TUTOR-MENTORING OF FOUNDATION MATHEMATICS STUDENTS AT MONASH SOUTH AFRICA

by

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ABSTRACT

Research has shown that academic under-performance in higher education can be attributed *inter alia* to psychosocial difficulties arising from students' under-preparedness for the rigours of university life, the struggle to accommodate diverse cultural worldviews and poor proficiency in the language of learning and teaching (Chang 1999). As internationalisation of higher education institutions has became more common worldwide, the need for support systems to deal with problems of a multicultural student body has become essential if students are to have equitable opportunities for success. In this regard, Monash South Africa (MSA), an international multicultural higher education institution, introduced a tutor-mentor programme to improve academic outcomes among mathematics students in the Foundation Programme (FP). The impact of this programme was investigated by means of an empirical investigation and framed by a *bricolage* of learning theories which served as a conceptual framework for the study under the metaphors of acquisition and participation. The literature study showed that tutoring and mentoring programmes tend to be successful pedagogical supports. The empirical inquiry took the form of a mixed-method case study which explored the impact of participation in the tutor-mentor programme on mathematical performance among FP mathematics students at MSA. The participants in the study, which was carried out in two phases, were mathematics students, tutor-mentors and lecturers in the FP. Phase 1 quantitatively explored the extent of effectiveness of the tutor-mentor intervention, using a quasi-experimental non-equivalent control group design. Two formal tests were used to gather data, which were analysed by an analysis of covariance and the Johnson-Neyman technique. Quantitative findings supported the initial assumption of the study: that participation in the tutor-mentor programme as an intervention strategy improved the mathematics scores of FP students at MSA. Phase 2, a qualitative study, used purposive sampling. Data was gathered through focus group and individual interviews, observation, spontaneous conversations and photographs. Interpretation of the quantitative and qualitative data was presented according to the phases and thereafter integrated. Qualitative findings provided information about the dynamics of the tutor-mentor programme in providing academic and psychosocial support to students. Finally, a situation-producing theory was developed from the integrated findings, and recommendations made for improvement of practice.

Key words

Tutor-mentor programmes

Mathematics students

Higher education

Private higher education institutions

DEDICATION

This work is dedicated to my husband Don, my daughter Lynne and son-in-law Neil for their loving support and encouragement, and to my grandsons Daniel and Jonathan whom I love with all my heart.

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LIST OF ABBREVIATIONS

AARP	Alternative Admissions Research Project
ADP	Academic Development Programme
BICS	Basic Intercommunicative Personal Skills
CALP	Cognitive Academic Language Proficiency
EAL	English Additional Language
FIAC	Flanders Interaction Analyses Categories
FP	Foundation Programme
HREC	Human Research Ethics Committee
IT	Information Technology
LoLT	Language of Learning and Teaching
LPP	Legitimate Peripheral Participation
MSA	Monash South Africa
MSAFP	Monash South Africa Foundation Programme
MU	Monash University
NQF	National Qualifications Framework
SATAP	The Standardised Assessment Test for Access and Placement.
SAQA	South African Qualifications Authority
SCERH	Standing Committee in Ethics Research Involving Humans
ZPD	Zone of Proximal Development

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

BACKGROUND, PROBLEM FORMULATION AND AIMS

Treat people as if they were what they ought to be … help them to become what they are capable of (Johann Wolfgang von Goethe 1749 – 1832).

1.1. Introduction

Peer tutoring and mentoring has been in place in various forms of education for hundreds if not thousands of years (Wagner in Goodlad 1998:2). Towards the middle of the nineteenth century, tutoring and mentoring became neglected as an educational technique but regained status as a way of meeting acute educational needs (Goodlad 1998:2). Recent studies have shown that tutoring and mentoring have intellectual and psychosocial benefits for the tutor and the tutee and for the mentor and mentee, as they enrich education, reduce stress and help students achieve goals that cannot be achieved by other means (Goodlad 1998; Loots 2009; Powell 1997). This presupposes a relationship that recognises the tutor-mentor as a supporting friend and gentle critic to the tutee-mentee and therefore assumes incorporating both cognitive and affective aspects into a holistic tutor-mentor programme. As expressed by Hendricks and Hendricks (1995), 'The image of the lonesome hero may make for good drama, but real life is much different. Men [sic] need other men [sic] for support, guidance, encouragement, and accountability.' Student tutoring and mentoring 'should [however,] be seen as *solutions to problems,* not activities undertaken just for the sake of it (or as educational experiments)' (Goodlad 1998:6; emphasis in the original).

