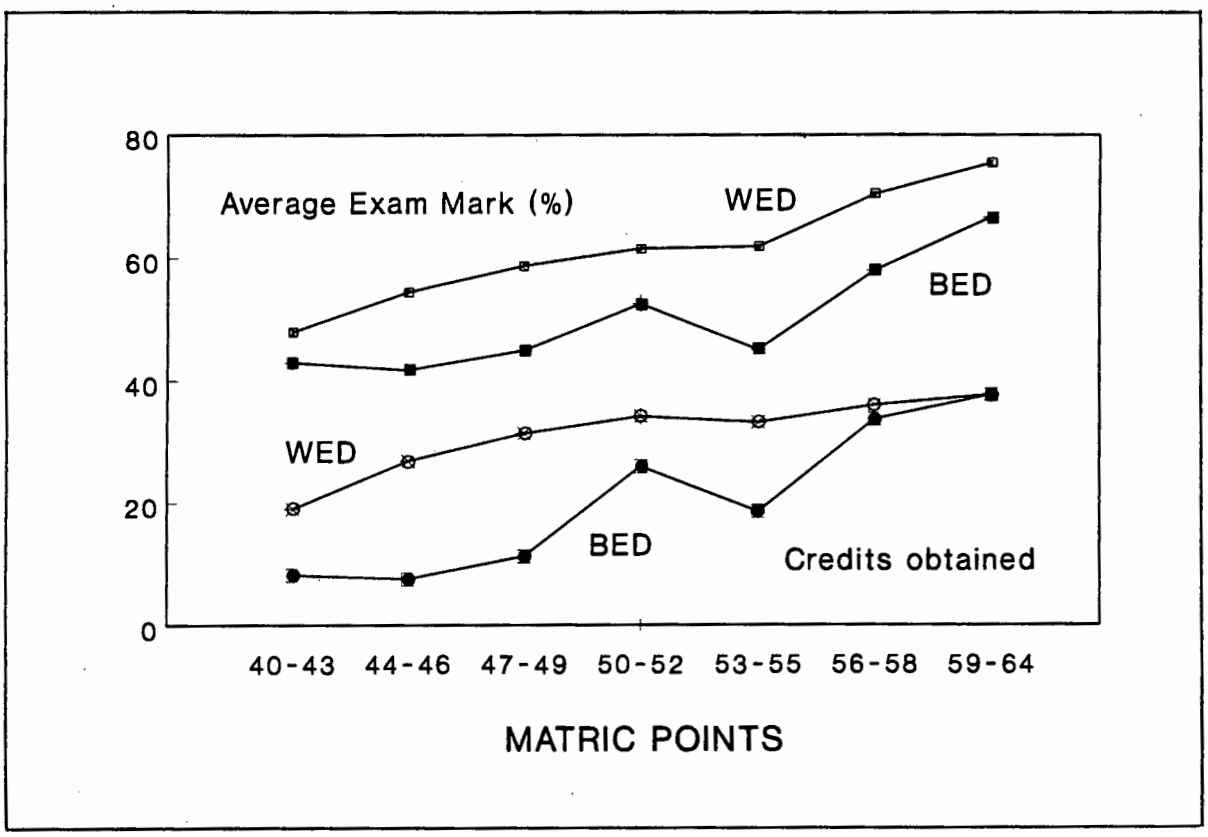

Fig 6: Mean performance variables by matric points and Education Department

An ANOVA was performed on the average exam mark (AVE) by matric Maths and Physical Science symbols of BED and WED matriculants. The results differ significantly by matric symbol for both Maths and Physical Science and for BED and WED matriculants, but the level of significance is higher for WED student.

A mean exam mark of below 50% was found for all students with a D symbol in matric Physical Science and for BED matriculants with either C or D symbols in matric Maths or Physical Science. The data also revealed a roughly linear relationship between both matric symbols and the average exam mark (Table 25 and Figures 7 and 8).

Table 23: Number of students in each credit category by matric symbols and Education Department

Credit Category		Matric Maths Symbol A	B	C	D	Matric Phy Sc Symbol A	B	C	D
WED	<14	3	1	2	3	1	2	2	4
	14-35	2	5	16	15	3	5	21	9
	>35	48	34	20	8	35	42	32	1
	Total	53	40	38	26	39	49	55	14
	%	34	26	24	17	25	31	35	9
BED	<14	2	3	13	5	0	1	14	8
	14-35	4	9	2	1	2	3	6	5
	>35	6	6	3	0	5	4	5	1
	Total	12	18	18	6	7	8	25	14
	%	22	33	33	11	13	15	46	26
All	N	65	58	56	32	46	57	80	28
	%	31	28	27	15	22	27	38	13

Table 24: Percentage of students in each credit category by matric symbols and Education Department

Credit Category		Matric Maths Symbol A	B	C	D	Matric Phy Sc symbol A	B	C	D
WED	<14	6	3	5	12	3	4	4	29
	14-35	4	13	42	58	8	10	38	64
	>35	91	85	53	31	90	86	58	7
BED	<14	17	17	72	83	0	13	56	57
	14-35	33	50	11	17	29	38	24	36
	>35	50	33	17	0	71	50	20	7
All	<14	8	7	27	25	2	5	20	43
	14-35	9	24	32	50	11	14	34	50
	>35	83	69	41	25	87	81	46	7

Table 25: Mean performance variables by matric symbols and Education Department

	Mean Average exam mark (AVE)		Mean credits obtained (C89)	
	WED	BED	WED	BED
Sample size	157	49	157	54
Matric Maths Symbol				
A	68.4	54.5	33.2	35.1
B	65.7	52.9	33.0	26.2
C	57.3	43.9	26.2	24.2
D	52.9	41.5	26.9	13.0
Matric Phy Sc Symbol				
A	71.6	58.0	35.1	30.6
B	63.9	54.1	32.0	34.4
C	58.4	46.9	28.6	28.3
D	48.1	45.5	18.0	19.0

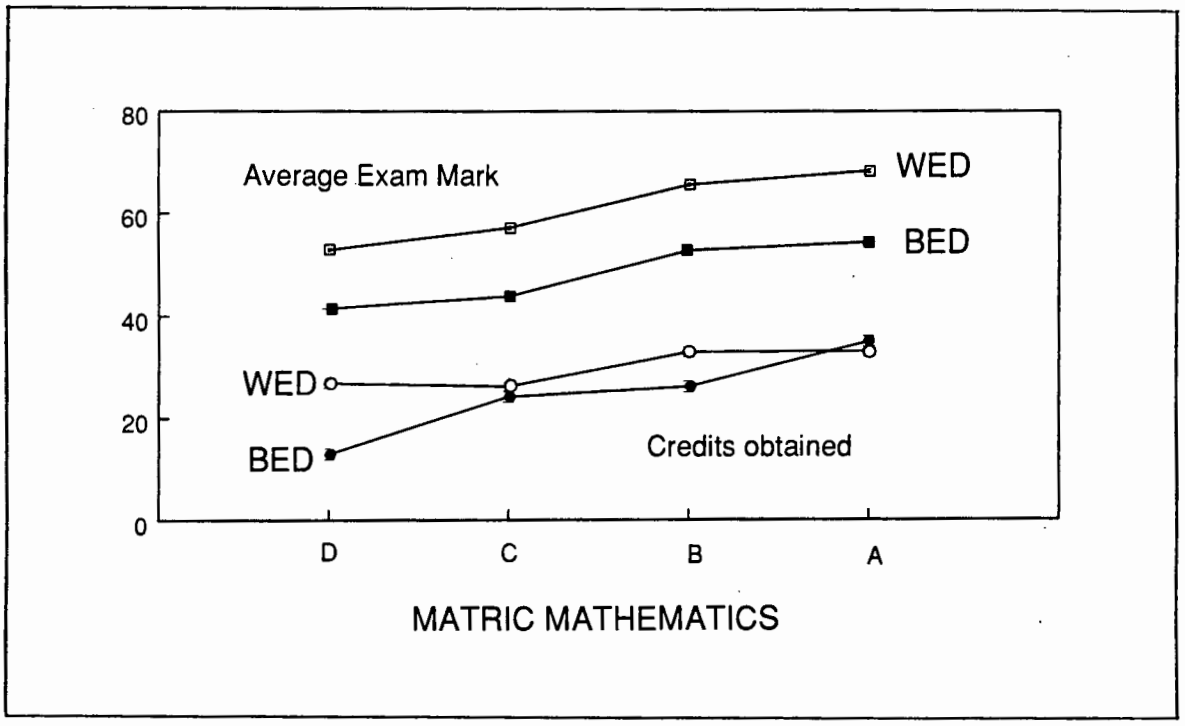

Fig 7: **Mean performance variables by matric Maths symbol and Education Department.**

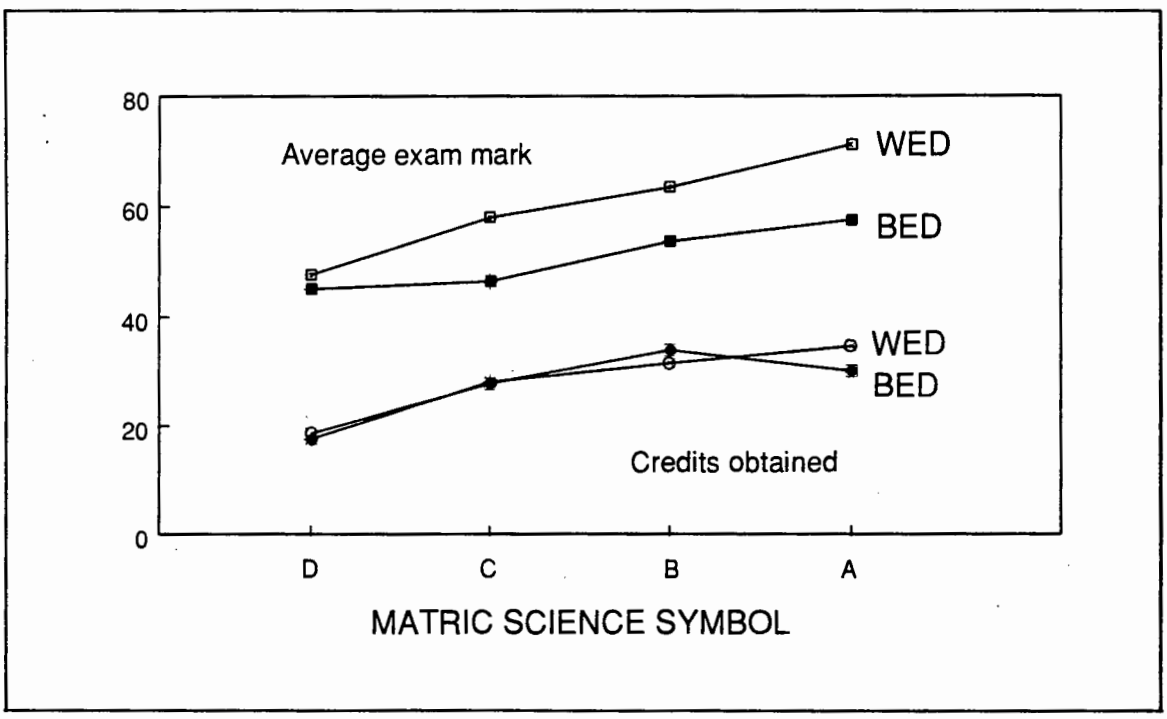

Fig 8: **Mean performance variables by matric Physical Science symbol and Education Department.**

4.5 PERFORMANCE IN SECOND YEAR

4.5.1 A selection of second-year courses

After consultation with several staff members, the results of a set of second-year courses were chosen for this study (Table 26). Students were registered for different second-year courses according to their Engineering discipline (Table 27). This created a problem of sample size which placed limitations on the use of statistical routines in the analysis of results. The second-year credit performance variable, C90, which contained the total number of credits obtained in second-year, was also available for the analysis.

Table 26: Second-year courses used in this study

Second-year Course	First year Credits	Pre-req	Pass Rts 88	89	90
Chemical Process Analysis (CHE223)	10	CEM100	60	56	66
Continuum Mechanics (CIV213)	4	AM	94	97	76
Electrical Engineering (EEE205)	2	MTH105 & PHY	82	80	76
Electrical Circuits (EEE206)	2	" "	70	61	72
Electronic Circuits (EEE207)	2		68	68	72
Electromech. Energy Conv.(EEE208)	2		71	69	88
Electronics in Measurement(EEE209)	2		78	79	94
Materials Science and Eng (MAT204)	4	CEM108	72	79	73
Calculus and Vector Anal.(SMS201)	2.5	MTH105	83	68	79
Linear Algebra (SMS202)	2.5	"	78	75	75
Engineering Statistics (SMS203)	2	"	81	77	82
Ordinary Different. Equ.(SMS204)	2	"	82	75	83
Partial Different. Equ.(SMS205)	3		-	-	75

Table 27: Sample size for each second-year course

Course	Chemical	Civil	Electrical	Mechanical & Material	Total
CHE223	23	-	-	-	23
CIV213	-	16	-	52	68
EEE205	-	19	-	52	71
EEE206	-	-	46	-	46
EEE207	-	-	45	-	45
EEE208	-	-	45	-	45
EEE209	-	-	46	-	46
MAT204	-	19	-	58	77
SMS201	24	15	43	43	125
SMS202	24	15	42	44	125
SMS203	22	15	-	12	49
SMS204	23	15	40	42	120
SMS205	-	-	41	-	41

The five Maths courses (SMS201-5) were academic courses, following on from the first-year Maths course MTH105W. (Only Electrical Engineering students registered for the course SMS205).

The Chemical Process Analysis course (CHE223) for Chemical Engineering students, was the only full-course amongst the set and was regarded as one of the most difficult second-year courses courses as is evident from the pass rates. It introduced students to production processes and required a combination of theoretical understanding, modelling and problem-solving skills as well as computing ability.

Five Electrical Engineering courses were selected for the study. The EEE205 course was an introduction to Electrical Engineering for non-electrical engineering students while the other four courses EEE206-209 were for electrical engineering students only. EEE206 was an introduction to basic circuit theory and analysis technique and involved the use of advanced mathematics. The other three electrical courses were more practical and applied. EEE207 dealt with electronic components and basic electronic circuits,

EEE208 provided an introduction to power systems and machines, and EEE209 surveyed basic principles of measurement electronics, with emphasis on applications to the measurement of non-electrical quantities.

Continuum Mechanics (CIV213) was largely a continuation of sections of the first-year Applied Maths and Physics courses. Materials Science and Engineering (MAT204) was an introduction to engineering materials and the relations of mechanical, electrical and chemical properties to the structure of materials.

4.5.2 Education Department and performance in second year

The difference in the second-year credit performance variable C90 for WED and BED matriculants was almost significant with the mean credits obtained by BED matriculants slightly lower than that obtained by WED matriculants (Table 28). When compared with the large difference in the first-year credit performance variable C89 in Table 8, this would tend to suggest that the difference in performance between BED and WED matriculants was greatly reduced in second-year to the point where it was almost no longer significant.

A similar trend was observed with the results of the subset of second-year courses in this study (Table 29 and Fig 9). Except in the case of two courses, the mean result for BED matriculants was slightly less than for WED matriculants but the difference was less than had been found in the first year. Although the differences were found to be statistically not significant, because of the small sample sizes involved these results need to be treated with caution.

In the case of two courses SMS205 and EEE207, the mean results for BED matriculants were slightly higher than for WED matriculants.

Table 28: Credit performance variable C90 by Education Department

Education Department	Mean C90	N	K-W test Ave rank C90	
BED	28.0	30	71.9	Test stat = 3.37
WED	30.6	143	90.2	p = 0.067

Table 29: Mean second-year course results by Education Department.

Variable	WED Mean (N)	BED Mean (N)	T-stat	p value
SMS201	63.3 (108)	57.6 (17)	1.55	0.125
SMS202	56.8 (108)	53.5 (17)	1.12	0.266
SMS203	65.1 (46)	54.0 (3)	1.35	0.183
SMS204	67.4 (103)	66.2 (17)	0.35	0.726
SMS205	56.8 (31)	64.9 (10)	-1.44	0.158
CHE223	58.1 (20)	50.0 (3)	1.18	0.249
CIV213	65.2 (63)	57.6 (5)	1.32	0.193
EEE205	61.4 (65)	57.2 (6)	0.68	0.501
EEE206	56.4 (35)	53.7 (11)	0.45	0.654
EEE207	58.3 (34)	59.1 (11)	-0.14	0.892
EEE208	62.8 (34)	58.4 (11)	1.09	0.281
EEE209	73.7 (35)	65.1 (11)	2.24	0.030
MAT204	64.6 (71)	54.5 (6)	1.50	0.138

4.5.3 Gender and performance in second-year

While the mean number of credits obtained in second year was slightly higher for female students, the difference was not found to be significant (Table 30). As evident from the mean results of the second year courses in Table 31 and Fig 10, no significant differences were found between the second-year performance of male and female students. While sample size once again limits the reliability of the t-test, the mean results for female students was slightly higher for 8 of the courses and slightly lower for 6 courses in the study.

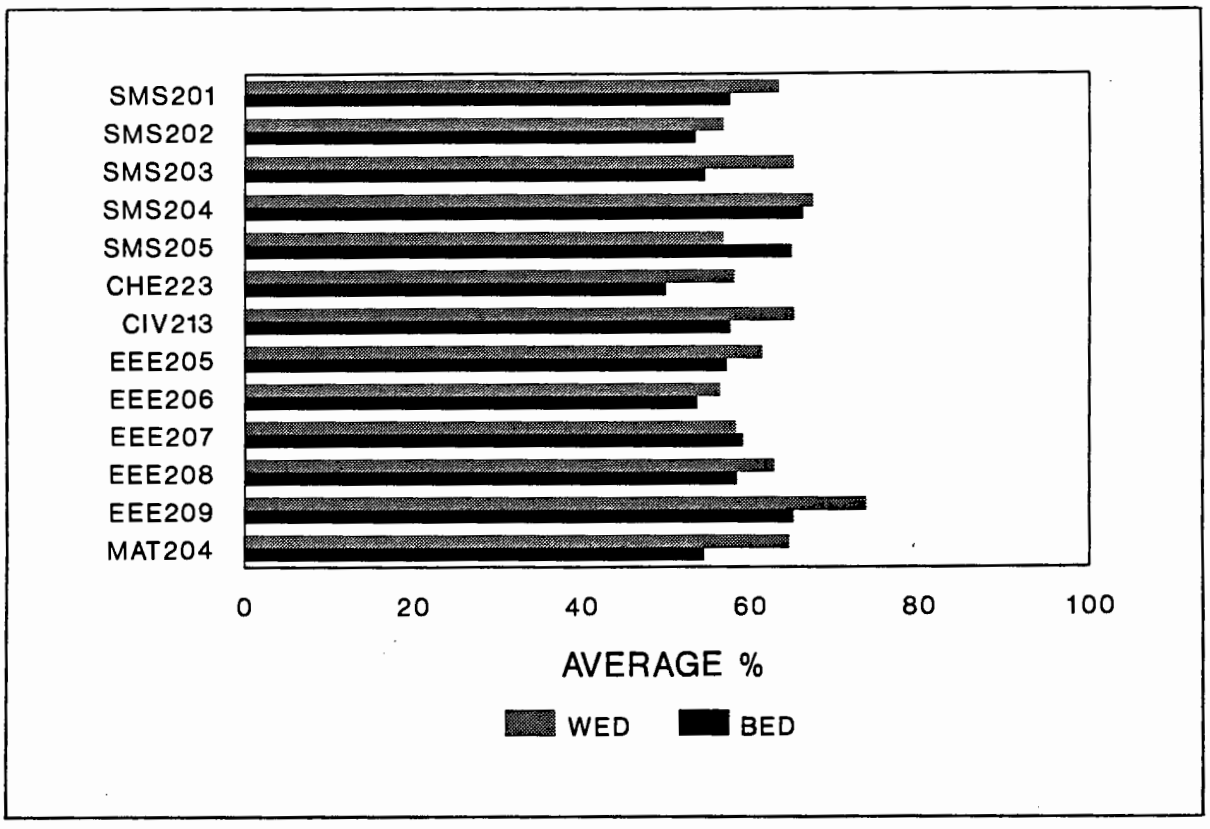

Fig 9: Mean second-year course results by Education Department

Table 30: Second-year credit performance variable C90 by Gender

Gender	Mean C90	N	K-W test Ave rank C90	
Female	31.4	18	103.9	Test stat = 2.33
Male	30.0	155	85.0	p = 0.127

Table 31: Mean second-year course results by gender

Variable	Female Mean	N	Male Mean	N	T-stat	p value
SMS201	66.8	13	62.0	112	1.15	0.251
SMS202	58.8	13	56.1	112	0.82	0.411
SMS203	63.3	7	64.6	42	-0.23	0.823
SMS204	69.8	13	67.0	107	0.73	0.466
SMS205	61.4	5	58.4	36	0.40	0.694
CHE223	59.4	5	56.3	18	0.54	0.596
CIV213	59.3	4	65.0	64	-0.89	0.378
EEE205	59.0	5	61.2	66	-0.33	0.746
EEE206	54.6	5	55.9	41	-0.16	0.873
EEE207	56.2	5	58.8	40	-0.32	0.749
EEE208	65.2	5	61.3	40	0.70	0.487
EEE209	74.8	5	71.3	41	0.63	0.532
MAT204	54.7	6	64.6	71	-1.47	0.145

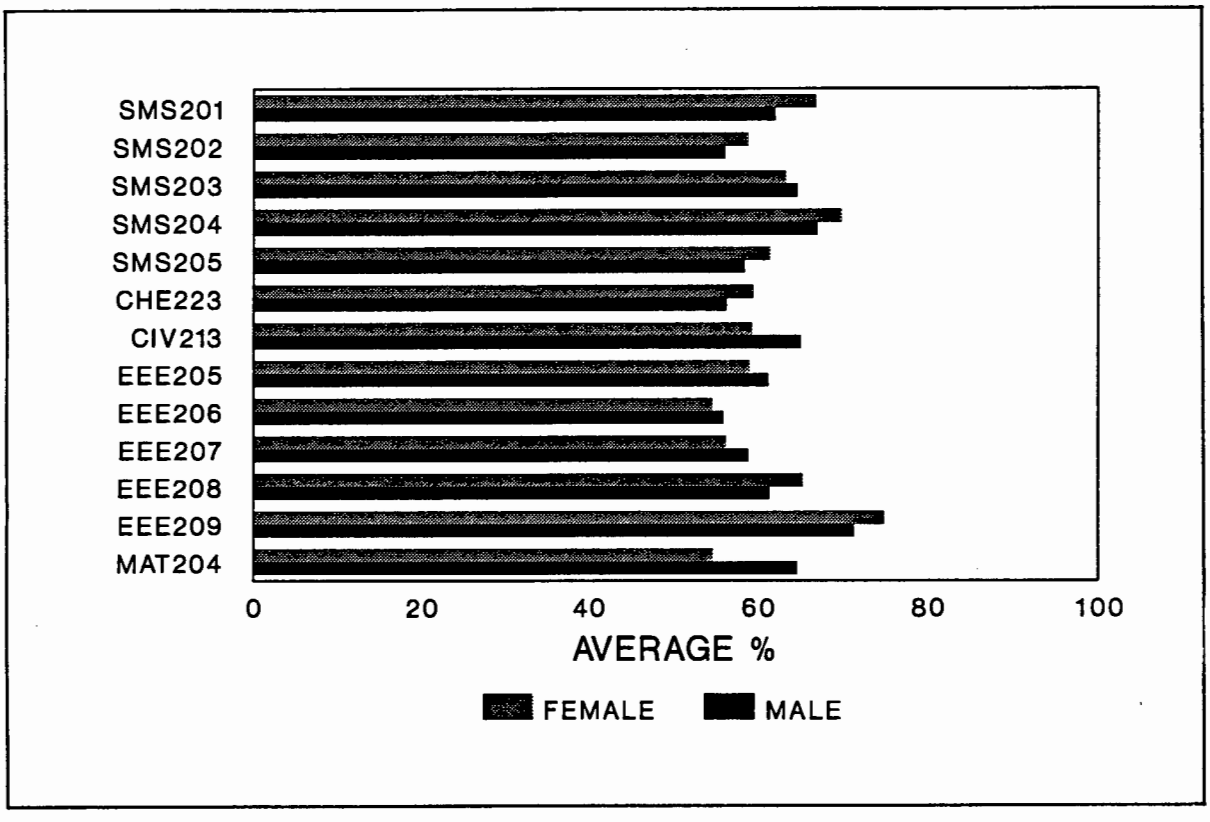

Fig 10: Mean second-year course results by gender

4.5.4 Matric results and performance in second-year

A correlation analysis using Spearman's rank correlation coefficient revealed that four courses, EEE206, EEE207, EEE208 and SMS205 showed no significant correlation with school results with the course EEE209 showing only moderate but significant correlation with the matric Physical Science symbol (Table 32).

Matric points and Physical Science symbol displayed moderate correlations with most of the remaining second-year courses with a high level of significance. The matric Maths symbol displayed the weakest set of correlations of the three matric results.

Performance in matric Physical Science appeared to be a better predictor of performance in second-year than performance in matric Maths.

An ANOVA analysis of the average credits obtained in second year revealed significant differences between matric point categories for both WED and BED matriculants (Table 33) but the relationship did not appear to be linear (Fig 11). The mean number of credits obtained by students from all matric point categories was well above the 14 credit exclusion level.

Table 32: Rank correlations between matric results and results in second-year courses

	Matric Points	Matric Maths	Matric Physics
C90	.481***	.336***	.440***
CHE223	.511		.542
CIV213	.418**	.251	.431**
EEE205	.417**	.280	.472***
EEE206			
EEE207			
EEE208			
EEE209			.372
MAT204	.459***	.277	.443***
SMS201	.360***	.256*	.347***
SMS202	.384***	.275*	.261*
SMS203	.511**	.359	.508**
SMS204	.364***	.233	.288*
SMS205			

Notes: 1. Correlations with p >.05 have been left blank
2. *** significant at .0001 level
** significant at .001 level
* significant at .01 level
significant at .05 level

Table 33: Second-year credit performance (C90) by matric points and Education Department

	Matric Points							
	40-43	44-46	47-49	50-52	53-35	56-58	59-63	F-ratio p
WED	22.5	24.3	32.8	28.6	31.7	34.8	37.5	6.99 .000
BED	17.0	17.2	25.2	31.5	23.0	22.0	38.5	3.54 .013
All	21.9	23.3	31.4	29.4	30.6	34.4	37.6	8.58 .000

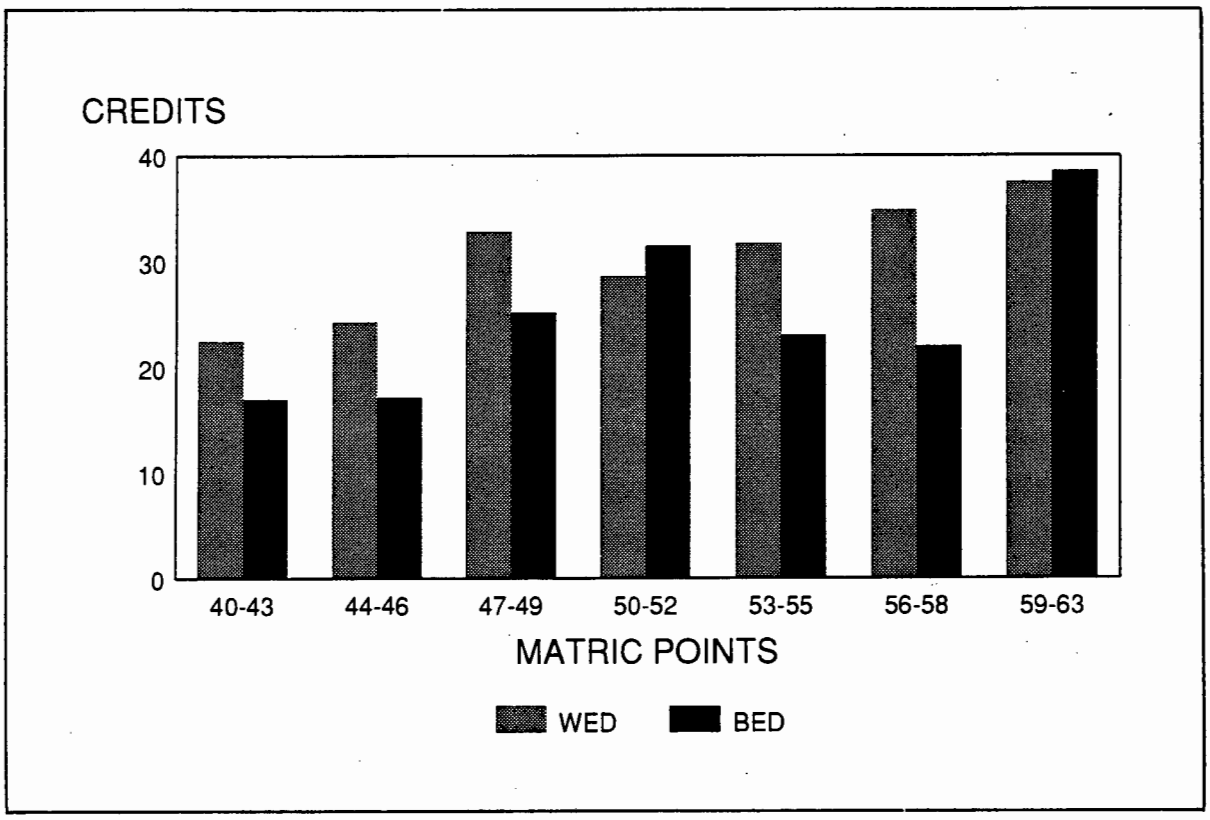

Fig 11: Second-year credit performance (C90) by matric points and Education Department

4.5.5 First-year results and performance in second-year

On the assumption that the results of first-year and second-year courses were normally distributed, a Pearson correlation analysis was used to investigate the relationship between performance in these two sets of courses (Table 34).

Table 34: Pearson Correlations between first- and second-year results

Second-year Course	N	First-year full-courses MATHS MTH105W	PHYSICS PHY	APP MATHS AM	CHEM CEM100W
CHE223	23	.670**	.650**	.746***	.692**
CIV213	68	.483***	.596***	.585***	X
EEE205	71	.473***	.440***	.324**	X
EEE206	46		.298	.420*	X
EEE207	45	.412*	.386*	.596***	X
EEE208	45	.314	.555***		X
EEE209	46	.300	.302	.408*	X
MAT204	77	.586***	.588***	.536***	X
SMS201	125	.644***	.613***	.620***	.702***
SMS202	125	.520***	.392***	.472***	.618**
SMS203	49	.629***	.682***	.662***	.727***
SMS204	120	.561***	.544***	.528***	.728***
SMS205	41	.333	.364	.313	X

Second-year course	N	First year half-courses CHEM CEM108F	ENG DRAW MEC102W	INTRO/WATER INTRO
CHE223	23	X	.669**	X
CIV213	68	.529***	.243	.299
EEE205	71	.454***		
EEE206	46			
EEE207	45	.398*		
EEE208	45	.505**	.438*	.456*
EEE209	46			.392*
MAT204	77	.492***	.349*	.505***
SMS201	125	.496***	.303**	.362**
SMS202	125	.298*		
SMS203	49	.525*	.394*	.443
SMS204	120	.462***	.341**	.399***
SMS205	41			

Notes: 1. Correlations with p >.05 have been left blank.
2. *** significant at .0001 level
** significant at .001 level
* significant at .01 level
significant at .05 level
3. X indicates no common students registered

Significant correlations were found between first-year Physics (PHY) and all second-year courses, the weakest and least significant being with the courses in Electrical circuits, EEE206 and Electronics in measurement, EEE209.

First-year Applied Maths (AM) showed a significant correlation with each second-year course except for the Electromechanical Conversion course, EEE208 and correlated most strongly ($r > 0.7$) with the Chemical Process Analysis course, CHE223.

First-year Maths showed a significant correlation with each second-year course except the Electric Circuits course, EEE206. This is an unexpected finding as MTH105 is a pre-requisite of the EEE206 course which is a theoretical course which includes a variety of advanced mathematical applications.

The Chemistry full-course CEM100W correlated strongly ($r > 0.6$) with all the second-year courses for Chemical Engineers in the study.

The Engineering Drawing course correlated most strongly with CHE223W ($r > 0.6$). The remaining correlations were moderate to weak ($r < 0.45$). There were no significant correlations with 6 of the second-year courses. Of the electrical engineering courses only EEE208 showed a significant correlation with Engineering Drawing.

The Introduction to Engineering/Water Chemistry course, INTRO, showed a strong correlation with MAT204W ($r > 0.5$) and no significant correlation with five of the second-year courses.

The second year courses CHE223W, MAT204W, SMS201 and SMS204 displayed strong and highly significant correlations with all first-year courses while CHE223W had the strongest correlations of all courses with first-year Maths, Applied Maths and Engineering Drawing.

While these correlations can only be fully interpreted by analysing the contents and curricula of the courses involved, the following tentative conclusions are drawn from the correlation analysis:

1) The first-year courses in Maths, Applied Maths and Physics showed significant correlation with almost all of the subset of second-year courses. This would seem to support the view that good performance in these courses in first-year establishes a solid foundation for performance in second year. Further investigation is needed to assess whether this holds true beyond second year.

2) The courses offered by the Electrical Engineering Department displayed no significant correlation with several of the first-year courses with the exception of the Physics course. As explained in Section 4.4.1 the reason for this lack of correlation could be that these courses involved content and skills that were unrelated to most of the work covered in the first-year courses. To an extent this could be said to have been the case for the more practically oriented courses. However the lack of correlation between EEE206 and one of its pre-requisites, MTH105 is difficult to explain in this way.

3) The Partial Differential Equations course SMS205 for electrical engineers, displayed moderate correlation of low significance with the first-year full courses and no significant correlation with the half-courses. According to a lecturer in Electrical Engineering this course is regarded as a key course for the discipline as it deals with the applications of mathematical modelling to engineering problems.

4) The second-year course with the lowest pass rates, the Chemical Engineering course, CHE223W, had the strongest correlations with Applied Maths and Engineering Drawing and displayed strong correlations with all first-year courses. This could be explained by the fact that the course is a general course which synthesizes much of the first-year material in chemistry, maths,

physics and modelling and problem-solving and applies it to the analysis of chemical processes.

The same reason could explain the significant correlations between the courses MAT204W and CIV213 and all first-year courses.

4.6 CONCLUSIONS

4.6.1 First-year performance

This study has found that Education Department of matriculation was a strong determinant of performance in first-year Engineering at UCT in 1989 for the South African matriculants of 1988.

WED matriculants performed significantly better in all first-year courses and performance variables. A significantly larger proportion of BED matriculants were excluded and a significantly greater proportion of WED matriculants passed all courses.

Furthermore no association was found between gender and performance in first-year Engineering. This supports findings by Moran (1987) and Stoker et al (1985).

Although no significant difference was found in the performance of 1988 matriculants and students with post-matric experience, this latter group contained students with diverse experience. More detailed study is needed of the relationship between different kinds of post-matric experience and performance in Engineering.

All first-year results correlated strongly with WED matric results with the matric Physical Science symbol in general displaying a stronger correlation than the matric Maths symbol. Correlations with BED matric results were generally lower than those for WED matriculants with no significant

correlation between BED matric results and Engineering Drawing (MEC102W) and the Introduction courses (END102S and CIV101S).

The results of this study show that BED matriculants with below 47 matric points or a C or D for either matric Maths or Physical Science, and WED matriculants with a D symbol in either matric Maths or Physical Science, were at risk of being excluded at the end of first-year.

At the other extreme BED matriculants with above 55 matric points, and WED matriculants with above 50 points, had a probability of more than 50% of passing all courses. This would suggest that the majority of students with below 50 matric points are unlikely to complete their degree in the minimum time of 4 years.

Bearing in mind the problems associated with the reliability and validity of matriculation results, the above information could assist with identifying first-year students who are at risk of exclusion or of not passing all courses. However this information should be used together with other biographical information and interviews of students to assess whether they are in need of counselling and support, or whether they should be offered the opportunity of following a structured 5-year degree programme such as ASPECT.

4.6.2 Second-year performance

Given the limitations of sample size, it would appear that BED matriculants who made it to second-year performed almost as well as their WED counterparts. The differences in second-year credits obtained and course results between BED and WED matriculants were much less than in first-year.

No significant difference was found in the performance of male and female students in a selected set of second-year courses nor in the credit performance variable for second-year.

Performance in the major first-year courses of Maths, Physics and Applied Maths correlated significantly with most of the second-year courses in the study. This would appear to confirm the performance in these courses in first year as reasonable predictors of performance in second-year.

A subset of the second-year courses under investigation, the maths course SMS205 and three electrical engineering courses EEE206, EEE207 and EEE208, revealed no significant correlation with matric results. For the remaining courses, matric points and the matric Physical Science symbol displayed significant correlations, with the matric Maths symbol displaying lower or non-significant correlations.

A similar subset of second-year courses, including SMS205 and several electrical engineering courses correlated poorly or not at all with several first-year courses. It is unclear how this result should be interpreted. As explained in section 4.4.1 the lack of correlation between two sets of results can be interpreted in several ways. It is recommended that this be investigated further.

Matric Physical Science emerged as the subject with the most significant and strongest correlations between school matric and first-year results while first-year Physics and Applied Maths results displayed strong and significant correlations with second-year results. This could be interpreted to mean that the concepts and skills learnt in Physical Science at school were relevant to most of the courses in the Engineering curriculum included in this study. Furthermore both first-year Physics and Applied Maths involve problem-solving, an important component of Engineering courses beyond first-year.

The central role of Physics could help explain why the difference between BED and WED matriculants is so marked, especially in first-year. It is in Physical Science education where the inequalities between the different Education Departments has been most stark. The lack of properly trained

teachers, laboratories and equipment has meant that students from most Black Education Departments matriculate without being exposed to the skills and concepts underlying scientific investigation.

CHAPTER 5

INTERVIEWS WITH FIRST-YEAR ENGINEERING STUDENTS

5.1 INTRODUCTION

5.1.1 The interviews and interviewees

While the previous chapter presented an objective view of student performance in retrospect, this chapter presents the students' own perspective of their performance in first-year Engineering, while they were still engaged in the programme. Evidence has been presented that BED matriculants performed significantly worse than WED matriculants. The interviews helped to explain why this was so. The aims of the interviews were:

(a) To identify academic and non-academic problems experienced by first year engineering students, in particular, black students and women, and to determine what effort students had made to overcome these problems;

(b) To investigate whether students who failed in April perceived themselves to be in need of assistance, and if so, what kind;

(c) To determine whether or not students would have been willing to change to a reduced-curriculum academic support programme (5-year plan) after the April tests;

(d) To investigate student needs and suggestions for improving the first-year programme.

The quantitative methods used in the previous chapter were unable to deal satisfactorily with categories of students where the sample size was small, such as female and African students. For this reason the interview sample was biased towards these groups of students as well as those who, by their

poor performance in the April and June class tests, showed signs of not coping academically.

To identify the latter target group a grid was made of the number of tests failed in April and June (Appendix 1). Each cell with address n/m contained the number of students who had failed n tests out of 4 in April and m tests out of 5 in June. For example, there were 7 students in category 4/5 which meant that they had failed all their class tests in April and June.

All students in categories 3/3 to 4/5, and all black first-year engineering student were sent letters inviting them to be interviewed, and were telephoned. Every student reached by telephone agreed to be interviewed. The author was introduced to the first-year class during an Engineering Drawing period, and invited students to participate in the pilot interviews used to test the interview questionnaire. Only two students, both white, volunteered and their interviews are included in the study. A week later the author again addressed students at an Engineering Drawing class and invited them to be interviewed. An attempt was made to contact students who had withdrawn from UCT after the April class tests. Only one student was reached in this way and interviewed telephonically.

The interviews were held during September and October 1989. Interviewees completed a 2-page questionnaire (See Appendix 2) giving details of their educational and family background, their activities since leaving school and information on accommodation and finances while at university.

The interviews were conducted in English by the author. The structure of the interviews was kept as informal as possible with students being encouraged to speak freely in response to open questions rather than sticking rigidly to a predetermined order of questioning. Responses were written onto the interview questionnaire during the interviews (See Appendix 3). As it was not possible to write down everything, a potential source of biasing of the data

was introduced by the author's decisions on which comments or remarks to record.

More than half of the African students, 40% of the black SA matriculants, and a third of all female students in the first-year engineering intake were interviewed (Table 35). Of the 27 female students in the class only 6 were excluded, 5 of whom were interviewed. (Table 36).

Table 35: Gender and population classification of interviewees

Pop Class	Male	Female	Total	% of SA Matriculants
African	14	1	15	63
Coloured	11	3	14	30
Indian	4	3	7	37
White	9	2	11	5
Total	38	9	47	16

Table 36: Female interviewees educational backgrounds and first year results (C89)

Educational Background	N	Credit Category (C89) <14	14-35	>35
AED matric 1988	1	1	0	0
CED matric 1988	2	1	1	0
IED matric 1988	2	2	0	0
WED matric 1988	3	0	1	2
Technikon	1	1	0	0
Total	9	5	2	2

Table 37: Interviewees educational backgrounds and first year results (C89)

Educational Background	N	Credit Categories (C89) <14	14-35	>35
AED Matric 1988	4	4	0	0
CED matric 1988	11	3	7	1
IED matric 1988	5	4	1	0
WED matric 1988	14	1	6	7
Postmatric year	3	0	2	1
Technikon/Tech college	8	2	4	2
Repeat matric	1	1	0	0
Total	46	15	20	11

Most interviewees (N=34) had matriculated in 1988 (Table 37) from segregated government schools according to their population classification. Four African interviewees were WED matriculants from private schools, (3 of whom had attended the Wits Engineering Faculty pre-university programme in January 1989) and two coloured students and one Indian student were JMB matriculants from private schools.

Eight interviewees, of whom 1 was female, had completed a Diploma at Technikon or Technical College. Two African interviewees had completed a postmatric year at private schools studying UNISA modules in Maths, Physics and Chemistry and had attended a 4-week pre-university drawing course at the Peninsula Technikon prior to registering at UCT. A third African student had completed A-levels at St Marks.

Table 38 gives the number of interviewees from each A/J grid target group category with the total number of students in each category given in brackets. Students in categories 4/4 and 4/3 were under-sampled compared to the other categories. Over 60% of the black students in the target group were interviewed.

Table 38 : Interviewees by A/J grid category

Category	No. interviewed (No. in class) A	C	I	W	Total	% of Class interview
4/5	1(2)	1(1)	2(3)	0(1)	4(7)	57
4/4	0(1)	0(2)	1(2)	1(4)	2(9)	22
4/3	0(0)	1(2)	0(1)	1(5)	2(8)	25
3/5	2(2)	2(2)	0(0)	0(2)	4(6)	67
3/4	1(1)	3(5)	1(1)	2(9)	7(16)	44
3/3	2(3)	1(1)	1(1)	1(6)	5(11)	45
Total	6(9)	8(13)	5(8)	5(27)	24(57)	42

Twenty-three interviewees, including 17 black students, were from outside the target group categories. This was as a result of the special effort made to interview black students. The proportion of interviewees from the target group who were excluded was substantially higher than the proportion of interviewees from outside the target group (Table 39). Fifteen interviewees were excluded, 13 of whom fell within the target group. It would therefore appear that the strategy of using the A/J grid to identify students with problems was successful.

Table 39: Target group and first-year results (C89)

Credit results	A	C	I	W	Total
(a) In target group					
< 14 (excluded)	3	3	3	4	13
$\geq$ 14	3	5	2	1	11
(b) Outside target group					
< 14 (excluded)	1	0	1	0	2
$\geq$ 14	8	5	1	6	20

The interview sample was not designed to be representative of the intake. As a large proportion of interviewees obtained poor academic results, the problems listed and suggestions generated by the interview sample could be

said to reflect the experiences and views of students who encountered serious problems in first-year Engineering at UCT in 1989.

It is difficult to assess how honest students were in their responses to the interview questions. The author, a white male staff member, interviewed a disproportionately large number of black and female students. This meant that there were at least four potential levels of resistance to be overcome, i.e. researcher/researched, black/white, female/male, and student/staff. Instances where the author felt this may have interfered with the interview process are mentioned in the course of this chapter. In an effort to reduce this resistance the author spent several afternoons talking to first-year students about the research. The fact that he did not teach or tutor any of the interviewees was an advantage as students may have been reluctant to be open about their views with one of their lecturers or tutors. Another positive factor may have been the author's association with ASPECT which had developed a reputation for assisting and advising black students.

With a few exceptions, white interviewees gave brief replies to most of the open questions and had few suggestions on what assistance would be of help to students. In contrast most black students, particularly female interviewees, spoke at length of their experiences, and made several suggestions.

5.1.2 Reasons for studying Engineering

A high proportion of black interviewees said that Engineering had not been their first choice of study. Six black male students gave Medicine and one Sports Science as their first choice of career. An eighth black student gave the following explanation of how he came to be studying Engineering:

> At school I didn't know what I wanted to do with my life. I spoke to the guidance counsellor... advised Commerce, Engineering and Law and left the choice to me. I applied to Dentistry at Wits. I applied and was accepted for Commerce at UCT. I decided to come to UCT to

> experience life away from home. During registration week I don't know how I decided to register for Engineering. [IM2][7]

One white male student said

> My parents advised me to do Engineering because I have always designed things... I was never keen to become an engineer because of the destruction of the environment [WM1]

One black and one white female student said that Engineering had not been their first choice of career. The white student had completed a Diploma in Engineering and had wanted to study Geophysics but could only find sponsorship for Engineering. The black female student had wanted to study Physiotherapy but had changed her mind after attending an Engineering talk at UCT.

Amongst all white male students the main reason given for studying Engineering was an interest in building or fixing things and knowing "how things worked" while only one female and one African student mentioned this as a reason for choosing to study Engineering. Interviewees also spoke of the influence of information obtained from universities (8) and schools (8), and the availability of bursaries (3) in their decision to study Engineering.

Advice from family members or friends who were engineers or in technical professions, or who were at university, appears to have been the major influence in the case of 10 students and was the factor most frequently

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7 The system of numbering interviewee quotes identifies both the population classification and gender of the interviewee, eg. IM2 - an Indian male student; WF3 - a white female student; AM8 - an African male student etc.

mentioned by African interviewees. A student from Transkei, whose brother was doing a B.Sc. Degree at Fort Hare, explained that:

> I chose because of my brother's advice of Medicine or Engineering. I heard Medicine was the toughest so I didn't choose that one. I enrolled for Chemical Engineering without knowing what it is. [AM4]

Other factors mentioned by black students were the activities of companies (5), good career prospects (3) and information on Radio and TV (2).

5.2 CASE STUDIES

5.2.1 Introduction

The following case studies present as accurately as possible the description given by one WED matriculant and three BED matriculants, of their experience of the first-year Engineering programme. The case studies were selected from interviewees who were 1988 matriculants, who had experienced a range of problems, and who spoke freely and fully about these problems. Students with different backgrounds were selected but it is not intended that these case studies be seen as typical or representative of any group of students. The students' real names have not been used. The personal details of the four students are compared below:

Names	Lindiwe	Johannes	Alli	Jeremy
Gender	Female	Male	Male	Male
Pop Class	African	Coloured	Indian	White
Age	18	18	18	18
Home	Kwa Thema	Cape Town	Lenasia	Cape Town
Home language	Zulu	Afrikaans	English	English
Matric Dept	AED	CED	IED	WED
Matric year	1988	1988	1988	1988
Matric aggreg	C	B	B	C
Matric points	47	52	49	46
Engineer Dept	Civil	Mechanical	Chemical	Electrical

5.2.2 LINDIWE

Lindiwe was an African student from Kwa-thema. Her father worked as a clerk, having passed Std 8, while her mother, who completed Std 6, was looking after the house and family. The only family member with a degree was an uncle, who had a B.A. Degree in Agriculture. She matriculated in 1988 from a school under the DET with B symbols in English 2nd language and Maths, a C in Zulu 1st lang and D symbols in Physical Science, Biology and Afrikaans 2nd Language.

"At school I was a PROTEC[8] student and we had site visits and talks. In 1986 we visited LTA. They were busy building a bridge. I really liked that. Then we spoke to many engineering students and visited a whole range of factories and mines. In 1988 we went to the Wits Engineering Faculty Open Day."

As a result of this exposure to a career in Engineering she applied to study Civil Engineering at UCT. She was accepted and obtained a full scholarship from the SA Institute of Race Relations.