Early studies on tutoring and mentoring at higher education institutions were pragmatic and investigated the reasons why such programmes were considered necessary. Practical issues such as encouraging students' self-involvement in learning and reducing absenteeism (Falchikov 2001:67-68) were stressed. Later studies paid more attention to the theories behind tutoring and mentoring, and less to practical aspects (Falchikov 2001:68-69). There was, therefore, an imbalance in what was being emphasized. However, the main concern of all studies reflecting the practical concerns of institutions was and remains ensuring optimum teaching and learning and retention of students to graduation and beyond.

Tutoring and mentoring have particular benefits for first year higher education students. First year students are confronted with what to them may be unusual and unexpected challenges which are however are generally considered a normal part of student experience and personal growth. Most are able to cope with the 'normal' psychosocial and academic stresses, but a small number do not, and as a result, either leave university or fail academically. Not only is the environment new to students, it also creates particular stresses for which the majority of first year students are unprepared (Carreras & Fernandez-Castro 1998; Crosling & Webb 2002; Cross, Shalem, Backhouse, Adam & Baloyi 2007; Lazarus & Folkman 1984; Lucas, Damianova, Burney & Ponto 2006).

Political, economic and social changes have opened the doors of higher education institutions worldwide to an increase in student numbers (massification[1]) and a nationally and culturally diverse student body. Higher education institutions have thus moved 'from an elite [selective and relatively small number of students] to a mass [less selective and much larger numbers] system' (Crosling & Web 2002:3). In South Africa, trends in higher education institutions have led to an expansion in the intake of students, especially from those parts of the community that had previously been excluded for economic, social or political reasons. Furthermore, cross-border movement has increased national and cultural diversity on university campuses as an increasing number of foreign students are registering at South African higher education institutions (see Table 1.1; Figure 1.1; Figure 1.2).Increased access to higher education and the increasing number of multinational and multicultural students has confronted institutions and students with new and diverse problems. These difficulties have affected teaching and learning, and academic outcomes (Astin 1993; Chang 1999; Orfield & Kurlander 1999) and have led to the need for additional student academic support and mentoring.

Crosling and Webb (2002:8) emphasize the need to support university students in their learning, since lack of academic and psychosocial support is a major cause of students abandoning tertiary studies and as a result, potential contributions to academia are lost. These findings are supported by Page, Loots and du Toit (2005) who highlight the need for tutoring and mentoring strategies as support mechanisms at South African universities. According to Lucas et al

[1] Massification of higher education institutions means increased access to universities and increased numbers of students registering at universities especially of socially and economically disadvantaged sections of the population (Pokorny & Pokorny 2005).

(2006:3), there is 'a considerable body of evidence to show that the university experience for students is stressful'. Against this background, the discussion turns to the needs of Monash South Africa (MSA) students.

1.1.1 Monash South Africa

MSA, an international, cross-cultural private higher education institution, was founded by Monash University (MU), Australia, in 2001. It is located in Ruimsig, in the north-west part of Johannesburg, South Africa, and, being in the main southern African metropolis, is in easy reach of present and potential students. There has been a steady increase in MSA student numbers and in cultural and national diversity (Table 1.1; Table 1.2; Figure 1.1; Figure 1.2).

Table 1.1: MSA student numbers

Year	South African	Foreign	Total	% Growth
(2001)	(unknown)	(unknown)	(52)	N A
2002	61+*9*=70	81+*34*=115	142+*43*=185	256
2003	118+*5*=123	119+*104*=223	237+*109*=346	87
2004	158+*11*=169	191+*131*=322	349+*142*=491	42
2005	170+*25*=195	406+*230*=636	576+*255*=831	69
2006	205+*106*=311	618+*334*=952	824+*440*=1264	52
2007	253+*96*=349	858+*499*=1357	1111+*595*=1706	35
2008	426+*98*=	1717+*504*=2221	1541+*602*=2143	26

Source: MSA Department of Advancement 2009 Statistics.

Undergraduates + *FP*= Total student numbers for that year.

Table 1.1 shows the total numerical growth of MSA students, including Foundation Programme (FP) students, and compares foreign and domestic student numbers between 2001 and 2008. The italicised, underlined numbers represent FP student intake. The numbers for 2001 exclude FP students. From 2003, the undergraduate intake for each year includes ex-FP students accepted for the undergraduate degree programme.