"The people I spoke to only told me the good parts and never told me the difficult parts. It is very hard... At first I was very confused and got lost. The map was very confusing. They tell you all these things in the first week. The meals were terrible, I missed home cooking. I was very homesick and had to call my parents many times... There was also the problem of the weather. It made me depressed especially the rain in winter and getting wet.

"I managed to make friends in the second week but the first month was bad. Everyone was shocked that I was doing Engineering because I was a woman,

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8 The Programme for Technological Careers (PROTEC) is a career development organisation that works with DET high school students.

but they encouraged me. I thought I'd meet another black female student doing Civil that I could talk to or relate to.

"[On my]first day of lectures I couldn't follow the Physics [lecturer] but grasped a bit. I discovered he'd done the whole chapter in 45 minutes. I was shocked. Mr B's pace was too fast, a chapter a day... I had no experience of a lab before and couldn't do my experiments right... Everyone else could manage. I messed up the first practical. It was the first time in a lab, for Chemistry too... I had no background in Calculus so I couldn't follow the lecturers and couldn't cope with the pace... Maths was my favourite subject but I couldn't relate to anything. She kept saying 'You know this... you've done this'. I felt angry, inferior, [as if] I don't belong. I fell behind. I couldn't understand [the textbook] Swokowski. By the end of the first term I was very far behind."

In April Lindiwe failed the Chemistry and Applied Maths tests.
" I couldn't write [the] tests in 45 minutes. The questions used to take me hours. The major problem is the pressure of time ... I'd never failed at school. I felt I didn't belong here and wanted to go back home. I phoned my parents. I felt frustrated and depressed. There was also the pressure of losing the bursary.

"After the April tests I felt I needed extra lectures in Applied Maths and Physics and someone to go through the tutorial with me in Applied Maths. In Drawing, we need extra drawing sessions. I didn't understand my Engineering Drawing lecturer and so couldn't do any of the worksheets without help from friends... It confused me. I think I needed background in drawing... I feel that black students need more help but it may be a problem with everyone. ... [I needed] More tutorials in Chemistry and more demonstrations of what must be done in practicals and more explanation of how to do the write up, how to reach a conclusion. Not such a short pre-prac."

When asked whether she would have considered changing to a 5-year plan after the April tests, she replied:
"Yes, it would have been a solution... others are in a rush to finish in 4 years. They wouldn't want to change. I'm not interested in the length of time... When I speak to ASPECT students I feel maybe I should be doing this. Thandi (a female ASPECT student) gave me the feeling that it is the solution. My bursary officer said he would have been willing to pay for ASPECT."

In June she failed all 4 class tests and the exam in Chemistry.
"[After June] I consulted senior students for help and advice and spent all my vac working with friends from other universities... [The] lecturers suggested changing courses, or dropping courses. I went to talk to the bursary co-ordinator. She suggested I change to the half course in Maths and go and see Mr S [student counsellor and Engineering Drawing lecturer]. Mr S suggested I drop Drawing, so I did that."

By September, Lindiwe had withdrawn from Engineering Drawing, changed to the half-course in Maths and had a supplementary examination in Chemistry. When asked how she thought she would do at the end of the year she replied:
"I don't think I have solved my problem. I'm battling to get my DP[9] in Applied Maths and Physics... I can understand the [Physics] lecturers best. I can do the tuts. I [still] have a problem with the practical experiments... I will pass Maths 101S and Water Chemistry and try and pass Physics and Applied Maths [but] it's just my speed."

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9 Students have to obtain above a minimum level in class tests and work during the year to qualify for a "duly performed" (DP) rating and be allowed to write the final examinations in each course.

At that stage she was also worried about vacation work.
"I have applied to many companies. They refused. I lost hope. I talked to PROTEC and the assistant bursary manager. PROTEC people have found me a job."

A few weeks after the interview, Lindiwe completed a questionnaire as part of this study in which she chose the following as the most important suggestions to assist first year engineering students; special tutorials for people who have never done Engineering Drawing and more Engineering Drawing tests; pre-Engineering lectures in January or February; clearer explanations of Chemistry and Physics practicals; clearer explanation at the beginning of the year of what to expect and, more tutorials in PHY102W, CEM108F and computing.

She added a few suggestions of her own.
"Inform students about ASPECT after the April tests... maybe Engineering Drawing should be a second-year course, maybe there should be less courses."

In the final exam Lindiwe passed the half-courses in Maths and Water Chemistry as she had predicted, but failed both Physics and Applied Maths. She did not write the supplementary exam in Chemistry and was excluded from the Engineering Faculty.

In correspondence with the author she described how she felt at the time.
"I lost all my confidence. I felt stupid and a failure in life. I thought it was the end of the world for me - no one can talk to a varsity drop-out. I lost my sponsor and all my friends turned away from me. My parents were very supportive and understanding, that's the only thing that helped me survive. "

She spent a few months at home and her family paid for her to register for a Diploma in Civil Engineering at the Peninsula Technikon in the second

semester of 1990. She passed all her courses, and obtained sponsorship from PROTEC to continue her studies in 1991.

5.2.3 JOHANNES

Johannes was an Afrikaans-speaking student living with his parents in Elsies River, a working-class suburb of Cape Town. His father worked as a driver and had completed Std 8, while his mother was at home having completed Std 5. His family was paying for his studies but he hoped to get a bursary for the following year. The only family member with a degree was an uncle with a BA degree and a Bachelor of Education Degree.

He matriculated in 1988 from an Afrikaans-medium school under the House of Representatives (Coloured Affairs) obtaining A symbols for Maths and Biology, C symbols in Physical Science and English 2nd Language, and D symbols in Afrikaans 1st Language and Geography.

"At first I wanted to do Medicine but I couldn't get a bursary so I decided to do Engineering. I read the [UCT] Prospectus and Mechanical Engineering appealed to me."

"Nothing happened that I expected. I never thought of university being this hard. The work is very difficult and there is a large workload. I didn't know anyone and my home language is Afrikaans and sometimes I couldn't cope... Language was a block. I can't think of a word to say so I rather leave it. It was a problem making friends. I only began mixing with people after the July vac... The explanation at the beginning of the year I didn't understand. I was lost and too shy to ask. One doesn't feel free to talk to people because of the cold atmosphere... Everyone is so professional. They treat you like you are part of a machine, not like a human being. It's very cold. The procedures to quit a course, or if a student card is lost, is too much. It scares you... One has to adapt to UCT, being one out of 300 students."

Johannes found everything so intimidating that he was unable to deal with even small problems.
" I didn't know where to go to for the Maths pracs. It was written on the board but I didn't know which one. I was told to go to Dr G. [but] I was too scared to go. It took me two weeks to get myself together to go to him."

Living at home he had problems finding a place to study.
"I study in the kitchen, so I usually study at night or in the library and I can't concentrate on the weekends... I had to leave at 7am to get to Physics at 8.10. When I get there the place is so full so I can't take notes - I dropped out of Physics before June because of that."

Chemistry was his worst subject. He hadn't liked it at school and he found the pace too tough. With Maths, "it's a personal thing. I've always liked Maths. I couldn't cope in the beginning. Only after June I started coping."

He failed all 4 class tests in April.
"I realised I didn't have any idea of what was going on... I didn't understand the questions, especially in Maths. I didn't know how to answer... I got depressed... I worked harder, spent more time. For example I began using the library when I am free. I never considered leaving. I want to break out of the cycle in my family."

When asked whether he would have changed to a 5-year plan if he had been advised to do so after the April tests, he replied:
"Yes, I would have dropped Physics immediately. I felt I didn't have enough time, then I would have had more time to concentrate...I didn't know what would happen if I dropped a course until after June."

In June he again failed all class tests and obtained a supplementary exam for Chemistry.

"I was very depressed because of these results. I thought my parents feel I was wasting their money. My mother encouraged me to carry on and not drop out. My father was not interested... [After June] I decided to leave Physics because I had missed so much, especially practicals. I spent more time [studying and] stopped going to disco's.

"I prefer to work alone [but] I started asking people. In the past I wouldn't want to ask anyone... At the beginning I didn't feel free to ask the lecturer a question... After June I began to go up to the Maths lecturer after lectures. Mostly I feel I must sort it out [on my own]. I didn't want to go [to student counsellors] because of all the procedures."

In September Johannes was asked how he felt about the end of the year exams, he said, "I feel I am coping with the subjects I have left now. I will make it in Maths and possibly Applied Maths."

Looking back over the year he had the following suggestions:
"[Lecturers should] watch the test marks of students and try and speak to students who look like they are struggling. If I had someone to explain where to go to, someone to speak to me, to explain to me what is going on. I had many questions but no-one to ask, I was too scared... Lecturers should try and motivate the students more. The 'I don't care a damn' attitude of lecturers puts one off. They say if you don't understand it's your problem. Often one can't even make out the handwriting. They don't try make the lectures exciting... [They] should spend a bit of time telling students about problems students had in past years so they can know what to expect."

He had never considered transferring to Technikon.
"I think that kind of training is not for me. There's very little understanding [required], just using formulas."

At the end of 1989 Johannes passed Maths, Engineering Drawing and Introduction to Engineering, but failed supplementary exams in Applied Maths and Chemistry. He obtained a total of 16 credits and was allowed to continue into the second year. In 1990 he passed the remaining first-year courses and one second-year half-course, obtaining a total of 25 credits.

5.2.4 ALLI

Alli matriculated in 1988 from a school near his home in Lenasia. His father was a qualified teacher with a degree in Fine Arts, but worked as a sales representative. His mother had matriculated and previously worked as a teacher but was at home looking after the family.

Alli had written the House of Delegates (Indian Affairs) matriculation exam obtaining an A-symbol for Biology; C symbols for Mathematics, Physical Science, English 1st language and Accounting and a D for Afrikaans 2nd language.

"I didn't work too hard at school. I was interested in Chemistry as my father was a Science teacher. In Std 9 I decided to do Chemical Engineering. I spoke to a friend at Wits who explained what it was."

He had been unable to obtain a bursary so his family and a family friend paid part of his fees and UCT helped raise a loan for the rest. The first-year programme had not been what he had expected.
"I didn't realize it would be that difficult. I came planning to fish regularly but there is no time. I didn't realise I would be working every afternoon... Most of my friends are not doing Engineering. They have a lot of free time and are always going out partying. So I went with them."

In April he failed 3 class tests, and only passed Chemistry.
"I was shocked and depressed. It was the first time I had failed so badly. I was afraid it would get more difficult. I was too depressed to go to student

counsellors... I didn't realise what was expected of us. I didn't do anything unless I had to hand it in... I needed someone to explain what is needed of me, how to work. I need more guidance in tuts... I was scared to ask because they will think we are babies or something. Possibly a phone number for tutorial advice would help.

"I developed very bad study habits from school. Also living at the [self-catering] flat [means] having to prepare my own food, shopping, takes a lot of time... There's no-one to wake me up for first lecture... I would rather go into res.

"I felt I am letting my family down by failing. I am the eldest, the role model for my brothers and it's costing a lot of money. I have applied for about 20 bursaries for next year and all have refused."

At that stage though, he would not have dropped a course.
"I'd feel it's much too early in the year to start dropping courses. I knew I hadn't worked hard enough. If I dropped courses how would I be able to apply for a bursary. Will I be able to afford a 5-year programme?... Only students who have full financial support will be able to accept that... I want to work as soon as possible."

The course that gave him most problems was Physics.
"It's first lecture... I wasn't aware of the work required. The tuts are every 3rd or 4th week so there is no-one to help really... [In Chemistry] one can understand what is happening. There is a lot of help in the form of tuts to be handed in and fully worked solutions are given... In the first half of the year I developed a negative attitude to Engineering Drawing. I never did proper drawing at school."

" [The Chemical Engineering student counsellors] would just speak to us in general. I spoke to Mr R [the Maths lecturer] about Maths. He said I must just work, so that wasn't any help."

In June, Alli failed everything except Engineering Drawing. He had serious doubts as to whether he was going to cope with the course. During the second semester, he started attending tutorials and practicals every day. He went to the 5th period tutorials in Maths and sat in on the MTH101S lectures during lunch for revision. He formed a study group with two friends and cut down on his social life.

By September he was unsure how he would do at the end of the year.
"I feel I might pass. I just have to work all the time. I'm uncertain about Physics and Applied Maths."

He had the following suggestions to make:
" There should be a pre-orientation course of about 2 weeks to get people ready for the year. Run an introductory course, the year is too short as it is. One knows about the first year dropout rate but you think they didn't work. In Orientation Week they should explain to students how much work we should do, how to use tuts, and not to compare with other students. Different faculties should co-ordinate their tests and tut-sheets so that they are not one on top of each other.

"When we applied to companies like SHELL we were asked would we like a bridging course but we didn't know what that meant. Many of us would like to do ASPECT. There is more time and the bursary gives more financial security. I would have worked much harder."

Alli failed everything and was excluded at the end of the year.

5.2.5 JEREMY

Jeremy was a white student who grew up in Kempton Park but had moved to Cape Town where he completed his Cape Senior Certificate at a Technical High School in 1988. He obtained a C aggregate with an E for English, D

symbols for Afrikaans 2nd language and Mathematics, and a C for Physical Science.

He lived at home in Pinelands with his father, a transport Engineer, and his mother who worked as a secretary. His father had qualified with a Diploma in Road Transportation, while his mother had passed matric. He had obtained a part-bursary from Mobil and his parents were financing the rest of his expenses.

He remembered deciding to be an Engineer in about Standard 5.
"I am interested in fixing things, it's my hobby. I always wanted to do Engineering."

The first-year Engineering programme had been as he had expected it would be, except more difficult. He said the work had been very tough and "very different from school". The only problem he had encountered was getting used to the huge lectures and the workload.

Although he reported failing 3 courses in April, he had only failed Chemistry and Maths.
"I wasn't too pleased about the results and decided to work harder and get some extra help... The Departments should have mock papers so that students know what to expect in the tests."

He would not have considered changing to a 5-year reduced curriculum programme at that stage.
"I felt I had to work harder and could do it... All my friends felt try harder next time... Rather introduce this programme after June. "

By the time the June exams arrived he felt he wasn't coping.
"I was worried about getting good marks because of the bursary. I didn't know what to expect in the tests and exam. I went to the library and got past papers."

In June he passed everything except Maths, the course he found most difficult to grasp.
"After June I went for private lessons in Maths. It's helping. I thought of changing to [the half-course] MTH101S, but I heard that MTH105W is a pre-requisite for the second-year Electrical courses. Drawing was the easiest course because I did it at high school."

The only members of staff he went to for assistance were the Physics tutors who he said were able to help him. He felt there should more tutorials for Physics. At the time of the interview he said he was feeling more confident in most subjects except Physics and Maths.
"I may get a supp in Maths but should pass the rest."

At the end of the year he obtained 20 credits with supplementary examinations in both Maths and Applied Maths which he failed. In 1990 he passed these two courses and one second-year half-course, MAT203F obtaining a total of 20 credits.

5.2.6 Summary
The three black first-year engineering students came to UCT with good academic records and shared an experience of alienation and confusion during their first few weeks at university. In contrast Jeremy, a white matriculant, made no reference to experiencing feelings of this kind, or any non-academic problems.

Lindiwe's experience points to the importance of the role of organisations like PROTEC and Engineering Faculties themselves in motivating "non-traditional" students to study Engineering. Johannes' and Alli's motivation for studying Engineering was less clear although Johannes seemed driven by a desire to break out of the socio-economic class of his family. For Jeremy,

Engineering was in the family and he saw it as a logical progression from his hobbies and interests.

Lindiwe had to deal with homesickness, and lack of female companionship. Johannes experienced shyness, problems speaking English, together with inadequate studying facilities and problems with transport to UCT. He was also severely intimidated by the strangeness of the institution. Alli suffered from a lack of preparedness for the amount of work involved, and the influence of his non-engineering friends who were always "partying". In the opinion of these students, these problems clearly affected their academic performance.

Johannes' non-academic problems dominated his account of his experiences, and he made very little mention of academic problems. Alli's academic problems seemed to be a result of poor study habits, and lack of self-discipline. For Jeremy the problem appeared to be that he had not worked hard enough.

In contrast Lindiwe felt academically unprepared for the work. She had had no experience of laboratories or experimental method in Physics or Chemistry, and had no background in Calculus or Engineering Drawing.

All except Jeremy felt that they had needed more information and help in finding out how the university works and what was expected of them. By April both Johannes and Lindiwe would have been willing to change to a 5-year plan. While Lindiwe sought solutions in the structure of the curriculum, by dropping courses and suggesting more tutorials, Johannes and Alli said they had needed more counselling and motivation from the staff.

Johannes was able to overcome his problems and avoid exclusion at the end of the year. Despite his initial low motivation for studying Engineering, his determination to break out of the social conditions of his family appears to

have been a significant driving force. The only action he mentioned besides working harder, was to overcome his shyness, come out of his social isolation and start to make friends and approach staff for help.

The experiences and problems of these four students were by no means unique as will become clear from the analysis of interviews presented in the rest of this chapter, and the results of the survey in Chapter 6.

5.3 NON-ACADEMIC PROBLEMS

A wide range of problems which had their origins in non-academic factors were mentioned by most black interviewees. White interviewees, and those black interviewees who had attended private schools mentioned very few problems of this kind. Most of this latter group had attended a pre-university course at Wits Engineering Faculty, lived in residence and were financed by scholarships.

5.3.1 Living away from home town

The intimidating effect of the institution on new-comers, so vividly described by Johannes and Lindiwe and referred to by other black students, was compounded for seven interviewees by the experience of living away from home for the first time. They spoke of suffering from severe homesickness and having to adjust to the loss of support of their families and friends.

> Being far away from home. I don't have moral support. No letters or telephone calls from home. I was very homesick. [AM4]

> Leaving home and not seeing my parents was difficult. The first night here I cried myself to sleep. I was glad in a way but it took a long time to get used to being away. [CF1]

> At the start we didn't know where to go to or what to do... The first two weeks were terrible. I cried for two weeks. [CF3]

> The first few days I was very confused. The time we had to get to know the place was too short. I still don't know this place. [AM2]

> When I arrived here I was longing for home. It took a while to socialise with other people. In my first weeks here I couldn't understand most things. I thought that this was not the right place for me. [AM9]

Finding accommodation was a serious problem for several (5) black students from outside Cape Town.

> Only when I got here was I told there was no accommodation. I had to look for a place to stay. In the first semester I stayed in Fairways. Five of us had to share a room. The family weren't really prepared to accept the responsibility that came with providing accommodation. There were misunderstandings. Studying and the TV is making a noise [was a problem]. I kept trying to get into res. The Student Advice Office helped a lot. I knew someone working there. [AM2]

> I came late on the Monday of registration week and I didn't know anything about the courses I could do. I didn't attend anything concerning Engineering as I was busy finding a place... When I came here I was told I didn't have accommodation. I had to squat illegally in the res at first. I couldn't find good accommodation. Student Advice Office helped me to find a place in Rylands but I didn't have the money to pay. It didn't work out. When I paid late I asked for the food to be improved so then they chased me away, so I came back and squatted. Then I found a place in Fairways but the travelling was a problem. After a month I got a place in res. [AM3]

> When I first came here I had a problem with accommodation. They said I was on a waiting list. For two weeks we went to Glencairn every day with a minibus. There were about 30 of us staying in hotels. It was organised by Student Advice Office. I couldn't study there. I couldn't buy books as there was no place to put them. Our luggage wasn't safe. [AM8]

When accommodation was available, it was often not conducive to studying. A student boarding with his uncle explained that,

> My aunt doesn't actually want me there, but she won't tell my uncle. I feel unwanted so I work at UCT as late as possible. [CM4]

Severe personal problems were mentioned by 4 students all of whom had homes outside Cape Town.

> The problem of being away from home really affected me...My wife and I could not cope with the distance. There were big problems. She was jealous of me and I was jealous of her. I had to go home in April... After I went home things were sorted out. [AM14]

A black female student who was eventually excluded explained that

> Personal problems had a major effect for about 2 months after the June vacation. I stopped attending lectures and had no motivation to work. It has sorted itself out now. I didn't get help. I missed the third quarter. [IF1]

Another student [IM2] from Pretoria missed 2 weeks of work during May when his father fell ill and he had to go home and help with the family business. He missed the Chemistry practical exam and was refused a DP. He was also excluded at the end of the year.

A white student from the Transvaal who passed in 1989 but was excluded in 1990, missed several weeks through illness and experienced a conflict between his obligations to his girlfriend and his work.

> I came to Cape Town with my girlfriend and she had to find work. She doesn't know anyone here and I feel responsible for her. We are planning to get married... I hardly worked over the weekends because of my obligations to my girlfriend. [WM9]

5.3.2 Living on or off campus

Twenty interviewees, including 12 coloured and 6 white students, had homes in Cape Town. All lived at home, except for 2 coloured students, one of whom stayed in residence and the other boarded. Most of the students from outside Cape Town were staying in residence except for 3 white students, 1 coloured student and 1 Indian student who were boarding or sharing with friends.

The main problems mentioned by students living off campus were transport to UCT, lack of study facilities and having no one to work with.

The problem of transport was mentioned by 8 students, including 2 white students, who lived in places such as Elsies River, Surrey Estate, Bellville, Fish Hoek, Fairways and Durbanville. They reported having to travel for between 2 and 4 hours a day, and found it difficult arriving in time for Physics in first period, as was mentioned by Johannes.

> I wait at the bustop and the full buses go by. [I am] Always late for first period, Physics. I haven't been able to hand in problem sets at ten-past-eight on Fridays. [CM10]

Inadequate study facilities were a problem for 4 students living at home and 3 students who were boarding.

> I can't study late at night in the library then the travelling is difficult, so I have to study at home in the living room when people are asleep. The family watches TV in the lounge. Sometimes they agree to watch in the bedroom. [CM2]

> I share a room with my brother in Std 9 and we have to share a desk. [CM5]

> I study in the kitchen so I usually study at night or in the library [CM9]

For some students, living in residence had its problems.

> Res is not a solution for me. I'm vegetarian and halaal. I have to go out to eat and buy take-aways every night. [IF1]

> I have a problem sharing a room. My roommate is doing Social Science. There are many functions, videos and distractions at Leo Marquard Residence. [AM4]

5.3.3 Financial Problems

Sixteen interviewees, including 13 African students, were on full bursaries, 14 students were being financed solely by their families, and the rest by a combination of family, loans and part-scholarships. Problems of a financial nature were mentioned by 17 students, including one white student and two students on full bursaries.

Only a few students experienced a shortage of money to live on. In the case of one African student [AM8], money for living expenses had not been included in his bursary. Another African student, whose mother worked as a domestic worker and whose father was deceased, was almost destitute when he arrived in Cape Town. A friend had promised to raise money through a

bursary scheme but this had fallen through. He eventually received a part-scholarship and loan through UCT.

> When I came here I was told I didn't have accommodation... Students Advice Office helped me find a place in Rylands but I didn't have money to pay... I couldn't afford textbooks. I only bought the Physics textbook late in April. I am lucky I am a Christian. Some guys from this Christian group Life Ministry helped me, lent me money. I still owe them. I applied for a lot of companies and bursaries... I'm not the only one facing financial problems. Try get financial assistance to first-year students. [AM3]

Another black student explained that

> My sister is financing me and sends something every month. I am constantly thinking of where I'm going to get money, even busfare. [CM7]

Ten black students were worried about finances for the following year, while two students spoke of how aware they were of the money that would be wasted if they failed. A student who was failing and on a full scholarship [CM4], spoke of the anxiety of having to tell his bursars his results. He was excluded at the end of the year.

A student who had failed to obtain a company bursary, was living at home and being financed by his father [CM11]. His relationship with his father had begun to deteriorate when he realised that he would not be able to pass everything. On the advice of a student counsellor he visited the Peninsula Technikon and decided to leave UCT and register there.

Only one white student [WM9] mentioned being worried about finances because his father had to support himself, a sister studying in the USA, and one at Wits Medical School.

5.3.4 Language-related problems

While the majority (22) of interviewees spoke English at home, other home languages included Afrikaans (7), Zulu (6), Tswana (3) and nine other languages.

Seven interviewees had been taught at school through the medium of Afrikaans. Four of these students mentioned language-related problems of the kind described by Johannes. A large part of these problems appeared to be social and had to do with the students' confidence in their new environment, and their ability to make friends and make themselves understood. Added to this was the anxiety of not being able to understand the academic work.

> It was difficult to mix with other students talking English all the time but by June I had made some friends... I was worried about the language. What happens if they ask words I don't understand in the exams? [CM2]

> The language [problem] was very bad at the beginning. I didn't know what they were talking about. I didn't know what to do. I must translate everything. It took about two months. I got support from my friends from Paarl. [CF1]

Suprisingly only one African student said that language was a problem for African students in general.

> Black [African] students feel shy in class because of the medium of instruction. I won't speak in class, but I will talk to lecturers afterwards. [AM14]

Either the language related difficulties experienced by African students at university are exaggerated by the academic community (Young 1978,

Buthelezi 1984, Starfield 1985) or there was an unwillingness amongst African interviewees to acknowledge them. Having already succeeded in secondary school through the medium of English, it may have appeared to African students that any admission of inadequacies in this regard would have been interpreted as an admission of an inability to cope at university.

In contrast, Afrikaans interviewees spoke freely about their language difficulties. As UCT was their first experience of learning in a second language they would have been expected to experience problems and this might explain why they spoke about them more easily. It would appear from the results that most of the Afrikaans-speaking students, like Johannes, were able to overcome their language-related difficulties. Only one interviewee in this group was excluded at the end of the year. This particular student explained that,

> At first I thought my being Afrikaans was going to be a problem, but it wasn't that bad. I used a dictionary a lot. [CM4]

Another aspect to consider is that Afrikaans-speaking students who choose to study at an English-medium university could be expected to have a high degree of motivation and determination to overcome any anticipated language difficulties.

5.3.5 Social problems

Many of the social problems referred to in the case studies were mentioned by other students i.e. problems of making friends (4) and having no time for a social life (4) contrasted with the apparent continual partying by non-engineering friends (3). A student for whom the biggest problem was finding friends to work with said,

> I was very alone. Didn't know anyone in my classes. Only got to meet people during the second semester. [AM5]

A student who had been a top academic student at school as well as an outstanding athlete, member of the SRC, and of various societies, described how he missed these aspects of life at UCT.

> [It was difficult getting used to the] changed environment. I'm not involved in any extra-curricula activities. At school I was very active. Here there is not time. For the first six months I had to struggle to get used to this place. [IM4]

The following quotes imply that the experience of black and white students living and studying together may have been difficult for some students, although this was not explicitly referred to by the other interviewees. A student who had spent a year at a white private school doing a post-matric explained that,

> For most people the problem is adjusting to UCT... In Freshers' Week the things happening are strange to black guys from the townships. It seems only for white guys, like beer gardens. Most black guys stay away. Only went on tours of the university... The black students don't have access to transport to organise their own outings. Black students at Smuts wanted to go to Table Mountain and could not get a bus. [AM1]

A second student remarked that

> I was lucky to come into UCT from a private school. I'm used to interacting with whites. [AM10]

Either the black interviewees in general had not experienced problems in their interactions with white students and staff, or they omitted to mention these in the interviews. If the latter was the case it may have been because

the interviewer was white. Black students may have spoken more freely about problems of this nature to a black interviewer.

Only two white interviewees referred to problems of a social nature and in both cases they had appeared to be primarily related to motivation and self-discipline.

> [There is] too much freedom... I never studied at school so I haven't been studying here... I never attended lectures at the beginning. Maybe lectures should be compulsory for first-years. I just had a jol and didn't work... Wasn't worried [because of] peer pressure, everyone laughs and jokes around. [WM3]

> I've had doubts about being an Engineer and I missed my parent's support. At school one was threatened. Now one is working for oneself. When I get things that don't seem relevant... it's difficult to motivate myself... It's a matter of getting used to the new environment. [WM3]

5.3.6 Issues raised by female interviewees

Five black female interviewees spoke of their experience as female engineering students. As was mentioned by Lindiwe, an initial problem was the reaction of other students to women studying Engineering. This reaction tended to come mainly from students outside the faculty.

> In the faculty it is fine being a woman but on campus people feel I'm a freak. [CF1]

> Non-engineering students tend to undermine me because I'm a woman doing Engineering they don't think I am serious. [F1]

> Some of the guys keep at me. Why am I doing Engineering it's a man's field. I ignore them. After I showed them I can do better than them especially with Drawing, then that stopped. [F2]

One women [F2] mentioned that she had been restricted in her choice of engineering discipline as the bursars she had applied to would only sponsor women doing Chemical Engineering. Another spoke of problems finding work, but her remarks suggested that she felt she was discriminated against because she was black rather than female.

> I can't find vac-work. Who wants a coloured woman engineer? After I graduate I may rather go work overseas than cope with this. All the white women have found jobs. It would be nice if varsity organised places for us to work. [CF3]

Many female interviewees said they were at a greater disadvantage than male students with respect to understanding Engineering Drawing. This will be discussed in the next section.

Both of the female interviewees who passed all their courses were WED matriculants from Cape Town and lived at home. The one, an Indian student, had written JMB at a private school. Of the 5 female interviewees who were excluded, 4 were BED matriculants in 1988, and one was a white student who had already completed a Diploma in Engineering. Three of the five were registered for Chemical Engineering, the most demanding of the Engineering curricula.

All 4 female interviewees with homes outside Cape Town and only 1 of the 5 female students from Cape Town were excluded.

5.3.7 Summary

Non-academic problems featured only marginally, if at all, in the account given by white interviewees, or WED matriculants, of the first-year Engineering programme. Only one white student mentioned having to deal

with several non-academic problems, while two mentioned problems of motivation and two mentioned travelling problems.

In contrast, all of the black interviewees, except the few black WED matriculants and those who had completed a postmatric year, experienced several non-academic problems.

For students living at home in Cape Town the problems appeared to be mainly transport and travelling to UCT, lack of adequate study facilities, and not having easy access to other students. Students from outside Cape Town faced the physical problems of finding accommodation and adapting to the conditions in residence, while at the emotional level there were also the problems of loneliness, severe personal problems and loss of support from family and friends.

While a few interviewees had experienced severe financial difficulties, most of those who mentioned finances were insecure about funding for the following year and the rest of the degree.

Language-related problems were mentioned by most Afrikaans-speaking interviewees but by few African interviewees.

The interviews suggest that female engineering students in general, but black female students in particular, experienced problems as a minority in the overwhelmingly white male environment of Engineering. The high failure rate amongst female students with homes outside Cape Town needs further study. The lack of emotional, social and academic support from their families and from other students, could be one of the factors associated with this poor performance.

The impact of the problems described in this section are difficult to measure but they clearly affected the emotional and psychological well-being of most of the students interviewed.

5.4 ACADEMIC PROBLEMS

5.4.1 General

Academic problems were mentioned throughout the interview and in response to an open question on problems (Qu A.3).

Almost half the sample (21) replied that there was too much work or too little time. Ten students said the work was too difficult, while four mentioned that they had not known what was expected and had not been working.

> I just didn't know what was going on. Bombarded with work from all sides. They work very fast. [CM3]

Lindiwe's frustrations with lecturers' expectations that she had covered certain sections of work at school were echoed by five other black students.

> Staff assume you know the stuff, especially practicals in Physics. I don't know where I am supposed to know the stuff from. [IM4]

> In Maths they assume you came across things at school and we never did. [AM2]

> I was weak in Chemistry at school. The lecturer expected one to know the school work. [AM12]

Problems with the lecturing in general were mentioned frequently.

> Often one can't even make out the handwriting on the board. They don't make the lectures exciting. [CM9]

> Improve the way the OHP is used - it's a problem. [AM9]

> If [only] the lectures were presented in a different way, in a way that tries to make the link between high school and university. [AM3]

However most of the criticisms of lecturing were levelled at particular courses and are presented in the next section. A few (4) remarked that the lecture theatres were too big.

> The lectures are so big. I was always at the back. Most of the time I couldn't hear and I'm short-sighted. When it's hot I'd fall asleep. [WM9]

> I was frightened at first. So many people in a lecture. It troubled me that the lecturer didn't know me. He didn't care... [But I like the fact] that I was treated so adult-like. At school we were still seen as children. When I came here I was called Ms B. It made me feel more responsible. Lecturers expected you to work by yourself. I liked that. It was a challenge. [CF1]

Several (5) students were critical of the way the practicals in Physics and Chemistry were run.

> Make the practicals more useful. No-one knows what's going on or why they are doing what they must do. [CF2]

> Practicals - I hated. Demonstrators wanted to go home early once and offered extra marks for those who finished early. Practicals must be more clearly linked to the theory we do in class. It is often out of phase and we didn't understand and just do what we are told. [WM7]

> Practical parts of the course are too separate - they need to be more closely fitted. [CM10]

> [In Physics] practical sessions take too long and don't count enough. [WF1]

> I thought the [CEM100W] practicals would give more insight. Practicals didn't teach much. [AM6]

While one white student said she had difficulty adjusting to university after studying at Technikon, two black students spoke of the problems of adjusting from school to university.

> I was told first year would be tough and about the gap between school and university. I didn't expect the gap would be that big. I feel I wasted my time at school. [CM5]

> The transition from standard ten to varsity was shocking. [CM2]

An African student ascribed his problems to his disadvantaged educational background. He had served an apprenticeship before coming to UCT. His father was a manual labourer with no formal schooling while his mother had completed Standard four and looked after the family. His problems were further complicated by the fact that the Maths syllabus had changed since he had matriculated in 1984.

> At the beginning I thought I just had to work hard. But now I think that the background and schooling is affecting me, considering the discrepancies between education systems... One works very hard, sits with books and just don't understand - particularly with Maths... In Maths they assume you came across things at school and we never did. [AM2]

Despite the upheavals that had occured in black education in SA during the period when this sample of students were at high school, only one student

mentioned that he felt this had affected him and his ability to cope at university. With reference to the school boycott of 1985 he commented that:

> I used to be an A student in Standard seven. We were promoted to Standard eight. If I'd repeated things would have been better. I didn't cope in Standard eight. In Standard nine, 90% of my class failed. I scraped through last year, got a D. I don't feel I have a solid foundation. [CM10]

Either the remaining black interviewees had not experienced major disruptions at the schools they attended, or they felt unwilling to raise them in the interview possibly for reasons related to the fact that the imterviewer was white. A third possiblity is that some students may not have considered them to be relevant to the problems they were experiencing at university.

5.4.2 Comments about specific courses

Interviewees were asked to identify their "worst" and "best" courses. However it was not always clear what students meant by these categories. In some cases "worst" meant the most disliked, and in others, the most difficult course. In the same way "best" could have meant the most enjoyable or the easiest. A second problem was that the interviewees did not all attend the same lectures and tutorials. Table 40 gives the number of interviewees in each course (N), the number who commented on the course and how many rated it "worst" or "best". The pass rate of the interview group is given for each course.

Table 40: Course ratings

Course	N	No. of comments	"Best" course	"Worst" course	Interviewee Pass rate (%)
MTH105W	47	36	12	14	40
MEC102W	47	21	6	5	63
PHY102W	26	20	7	5	58
PHY104W	21	11	3	3	76
AMA102W	26	13	1	5	23
AMA104W	21	12	2	5	43
CEM108F	39	17	2	6	69
CEM100W	8	8	5	0	38
END102S	33	8	3	0	79
CIV101S	5	0	0	0	100

Mathematics (MTH105W)

Maths received the most votes as both the "best" and "worst" course. Students mentioned the fast pace and heavy workload (5) as well as their frustrations with the lecturers' expectations that they had covered work at school (4).

Eight students were very positive about the Maths course and praised the tutorial programme. They said they liked the subject even though they found it difficult (3), or that they enjoyed it because they could do the work (1). Two students who had done a postmaric year said their was a repetition of work they had already done. While two students requested more tutorials, most of the comments indicated that there were sufficient tutorials. Some students were unhappy with the quality of the tutoring. Their comments in this regard appear in Section 5.6.1 under suggestions for improved tutorials.

On the negative side one student said he feared Maths, another that had he no interest in the subject, and a third that it had no value as he had never been shown why it was useful.

Engineering Drawing (MEC102W)

Six students, all male, and all of whom passed, indicated that MEC102W was the best course they had attended. Three of these, like Jeremy, had done Drawing previously, at school or Technikon. One student said he enjoyed the course because of the lecturer.

> Mr S cares. He is more relaxed than other lecturers when he explains things. He explains everything nicely. [CM10]

Lindiwe's experience was very different, one that was shared by several female interviewees. Many female interviewees experienced problems with the Engineering Drawing course and there was a strong indication that they felt male students had an advantage over them.

> I started off with a negative attitude because Mr S terrified me. The guys know the instruments. I didn't know what a T-square was. All the girls in the class found it difficult getting into Drawing. [IF1]

> The guys have some sort of an introduction [about Drawing]. I had no idea. [IF3]

The lecturer's particular style affected students in different ways. Consider what the following female student had to say:

> At the beginning I never knew what was happening. Most of the guys knew how to use a set-square. I asked S. He said, "typical female logic". So I decided to show him. Mr S made me work. At the beginning I never liked him but he was a challenge. He wants to force you to work. The first 3 or 4 weeks... was terrible. He didn't want to help me. He taught me how to work it out for myself. [CF1]

Five students, of whom 3 were female, rated it the " worst" course.

> The worst subject is Drawing. It is difficult to visualise what is going on... I will pass everything except Drawing, will fail it hopelessly. [CF3]

Five black students, of whom 4 were African, dropped the course, while a sixth student indicated that she had wanted to but had believed one could not. The main problem appears to have been the pace of the course and the lack of tutorial assistance.

> I didn't understand what was going on. Lectures too quickly and too many people. Really lost... Needed help but I didn't know anyone to turn to. [CM11]

Physics (PHY104W and PHY102W)

The 21 electrical engineering interviewees were registered for PHY104W. The three students who rated it their "best" course said they enjoyed the subject despite it being difficult. One of the 3 students who rated it the "worst" course had the following to say:

> It is too heavy for a first year course. In the practicals they assumed we knew a lot of things. They did a survey in the first semester and I don't think they took notice of what we said there...I knew I needed help - extra lessons, someone to explain to me the weekly problem sets. There was a special tut and I attended them for about 2 months. [IM4]

The most frequent complaint (6) was that there was not enough help for students with problems. Two interviewees had their DP's refused and one withdrew from the course.

The remaining interviewees (26) were registered for PHY102W. Three students said that they enjoyed the course while some praised the system of handing in weekly problem sheets.

> I've always enjoyed Physics at school. It's well organised here. Lectures, practicals and tutorials are well co-ordinated. The system gives lots of practice. [CM6]

This view was not shared by everyone. Both Lindiwe and Alli have described the tremendous problems they experienced with this course. The main problems were the lack of tutorial help, the practicals, and the relationship between students and the staff.

> It doesn't seem relevant. The Physics Department doesn't seem to have much of an interest in the students. [They have] no contact with the students. [IF1]

While no students mentioned dropping the course officially, three students had their DP's refused, one of whom said he had withdrawn from the course unofficially.

Applied Maths (AMA104W and AMA102W)

Only two of the electrical engineering interviewees rated AM104W as their "best" course: one because of the link with Physics and computing, and the other because he found the work interesting. The former had his DP refused while the latter failed at the end of the year. The five students who said it was their "worst" course all passed the course at the end of the year. Several (four) students were very critical of one of the lecturers, while others mentioned the lack of help with computing and the duplication with work in Physics. At the end of the year, two interviewees had their DP's refused and one was absent from the exam.

Of the twenty-six students registered for AMA102W only 2 students, who both failed the course, had any positive comments to make. One rated it his "best" course without reason while the other said simply that she had enjoyed

it. As was the case with AMA104W, of the 5 students who rated it their "worst" course, 3 were amongst the few interviewees who passed the course. The lack of help for students who were struggling and the overlap with Physics were mentioned. One student said he had decided to change lecturers while another said she had dropped the course.

Chemistry (CEM100W and CEM108F)

The 8 Chemical Engineering students registered for the full course CEM100W, were on the whole complimentary about the course although only 3 passed, one of whom regarded it as the "worst" course. It was regarded as the "best" course by 5 of the students, 4 of whom failed. The only suggestion made to improve the course was for more tutorials. One student who commented on how much she enjoyed the course and how approachable the staff were, was absent from the exam. Amongst the reasons students gave for liking the course were the following:

> One can understand what is happening. There is a lot of help in the form of tuts to be handed in. Fully worked out solutions are given. [M1]

> Theory and practice are closely related. [F3]

The remaining 39 interviewees were registered for the Chemistry half-course CEM108F and wrote the final exam in June. Two students regarded it as the "best" course, one because he had passed without working, and the other, who had failed the course in June, because most of the work had been done in matric. The only other positive remark related to the way in which it continued on from work done at school.

The remaining remarks were critical of the course, with 6 students rating it their "worst" course. The main problems raised were the lack of tutorials or other forms of assistance (5), the lectures and lecturers (4), the pace (4), the

use of multiple choice questions (MCQ) in tests and exams (2), and the lack of help with practicals (1).

> I hated it. I felt obligated to go. We had the worst lecturers ... in a big lecture theatre with too many students [CF1]

> [The problem was] the lecturer, his accent and method. People stopped coming to class. When I saw that I couldn't write notes I stopped going and waited for the notes to come... Needed someone to explain what was going on. I was going to the practicals but I didn't know what was going on - even got good marks. Too squashed. Too much to do before June. [CM10]

Despite these problems, 67% of the interviewees passed the course, while two students had their DP's refused.

Introduction to Engineering (END102S) and Water Chemistry (CIV101S)

Three of the 33 interviewees registered for the Introduction to Engineering half-course rated it their "best" course while 4 said it had played a large role in motivating them and helping them to choose a specific field of Engineering. A student suggested it be made into a full course. Only one student made a negative comment about the course and said he wasn't sure what it was about.

None of the five Civil Engineering interviewees commented on the Water Chemistry course.

5.4.3 Summary

While the workload and pace were the most frequently mentioned problems, many students referred to problems with the lecturing, and the lack of tutorials or other forms of assistance.

There were often contradictions between what students said they felt about a particular course in September and their final results in the course. The interview data is a representation of student accounts and should not be looked at in a predictive way. The role of the student in the interview also needs to be considered. Fleming (1986) argues that students act in the interview situation in order to be judged as competent interviewees and in ways that reflect positively on themselves as students. This may explain why weaker students appeared to speak favourably of certain courses which they eventually failed, while stronger students were more critical.

5.5 STUDENT FEELINGS AND ACTIONS TAKEN TO DEAL WITH PROBLEMS

It has been the experience of the author and other members of staff that first-year students who failed most of their class tests, particularly in April, were reluctant to accept advice on possible courses of action they could take, such as reducing their curriculum and planning for a five-year degree. The author wished to investigate the actions students took when they were failing most of their class tests and, with the introduction of the ASPECT five-year curriculum, to assess the acceptablity of changing to a five-year curriculum amongst students who were not coping.

5.5.1 Feelings after the April class tests

Interviewees were asked to recall how many tests they had passed or failed in April, how they had felt about their results and what sort of help they had needed.

Most students (35) correctly recalled the number of tests they had failed in April, but 6 recalled failing fewer, and 3 more, than had in fact been the case. The most extreme case was Lindiwe who said she had failed all 4 tests in April, when in fact she had only failed 2. Two students said they could not remember.

Table 41 gives the number of tests failed in April and the credit result categories for the interviewees who wrote the final exam. Of particular interest are those students who failed 3 or 4 tests in April and recovered to pass at the end of the year. This group of students will be investigated in Section 5.5.4.

Table 41: The number of tests failed in April versus credit results

Tests failed in April	N	Credit result categories <14	14-35	≥36
0	3	0	0	3
1	2	0	0	2
2	8	2	4	2
3	21	9	9	3
4	12	4	7	1
Totals	46	15	20	11
%	100	33	43	24

The 5 students who failed no tests or one test in April were private school WED matriculants and passed all their courses at the end of the year. The 3 African students in this group had been to the same school. The two remaining students, an Indian female student and a white male student, had written the JMB matric. The main suggestion made by this group of students was for the tutorials to be improved.

Amongst the students who failed two or more class tests in April, only a few (3) said they had expected their poor results. The majority (25) had been shocked at how badly they had performed.

> I felt dead, shocked, disappointed. I never failed a course in my whole life. I didn't know what to do. [CF1]

I felt terrible - wanted to drop out. [CM7]

It was a dreadful feeling. You come from school where you naturally pass everything. It pushes you to work harder. [CM3]

I realised I didn't have any idea what was going on. I got depressed. [CM9]

My best friend tried to commit suicide... He passed all his tests... I feel worse... I felt like going to a black university because it was too difficult for me here. [AM4]

A completely different response was described by 12 students who said that they had not felt bad about their results because of the view amongst their peers that the April test results were not to be taken seriously.

Because most feel the first test is not a serious indicator - everyone tells you that everyone gets low marks in the first test. [CM4]

I was so down when I saw my Maths results, I thought I would never make it through UCT. Then I saw other students' results. I didn't do too badly in the other subjects... Everyone just told me don't worry it's just the beginning of the year. [IF2]

Everyone else failed so I felt it was normal. No-one I knew passed and my marks weren't that bad. [CF2]

Only one student who had failed all 4 tests had felt this way, it would appear, through ignorance.

> I didn't really worry that much because I hadn't really worked that hard. At first someone told me that 30% was a pass. I didn't think I had done too badly. Then I heard 50% was a pass. [WM7]

The April class test results were not regarded as a fair assessment of ability by most of the interviewees (30). Some said they had not really prepared properly (7) because they hadn't worked hard enough or were still settling in. Others said they could have done better (4) or that the tests covered only a small part of the work (3).

Of the 10 students who felt their poor results were fair assessments of their abilities two African students made the following comments;

> I deserved those marks because it was difficult to cope with the standard. [AM9]

> At the beginning of the year I wasn't very stable. The mental framework I came with was wrong. To our society varsity is a mystery. [AM12]

Most interviewees (34), including the 5 who had failed no tests or one test, felt they had needed assistance after the April tests, mainly in the form of more and better tutorials, someone to talk to, and motivational input. These needs will be dealt with in more detail in Section 5.6.

Of the 13 interviewees who said they had not wanted help after April, two students gave no reasons while the rest said that they had to be able to do the work alone and were convinced they would do better in the next tests. Of this group, five students were eventually excluded.

> I was very confused. I didn't know if I was capable of helping myself - then I decided this is something I must sort out for myself. [CF1]

I felt it was my own problem. I would have to work on it...Most students felt the same way but we didn't really discuss it. [WM5]

I had worked for it... I failed so no-one can help me. Maybe I don't really know how to work. [WM1]

5.5.2 Students attitudes towards 5-year plan

As expected, the majority of interviewees (36) said they would not have heeded advice to change to a 5-year plan after April. Some (16) felt April would have been too soon to make such a change while others (8) said they had thought they could still pass all the courses at the end of the year. Of this latter group two were excluded at the end of the year. A third reason given by four students was the financial and time implications of an extra year. Two students commented that,

At that stage I felt I could not do it. It would be humiliating, degrading. By June one could consider it. [CM4]

All engineering students did well at school and feel they will do well at university. [CM1]

The remaining 11 interviewees, like Johannes and Lindiwe, said they would have changed to a 5-year plan after April if they had been given this option. Of this group, 4 were excluded at the end of the year, one passed all courses, and one had transferred to a Technikon in June. A total of 18 students said that they knew of students who would have wanted such an option.

A few friends of mine thought of doing that but we talked them out of it. [AM13]

> The Engineering Faculty should promote it as a positive option not an embarrassment. [CF3]

Several of the black and female interviewees displayed interest in a 5-year programme like ASPECT. Three AED matriculants who were eventually excluded had the following to say:

> [After April] I was beginning to feel this thing is too much for me. The transition from Standard Ten to University is too difficult for me... Every student coming straight from Standard ten especially from DET should do ASPECT. If I had known about ASPECT and what the Engineering programme was like I would have decided to do ASPECT. [AM8]

> I think it would be good for black students [to go on a 5-year plan]. I wish I was doing ASPECT. I would suggest ASPECT for all black students. [AM4]

> I was advised by someone who did pre-engineering at Wits that I mustn't do ASPECT or ASP as it's a waste of time.
> [AM3]

This last student indicated that he would have changed to a 5-year programme after April. Two African students who had done a postmatric year before registering at UCT both felt that an ASPECT-type year would have been preferable to the postmatric year they had completed.