Table 1.2 shows total numerical growth of MSAFP students and compares foreign and domestic FP student numbers from 2002 to 2008.

Table 1.2: MSAFP student numbers

Year	South African	Foreign	Total
2002	9	34	43
2003	5	104	109
2004	11	131	142
2005	25	230	255
2006	106	334	440
2007	96	499	595
2008	98	504	602

Source: MSA Department of Advancement 2009 statistics

The large proportion of FP students amongst total MSA students from 2003 to the present is evident from Table 1.1 and Table 1.2 and shows the importance of the FP as an access pathway into undergraduate studies. Of particular interest to the study is the large number of foreign compared to local students (excluding 2001 when there were only undergraduate first year students for whom no breakdown of nationalities was available).

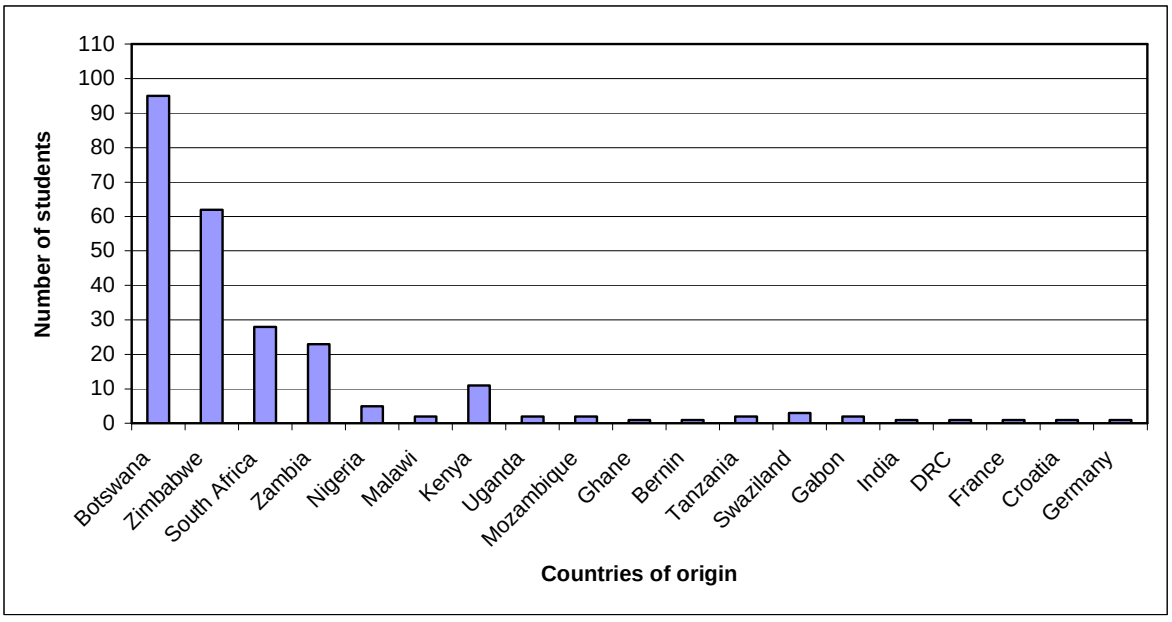

Figure 1.1: Number of 2005 MSAFP students per country of origin

(DRC: Democratic Republic of Congo)

The pilot study, which was confined to the MSAFP of 2005, indicated that southern Africa was the main source of FP students, with students from Botswana and Zimbabwe in the majority. However, because the MSAFP student profile changes and numbers increase each year, the 2008 case study consisted of a different set of students (Figure 1.2) to that of the 2005 pilot case study (Figure 1.1).