> If I came straight from matric I would have wanted a 5-year programme... I think the ASPECT course is a good idea, better than the postmatric. With the postmatric has meant I repeat doing everything again. [AM7]

> If I hadn't done a postmatric I would have liked to come on ASPECT because I think ASPECT prepares one better than the postmatric. [AM1]

As was mentioned by Alli there was a lack of information about alternative programmes, such as ASPECT, so that students were not aware of the options. Two of the comments made by coloured students were,

> I heard about ASPECT but thought it was only for Blacks [i.e. African students]. How could one get onto the course? [CM2]

> It is a pity ASPECT is so isolated. I would have liked a pre-university year or an ASPECT programme. [CM5]

From the interview data it would appear that a number of black students would have preferred to have been registered on a 5-year plan along the lines of ASPECT or to have had the opportunity to change to such a programme after April.

5.5.3 Actions taken when not coping

Only two interviewees had never felt they weren't coping with the first-year programme. One, who eventually transferred to Technikon, said he had only struggled with Drawing, while the other, who obtained 32 credits at the end of the year, said that although he kept falling behind senior students had told him that was normal.

The times when most students felt they weren't coping were just before the June tests (15), after the April tests (13), and after the June tests (8). Four African students said they had not coped during the first few weeks.

The anxieties associated with this sense of not coping were well described by a student who was eventually excluded.

> At school one looks at the stuff and knows what's going on. I was 15% ahead of the class. Now, I'm getting nothing. I can't tell them at home. I am the first to go to university. I can't tell them how tough it is. They wouldn't understand. There's a terrible psychological strain. [CM4]

When asked what action they had taken when they realised they were not coping most interviewees (23) said they had worked harder. The second most frequent response (13) was that they had started working with other students or formed study groups. Two students said they had tried this but it had not worked.

> I tried working as a group but it turned into a social session so I went back to working on my own. [IF1]

> I did try to work with a friend but I discovered it didn't help. I want to understand it on my own, be self-sufficient. [WM1]

Other actions taken by students were attending extra tutorials (7), dropping one or more courses (7), or changing to the half-course in Maths (6). Others said that they had made use of the tutors in residence (3), organised private lessons (2), done nothing (2), changed lecturer (1), and sorted out personal problems (1).

Twenty-five students indicated that they had approached staff members for help. These included lecturers (14), student counsellors (14), tutors (4) and others (3) such as the Student Advice Office workers.

The advice students received often depended on who they approached. One group of staff members advised students who were having problems to drop a course. While two students said they had taken this advice a white female student straight from school and an African male who had done a postmatric year, explained how they had felt about this advice.

> I went to speak to tutors to get help... Lecturers and staff seem unapproachable. Student counsellors suggested a 5-year plan and other depressing advice. Why did you fail? They should be more positive and encouraging. [WF2]

> In April I spoke to the Physics tutor. He advised me to drop Applied Maths and concentrate on the rest. He told me to speak to the counsellor in Engineering. I didn't because I didn't want to drop those subjects. [AM1]

Both of these students passed all their courses at the end of the year.

Other staff members advised students not to drop anything and to work harder.

> I went to the counsellor because I was thinking of dropping to [the half-course in Maths] MTH101S. He explained that most students do Engineering in 5 years. He suggested I work on all subjects and give it a go. [WM7]

> Mr D told me to carry on and work harder. I was considering changing to MTH101S but he talked me out of it. [M3]

The first student quoted above was eventually excluded while the second only failed Maths. In commenting on this kind of advice one student said,

> Now I think the advice given by the advisor to my friend was wrong. It would have been better for my friend to have dropped one course. [WM7]

A female student had the following experience:

> I went to see Applied Maths lecturers. They've helped with particular problems. Didn't bother to go to engineering counsellor Mr D because a friend of mine said he's pathetic. Went to see Mr B before June but he chased us away. He didn't have time. Went to see the engineering counsellor for Chemical Engineering. He helped. [CF3]

Of the 21 students who said they had not sought help from staff, six said they had never felt the need. All six continued to second year, although only two passed all courses. The remaining 15 said that they had felt that they had to deal with their problems on their own by working harder and could not see how staff would be able to help (8), or that they had been too shy. (2)

> I wanted to but felt a bit embarrassed and afraid, especially during the first semester. I needed someone to guide me. [CF1]

> It's not clear what is offered. I have heard of student counsellors but don't know what they are supposed to do. I was given a sheet at the start of the year but there is not enough information. [WM6]

Two female students who failed three tests in April and June, and who were eventually excluded, explained why they never went to staff for help.

> I'm not one who goes and asks for help - I haven't been to anyone. They can't help except to tell you to drop a course. I didn't want to do that, but I wanted to drop Engineering Drawing. I thought one can't drop Drawing. [CF2]

> They will tell me to drop courses which I don't want to do. [WF1]

5.5.4 Students who recovered to pass the year

Of the 33 students who had failed 3 or 4 tests in April, 20 managed to recover sufficiently to avoid being excluded at the end of the year. (Table 41). Two "recovery groups" were identified.

The first recovery group consisted of the 8 students who had failed all 4 tests in April and managed to obtain more than 14 credits at the end of the year.

A female WED matriculant in this group passed all her courses. Her father and several family members were engineers and she was very motivated to do Engineering. She explained that she had failed in April because she hadn't worked hard.

> I thought that if I understand the lectures it would be fine... [After April] I tried to learn differently. Worked harder. I went for extra help in Maths, the 5th period tutorial. In Physics there wasn't anything available. I just had to work harder. [WF2]

The remaining 7 students included Johannes who has already described how he began asking people for help. An African student in this group who had already completed a Diploma in Engineering was the student who had managed to resolve his marital problems after April. He held strong views on what it took to succeed at university.

> I wouldn't regard myself as a matriculant. I teach myself and have been working and studying for many years. The input the Department gives is enough. One must just work hard. Those who are battling need to devote more time to their studies. Self-discipline and motivation is important. [AM14]

The other woman in this "recovery" group was the Afrikaans-speaking student from Paarl. After failing everything in April she obtained 19 credits at the end of the year and went on to pass all 33 credits in her second-year. She explained what she had done after April:

> Then I decided this is something I must sort out myself...I decided I'm not going to work so hard anymore. I was just going to understand the work and enjoy life here. Everything seemed to fall into place. We formed a "working club". We work - it's more fun. We help each other. I'm not working alone anymore. I use free periods and lunch effectively. [CF1]

A student in this group who scraped through at the end of first year with 17 credits and went on to obtain 29 credits in his second-year, he explained what he had done after failing all the April class tests:

> I spoke to guys in 2nd and 3rd year and they reassured me. They advised me to keep up with the pracs and tuts... I spent more time working on weekends...I began using time on campus more effectively...In the second semester we formed a group of three or four of us and we work together on Physics. [IM4]

A second African student who had already completed a Diploma scraped through with 15 credits at the end of the first-year obtained 26 credits in second-year. He explained what action he had taken after April:

> I put a lot of effort into my Maths because I did well at Tech. There is a lot more theory here that I didn't expect. I began working closely with a friend. We work together on Maths and Applied Maths... I cut my extramural activities especially on weekends when I used to play golf. [AM12]

The second recovery group consisted of the 12 students who had failed 3 class tests in April and recovered to obtain more than 14 credits at the end of the year. Of the three interviewees who passed everything at the end of the year, two said they had not been working before April and just started working harder. The third student, a mature student who had completed a Diploma, had wanted to drop out, but said he had been motivated by a fellow student and had just worked harder.

A student who obtained 19 credits at the end of the year had used several strategies to overcome his problems.

> I set up a study timetable and forced myself to work on campus in the library during free periods to complete assignments before I go home. I changed to MTH101S. I formed a group just before the June exams. [CM3]

Few of the remaining students gave details of what they had done except to say that they had worked more closely with friends (3), worked harder (2), used the tutorial programme more regularly (1), cut down on sport (1), or spoken to counsellors and older students (1). Two students in this group who passed with 16 credits at the end of the first year obtained between 27 and 29 credits the following year.

5.5.5 Student expectations of passing

Question B.4 tried to assess how the interviewees were feeling about their prospects of passing at the end of the year. Four categories of responses are reflected in Table 42 together with the credits categories obtained at the end of the year.

Table 42: Student feelings in September and credit results

Student feelings	N	credits category <14	14-35	>35
A. Hopeless/struggling	5	4	1	0
B. Not sure	10	5	5	0
C. Will catch up	5	2	1	2
D. Fine	24	3	12	9
Total	44	14	19	11

The majority of students (60%) who gave responses A or B were excluded compared with only 5 (17%) of those who responded with C or D. This suggests that by September most of the interviewees had a realistic idea of whether they were going to pass or not at the end of the year.

In a further effort to assess how realistic students were in their expectations of passing, students were asked to predict which courses they thought they would pass (Qu B.5). Three groups of students were identified on the basis of the number of credits predicted and the actual number of credits obtained. Almost half the interview sample were over-optimistic about how well they would do at the end of the year (Table 43).

The most over-optimistic cases are listed in Table 44. Students CF2, IM1, WM7 and WM5 admitted during the interview that they were not coping, or were not confident of passing. However all three said they were planning to work hard and could pass.

Table 43: Prediction category versus credit result category

Prediction Category	N	%	Credit result category <14	14-35	>35
Group A	16	35	4	6	6
Group B	8	18	0	4	4
Group C	21	47	10	11	0
Total	45	100	14	21	10

Key : Group A - predicted to within 3 credits the number of credits they finally obtained.
Group B - performed better than they predicted.
Group C - performed worse than they predicted.

Table 44: The most over-optimistic interviewees

Interviewee	Credits predicted	Credits obtained
CF2	28	0
IF2	40	13
IM1	23	0
WM7	29	7
WM5	24	7
WF1	28	12

Student IF2 was very positive and confident at the time of the interview. She had enjoyed the year and thought UCT was wonderful. She said that she had been helped and encouraged by the student counsellors and various tutors and would definitely pass. She only passed Physics and Drawing. Student WF1 had a similar positive attitude to the exams predicting that she would pass all courses except Physics.

It is possible that the interview itself gave rise to some of this optimism. Fleming (1986) argues that the interviewee uses the interview as a form of action. Agreeing to be interviewed, and discussing issues are actions which the interviewee decides to take and which become part of the context in

which the matters being researched occur. The therapeutic effect of discussing problems at a level of detail which the students might never have had the opportunity to do before, may have led students to feel a sense of relief, and together with that optimism about how things would work out. Alternatively students portray events in the way they think the interviewer wants to hear or reflects themselves in a positive light.

5.6 STUDENT NEEDS AND SUGGESTIONS FOR THE FIRST-YEAR PROGRAMME

Suggestions relating to specific courses have been combined with comments made by students throughout the interview to provide a comprehensive view of what students felt they needed and suggestions they made for improving the first-year programme.

A theme that ran throughout the interviews was the lack of help available for students who were experiencing problems. Most students suggested more and better tutorials to help with academic problems, but there was also a strong appeal for more personal contact and involvement of staff members in the academic and non-academic problems encountered by students.

5.6.1 The tutorial system

Most interviewees (35) wanted more or better tutorials in one or more of the courses with the greatest need being in Physics (19). While the Maths Department received the most praise for the extent of its tutorial programme, several students (5) raised problems with the quality of tutoring.

> I was lucky with my Maths tutor - he was very good. Other tutors can't explain. Need an ASP-type programme for Maths. [WM7]

> Maths pracs are a bit of a farce they spend time helping the good students so I stopped going to pracs. [WM3]

> Our Maths prac leader often didn't pitch. [IF2]

> The tutor I had was useless. [CF2]

The poor quality of tutors and tutorials in general was referred to by several students. Four interviewees suggested decreasing the size of tutorial groups, or increasing the number of tutors, while two students suggested that tutors be trained.

> [In the Physics] tut classes I never learn anything. There is an honours or third year student. It should be voluntary with someone like a lecturer who is in touch with the work. [IF3]

> Our [Physics] tutor is forever out when we need help. [CF3]

> The [Applied Maths tutorial] system doesn't work because it has a few tutors for a large class. [CF2]

Several black and female interviewees echoed the need expressed by Lindiwe for a tutorial session in Engineering Drawing.

> One extra tut [in Engineering Drawing] for anyone who has problems. One Drawing session a week is not enough. It was the most frustrating course I did. At the beginning I was doing 18-20 hours a week and that led to problems. [IF1]

> I had no clue about Drawing. I'd never done it. I got the feeling that the demonstrators are not eager to help. There should be a tut session where one can go and ask help. My school had Drawing as a lower grade subject - not for those going to university. [WM7]

Other requests were for tutorial help in computing (4), special tutorials in all courses for people who weren't coping (4) and tutors in all the residences from the beginning of the year (2).

5.6.2 Personal contact, counselling and motivation

The second most frequent suggestion (29) was for more contact and better communication between staff and students. Many students shared Johannes' and Alli's need for someone to explain what was going on and advise them about the work.

> Initially at Freshers' Week I didn't know what was going on or who to ask, so I asked students... We are only encouraged to speak to student counsellors after June. Students need to see counsellors and be guided right at the beginning. [IF1]

> I needed to talk to someone about what I should do to cope with the standard here. [AM9]

> I wanted someone to discuss the work with. [AM8]

> If only I had personal attention - possibly smaller tut groups. [IF2]

As one student explained,

> Students need someone to guide them in the first semester, talk to them, look after them, to be interested in their well-being. Take a personal interest. [CF1]

There were several suggestions as to how this could be provided.

> Counsellors should be made available and come and discuss with students. Need more personal contact to motivate students. [IF1]

> Send letters after the first class test to inform people that they should come and speak to a counsellor. [CM7]

> More interviews between first-years and faculty to get to know what the options are and get to know the faculty better. [CM6]

> It would be good for us to be forced to go and talk to a lecturer or counsellor. That way the one who is shy will go and talk to someone. Each lecturer should make time when students can come and talk. [CM4]

Two students suggested that there be more contact between senior and junior students.

Fourteen students felt that the faculty and departments should play a more active role in motivating students. Some emphasized the need to explain to students at the beginning what to expect.

> We need a pep-talk at the beginning of the year, very specific, possibly second years to speak. [IF2]

> They must tell the students they are going to have to work hard. I know we can be told that and we won't listen. Also the importance of going to lectures and things like that. [IF3]

> One knows about first year drop-out rates but you think they didn't work. In orientation week they should explain to students how much work they should do, how to use tuts, not to compare with other students. [IM1]

> There ought to be some kind of motivation for students to work harder. Students don't realise they have to do things alone. [IM2]

> Engineering Faculty should try and show students how much work is involved and when it is too late. [WM3]

However one students suggested a different approach,

> Encourage students to think positively towards Engineering. Don't tell them it's difficult when they get here. Encourage them to work hard from the first day. Must know where to go if they want help. [AM6]

A group of students (4) said that the Introduction to Engineering course had played a large role in motivating them. It was suggested it be made into a full course.

> I have been motivated by Intro to Engineering. [The faculty must] have more courses like Intro to Engineering to increase interest and motivation. [CM6]

There was also the suggestion that a short pre-Engineering course be run in January or February.

> Run a couple of weeks before the start of the year especially for DET students, especially in Maths and Science. [AM2]

> More introduction to what is going to happen. Students are plunged into very hard work. Maybe start a few weeks earlier with introductory courses on what the syllabus is going to be on... I attended the Wits pre-university but I didn't take it seriously. [AM10]

One student felt that the information that had been sent to the schools was inadequate and that communication with students at schools needed to be improved.

Explain to students at school what varsity is about. The booklet UCT sent out doesn't explain. [IM2]

5.6.3 Other suggestions

Several students said they had needed help with study methods.

[Students need] help with study methods. Offer an extra course with a small group on effective methods to study. Mr S gave us a big blue book. I read it - it didn't help. We are groping trying to decide how to change. [WM7]

I don't think I had an efficient way of working, no plan or timetable. [IF1]

The workload was too big for my approach to exams. I used to cram before tests. [AM11]

My performance was very low. I thought that my study method was the main factor... I never drew up a study timetable and then it was only when I had something to submit. [AM12]

One specific suggestion was that the Faculty encourage working in groups as an effective way to study.

Help with study methods. Suggest students form groups. Form small-group tuts of about 5 people. Set group assignments. People who come from school don't like sharing. They compete and want the best. [WM9]

One can't work alone in Engineering one needs to work with students and staff. Black students believe in working as individuals and they can't

> make Engineering working as individuals. Encourage students to work in groups. [AM14]

> At school I worked alone so I don't know how to work together with other students. I can't work in a group [AM4]

Students living off campus needed help to form study groups. Some students in residence also appeared to be isolated from students in their courses.

> When I sit with a problem at home and there's no-one to help, I feel depressed, feel stupid. [CM4]

> Mostly I work on my own. If I have a problem I phone a friend. There isn't time to organise to get together a group [WM7]

> There's no-one in first year in my res. I was working alone. [AM8]

Several students said there was a need for help in coping with tests and exams.

> I'm worried about the exams. I am slow and can't finish the paper. I need someone to help me with the problem of being slow. Usually I start at the wrong place with a problem and have to start again. I also have a problem writing quickly. [AM1]

Problems with the MCQ system of testing, used at that stage only by the Chemistry Department, and problems understanding test questions were mentioned several times.

> They use the negative marking MCQ. They must change that. It caused a very unpleasant atmosphere. An educated guess and a wild guess are indistinguishable. [WM7]

I don't like the MCQ's. [IM4]

I don't understand the question, especially in Maths. I didn't know how to answer the style of the questions. [CM9]

I am not used to the way questions are asked in the tests and exams. [AM8]

There were requests for shorter and more regular tests especially in Drawing (2) and that class tests be co-ordinated not to all coincide (2). Jeremy suggested that Departments have mock papers so students know what to expect in tests.

There was a suggestion by 4 students, including 3 female students, that the faculty assist with finding vacation employment while 2 students suggested the academic year be lengthened to make more time for the work. One student suggested replacing AM104W with a half-course in computing while another said a half-course in Applied Maths to convert to in the second semester would be helpful.

5.7 CONCLUSIONS

A wide range of academic and non-academic problems experienced by first-year Engineering students were identified in the interviews. The following non-academic problems were identified and included in the survey questionnaire to assess the extent to which they were experienced by South African matriculants in first-year.

Adjusting to UCT
Language-related difficulties
Lack of personal attention
Financial difficulties
Travelling
Personal/family
Accommodation
Lack of study facilities
Finding friends to work with
Illness
Too much freedom

The interview data appears to indicate that several groups of students experienced common problems. Black students, and BED matriculants in particular, formed the majority in most of the groups listed below.

a) Students living away from their home town experienced problems adjusting to being away from home and the lack of support from family and friends; finding accommodation; and dealing with severe personal, often family-related, problems.

b) Students living off campus experienced transport problems; the lack of adequate study facilities; and isolation from other Engineering students.

c) Students who had been taught in the medium of Afrikaans, mainly Coloured students, experienced severe problems of self-confidence and difficulties communicating with other students and staff.

d) Black students made specific mention of social problems, in particular the problem of adjusting to the university environment; inadequate schooling; and financial difficulties.

e) Female students had to cope with the attitude of students to their choice of career as well as particular problems with Engineering Drawing.

Students who fell into several of the above groups, such as black female students living away from home, experienced many of the problems listed.

The majority of interviewees said that the workload and shortage of time were the main academic problems. Other issues identified were the lack of adequate preparation at school (mainly raised by black students); the relationship between practical work and theory; problems with teaching styles and inadequate tutorial systems. Many of the interviewees expressed unhappiness about the quality of lecturing. A substantial group of interviewees felt they had needed assistance with study methods, examination techniques and time management.

To overcome academic problems the majority of interviewees said that they had simply worked harder. Students who had approached staff, or student counsellors for advice reported either being advised to drop a course, or to study harder. Other actions taken included working with other students; forming study groups; attending extra tutorials, and dropping a course, or changing to an half-course.

The majority of students said they had felt the need for some assistance after the April class tests. The main requests were for more and better tutorials and someone to talk to.

While a substantial group of students who failed all courses in April managed to avoid being excluded, no single strategy emerged to explain their recovery. Many in this category admitted that they had not worked hard enough for the April tests and that the results had shocked them.

Almost all the interviewees acknowledged feeling that they were not coping at some stage during the year. However at the time of the interviews only 33% were still feeling unsure of passing. The interviews suggest that the period after the April class tests was a time of intense emotional and psychological stress for most of these students. The combined effects of alienation and intimidation, together with the experience of academic failure for the first time, made it the time when students were most in need of counselling and support.

Most students said they would not have accepted a suggestion to change to a 5-year plan after April. However 30% of black students said they would have chosen such an option if it had been available to them. Black students in general and African students in particular, displayed an interest in the ASPECT programme.

The following list of suggestions for improving the first year programme emerged from the interviews.

a. Hold pre-Engineering lectures in January or February.
b. Give a clearer explanation at the beginning of the year of what to expect.
c. More tutorials in certain subjects.
d. Special tutorials for students who have never done Drawing.
e. Special tutorials in computing.
f. Help with study methods.
g. Clearer explanation of Chemistry and Physics practicals.
h. More active help from lecturers and student counsellors.
i. Assistance with planning a 5-year degree after April tests.
j. Assistance with planning a 5-year degree after June tests.
k. More half-course options after June.
l. Longer academic year.

m. Help finding vacation work.
n. Ensure tests do not fall on top of each other.
o. More Engineering Drawing tests.
p. More frequent but smaller class tests.

This list was also included in the survey questionnaire. Students were asked to identify the most important suggestions and to rank them. The results of the survey are described in the following chapter.

CHAPTER 6

SURVEY OF FIRST-YEAR ENGINEERING STUDENTS

6.1 INTRODUCTION

The aim of the survey was to collect biographical information with which to develop the profile of the first-year engineering intake, and to assess the views of the student intake on the issues raised by the interviewees. Several of the questions contained lists of options which had been generated by the interview data (Appendix 4).

The questionnaires were handed out before two Engineering Drawing lectures in October. Only students studying Engineering for the first time at UCT were asked to complete them. Most students returned the completed questionnaires to the author after the lecture. Students were told that they did not have to fill in their names, to encourage as many as possible to complete the questionnaire without fear of reprisal.

To reach those students who had not attended the Engineering Drawing lectures, questionnaires were made available at an Introduction to Engineering lecture. In a further attempt to reach students who had not responded, the questionnaire, together with a self-addressed envelope, was posted to 31 students in the interview target-group categories 3/3 to 4/5 who had not been interviewed or completed a named questionnaire. Five of these students replied saying that they had completed questionnaires anonymously, and 10 returned completed questionnaires.

The sample sizes for different categories of students are reflected in Table 45. Questionnaires completed by foreign students were not included as the study was mainly concerned with the responses of South African matriculants,

40 of whom returned anonymous questionnaires. The responses of the 170 students who wrote their names on the questionnaires were available for analysis with the first-year performance variables.

Although 72% of the South African matriculants in the intake were sampled, the biographical data and comparisons of means were used to assess the representivity of different categories of students.

Table 45 : Representivity of the questionnaire sample

Category	Sample size Named	Anon	Tot	Categ. size	% of categ. sampled	% of credit categ. sampled <14	14-35	>35
SA matric	170	40	210	290	72	48	56	62
Population Class								
African	17	3	20	24	83	71	57	80
Coloured	18	6	24	45	53	50	38	35
Indian	11	0	11	18	61	50	67	75
Black	46	9	55	87	63	56	48	55
White	124	31	155	203	76	33	61	64
Education Dept								
Black ED	35	11	46	68	68	58	48	48
White ED	135	29	164	222	74	31	59	64
Matric year								
1988	118	29	147	211	70	47	54	59
pre-1988	52	11	63	79	80	50	62	71
Degree		*						
Chemical	25	2	27	48	56	50	29	59
Civil	30	8	38	48	79	80	71	55
Electrical	51	14	65	91	71	38	48	65
Mechanical	56	13	69	85	81	33	68	67
Materials	8	0	8	18	44	50	38	50
Gender (identified from named questionnaires only)								
Female	12	-	12	25	48	33	67	46
Male	158	-	158	265	60	50	55	64

*Does not total 40 due to missing information

Students who obtained more than 35 credits in the final examinations were better represented (62%) than those who obtained fewer than 14 credits and were excluded (48%). Of the students who obtained fewer than 14 credits, white students (33%), WED matriculants (31%), female students (33%), Mechanical (33%) and Electrical students (38%), were under-represented. African students were over-represented (83%) in most categories while coloured students were under-represented in general (53%) but particularly in the categories of students who obtained more than 14 credits. Female students were also under-represented (48%) in the sample.

No significant difference was found between the number of credits obtained (C89) by the 170 named respondents and the remaining SA matriculants (Table 46). This was confirmed by a Chi-square test which found no significant association between credit category and whether or not students were in the named sample.

However, a t-test analysis of the average exam mark, AVE, revealed that the named respondents performed significantly better than the rest of the SA matriculants. It would appear therefore that the sample of named respondents was biased towards students who obtained higher average exam marks in first year. One reason may be that there was a greater willingness amongst students who were performing well to put their names on the questionnaire. A second possible explanation was offered by the Engineering Drawing lecturer who said that students who were running the risk of failing were often advised to withdraw from Engineering Drawing and concentrate on their other courses. Students who had taken this advice would not have been in the Engineering Drawing class when the questionnaires were distributed.

Table 46: Named sample by results

	Rest of SA matric	Named sample	Total	Statistical test
Average exam mark				T-test
N	116	168	284	T=2.66
mean AVE	57.3	61.3	59.7	p=8.2E-3
Credits N	120	170	290	K-W Test
mean C89	27.9	29.9	29.1	Test stat=2.43
Ave rank C89	136.7	151.7		p=0.119
Credit category	N %	N %	N	
<14	22 18	20 12	42	Chi-squ=3.34
14-35	33 28	42 25	75	df=2 p=0.188
>35	65 54	108 63	173	G=0.19;p>0.05
	120 100	170 101	290	

6.2 BIOGRAPHICAL INFORMATION

6.2.1 Biographical variables

Investigations were conducted into the variation of biographical variables between African, coloured, Indian and white students as well as between black and white students. Associations were also investigated between biographical variables and credit result categories.

Associations were investigated using the Chi-square test with the Yates correction for 2 X 2 tables. The Chi-square value and its associated significance value (p) is only an indication of whether a significant association exists between the row- and column-variables of a table. Significance levels of $p<0.05$ were accepted as indicating a significant association between variables. As the Chi-square value does not indicate the strength of that association, two measures of the strength of an association

were used, namely Pearson's Phi coefficient and Goodman and Kruskal's Gamma (G). Phi is defined as follows for 2X2 tables:

$$\text{Phi} = \frac{\text{difference between the two cross products on the diagonal}}{\text{SQRT(product of the four marginal frequencies)}}$$

Phi takes on values from +1.0 to -1.0 with the value of zero indicating independence between the two variables. Phi is related to the Chi-square value by the following formula:

$$(\text{Phi})^2 = \frac{\text{Chi-square value}}{\text{Total sample size}}$$

Goodman and Kruskal's Gamma (G) is normally used for tables with ordinal-scale values and is not restricted to 2X2 tables. In this study the Gamma measure is used for all ordinal tables greater than 2X2, but in particular in cross-tabulations with the three credit result categories. The value of Gamma also ranges from +1.0 to -1.0. The significance (p) of Gamma measure was calculated by a z-transformation (Lutz, 1983:439).

The univariate analyses that have been conducted with the biographical variables do not take into account the inter-relationships that might exist between variables. The results of a brief multivariate analysis are reported in Section 6.2.3.

Table 47: Biographical variables

Variables	Categories	Sample size N	%	Association with Pop	Credit Cat
Home town	Cape Town	106	51	*	
	Other	101	49		
Home language	English	163	78	*	*
	African lang	20	10		
	Afrikaans	15	7		
School Medium of instruct.	English	187	89	*	s
	Other	22	11		
Matric Year	1988	147	70	*	
	Pre-1988	63	30		
Father's Education	Below Std 10	34	19	*	*
	matric/diploma	60	34		
	Degree	82	47		
Mother's Education	Below Std 10	45	26	*	*
	Matric/Diploma	91	52		
	Degree	39	22		
Father's Occupational Class	Upper	44	21	*	*
	Upper-middle	88	42		
	Lower-middle	36	17		
	Lower	16	8		
	No fathr/unclear	26	12		
Mother's Occupational Class	Upper	11	5	*	
	Upper-middle	46	22		
	Lower-middle	46	22		
	Lower	6	3		
	At home	88	42		
	No mothr/unclear	13	6		
Accommodation	In residence	94	45	s	
	At home	83	40		
	Other	33	15		
Finances	Family	74	35	*	*
	Full bursary	80	38		
	Other	56	27		

* - significance value $p<0.05$
s - sample size too small to establish the significance of an apparent relationship

The tables containing the data used to investigate the relationship between biographical variables and population classification and performance can be found in Appendix 5.

All biographical variables showed an association with population classification. This would appear to confirm the difference in home background and circumstances at university of black and white students. Several variables also showed association with results (Table 47).

Home town

The home town varied greatly by population classification. Only 16% of the African students surveyed had homes in Cape Town, compared to 96% of the coloured students and 51% of the whole sample (Table A5.1). No association was evident between home town Cape Town and credit category.

Home Language

Fifteen home languages, including 10 different African languages were identified in the sample. As expected, most students (78%) spoke English at home, but 38% of the coloured students sampled indicated Afrikaans as their home language (Table A5.2). As only 53% of the coloured students are represented in the survey sample it is uncertain whether this result can be generalised to the rest of the coloured students. The language-related problems that this particular group of students experienced have been described in the previous chapter.

A fairly strong association (G=0.49) was found between students with English as home language and credit result category. Students with English as home language performed significantly better than the rest of the students.

School Medium of Instruction

Most students, including all African and Indian students, and 92% of the white students in the sample, had received instruction at school through the medium

of English (Table A5.3). Twenty students, including 42% of the coloured sample had attended Afrikaan-medium schools, while two students had attended French or German-medium schools. While the association with credit categories was almost significant, the mean number of credits obtained by students who had attended English-medium schools was significantly higher than for other students.

Year of matric

The year of matric variable showed an association with population classification. All of the Indian students and only 35% of the African student sample had matriculated in 1988 (Table A5.4). No association was found with credit category.

Parents' education

The sample size for this data was reduced to 176 for fathers and 175 for mothers by the fact that approximately 16% of the sample did not answer this question while others wrote that they did not know their parents' educational qualifications.

Three educational categories of below Std 10, Std 10 or Diploma, and university degree, were created. There were very strong associations between population classification and both father's (G=0.77) and mother's (G=0.76) educational background (Table A5.5), reflecting the extent of educational deprivation amongst the black community relative to the white community. While 58% of white fathers had university degrees, this was the case for only 13% of black fathers. Similarly, while 83% of white mothers had a Std 10 or diploma or a university degree, only 33% of black mothers had received this level of education.

The association with credit category was fairly strong for both father's (G=0.59) and mother's (G=0.55) educational background. Over 70% of students whose mothers or fathers had Std 10 or more passed all courses (Table A5.6).

A significantly larger proportion of students whose parents only had an education below std 10 were excluded when compared to the rest of the class while a smaller proportion of such students passed all courses.

Parents' occupational class

The occupational categories used in this study and the method of grouping these categories into classes were based on Simkins and Hindson (1977). The main adjustments made to their scheme were to divide the Petty-bourgeois class into an Upper-middle and a Lower-middle class, and to include the blue-collar technical category into the Lower-middle class rather than the Lower class. This was done after it was found that most parents in the blue-collar technical category had university degrees (for example, farmers).

The class categories used were:

I Upper Class	: Executive, high administration and owners of companies (large or small)
II Upper-middle	: Professional and semi-professional
III Lower-middle	: Clerical, supervisory, sales, non-manual and blue-collar technical
IV Lower Class	: Skilled, semi-skilled and unskilled workers

For statistical purposes these classes were further combined into two categories, Lower/Lower-middle and Upper/Upper-middle. The 'parents at home' and 'no parents' or 'unclear' categories were omitted from the analysis of fathers' occupational class (Table A5.7). The significant association found between fathers' occupational class and population classification was to be expected given the nature of South African society. Students with fathers who had Lower/Lower-middle class occupations performed significantly worse than students with fathers in Upper/Upper-middle class occupations. Seventy-one percent of students with fathers in Upper/Upper-middle class occupations passed all courses.

The analysis of mothers' occupational class was complicated by the fact that 57% of black and 40% of white mothers were at home. Omitting this group, as was done when analysing the fathers' occupations, would have rendered the sample too small for worthwhile analysis. As an alternative, the 'mothers at home' category was tabulated in front of the lower/lower-middle class category. This rendered the data no longer ordinal and made the Gamma test inapplicable. The Chi-square test revealed a significant association was evident between black and white students and mother's occupational class (Table A5.8), but no significant association between these three occupational categories and students' credits category.

Accommodation

Accommodation also varied with population classification. Only 13% of coloured students sampled lived in residence compared with 90% of the African sample (Table A5.9). Since the ending of residence segregation, a policy of affirmative action towards African students by sponsors and the university has resulted in the majority of African students being accommodated in residence. This continued to be another aspect of students' life at university that was dependent on a student's population classification. No association was found between accommodation and credit categories.

The impression gained during the interviews was that female engineering students in residence experienced social isolation and lack of support and that this seemed to affect their academic performance. Female students living at home appeared to perform better than those living elsewhere. In the survey, none of the named sample of 6 female students living at home obtained fewer than 14 credits, while 2 of the 6 female students living elsewhere were excluded (Table 49). The sample is too small for generalisations to be made.

Table 48: Place of residence of female sample by credit category

Credits	At home	Not at home	Total
<14	0	2	2
14-35	3	1	4
>35	3	3	6
Total	6	6	12

Financing university study

Significantly more white students were financed by their families than black students, with not a single African student in this category. Only 2% of students with family finance obtained less than 14 credits compared with 17% of the students who were financed in other ways (Table A5.10).

The students on full bursaries included 80% of the African sample but only 18% of the Indian sample. A slightly higher proportion of black students (44%) were on full bursaries compared with white students (36%). A significant association was found between credit category and students on full bursaries (Table A5.11), with 75% of students in this category passing all courses.

Summary

From the above information the following points emerge:

a) The strongest associations found within the biographical data were between population classification and parents' educational background.

b) Associated with exclusion were:
   * not having English as home language and
   * parents' educational background being less than Standard 10.

c) Associated with passing all courses were:
   * the educational qualification of either parent being greater than Standard 10, and
   * father's occupation being Upper/Upper-middle class.

d) The strongest association with not being excluded was being financed by one's family, while being on a full-bursary was associated with passing all couses.

It should be borne in mind that these findings are the result of univariate investigations and hence suffer from the limitation that the associations identified between individual variables and performance are likely to overlap with other variables, but particularly in the South African context, with the population classification variable.

6.2.2 Reasons for studying Engineering

As was evident from the interviews, a significantly higher proportion of black students indicated that Engineering had not been their first choice of career (Table 49), with 13 of these students giving Medicine as their first preference. Only one of the sample of 12 female students indicated that Engineering had not been her first choice.

Table 49: First choice of study

First choice	Pop. class. Black		White		Total	
	N	%	N	%		
Engineering	44	80	141	92	185	Chi-square=4.91
Other	11	20	12	8	23	p=0.027
						Phi=-0.15
Total	55	100	153	100	208	

Students were asked to indicate which factors mentioned by interviewees had influenced their decision to study Engineering (Table 50). An interest in designing and building things (Factor A) was the most popular reason for all groups of students but was indicated by a greater proportion of White students and Indian students than African and coloured students (Table 51). Only 30% of African students indicated that career prospects (Factor B) had influenced

them compared with 62% of the sample as a whole. Performance in Maths and Science at school (Factor C) was the second most popular factor for African and female students, with 75% of female students indicating this reason compared with 48% of the whole sample.

While only 20% of white and coloured students and 33% of female students had been influenced by a teacher or careers counsellor, not one Indian student and only one African student indicated that this had been the case.

From the poor support for Factors E and F it would appear that few students were doing Engineering for reasons such as having been awarded a bursary or because they had not been accepted into their first choice of study. It is interesting to note that not a single female student indicated either of these reasons.

Besides the 6 factors listed by interviewees, students also mentioned the activities of PROTEC (2) and family involvement with Engineering (2) as influencing factors. One female student wrote that she had registered for Engineering out of "defiance".

Table 50: Factors influencing decision to study Engineering

Factor	Frequency	%
A.	Interest in designing and building things	165	79
B.	Engineering offers good career prospects	129	62
C.	Did well in Maths and Science at school	101	48
D.	Was advised by career counsellor/teacher	37	18
E.	Was awarded a bursary to do Engineering	14	7
F.	Didn't get accepted into first choice.	6	3

Table 51: Support for factors influencing decision to study Engineering

	A	C	I	W	Total		Female
Sample	20	24	11	154	209		12
Factors					N	%	
A	12	13	9	131	165	79	10
B	6	14	8	101	129	62	8
C	8	10	2	81	101	48	9
D	1	5	0	31	37	18	4
E	2	1	1	10	14	7	0
F	1	1	2	2	6	3	0

6.2.3 Multivariate analysis

The above investigation has explored the nature of the relationship between each biographical variable and credit result category. In Chapter 4 an investigation was carried out into the relationship between variables such as Educational Department, school results, and gender and first-year performance. Studies involving one independent variable at a time provide only limited information as performance in first-year is affected by combinations of these variables. The determining variables in turn may be intercorrelated and hence overlap in their explanatory power.

Numerous multi-variate techniques exist which enable the effect of several independent variables on a dependent variable to be investigated simultaneously. The author has limited this study to a preliminary investigation of the effect of a set of biographical variables on the average exam mark performance variable (AVE). The AVE performance variable was chosen because, unlike the credits performance variable C89, it displayed a normal distribution. A Stepwise Variable Selection procedure was used to identify those variables that explain the greatest degree of variation in the dependent variable AVE. Dichotomous biographical variables were used with the value of 0 or 1.

With the F-to-enter set at 2, the variables, Education Department, full bursary, living in residence, and home-town Cape Town were selected and fitted to a model which yielded a highly significant regression and explained 26.5% of the variation of the AVE performance variable (Table 52). Of the biographical variables, Education Department had the greatest influence on the AVE performance variable, followed by funding by a full bursary. Living in residence and home-town Cape Town had roughly the same influence on average exam marks.

Table 52: Stepwise selection of biographical variables

Variables in model	Coeff	F-Remove	
Education Depart (White)	13.65	40.5	R-SQ = 0.2652
Full bursary	5.02	7.9	R-SQ (ADJ)=0.2469
Living in residence	3.65	2.6	Std Error=10.879
Home town Cape Town	3.19	2.1	F-ratio=14.52
CONSTANT	45.13		p=0.0000
Variables not in model	**P Corr**	**F-Enter**	
Straight from school	0.083	1.1	
Gender (Male)	0.062	0.6	
Pop. Class. (White)	0.059	0.6	
Family finance	0.037	0.2	
First choice Engineering	0.022	0.1	
Living at home	0.014	0.0	
English home language	0.014	0.0	

A second analysis was done on the four variables selected above together with three matric result variables which were not dichotomous (Table 53). A highly significant model was fitted containing four of the variables and explaining 43.5% of the variance in the AVE performance variable. Education Department again emerged as the variable with the greatest influence on the average exam mark, followed by the matric Physical Science symbol. The position of the matric Physical Science symbol with respect to the matric Maths symbol

appears to support the finding in Chapter 4. The association of a full-bursary with good performance was once again evident.

In a final multivariate analysis, a variable containing the number of tests failed in April was included with the seven variables used in the previous analysis. A highly significant model explaining 51.2% of the variance in AVE was fitted with only three of the variables (Table 54). The number of tests failed in April was second only to Education Department in influence. It should be noted that Matric Point scores were selected in the model rather than the matric Physical Science or Maths symbols.

Table 53: Stepwise selection of biographical and matric result variables.

Variables in model	Coeff	F-Remove	R-SQ = 0.4352
Education Dept (White)	13.16	48.1	R-SQ (ADJ) = 0.4212
Matric Ph Sc Symbol	2.82	10.4	Std Error = 9.523
Full bursary	3.81	6.2	F-ratio = 31.20
Matric Maths symbol	1.78	4.9	p=0.0000
CONSTANT	19.81		
Variables not in model	**P Corr**	**F-Enter**	
Home town Cape Town	0.11	1.9	
Living in residence	0.10	1.6	
Matric Points	0.87	1.2	

Table 54: Stepwise selection of biographical, matric results and performance in April variables

Variables in model	Coeff	F-Remove	R-SQ = 0.5120
Education Dept (White)	10.33	32.6	R-SQ (ADJ) = 0.5030
Tests failed in April	-3.78	33.5	Std error = 8.83
Matric Points	0.47	19.7	F-ratio = 57.00
CONSTANT	35.65		p=0.0000

6.3 NON-ACADEMIC PROBLEMS

6.3.1 Overview

Students were asked to indicate which of a list of non-academic problems raised by interviewees they had encountered. They were also asked to rate the seriousness of the problem from 1, for not serious, to 3 for very serious. It is not always clear whether students who indicated a particular problem meant the same thing. For example students who indicated the problem of travelling could have been referring to travelling to university each day, or to homes elsewhere in the country during the holidays.

Table 55 lists the non-academic problems in order of frequency together with a "seriousness" rating calculated by adding together the frequencies multiplied by the corresponding seriousness rates for each problem. The "problems in res" category was added to the original list as it was mentioned by several students.

A group of 25 white students (16%) and only one black student (2%) did not indicate a single non-academic problem. This suggests that white students were less likely to experience non-academic problems than black students. It is interesting to note that of the 18 named students in this group, none obtained fewer than 14 credits and 15 passed all courses.

Five students indicated that they had experienced all or 10 of the non-academic problems in the list. Of this group, one had completed the questionnaire anonymously and of the rest, only one was excluded at the end of the year.

A group of 42 students, or 21% of the sample, indicated that they had experienced more than 3 of the problems. This group contained a significantly greater proportion of black students and performed significantly worse than students who had experienced less than 3 of the problems (Table 56). There

was a strong association (G=0.61) between the number of non-academic problems indicated and results category.

Each group of students who had indicated a particular problem was investigated for associations with population classification and credit categories.

Table 55: Frequency and associations of non-academic problems

Problem	Frequ N	%	Serious	Association with Pop	Cred Cat	
				Phi	Chi-squ	Gamma
a. Adjusting to UCT	110	53	165	0.16*	0.71	0.12
b. Travelling	59	28	100	0.05	5.03	0.26
c. Lack of personal attention	52	25	82	0.18*	5.66	0.36
d. Finances	47	22	85	0.26***	11.69**	0.46*
e. Finding friends to work with	47	22	74	0.11	8.17*	0.29
f. Too much freedom	45	22	76	0.07	9.49**	0.43*
g. Personal/Family	43	21	74	0.09	11.85**	0.36
h. Lack of study facilities	29	14	49	0.25***	8.84*	0.50*
i. Illness	24	11	31	0.07	8.04*	0.39
j. Accommodation	20	10	36	0.12	9.97**	0.41
k. Problems in residence(1)	17	8	33	0.12	2.49	-0.13
l. Language	17	8	22	0.40***	12.63**	0.44

Key: * - significant association p <0.05
** - significant association p <0.01
*** - significant association p <0.001
(1) - added to the original list

The following associations were found:

a) Black students experienced the problems of adjusting to UCT, lack of personal attention, finances, lack of study facilities, and language, to a significantly greater extent than white students.

b) Significant associations were found between non-academic problem and credits category for students who experienced the problems of lack of study facilities (G=0.5), finances (G=0.46) and too much freedom (G=0.43). Significant proportions of students who experienced these problems performed poorly.

c) Significant associations were also found between credit category and students who experienced the problems of language (G=0.44), accommodation (G=0.41), illness (G=0.39) and personal or family problems (G=0.36), but in these cases the relationships also showed a non-linear pattern. Similar proportions of students who experienced these problem passed all courses or were excluded.

Table 56: Number of non-academic problems indicated by population classification and credit categories

	No. of problems LE 3		GT 3		Total	Statistic
Pop Class	N	%	N	%		
Black	34	62	21	38	54	Chi-squ=13.72
White	133	86	21	14	155	p=2.1E-4
						Phi=-0.26
Total	167	79	42	21	209	
Credits						
<14	8	6	12	38	20	Chi-squ=26.13
14-35	34	25	8	25	42	p=2.1E-6
>35	95	69	12	38	107	G=-0.61;p<0.001
Total	137	100	32	101	169	

6.3.2 Details of associations found

(a) Adjusting to UCT

This problem, indicated by 53% of the sample, was more frequently cited by black students than by white students, and was rated as more serious by black students (Table A6.1). This appears to support the interview data that adjusting to UCT was more traumatic for black students than for white students.

(b) Travelling problems

Of the 59 students who indicated this problem, 12 were living in residence while 47 were living at home or elsewhere. It is unclear what travelling problems the students living in residence were referring to. They could have meant travelling home during the holidays, or travelling to upper campus every day. The association with results was not found to be significant but suggests that a greater proportion of students who experienced this problem obtained fewer than 14 credits (Table A6.2).

(c) Lack of personal attention

Significantly more black students than white students indicated that they had experienced this problem. Of the 52 students who indicated this problem, 24 rated the problem as serious or very serious. Half of these were black students, representing 22% of the sample of black students. A significantly lower proportion of students who indicated this problem obtained more than 35 credits (Table A6.3).

(d) Financial problems

Black students experienced financial problems to a significantly greater degree than white students. Students who had experienced financial difficulties were excluded at a higher rate and a smaller proportion passed all their courses (Table A6.4). Not unexpectedly, fewer students who were financed by their own family or had full bursaries, experienced financial problems than students financed by other means.

(e) Finding friends to work with

A non-significantly larger proportion of black students than white students indicated this problem. While a significant association was found between students who had problems finding friends and credit categories, the Gamma-value was not significant as the data revealed a smaller proportion of students in the middle credit category than in the lower or upper credit category (Table A6.5). All 9 students who experienced this problem and obtained fewer than 14 credits were black.

The problem of finding friends to work with showed a significant positive association with students who were not living in residence. A further significant association was found with students who did not have English as a home language, providing further confirmation of the problem that was frequently raised in the interviews by Afrikaans-speaking students.

(f) Too much freedom

A slightly larger proportion of the black sample (27%) than the white sample (19%) indicated that they had experienced this problem. This would appear to contradict the impression gained during the interviews that this problem was mainly experienced by white students. A significantly higher proportion of students who did not indicate this problem passed all their courses (Table A6.6).

(g) Personal or family problems

A very significant association was found between students who had experienced personal or family problems and credit result categories. A higher proportion of students who had experienced these problems obtained fewer than 14 credits. This association between personal problems and exclusion supports the evidence in the interviews of the effect of severe personal problems on academic performance (Table A6.7).

(h) Lack of study facilities

Black students appear to have experienced this problem to a significantly greater extent than white students (Table A6.8). It is interesting to note that indication of this problem was independent of whether students stayed in residence or not. However, significantly more black students than white students who did not live in residence indicated this problem. The home conditions of black students often did not provide an adequate learning environment for students, a problem raised by many black interviewees living at home.

A strong association was found between students who indicated this problem and credit categories. Students who indicated this problem obtained significantly lower credits than the rest of the sample.

(i) Illness

While no association was evident between students who indicated that they had been ill and population classification, an association was found with results (Table A6.9). The distribution of students who had experienced illness across credit categories was non-linear with a smaller proportion in the middle category than in either the lower or upper categories. Of the students who obtained fewer than 14 credits, all 6 who had been ill were black students.

(j) Accommodation

While no association was evident between students who had experienced accommodation problems and population classification, an association was found with results (A6.10). Once again the distribution of students who had experienced this problem across credit categories was non-linear with a smaller proportion in the middle category than in either the lower or upper categories. Of the students who obtained fewer than 14 credits, 5 of the 6 students who had experienced accommodation problems were black students.

(k) Problems in Res

Seventeen students, or 18% of the sample living in residence, mentioned problems such as noise and distractions, conflicts with wardens or roommates, and complaints about the food. Only 2 of. these students were black and none was female (Table A6.12). None of the students who raised these problems obtained fewer than 14 credits. It should be remembered however that this problem was not amongst the problems listed in the questionnaire and was extracted from the group of "other" problems noted by students.

(l) Language

Of the 15 black students who indicated that language was a problem, 7 were African and all rated the problem as not serious. Of the 6 coloured students, 3 indicated the problem was serious or very serious. While the sample is small it would seem to support the evidence in the interview data, that Afrikaans-speaking coloured students perceived language-related problems to be more serious than African students did (Table A6.12).

Two white students and one black student who indicated language problems gave English as their home language. It is possible that the problems they were referring to were related to difficulties understanding the lecturer, for example, because of a foreign accent or the use of unfamiliar terms. These problems were also raised during the interviews.