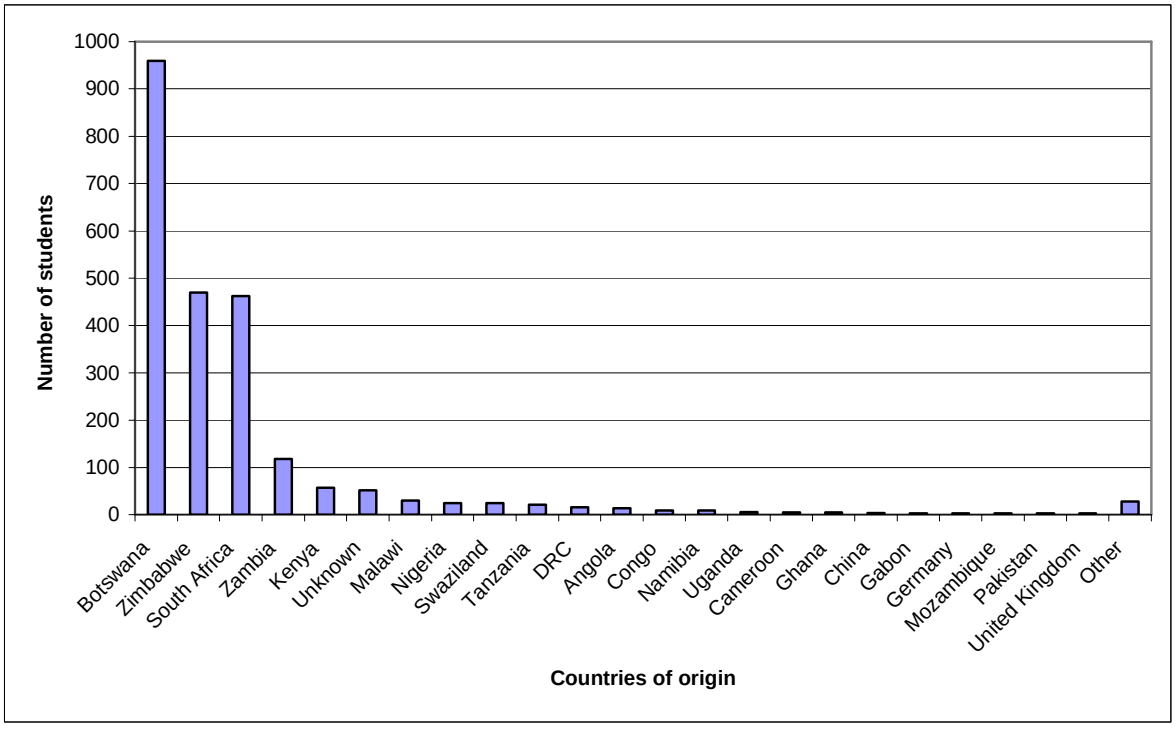

Figure 1.2: Number of 2008 MSA students per country of origin

(DRC: Democratic Republic of Congo)

In Figure 1.2 'Other' refers to two or less students from each of the following countries: Argentina; Benin; British Antarctic Territory; Bulgaria, Burundi; Equatorial Guinea; Ethiopia; France; Greece; India; Lesotho; Liberia; Lithuania; Netherlands; Portugal; Russian Federation; Sierra Leone; Singapore; Taiwan; Togo and Turkey.

Between 2002 and 2008 there was a noticeable growth in the number of South African students and a growing number from East, Central and West Africa increasing the domestic and international multicultural mix on the MSA campus. A small number of students are domiciled

outside Africa, mainly in Europe, the United States of America and Asia (see Figures 1.1 & 1.2), with distribution remaining fairly consistent up to the time of the 2008 study.

These developments, while in line with the MSA's aim of providing opportunities for a cultural diversity of students, has created problems for students and the institution (Maitland & Manson 2006) There are particular problems relating to the use of English as the language of learning and teaching (LoLT) since most students are English Additional Language (EAL) speakers (Cummins 1984; Heugh 2008; Lazenby 1997; Lemmer 2009a in process). Furthermore, although university experience may appear liberating for young people, the almost unlimited freedom they experience may lead to feelings of anxiety, increased stress levels and associated problems. Most FP students are adolescents or young adults experiencing and attempting to cope with many of the complex and challenging changes in this particular phase of life (Theron & Dalzell 2006:397). Vulnerability to stressful situations causes many to experience psychosocial and cognitive difficulties as new students. Awareness of the problems of FP students at MSA indicated the need for a support programme that would serve their psychosocial and academic needs. The tutor-mentor programme was developed in recognition of these needs.

A pilot study (Maitland & Manson 2006) confirmed that many MSAFP students were unable to deal with the challenges they encountered as first year students in a multicultural student community and thus were particularly vulnerable to stress. The pilot study indicated that, together with heightened anxiety, many FP students suffered physical, psychological[2] and/or psychosomatic[3] disorders which in turn led to mediocre academic performance and sometimes failure. The needs and problems encountered by the students were various and affected them in different ways. However, particular problems appeared to be related to cultural diversity and lack of proficiency in English as the LoLT (Howie 2003; Essien & Setati 2007; Lazenby 1997; Lemmer 2009a in process; Lemmer 2009b in process; Manyike & Lemmer 2008; Setati 2006; 2008). This affected all areas of the students' learning including mathematics. In particular, learning mathematics in a classroom where English is the LoLT is problematic for many EAL students at MSA (Maitland & Manson 2006). While students' understanding of

[2] Psychological disorder – arising in the mind – imaginary

[3] Psychosomatic disorder – caused or aggravated by mental conflict, stress, etc

mathematical terminology may be more than adequate, understanding mathematics through the medium of English appeared to be where EAL students came short.

In view of the above, a programme providing support and guidance, particularly for mathematics students, was deemed necessary at MSA. This study explores the impact of a tutor-mentor programme aimed at the improvement of mathematics performance of FP students at MSA.

1.2. Statement of the problem

Against the above background, the main research question was formulated as follows: *How does participation in a tutor-mentor programme impact on the mathematics performance of FP Information Technology (IT) students at MSA?*

A hypothesis was formulated from the main research question as follows: *Participation in the tutor-mentor intervention programme improved the mathematical performance of FP IT students at MS*A.

The research question has been further sub-divided as follows:

1. What is the relevance of the various learning theories to tutor-mentor programmes? Upon what theoretical framework or frameworks can such programmes be based?

2. Against the background of the trends in higher education institutions in South Africa, and multiculturalism and multinationalism at MSA, what is the function of the FP at MSA? What are the needs of FP IT students? What are the needs of FP IT students regarding mathematics? How are these needs being addressed by tutor-mentorship initiatives?

3. What is the impact of the tutor-mentor programme with regard to the mathematics performance of the FP IT students?

4. What recommendations for practice can be made based on the findings of the literature and the empirical inquiry?

1.3 Aims

The aims of the investigation are defined on the basis of the problem formulation together with the research questions and the hypothesis of the study.

The main aim of the study was to explore if and how participation in the tutor-mentor programme improved the mathematics performance of FP IT students at MSA.

The sub-aims of the investigation were to:

- Provide a theoretical framework for tutor-mentorship programmes based on a *bricolage*[4] of learning theories under the umbrella of acquisition and participation metaphors[5].
- Describe the context of MSA and the FP within an international private higher education domain and against the background of the trends in higher education. Describe the needs of the MSAFP students and the current endeavours with regard to tutor-mentorship at the institution.

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[4] A *bricolage* of learning theories are ideas adapted and used from a range of theoretical sources rather than adhering to one particular theoretical perspective (Cobb 2007:29). '[Research design of this kind] resembles the thinking process that Lawler (1985) characterises by the French word ***bricolage***, a metaphor taken from Claude Levi-Strauss. A *bricoleur* is a handy man who invents pragmatic solutions in practical situations … [T]he *bricoleur* has become adept at using whatever is available. The *bricoleur's* tools and materials are very heterogeneous: Some remain from earlier jobs, others have been collected with a certain project in mind' (emphasis in original) (Gravemeijer in Cobb 2007:29).

[5] The integration of acquisition and participation metaphors describes the means by which cognitive functions are developed through social participation; the idea that a person's cognitive abilities are essentially the outcome of socio-cultural encounters (Crook 1994:38); that new knowledge is acquired through participation in supportive social interactions; (Crook 1994:38;33). Acquisition and participation metaphors provide a way of explaining the processes that turn old information into new information (Sfard 1998:4).

- Explore the impact of the tutor-mentor programme with regard to the mathematics performance of the FP IT students through an empirical investigation using both a quantitative and a qualitative component.

1.4 Research design

The problem was investigated by means of a literature study and an empirical investigation.

1.4.1 Literature review

A literature study set the investigation within a framework of a *bricolage* of learning theories and described different approaches to tutoring and mentoring applicable to the MSAFP. This involved a review of developmental, cognitive constructivist, social constructivist, social and socio-cultural learning theories that set the study within a theoretical framework. The literature reviewed included books; journal, relevant policy documents and legislation and Internet-based sources. The description of MSA also relied on consultation with management and perusal of official documents, institutional statistics and curricula.The literature study provided a conceptual framework for the ensuing empirical inquiry.

1.4.2 Empirical investigation

The design chosen for this investigation was a mixed method case study using a sequential explanatory and exploratory strategy (Creswell 2003:210-215; see also Creswell 2002; Eisenhardt 1989; Flyvbjerg 2006; Yin 1994; Yin 2009). The mixed method study was done according to two phases: Phase 1 comprised the quantitative component; Phase 2 comprised the qualitative component. A brief description of the research design is given in this section. A detailed description of the research design is given in Chapter 4.