While a significant association was found between the experience of language problems and credit category, the relatively high strength of this association (G=0.44) was not found to be significant, as the relationship appeared to be non-linear. The sample of students who said they had experienced language problems comprised of two main groups, those who passed all courses (despite these problems) and those who were excluded.

6.4 ACADEMIC PROBLEMS

6.4.1 Academic problems described

Students were asked to describe any academic problems they had experienced. The range of problems raised can best be conveyed by quoting in full what was written by the following students, four of whom were black (A to D) and three white (E to F).

Student A

I had a bad background in mathematics and found it difficult to follow lectures. Lecturers in general were unable to explain concepts on a low level. Also found it difficult to adjust to changing of lecturers in every course. Lectures I feel could have been made more interesting. Trouble in taking notes in lectures was also a major factor. Also too many courses to concentrate on.

Student B

The pace of the courses as opposed to school courses is vastly different and within a matter of the first term I was lost. It took me a full six months to adjust to this new pace of education and by this time I was totally behind on my courses. I know I sound quite stupid but this is really not a fact. I had a B aggregate in matric and have also won various awards in Maths and Chemistry but I just cannot handle the pace here.

Student C

I could not cope with the workload. It was really too much. I worked hard but the results were a mismatch to the effort I put... the question I am faced with now is whether I am failing to cope academically or whether I am studying ineffectively.

Student D

The new way of teaching - lecturing. The terminology used by some lecturers (British, American) was sometimes confusing as we were used to

the terminology used by our school teachers (Mathematics, Physics, especially). Didn't understand the work - was too shy to ask questions and therefore was frustrated and this put me off studying.

Student E

I took too long to adjust to the amount of work required throughout the year. I didn't do the tutorials and kept on falling far behind in my work. When the exams drew near I found it impossible to catch up on all my work - forcing me to drop a couple of courses... I was a FOOL - which I only realised too late.

Student F

Lectures were far too vague in particular areas which are relevant to Engineering. I feel there should be more in-depth explanation so that the students fully understand the topic. Forget the story of piling on so much work that the students will never manage to complete it all - rather let him understand and enjoy what he is doing.

Student G

Keeping up with the quantity of work to be done. Motivation was only to pass this year so that I can get on with engineering. No motivation out of interest in subjects. Subjects had little relevance to engineering except for drawing and water chemistry. Besides these subjects, this year was like being at school again, and I hated school.

The academic problems mentioned were grouped into categories (Table 57). A brief discussion on each category follows. The questionnaire reference number appears in square brackets after quotations.

Of the 21 named students who did not indicate academic problems, 14 passed all their courses and three were excluded. Of the three, one had had to cope with serious personal problems during the year, while another had suffered from loss of hearing and had had an operation to correct it.

Table 57: Categories of Academic problems

Category of problems	Frequency N	%
Workload and pace	78	37
Problem with specific courses	44	21
Teaching method/boring syllabus	39	19
Motivation/self-discipline	38	18
Study methods, tests and exams	23	11
Long break since school	17	8
Big jump from school	11	5
No academic problems	30	14

Workload and pace

A large number of students simply wrote the word "workload" or said there was never enough time to do everything. As explained elsewhere in this study, it was widely acknowledged that the first-year Engineering curriculum was a demanding one. A significantly higher proportion of black students indicated that the workload and pace had been a problem (Table 58).

Table 58: Problem of workload and pace and population classification

Workload/pace	Black		White		Total	
	N	%	N	%		
A problem	31	56	47	30	78	Chi-squ=10.70
Not a problem	24	44	108	70	132	p=1.1E-3
						Phi=0.23
Total	55	100	155	100	210	

Problems with specific courses

Several students made comments about specific courses (Table 59).

(a) Mathematics (MTH105W) received more comments than any other course. The main problems were the pace of the lectures and the volume and difficulty of the work.

Table 59: Number of comments on specific courses

Course commented on	Frequency
Mathematics	20
Applied Mathematics	13
Physics	9
Engineering Drawing	7
Chemistry 108F/100W	7

(b) In Applied Mathematics, the main complaint was the quality of lecturing. One student wrote that,

> the main problem was the lecturing team... seemed disinterested and unmotivated and did not present the material in a structured manner. [89]

To deal with this problem, several students wrote that they had changed lecturers, and one said he had worked on his own.

> Applied Maths has two lecturers. One is very boring hence I did badly and the other is excellent hence I did better when I changed. [175]

Other problems referred to by more than one student were that the material was difficult to understand, and that it overlapped with much of the work covered in the Physics course.

(c) There was no general problem with the Physics course other than a reference by 4 students to the poor quality of lecturing.

(d) Most of the comments on Engineering Drawing were about the difficulty of grasping the main concepts of the subject. Some students felt that the assistance available was inadequate.

Teaching method/boring syllabus

Dissatisfaction with the teaching has already been referred to in students' remarks about specific courses but was also mentioned by 27 other students, without reference to any particular course.

> Lecturers seem unmotivated and don't tend to instil much enthusiasm for the course. [A22]

> Disinterested demonstrators, lecturers - not interested in you or your problems. Need to improve lecturers, lecturing standards and ability to lecture. [53]

> Certain lecturers are useless so work is near impossible to grasp. [68]

A second group of 16 students felt that the syllabus was boring and irrelevant to Engineering, as mentioned by Students F and G earlier. One student had the following suggestions to make:

> Try get the message across to enjoy university life - not too much, but not think it's a drag. Introduce a more Engineering-like course early on. Possibly one of the easier 2nd-year courses to get students involved and interested more. [96]

Motivation and self-discipline

The fourth most frequently-mentioned problem was the one of self-discipline and motivation (Table 60). This was raised by a significantly higher proportion of white students than black students. Ten students mentioned both the problem of motivation and self-discipline, and that of teaching methods and boring syllabuses, indicating a possible relationship between the two sets of problems.

> [I] had motivational problems in first semester because I found no relevance in the subjects being studied to what I wanted to study. [115]

> Lack of motivation due to the fact that the courses done offered no real stimulation but were just more detailed or complicated versions of the school syllabus...[I] resigned myself to my fate and hoped for a better 2nd year...less emphasis on pure recollection of facts, rather emphasis on understanding and underlying principles....cover less work but in more detail and better explanations. [58]

Table 60: Problem of motivation and self discipline

	Black		White		Total	
	N	%	N	%		
A problem	4	7	34	22	38	Chi-squ=4.94
Not a problem	51	93	121	78	172	p=0.026
						Phi=0.15
Total	55	100	155	100	210	

Study methods, tests and exams

The three main problems mentioned under this heading were the lack of help with study methods and exam technique, tests and exams being scheduled on top of one another, and the short revision time before the final examinations.

A student who had worked for the Gazankulu government and had been to Technikon commented,

> I had a problem in acclimatising with the situation as far as studying is concerned. I think I lacked guidance at the beginning in study methods. The fact that I left school long also contributed... [15]

Long break since school

A group of 17 students who had matriculated prior to 1988 wrote of the problems of adjusting to academic work after the long break since school.

Some had been to Technikon and worked, while others had been to the army. A particular problem mentioned by this group of students was the fact that Calculus had not been in the school syllabus when they had written matric.

> Trying to adjust to the Maths after being out of school for 3 years and then coming to varsity. We did no Calculus at school. [100]

> My main academic problem was trying to adjust to academic life after being in the army for 2 years because they treat all first years as if they have just finished school. [117]

> Since I have been out of school for three years I found studying did not come easy and I blanked out during the first 2 sets of tests. [77]

Big jump from school

Finally, eleven students wrote of the difficulties they had experienced adjusting to the standard of work at UCT.

> There was quite a jump from school to varsity. The school I went to... did not cater for preparation for university - they wanted to get as many people through matric as possible. [65]

> Coping with university life caused by a disadvantaged educational background. [10]

6.4.2 Actions taken to overcome academic problems

Students were asked to indicate which of a list of eight actions they had taken to overcome their academic problems. Their replies are reflected in Table 61. Besides the actions listed, 7 students wrote that they had sought help from senior students and friends.

Table 61: Actions taken to overcome academic problems

Action taken	Frequency
Worked harder	140
Attended extra tutorials	52
Formed a study group	50
Consulted Engineering counsellor	26
Consulted lecturer regularly	17
Arranged private lessons	16
Changed to half-course in Maths	14
Dropped a course	13
No action taken	23

The following points also emerged:

a) No significant associations were found between the actions taken and results.

b) The strategy of forming study groups showed no association with students living in residence or with population classification.

c) Seven students had dropped Engineering Drawing and four Maths. No Indian student and only one coloured student had dropped a course.

d) A significant association was found between black students and the strategy of consulting Engineering student counsellors suggesting that black students made more frequent use of student counsellors than did white students (Table 62).

Table 62: Consulting Engineering student counsellors

	Black		White		Total	
	N	%	N	%		
Consulted	17	31	9	6	26	Chi-squ=21.32
Did not consult	38	69	146	94	184	p=3.9E-6
						Phi=0.10
Total	55	100	155	100	210	

6.5 SUGGESTIONS FOR IMPROVING THE FIRST YEAR PROGRAMME

The questionnaire contained a list of 16 suggestions which had been generated by the interview data. Students were asked to indicate which suggestions they felt would best assist first-year engineering students. The suggestions are listed in order of popularity in Table 63.

Table 63: Suggestions for improving the first-year programme

Suggestion	Frequency N	%
A. Co-ordinate class tests so that they are not on top of each other	115	55
B. Clearer explanation at the beginning of the year of what to expect	110	52
C. More tuts in specific subjects	80	38
D. More frequent but smaller class test	79	38
E. Clearer explanation of Chem and Physics pracs	78	37
F. Special tuts in computing	75	36*
G. Special tuts for those who have never done Engineering Drawing	72	34*
H. More active help from lecturers/counsellors	67	32*
I. Pre-Engineering lectures in Jan/Feb	66	31*
J. Help finding vac work	63	30*
K. Help needed with study methods	62	30*
L. Longer academic year	61	29*
M. More Engineering Drawing tests	50	24
N. Help to plan a 5-year degree after June tests	41	20*
O. Help to plan a 5-year degree after April tests	27	13*
P. More half-course options after June	27	13*

* significant positive association with black students

Black students supported a particular set of suggestions more strongly than white students (Table 63).

The 6 most popular suggestions made by black, white and female students are listed in Table 64. Suggestions A (co-ordinate tests) and F (computing tuts) were rated amongst the top 6 by all three of these categories of students.

Table 64: Most popular suggestions

Student	Suggestion	N	%
White	A	89	57
	B	75	48
	D	59	38
	E	56	36
	C	54	35
	F	46	30
Black	G	36	65
	B	35	64
	I	32	58
	H	30	56
	F	29	53
	A	26	47
Female	A,C,F	8	67
	B	7	58
	J,G	6	50

The most popular suggestions chosen by white students were related to class tests (A & D), tutorials in general and for computing (C & F) and better communication at the beginning of the year and with respect to Physics and Chemistry practicals (B & E).

Amongst black students the most popular suggestions were for tutorials in Engineering Drawing and computing (G & F) and clearer communication at the beginning of the year (B) and more help from lecturers (H). There was also support for better co-ordination of class tests (B) and for Pre-Engineering lectures (I).

Four of the top six suggestions chosen by the small female sample were the same as those chosen by white students. The exceptions were help with finding vac work (J) and the need for tutorials in Engineering Drawing (G).

Of particular interest were student responses to the two suggestions relating to assistance with planning a 5-year degree after the April or June class tests.

Altogether 56 students, 27% of the sample, indicated the need for assistance with changing to a 5-year degree during the year. This included 45% of black respondents and only 20% of white respondents (Table 65). About 13% of the respondents supported the need for assistance to change to a 5-year plan after the April class tests, a suggestion supported by 23% of the interview sample.

Table 65: Need for assistance with changing to 5-year degree.

Assistance to change to 5-year degree	Students		
	Black	White	Total
After April only	8	7	15
After April & after June	6	6	12
After June only	11	18	29
Total	25	31	56
% of sample	45	20	27

In the final question of the questionnaire, students were asked to rank, in order of priority, the suggestions that they had indicated. The first two suggestions listed by each student were counted and a priority ranking obtained which matched the popularity ranking of the suggestions.

The top suggestions ranked as priority by the 142 white students who answered this question were:

1. Co-ordinate class tests so that they are not on top of each other (46)
2. Clearer explanation at the beginning of the year (38)
3. More tutorials in specific subjects (31)
4. More frequent but smaller class tests (23)

The top suggestions ranked by the 46 black students who answered this question were:

1. Pre-Engineering lectures (22)
2. Clearer explanation at the beginning of the year (21)
3. Special tutorials in Engineering Drawing (10)
4. More active help from lecturers (8)

The same rankings as those obtained for black and white students were obtained when assessing the responses of BED and WED matriculants.

From the above information it would appear that most students wanted better communication and information especially at the start of the year. However while white students placed a change in the class test system and more tutorials high on their priorities, black students wanted pre-Engineering lectures, and help, particularly with Engineering Drawing. They also wanted more active assistance from lecturers and student counsellors during the year.

6.6 CONCLUSIONS

The survey confirmed that black and white engineering students came from vastly different backgrounds and experienced different problems during the first year, and supports much of the data obtained from the interviews.

First-year engineering students at UCT reported experiencing similar academic and non-academic problems to those experienced by first-year students at Wits as identified by Agar (1990), with the exception of library-related problems which were not mentioned. A few of the highlights of this chapter are discussed below.

Biographical variables

Only 30% of the African sample had chosen to do Engineering because of the career prospects. This is clearly a reflection of the way in which African students view their career paths in South African society. As there are few black engineers who can act as role models it would appear as if Engineering is a profession reserved for whites. Serious attention will have to be given to the image of Engineering as a profession in order to attract an increasing number of black students, in particular African students.

Individual biographical factors that were found to be significantly associated with good performance were:

* parents' educational background,
* English home language,
* fathers' occupational class, and
* being financed by a full scholarship or bursary.

Multivariate analyses revealed that:

* the very strong influence of Education Department of matriculation over performance in first-year was confirmed;

* matric Physical Science results contributed more to explaining the variation in average examination marks than matric Maths results;

* the number of tests passed in April was an important predictor of success in first-year.

Non-academic problems

The survey produced evidence that black students experience a different set of non-academic problems to white students and that there is an association between certain non-academic problems experienced during the first-year and academic performance. Two types of associations became apparent.

In the one type there appeared to be a linear relationship between the experience of a problem and performance. Examples are problems related to the lack of study facilities, finances and the experience of too much freedom. Students who experienced these problems performed significantly worse than those who did not. These problems appear to be difficult for students to overcome and have serious long-term effects.

While the problems of inadequate study facilities and finances have been presented in some detail in the interview chapter, the problem of too much freedom was only referred to by a few white students. From the survey it would appear that some students were unable to deal with having to be responsible for their own learning. This would indicate a lack of maturity on the part of these students, but is also a reflection of the type of study behaviour learned at school. Amongst the suggestions for improvements to the first-year programme, there was a great deal of support for more involvement of the staff in monitoring and counselling students which could be interpreted as a plea from students for help in dealing with this problem.

A second set of non-academic problems displayed a non-linear association with performance which is more difficult to interpret. Most students who experienced these problems, either performed well, and passed all courses, or were excluded. For example, 40% of the students who indicated that they had experienced language problems were excluded while 47% passed all courses. Only 13% fell into the middle credit category.

Other problems in this groups were illness, accommodation and personal and family problems. One possible explanation for this type of association is that students were referring to different problems which happen to fall into the same category or that these problems were experienced in different ways, and to different degrees. For example, some of the interviewees who spoke of experiencing on-going personal problems, performed poorly, while one student explained how he had managed to sort out his problem in April and passed all his courses at the end of the year.

Academic problems

A significant association was found between black students and the academic problem of workload and pace, and between white students and the problem of motivation and self-discipline.

Many students commented on how boring and irrelevant they found the syllabus indicating that the problems referred to by Granger (1980) are still very much in evidence. Granger's call for a review of the curriculum to address this problem would still appear to be appropriate.

No significant association was found between actions taken and results. Most students said they had simply worked harder to overcome their academic problems while the some attended extra tutorials and formed study groups. Black students made significantly greater use of Engineering student counsellors than did white students.

As was found in several of the studies reviewed (Honikman, 1982; Agar 1990) there appears to be dissatisfaction amongst students with the quality, clarity and stimulation of lectures. Where students have a choice, for example, where parallel lecturing occurs, many "vote with their feet".

Suggestions for improving first year

Support for the suggestions to improve the first-year programme highlighted the different needs of black and white students.

About 45% of black students supported the suggestion that students who were not coping be assisted with changing to a 5-year plan during the first-year, compared with only 20% of white students.

The small sample of female students surveyed expressed their specific interest in Engineering Drawing tutorials and help with finding work during the

vacation, however no reference was made to gender-related problems. Despite the finding in Chapter 4 that female students perform as well as male students in first and second year, the interviews revealed that female engineering students experience particular pressures and problems which require further investigation.

CHAPTER 7

CONCLUSIONS

A theme that runs through the findings of this study is that first-year engineering students at UCT experience a sense of distance between themselves and the elements that make up the university environment, and that this impacts on their academic performance.

The term "distance" is used to describe a multi-faceted experience which varies from one student to the next and is influenced by factors such as population classification, gender, the student's home and educational background, and the student's experience of the teaching and learning environment at the university. The sense in which this experience of distance occurs is broader than the 'alienation' as defined by Loo and Rolison (1986), and identified in studies by Honikman (1982) and Leon and Lea (1988).

This study has found that black and white first-year engineering students come from backgrounds that differ significantly in many important aspects and that they interact with the social and academic systems of the university in different ways. This finding is not unexpected given the vast differences in schooling and socio-economic conditions of black and white South Africans. The study also confirms that black engineering students at UCT experienced particular problems similar to those identified by Agar (1986, 1990) and Potter (1990).

While much attention has been paid in this and related studies to the effect of schooling on performance, it is clear from the results of this study that class-based factors such as parental education and access to finance are also significant predictors of academic success.

The findings of this study are summarised below and in the discussion that follows, suggestions are made of how the Engineering Faculty could put UCT's commitment to assist black students into practice.

7.1 SUMMARY OF FINDINGS

a. BED matriculants performed significantly worse in first-year Engineering than WED matriculants, with 43% of the former being excluded, and only 6% of the latter. All five DET and most IED matriculants were excluded. Black WED matriculants performed better than BED matriculants though not as well as white WED matriculants.

b. Matric point scores were good predictors of performance in first year for WED matriculants but less so for BED matriculants with the matric Physical Science symbol a better predictor than the Maths symbol.

c. No significant difference was found in the first-year or second-year performance of male and female students.

d. No significant difference was found in the first-year performance of students who came to UCT directly from school and those who had matriculated earlier. However the pass rates for students with different post matric experiences needs further investigation.

e. The possession of a full bursary was strongly associated with good performance in first year, being second only to matriculating from a WED.

f. The experience of certain non-academic problems was associated with poor performance in first-year, with black students experiencing a particular set of non-academic problems to a greater degree than white students. These included financial problems, lack of study facilities and language-related problems.

g. Groups of students were identified who experienced particular non-academic problems. These included students living off campus, students whose home town was not Cape Town, Afrikaans-medium matriculants, and black female students.

h. The majority of first-year students experienced problems with the amount of work, its content and relevance, and the way in which it was taught.

i. While suggestions by white students prioritised structural changes to the first year programme such as improving the class test and tutorial systems, black students suggested measures to improve their academic preparation, the communication between staff and students, and the system of counselling.

j. There was support from a small group of predominantly black students for the option of changing to a 5-year curriculum during the first-year.

k. BED matriculants appeared to perform almost as well as WED matriculants in second year, but the comparison was statistically inconclusive due to the small sample size of BED matriculants in second year.

1. Matric Physical Science and first-year Physics and Applied Maths results were the best predictors of performance in second year, while a set of second-year courses showed no correlation with matric results, and very poor correlation with first-year course results.

7.2 DISCUSSION OF FINDINGS

7.2.1 Distance from a career in Engineering

Black students as a group were less sure about Engineering as a career than white students, with few of the African students having chosen to study Engineering because of the career prospects. It is the author's view that this is a result of the profile of Engineering as a white profession, and that the lack of black engineers as role models accentuates the distance between the engineering profession and the black community.

The lack of contact between teachers at black schools and the engineering profession may also explain why the role of teachers in assisting black students in their career choice appears to have been negligible.

In contrast, a long-standing relationship exists between the Engineering Faculty staff and graduates and UCT's white feeder schools. Many of the staff and engineering graduates matriculated from, or have children attending, these schools. They have contact with the teachers and some participate in Careers Day activities. The fact that this sort of relationship does not exist with local black schools denies black high school students the opportunities available to white students in preparing for a career in Engineering.

The Engineering Faculty needs to work with black high school teachers and students, to provide prospective black engineering students with the opportunity of making informed decisions about Engineering as a career. This

would go some way towards ensuring that black students who register for Engineering at UCT have some idea of what to expect.

7.2.2 Distance from the academic system

While the poor results of DET matriculants in first-year engineering has been acknowledged for some time, this study has shown that CED and IED matriculants also performed significantly worse than their WED counterparts at UCT in 1989.

Lack of academic preparation

The gap between the academic demands of school and university is a major contributing factor to the experience of distance. Black students displayed a lack of confidence in their academic preparation, evidenced by their support for the suggestion of a pre-Engineering programme in January and February.

While there is conflicting evidence on the effectiveness of such programmes in addressing academic under-preparedness, they have become standard features of Minority Engineering Programmes in the USA and are regarded as invaluable in introducing black students to the social and academic systems of the university. Such programmes could help to reduce the experience of distance by new students.

The importance of Physics as suggested by the results of this study, together with the poor teaching of Physical Science in black high schools and the lack of support tutorials in first-year Physics and Applied Maths, could partly explain the poor performance of BED matriculants.

The existence of a relationship between performance in first-year Physics and Applied Maths and second-year engineering courses, highlights the need for support programmes and tutorials to help compensate black first-year students for their lack of exposure to the phenomena that underlie the principles and concepts developed in these courses. Given the lack of

laboratory facilities and qualified Science teachers at black schools, particular attention needs to be paid to the design of the practical components of Physics, Chemistry and other Engineering courses .

The issue of workload and reduced-curriculum

The question of workload and the pace of the work is linked to that of the engineering curriculum as a whole. The debate on whether to sacrifice volume of material for more depth in the treatment of topics has continued for many years. The Faculty's ability to introduce changes has had to take into account several external constraints such as the rules governing the accreditation of engineering courses in South Africa. An academic review process has been initiated at UCT under the Committee on Undergraduate Education and will be dealing with the question of curricula.

Most students in this study were not interested in a 5-year curriculum option, but a small group would have considered changing to a 5-year curriculum after April or June. In practice, however, the majority of Engineering students spread their curriculum over five or more years by default rather than design. The fact that about 40% of the students in first-year in 1989 did not pass all their courses at the end of the first year further emphasises the need for well-planned 5-year degree options.

Despite the fact that several of the interviewees who failed 3 or 4 tests in April recovered to avoid exclusion at the end of the year, evidence from the multi-variate analysis indicates that the number of tests failed in April is a significant predictor of performance.

It would therefore appear that a BED matriculant who has low matric points, and fails most of the class tests in April, should be encouraged to consider a 5-year curriculum.

The role of the academic staff

The distance that students experienced between themselves and the staff was graphically described in the interviews. The majority felt that staff should spend more time explaining to students what was expected of them, especially at the beginning of the year. As has been found in past studies, there were many complaints about the quality of lecturing and the perceived lack of concern for students on the part of lecturers. It may be that student complaints about lecturing and tutoring staff were concealing other learning problems they were experiencing.

Students wanted their lecturers to know them, to help them with the work, and to understand their problems and needs. Either they had unrealistic expectations of lecturers, or the lecturers concerned were not doing their jobs properly, or possibly both. The result was a serious problem in the quality of the learning environment as experienced by students.

Furthermore, many students found their courses unstimulating, and the relationship between the practical and theoretical components of courses not always clear. Such conditions encourage students to adopt a surface approach to learning and militate against their developing an academic interest in their field of study.

The period after the April class tests was the time of greatest emotional and psychological stress for most students. The effects of alienation and intimidation, together with the experience of academic failure for the first time, made it the time when students were most in need of counselling and tutorial support.