1.4.2.1 Philosophical assumption

The key philosophical assumption of this study was the view that 'reality is constructed by individuals interacting with their social worlds' and that 'all the parts work together to form a whole' (Merriam 1997:6). However, although the primary methodology was based on an ontological and epistemological interpretive philosophy there were elements of post-positivism in the research design as component parts of the tutor-mentor phenomenon were taken apart and studied (Merriam 1997; Hatch 2002; Hart 1998; Yin 1994; Yin 2009). Participants in this study were asked to interpret their experiences of the tutor-mentoring programme according to their *habitus* (Bordieu in Wenger 1998; Kozulin, Gindis, Ageyev & Miller 2003; www.wikipedia.org; www.newworldencyclopedia.org) which enabled me to gain insight into the participants' personal points of view and to support the findings of the study with empirical evidence.

1.4.2.2 Sampling

i) Phase 1

A hypothesis and null-hypothesis were formulated from the main research question and was tested in Phase 1. The hypothesis was formulated from the problem statement as follows: *Participation in the tutor-mentor intervention programme improved the mathematical performance of FP IT students at MS*A. The null-hypothesis was formulated from the problem statement as follows: *No relationship exists between participation in the tutor-mentor intervention and improved mathematics performance of FP IT students at MSA* (Charles 1988; Creswell 2002). The MSAFP tutor-mentor programme was identified as the independent variable and mathematics achievement as the dependent variable.

Phase 1 comprised a quasi-experimental non-equivalent control group design. The sample for Phase 1 included the entire FP IT mathematics population at MSA and consisted of all IT mathematics students (n=142). The participants were divided into Group **C** (n = 63) and Group ***I*** (n = 79). The decision as to the compilation of Group **C** and Group ***I*** respectively depended on the student's choice whether to participate in the intervention or not (self-selection). It is acknowledged that the sampling procedure used to form the two groups was not random. The use of using non-random sampling is discussed in detail in Chapter 4.

ii) Phase 2

Three groups of information rich participants were purposively selected for Phase 2: FP mathematics IT students; tutor-mentors; and lecturers at MSA. All the FP mathematics IT students (n=142) participated in Phase 2; all ten tutor-mentors involved in the FP IT mathematics tutor-mentor programme and all five lecturers teaching mathematics in the FP IT mathematics programme. This constituted a comprehensive sample.

1.4.2.3 Data gathering

i) Phase 1

The pre-test-post-test non-equivalent control group design was used with the pre-test (Test 1) serving as a base-line to evaluate change, to assess the degree of change and to control for selection bias (Tuckman 1978:131-133, 142). The choice of this particular method of evaluation was based on the assumption that because the FP mathematics students voluntarily chose to participate in the tutor-mentor programme without any form of coercion by either the researcher or the lecturers there was no selection bias. A quasi-experimental non-equivalent control group design was used for the descriptive statistics. However, because of non-randomization of the sample the analysis of covariance (ANCOVA), Homogeneity of Regression Slopes Test and the Johnson-Neyman Technique were the inferential statistical tests used (Huitema 1980) These tests compared two sets of data, that of Group *I* and Group *C* for significant differences (Tuckman 1978:253-2, 166-167, 269).

Numerical data in the form of Test 1 and Test 2 scores from Group *I* and Group *C* mathematics students were collected over a period of two semesters (one year). Test 1 was the first test of the year (March 2008) and Test 2 was the final examination at the end of the year (November 2008). Numerical data formed the quantitative basis of the study and relied on the Test 1 and Test 2 scores (pre-test and post-test scores). Continuous formative assessment marks were not part of the data. The mathematics scores of Group *C* and Group *I* were analysed using non-equivalent control group design statistical methods.

ii) Phase 2

During Phase 2 data was gathered by means of a semi-structured questionnaire, focus group interviews, individual interviews and spontaneous conversations with participants. Observation sessions enriched by photographs and field notes and documents such as minutes of meetings,

were also used. The focus group and individual interviews were audio recorded and detailed notes taken during and after the interviews. Transcriptions took place as soon as possible after each interview. Observations were semi-formal. Notes and photographs were taken during observation sessions. Two aspects of classroom observation were recorded:

1. Observation of tutor-mentors as part of the formal tutor-training evaluation.
2. Observation of student and tutor-mentor interaction during normal tutorial classes.

1.4.2.4 Data analysis

i) Phase 1

The arithmetic means of four sets of data consisting of Group *I* and Group *C* and the Test 1 and Test 2 scores of the entire MSAFP IT mathematics students were compared with respect to a specific variable to see whether there was a statistically significant difference between the results of Test 1 and Test 2 scores of Group *I* (Mulder 1982:147; Tuckman 1978:269). Four sets of independent data were collected and analysed using the ANCOVA, Homogeneity of Regression Slopes Test, and the Johnson-Neyman Technique statistical method of data analysis (Huitema 1980). Tables, figures and graphs are included in the presentation of the findings and in the appendices.

ii) Phase 2

Rich description formed the basis of the analysis. The collection, transcription, coding and analysis of the semi-structured questionnaire, interviews, observations, documents and visual material took place was an ongoing process.

1.4.2.5 Integration and presentation of data

The findings of the two sets of data from Phase 1 and Phase 2 were integrated to provide a rich description and to corroborate both sets of findings (Burns 2000:571). Fourth-level abstraction (Creswell 2002:273-274) led towards a situation-producing theory of tutor-mentorship at MSA (Dickoff, James & Wiedenbach 1968).

1.4.2.6 Ethical considerations

All data capture and storage was conducted strictly according to the Monash Human Research Ethics Committee's (HREC) guidelines and injunctions (MU 2008). Permission was given by the Standing Committee on Ethics in Research Involving Humans (SCERH) of MU - Reference Number 2005/918. Participation in both phases of the study by all participants was voluntary, confidential and anonymous. Participants who were photographed gave permission. Participants were at liberty to refuse to answer any questions and were free to withdraw from the process at any stage.

1.4.2.7 Issues of reliability, validity and trustworthiness of data

Possible issues that could inhibit the reliability, validity and trustworthiness of the findings were noted.

i) Phase 1

Non-randomization of the student sample and factors such as pre-knowledge and maturation of the sample during the study period, the small number of participants, and the confinement of the study to MSAFP mathematics students may have affected the reliability, validity and trustworthiness of the quantitative study.

ii) Phase 2

Personal relationships developed over time with students, tutor-mentors and lecturers may have led to inaccurate information being unintentionally proffered. Subjectivity and misinterpretation of the data because of the social and personal nature of the encounters between me and the participants was noted as a possible source of bias that would affect the reliability and trustworthiness of the findings. Initial findings were verified or clarified by the participants where necessary, and cross checking of analysis was done by an independent observer to triangulate findings.

1.5 Clarification of terms

Key terms used in the study are defined in this section. Full discussion of these terms is included in the literature study (Chapters 2 and 3).

i) Tutoring

Academic assistance provided to FP mathematics IT students by more experienced, trained undergraduate IT students.

ii) Tutee

An FP IT mathematics student who deliberately seeks academic assistance from a more knowledgable peer within the formal tutor-mentor programme offered at MSA.

iii) Mentoring

Support, guidance, counsel and advice provided to FP mathematics IT students by more experienced and suitably trained undergraduate students. *Mentoring* describes the character and function of a certain type of relationship. It is characterised by the mentor's commitment to serve someone and its developmental function – the growth of an individual.

iv) Mentee

An FP IT mathematics student who deliberately seeks emotional and/or social support, guidance or counsel from a sympathetic and more experienced peer within a formal tutor-mentor programme offered at MSA.

v) Foundation programme

An academic development programme aimed at developing academic skills and providing a pathway into undergraduate degree studies at MSA It is not a bridging programme but concentrates on developing academic skills necessary for undergraduate studies.

1.6 Chapter division

The study is organised according to the following chapters:
Chapter 1 presents the background to the study, the problem statement, aims of the research and the research design.

Chapter 2 provides a theoretical framework based on a *bricolage* of theories and describes the relevance of the theories to tutor-mentor programmes.

Chapter 3 describes the trends in higher education worldwide and some problems caused by this phenomenon. The international and local MSA student demographics, and specific internal and external problems encountered by foreign and local students are discussed. A brief history of MSA and the FP is given. The context of the FP within MSA is described, and the needs of FP students in general and mathematics IT students in particular are identified. The aims and characteristics of tutoring and mentoring programmes are defined and described, and an explanation is proposed of how such programmes can realistically meet the needs of higher education students through the use of peer tutor-mentoring as a support tool.

Chapter 4 explains the research design, including sampling, data gathering and data analysis according to the two phases of the empirical inquiry: the quantitative and the qualitative components.

Chapter 5 integrates and presents the findings of the investigation.