Most lecturers are unable to devote the necessary time to meet these needs. Their teaching, research and administrative obligations have also to be met. If the problems of first-year students are to be tackled seriously, staff have

to be given the time and resources to address them or else special counsellors need to be appointed.

7.2.3 Distance from the social system

Students' experience of distance from the university social system was influenced by factors such as population classification, language (in particular medium of instruction at school), whether they lived in residence, and whether they had family or friends in Cape Town. The following groups of students were found to have experienced particular problems and it is suggested that they require special attention.

1. Coloured Afrikaans-medium matriculants initially experienced severe problems of self-confidence and had difficulty communicating with other students and staff. This problem could be alleviated by pro-active counselling with this group of students at the beginning of the academic year.

2. The problems of students living off campus centred around the lack of adequate study facilities, isolation from other Engineering students and transport to campus. Students made very few suggestions on how these problems could be overcome. One possibility might be to establish an engineering student study centre of the kind common in engineering faculties in the USA. Such a centre, open 24-hours a day, could serve as a place where students could meet and work together.

3. Some of the students living away from home, particularly black female students, experienced severe psychological and emotional traumas during their first few weeks at UCT. There appears to be a need for a special counselling effort aimed at these students at the beginning of the year. As the majority of African students are housed in residence, a project of workshops held with this group during the first few weeks of the year could help them to adjust to the academic and

social environment. The isolation of black female engineering students in residence could also be addressed in this way.

The sample of female students interviewed and surveyed in this study was too small for the author to be able to make any generalisations. Very little information emerged on gender-related problems although the poor performance of black female engineering students suggests that where the factors of population classification and gender are involved, performance is affected. The data has provided a few pointers to the kinds of problems that exist for this group of students, but further research is needed. Efforts to increase the numbers of women registering for Engineering must involve a clearer understanding of the difficulties they encounter than has emerged from this study.

7.2.4 A final note

The purpose of this study has been to help the Engineering Faculty gain a deeper understanding of the problems experienced by its students. First-year students were given the opportunity to present their perspective of the problems they faced and to suggest ways of alleviating them.

Further research is needed into the effectiveness of different forms of academic support and other intervention activities in Engineering to find the best way of improving the performance of black students. The experience of the ASPECT programme, in its fifth year as this study ends, can provide valuable information in this regard.

Hopefully, in the not too distant future, black female students like Lindiwe, who register for Engineering at UCT, will find a friendly and supportive environment with other black female engineering students to "talk to and relate to", and they will all graduate in Engineering from UCT.

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APPENDIX 1
A/J GRID OF STUDENTS WHO FAILED CLASS TESTS

Pop. class	APRIL: No. of tests failed	JUNE: Number of tests failed							TOTALS
		5	4	3	2	1	0	withdrew before June	
BLACK	4	2	1		1	1			5
	3	2	1	3			1		7
	2	2	1		1	2	1		6
	1					2	1		4
	0					1	4		5
COLOUR--ED	4	1	2	2					5
	3	2	5	1	2	1			11
	2	2	7	1	2	2		1	15
	1		1	2	2	4	3		12
	0				1	1	2		4
INDIAN	4	3	2	1					6
	3		1	1					2
	2		2	1		1			4
	1	1	1	1	1	2			6
	0				1				1
WHITE	4	1	4	5	3	1	1	1	16
	3	2	9	6	2	5	1	1	26
	2	2	5	9	17	10	11	1	55
	1		3	6	9	9	33		60
	0			3	6	12	49		71

APPENDIX 2
PERSONAL BACKGROUND QUESTIONNAIRE

CONFIDENTIAL

ASPECT UCT SEPTEMBER 1989

All information shall be treated as confidential.

NAME..... STUDENT NUMBER.....

PERSONAL BACKGROUND

1. Where have you lived most of your life?

---

2. What is the language spoken at home?

---

3. In what language did you receive your secondary education?

---

4. Which secondary school(s) did you attend?

FAMILY EDUCATION AND OCCUPATIONAL BACKGROUND

5. What does your father do?

---

6. What does your mother do?

7.What is the highest educational qualification of your father?

8.What is the highest educational qualification of your mother?

---

9. Do you or any of your family have a university degree or technical diploma besides those mentioned above? Give details

---

AFTER SCHOOL

10. What did you do after leaving school?

a) Came straight to UCT
b) Worked (give details below)
c) Studied elsewhere (give details below)
d) At home
e) Other .....

Work details:

Study details:

AT UNIVERSITY

11. Where are you staying while at university?

a) In residence
b) At home with parents
c) Boarding
d) Sharing with friends
e) Other.....

12 How is you university education being financed?

a) Own/family financing
b) Full scholarship/bursary
c) Part scholarship/bursary
d) Loan
e) Other.....

APPENDIX 3
INTERVIEW QUESTIONNAIRE

CONFIDENTIAL

ASPECT UCT SEPTEMBER 1989

NAME..... STUDENT NO:..... DEGREE.....

SECTION A : FEELINGS ABOUT 1st YEAR ENGINEERING

A.1 What made you decide to study Engineering?

A.2 Has the first year programme been what you expected it to be?

A.3 Have you experienced any pressure/problems during this year? Give details

A.3.1 Academic work

A.3.2 Social

A.3.3 Financial

A.3.4 Other

SECTION B : FEELINGS ABOUT COPING

B.1 Have you ever felt you weren't coping during the year? YES/NO. If so, explain when and for what reasons, and what you did to overcome these.

B.1.1 When

B.1.2 Reasons

B.1.3 Action taken

B.2 Is there any particular course(s) that you have difficulty with? If so, give details.
M105W AM104 AM102 P104 P102 Ch100 Ch108F MEC102

B.3 Have you received assistance or advice from members of staff/student counsellors on any problems you have experienced? YES/NO
Explain

B.4 How do you feel now?

a) Hopeless ---

---

b) Bad results, but will catch up ---

---

c) Fine ---

---

d) Don't know ---

---

e) Other ---

B.5 How well do you think you will do at the end of the year?

SECTION C : FEELINGS ABOUT APRIL TESTS AND AFTER

C.1 How well did you do in your April Tests?

Failed 0 1 2 3 4 subjects

C.2 How did you feel about your results in the April Tests?

C.3 Do you think those tests were fair assessment of your ability? YES/NO
Explain.

C.4 Did you feel that you needed any assistance after the April Tests? YES/NO
If so, what sort of assistance would you have liked?

C.5 What kind of assistance do you think would be useful for first year Engineers after April?

C.6 The Faculty is considering offering students the opportunity to change to a 5-year reduced-curriculum programme with extra tutorials after April. Would you have been willing to change to such a programme after the April Tests?
Explain.

C.6 How do you think other students would feel about such a programme?

APPENDIX 4
SURVEY QUESTIONNAIRE

CONFIDENTIAL

ASPECT UCT OCTOBER 1989

All information shall be treated as confidential

NAME (Optional)_____

ENGINEERING DEGREE: _____

---

1. Where have you lived most of your life?_____
2. What language is spoken at home? _____
3. In what language did you receive secondary education? _____
4. Which matriculation examination did you write and in what year?_____

---

5. What did you do after leaving school? (Ring the appropriate letter):
   a) Came straight to UCT_____
   b) Worked (give details) _____
   c) Studied elsewhere (give details) _____
   d) Other (give details)_____

---

6. Where are you staying while at university?
   a) In residence
   b) At home
   c) Boarding
   d) Sharing with friends
   c) Other (please explain)_____

7. How is your university education being financed? (Ring more than one choice if appropriate)
   a) Own/family financing
   b) Full scholarship/bursary
   c) Part scholarship/bursary
   d) Loan
   e) Other (please explain)_____

8. Was Engineering your first choice as a career?
   a) YES
   b) NO

   If No, what career would you have preferred to study?

---

9. Which of the following factors influenced your decision to study Engineering? (Ring more than one factor if appropriate)
   a) Interested in designing and building things
   b) Was advised by careers counsellor/teacher
   c) It was my second choice and I didn't get accepted into _____ (please fill in)
   d) Was awarded a bursary to do Engineering
   e) Did well in Maths and Science in school
   f) Engineering offers good career prospects
   e) Other (please explain)_____

   _____

10. What does your father do? _____
11. What does your mother do? _____
12. What is the highest educational qualification of your father?_____
13. What is the highest educational qualification of your mother? _____

14. Tick off which of the following **non-academic problems** you experienced this year and give some idea of how serious the problem was. Use the scale: 1 - not very serious : 2 - serious : 3 - very serious.

	Tick if you experienced this problem	How serious was it?
a) Adjusting to UCT		
b) Language		
c) Lack of personal attention		
d) Financial difficulties		
e) Traveling		
f) Personal/family		
g) Accommodation		
h) Lack of Study facilities		
i) Finding friends to work with		
j) Illness		
k) Too much freedom		
l) Other (please explain below)		

---

15. Rank the following courses in order of difficulty (Column A) and order of interest (Column B) using the scale; 1 most - 6 least. (Put an X if you didn't do the course).

Course	Column A Order of difficulty	Column B Order of interest
Applied Maths AM104/102		
Mathematics M105w		
Physics P104/102		
Chemistry Chem 100W/108F		
Engineering Drawing		
Intro to Eng/Water Chem		

16. What were the main **academic problems** you experienced this year?

---

17. Ring the letters next to the **actions you took** to overcome your academic problems this year:

a) worked harder
b) Formed a group to work with
c) Consulted lecturer(s) regularly
d) Attended extra departmental tutorials in _____
e) Arranged private lessons in _____
f) Changed to the half course in Maths _____
g) Dropped the following course(s)_____

---

h) Spoke to Engineering student counsellor(s)

i) Took no action at all

j) Other (explain)

---

18. Here is a list of **suggestions** made by first year Engineering students during interviews. Ring the letter next to the suggestions which you feel will best assist first year engineering students:

a) Pre-Engineering lectures (in Jan/Feb)

b) Clearer explanation at the beginning of the year of what to expect.

c) More tutorials in the following subjects

---

d) Special tutorials for people who have never done drawing

e) Special tutorials in computing

f) Help needed with study methods

g) Clearer explanation of Chemistry and Physics practicals

h) More active help from lecturers/Student counsellors, e.g. call students in to talk to them regularly

i) Assistance with planning a five-year degree after April class tests

k) More half course options after June like M101S

l) Longer academic year

m) Help finding vac work

n) Co-ordinate class tests so that they are not on top of each other

o) More Engineering drawing tests

p) More frequent but smaller class tests

q) Other (please explain)_____

---

19. List the letters of the suggestions you have ringed above in order of priority:

APPENDIX 5

TABLES USED TO INVESTIGATE THE ASSOCIATION BETWEEN BIOGRAPHICAL VARIABLES AND POPULATION CLASSIFICATION AND CREDIT PERFORMANCE VARIABLES.

Table A5.1: Home town

	Home Town Cape Town		not Cape Town		Total	
Pop class	N	%	N	%		
African	3	16	16	84	19	Chi-squ=29.8
Coloured	23	96	1	4	24	df=3;p=1.5E-6
Indian	4	36	7	64	11	
White	76	50	77	50	153	
Total	106	51	101	49	207	
Credits						
<14	8	10	12	14	20	Chi-squ=0.71
14-35	21	25	21	24	42	df=2;p=0.702
>35	54	65	54	62	108	G=-0.08;p>0.05
Total	83	100	87	100	170	

Table A5.2: Home language

	Home language English		not English		Total	
Pop class	N	%	N	%		
African	0	0	20	100	20	Chi-squ=87.8
Coloured	15	63	9	38	24	df=3 p=0.000
Indian	9	82	2	18	11	
White	139	90	15	10	154	
Total	163	78	46	22	209	
Credits						
<14	9	7	11	31	20	Chi-squ=16.33;
14-35	33	25	9	25	42	df=2;p=2.8E-4
>35	92	69	16	44	108	G=-0.49;p<0.05
Total	134	101	36	100	170	

Table A5.3: School medium of instruction

	School Medium English		not English		Total	
Pop Class	N	%	N	%		
African	20	100	0	0	20	Chi-squ=29.58
Coloured	14	58	10	42	24	df=3 p=1.7E-6
Indian	11	100	0	0	11	
White	142	92	12	8	154	
Sample size	187	89	22	11	209	
Credits						
<14	15	10	5	29	20	Chi-squ=5.82
14-35	38	25	4	24	42	df=2 p=0.055
>35	100	65	8	47	108	G=-0.39;p>0.05
Total	153	100	17	100	170	
Mean Credits	30.5		24.5			T=2.07,p=0.040

Table A5.4: Year of matric

	Year of Matric 1988		pre-1988		Total	
Pop Class	N	%	N	%		
African	7	35	13	65	20	Chi-squ=21.82
Coloured	22	92	2	8	24	df=3 p=7.1E-5
Indian	11	100	0	0	11	
White	107	69	48	31	155	
Total	147	70	63	30	210	
Credits						
<14	15	13	5	9	20	Chi-squ=0.43
14-35	29	25	13	25	42	df=2 p=0.805
>35	73	62	35	66	108	G=0.09;p>0.05
Total	117	100	53	100	170	

Table A5.5: Parents' Education background by population classification

Education	Father					Mother				
	Black		White		Total	Black		White		Total
	N	%	N	%		N	%	N	%	
<std 10	23	51	11	8	34	31	67	14	11	45
Std 10/diploma	16	36	44	34	60	11	24	80	62	91
Degree	6	13	76	58	82	4	9	35	27	39
Total	45	100	131	100	176	46	100	129	100	175
	Chi-square=46.02 df=2 p=1.0E-10 G=0.77;p<0.0001					Chi-square=56.79 df=2 p=4.7E-13 G=0.76;p<0.0001				

Table A5.6: Parents Educational background versus results

	Educational Background							
	Father's				Mother's			
	<Std 10		≥Std 10		<Std 10		≥Std 10	
Credits	N	%	N	%	N	%	N	%
<14	9	33	7	6	14	38	6	6
14-35	7	26	27	23	7	19	27	25
>35	11	41	86	72	16	43	76	70
Total	27	100	120	101	37	100	109	101
	Chi-squ=18.62 df=2 p=9.0E-5 G=0.59;p<0.005				Chi-squ=24.56 df=2 p=4.6E-6 G=0.55;p<0.05			

Table A5.7: Father's occupational class by population classification and results

	lower/ low-mid		Upper/ Upp-mid		Total	Statistic
	N	%	N	%		
Black	25	56	20	44	45	Chi-squ=20.14
White	27	19	112	81	139	p=7.2E-6
						Phi=0.33
Total	52	28	132	72	184	
Credits						
<14	9	22	5	5	14	Chi-squ=11.40
14-35	11	27	26	24	37	p=3.3E-3
>35	21	51	77	71	98	G=0.43;p>0.05
Total	41	100	108	100	149	

Table A5.8: Mother's occupational class by population classification and results

	At Home		lower/ low-mid		Upper/ Upp-mid		Total	Statistic
	N	%	N	%	N	%		
Black	30	57	15	28	8	15	53	Chi-squ=7.21
White	58	40	37	26	49	34	144	p=0.027
								Phi=0.19
Total	88	45	52	26	57	29	197	
Credits								
<14	12	17	6	14	2	4	14	Chi-squ=4.43
14-35	15	21	10	23	13	28	37	p=0.351
>35	43	61	28	64	31	67	98	G=0.13;p>0.05
Total	70	99	44	101	46	99	160	

Table A5.9: Accommodation

	Not in Res		In Residence		Total	
	N	%	N	%		
African	2	10	18	90	20	
Coloured	21	88	3	13	24	
Indian	8	73	3	27	11	
Black	31	56	24	44	55	Chi-squ=1.4E-3
White	85	55	70	45	155	p=0.97
Total	116	55	94	45	210	
Credits						
<14	12	13	8	11	20	Chi-squ=2.38
14-35	27	29	15	20	42	p=0.303
>35	55	59	53	70	108	G=0.21;p>0.05
Total	94	101	76	101	170	

Table A5.10: Family finance

	Other finance		Family finance		Total	Statistic
Pop Class	N	%	N	%		
Black	45	82	10	18	55	Chi-squ=8.51
White	91	59	64	41	155	p=3.5E-3
						Phi=0.20
Total	136	65	74	35	210	
Credits						
<14	19	17	1	2	20	Chi-squ=22.50
14-35	17	15	25	45	42	p=1.3E-5
>35	79	69	29	53	108	G=-0.15;p>0.05
Total	115	101	55	100	170	

Table A5.11: Full bursary

	Other finance		Full bursary		Total	Statistic
Pop Class	N	%	N	%		
Black	31	56	24	44	55	Chi-squ=0.68
White	99	64	56	36	155	p=0.410
						Phi=0.06
Total	130	62	80	38	210	
Credits						
<14	13	13	7	10	20	Chi-squ=6.59
14-35	32	31	10	15	42	p=0.037
>35	58	56	50	75	108	G=0.33;p>0.05
Total	103	100	67	100	170	

APPENDIX 6

TABLES USED TO INVESTIGATE ASSOCIATION BETWEEN NON-ACADEMIC PROBLEMS AND POPULATION CLASSIFICATION AND CREDIT PERFORMANCE

Table A6.1:Problem of Adjusting to UCT

	A problem		Not a problem		Total	Statistical Test
Pop Class	N	%	N	%		
Black	37	67	18	33	55	Chi-squ=5.65
White	73	47	81	53	154	p=0.017
						Phi=0.16
Total	110	53	99	47	209	
Credits						
<14	12	13	8	10	20	Chi-squ=0.71
14-35	23	26	19	24	42	p=0.700
>35	54	61	53	66	107	G=0.12;P>0.05
Total	89	100	80	100	169	
	Not serious		Serious/ very ser.		Total	
Black	16	43	21	57	37	Chi-squ=6.23
White	51	70	22	30	73	p=0.013
						Phi=-0.24
Total	67	61	43	39	110	

Table A6.2: Travelling problems

	A problem		Not a problem		Total	Statistical Test
Pop class	N	%	N	%		
Black	18	33	37	67	55	Chi-squ=0.47
White	41	27	113	73	154	p=0.491
						Phi=0.05
Total	59	28	150	72	209	
Credits						
<14	10	20	10	8	20	Chi-squ=5.03
14-35	12	25	30	25	42	df=2 p=0.081
>35	27	55	80	67	107	G=0.26; p>0.05
Total	49	100	120	100	169	

Table A6.3: Lack of personal attention

	A problem		Not a Problem		Total	Statistical Test
Pop class	N	%	N	%		
Black	18	33	37	67	55	Chi-squ=6.52
White	34	22	120	78	154	p=0.011
						Phi=0.18
Total	52	25	157	75	209	
Credits	N	%	N	%		
<14	7	18	13	10	20	Chi-squ=5.66
14-35	14	35	28	22	42	df=2 p=0.59
>35	19	48	88	68	107	G=0.36; p>0.05
≤35 credits	21	53	41	32	62	Chi-square=4.79
>35 credits	19	48	88	68	107	p=0.029
						Phi=0.17
Total	40	101	129	100	169	

Table A6.4: Financial problems

	A problem		Not a problem		Total	Statistical Test
Pop Class	N	%	N	%		
Black	23	42	32	58	55	Chi-squ=14.53
White	24	16	130	84	154	p=1.4E-4
						Phi=0.26
Source of finance						
Family/full bursary	20	13	133	87	153	Chi-squ=27.06
Other	27	48	29	52	56	p=2.0E-7
						Phi=0.36
Total	47	22	162	78	209	
Credits						
<14	10	26	10	8	20	Chi-squ=11.69
14-35	11	29	31	24	42	p=2.9E-3
>35	17	45	90	69	107	G=0.46;p<0.05
Total	38	100	131	100	169	

Table A6.5: The problem of finding friends to work with

	A problem		Not a problem		Total	Statistical Test
Population Class	N	%	N	%		
Black	17	31	38	69	55	Chi-squ=2.42
White	30	19	124	81	154	p=0.120
						Phi=0.11
Accommodation						
In residence	13	14	81	86	94	Chi-squ=6.47
not in res	34	30	81	70	115	p=0.011
						Phi=0.18
Total	47	22	162	78	209	
Home Language						
English	29	18	133	82	162	Chi-squ=6.49
not English	17	37	29	63	46	p=0.011
						Phi=0.18
Total	46	22	162	78	208	
Credits						
<14	9	26	11	8	20	Chi-squ=8.17
14-35	7	20	35	26	42	p=0.017
>35	19	54	88	66	107	G=0.29;p>0.05
Total	35	100	134	100	169	

Table A6.6: The problem of too much freedom

	A problem		Not a problem		Total	Statistical Test
Pop Class	N	%	N	%		
Black	15	27	40	73	55	Chi-squ=1.03
White	30	19	124	81	154	p=0.310
						Phi=0.07
Total	45	22	164	78	209	
Credits						
<14	6	17	14	11	20	
14-35	15	42	27	20	42	Chi-squ=9.49
>35	15	42	92	69	107	p=8.7E-3
						G=0.43;p<0.05
Total	36	101	133	100	169	

Table A6.7: Personal or family problems

	A problem		Not a problem		Total	Statistical Test
Pop Class	N	%	N	%		
Black	15	27	40	73	55	Chi-squ=1.53
White	28	18	126	84	154	p=0.216
						Phi=0.09
Total	43	21	166	79	209	
Credits						
<14	10	29	10	8	20	Chi-squ=11.85
14-35	7	20	35	26	42	p=2.7E-3
>35	18	51	89	66	107	G=0.36;p>0.05
Total	35	100	134	100	169	

Table A6.8: The problem of lack of study facilities

	A problem		Not a problem		Total	Statistical Test
Pop Class	N	%	N	%		
Black	16	29	39	71	55	Chi-squ=12.78
White	13	8	141	92	154	p=3.5E-4
						Phi=0.25
Total	29	14	180	86	209	
Not in res						
Black	12	39	19	61	31	Chi-squ=16.78
White	5	6	79	94	84	p=4.2E-5
						Phi=0.38
Total	17	15	98	85	115	
Credits						
<14	6	25	14	10	20	Chi-squ=8.84
14-35	9	38	33	23	42	p=0.012
>35	9	38	98	68	107	G=0.50;p<0.05
Total	35	101	134	100	169	

Table A6.9: The problem of illness

	A problem		Not a problem		Total	Statistical Test
Pop class	N	%	N	%		
Black	9	16	46	84	55	Chi-squ=1.16
White	15	10	139	90	154	p=0.282
						Phi=0.07
Total	24	11	185	89	209	
Credits						
<14	6	32	14	9	20	Chi-squ=8.04
14-35	4	21	38	25	42	p=0.018
>35	9	47	98	65	107	G=0.39;p>0.05
Total	19	100	150	100	169	

Table A6.10: The problem of accommodation

	A problem		Not a problem		Total	Statistical Test
Pop class	N	%	N	%		
Black	9	16	46	85	55	Chi-squ=2.99
White	11	7	143	93	154	p=0.084
						Phi=0.12
Total	20	10	189	90	209	
Credits						
<14	6	35	14	9	20	Chi-squ=9.97
14-35	3	18	39	26	42	p=6.8E-3
>35	8	47	99	65	107	G=0.41;p>0.05
Total	17	100	152	100	169	

Table A6.11: Problems in residence

	A problem		Not a problem		Total	Statistical Test
Students in res	N	%	N	%		
Black	2	8	22	92	24	Chi-squ=1.28
White	15	21	55	79	70	p=0.258
						Phi=0.12
Total	17	18	77	82	94	
Named sample in res: Female	0	0	5	100	5	
Male	14	20	57	80	71	
Total	14	18	62	82	76	
Credits						
<14	0	0	8	13	8	Chi-squ=2.49
14-35	4	29	11	18	15	p=0.288
>35	10	71	43	69	53	G=-0.13;p>0.05
Total	14	100	62	100	76	

Table A6.12: Language problems

	A problem		Not a problem		Total	Statistical Test
Pop class	N	%	N	%		
Black	15	27	40	73	55	Chi-squ=33.20
White	2	1	152	99	154	p=8.3E-9
						Phi=0.40
Total	17	8	192	92	209	
Home Language						
English	3	2	159	98	162	Chi-squ=35.28
Not English	14	30	32	70	46	p=2.8E-9
						Phi=0.41
Total	17	8	191	92	208	
Credits						
<14	6	40	14	9	20	Ch-squ=12.63
14-35	2	13	40	26	42	p=1.8E-3
>35	7	47	100	65	107	G=0.44;p>0.05
Total	15	100	154	100	169	