Finally, an overview of the pertinent points of the study is given in Chapter 6. Guidelines are suggested for the improvement of the tutor-mentor programme based on the literature and empirical studies. Final conclusions are drawn and recommendations made for improvement of practice and for further study.

1.7 Conclusion

The increasing growth in access to higher education (Crosling & Webb 2002; Pokorny & Pokorny 2005) and multinational and multicultural diversity in higher education (McTighe Musil 1996; Gurin, Dey, Hurtado & Gurin 2002) point to the necessity for student support that caters to the academic and psychosocial needs of higher education students. A tutor-mentor programme that offers this kind of support may be beneficial as it caters for the holistic needs of the person and is particularly relevant to the needs of FP students at MSA. In the light of this, the problem formulation, aims, research design and organisation of this study are briefly described. The following chapter explores the relevance of a *bricolage* of theories which forms the conceptual framework of the study. This is set with a literature review which focuses in particular on tutoring and mentoring.

CHAPTER 2

THEORETICAL PERSPECTIVES WHICH INFORM TUTOR-MENTOR PROGRAMMES

> … *rather than adhering to one particular theoretical perspective, we act as* bricoleurs *by adopting ideas from a range of theoretical sources. …Analysis developed by using the framework [from synthesising constructivist and participative perspectives] bring the diversity in students' mathematical reasoning to the fore while situating that diversity in the social context of their participation in communal activities* (Cobb 2007:29).

2.1 Introduction

Although tutor-mentor programmes are not considered an integral part of the formal curricula of higher education institutions, their contribution to improved learning and therefore to output is increasingly recognised. Many South African institutions are struggling with the issue of over-crowded tutorials because of the increase in student numbers. This denies students an optimum educational experience because opportunities for individual attention cannot occur in such circumstances. Another problem caused by easier access to higher education that has become more evident in the past few years is that of unpreparedness for higher education studies. Many students are not prepared for the academic and socio-cultural demands of university life and are not able to deal with the pressures. These, and other problems, set students up for failure and early 'drop-out', to the loss of the institution, the country and the individual. International and local research studies (Austin, Covalea & Weal 2003; Chang 1999; Crosling & Webb 2002; Loots 2009) have uncovered many of the difficulties encountered by students and advocated the effectiveness of supportive interventions such as tutoring and mentoring programmes. These researchers and many others have shown that when students are supported socially and emotionally, academic performance improves and early attrition and failure are often prevented. While the introduction of tutor-mentor programmes into the pedagogy of higher education institutions can help to overcome these problems, if such a programme is going to be pedagogically acceptable in higher education, then it needs to be grounded in a sound theoretical framework (Glaser & Strauss 1967).

A supportive theoretical foundation is necessary to give integrity to the design and structure of a tutor-mentor programme. This will enable the programme to function holistically and give impetus to the psychosocial and cognitive development of the students. However, to find a theory that would fit all the requirements of this particular study was impossible as no specific tutor-mentor theory has yet been developed. For this reason, a number of perspectives, a *bricolage* of theories (Cobb 2007:29), was incorporated under the metaphors of acquisition and participation as a basis on which to build and to provide a robust framework for the study. The decision to draw on a synthesis of cognitive and socio-cultural perspectives was informed by previous research (Cobb & Bowers 1999; Cobb, Yackel & Wood 1992; Jaworski & Watson1994) and my own worldview. A synthesis of more than one perspective not only provides a more robust theoretical underpinning and framework for the study but enables better understanding of tutor-mentoring situations in the MSAFP mathematics classroom.

2.2 Justification for a multi–theoretical approach

According to Cobb (2007:3), if research is to be open to scrutiny and discussion then the choice of a theoretical perspective must be justified. With this in mind, the choice of theoretical perspective for the framework of this study was carefully considered so as to facilitate analysis of the collected data and provide theoretical justification for the study. Drawing on more than one theory in a single study has a number of theoretical and methodological implications which need clarification. Firstly, this study investigates a particular teaching and learning practice, (that of tutor-mentoring in FP mathematics classrooms at MSA), from a cognitive and a socio-cultural perspective. Secondly, because cognitive and socio-cultural perspectives provide different theoretical settings, each perspective will allow for a different approach to investigating the practices of tutor-mentoring within a teaching and learning paradigm (Greeno 1997; Greeno, Collins & Resnick 1996). Lerman (1996:133), however, argues that because of the different 'lenses' through which theoretical perspectives are viewed, using more than one perspective within a single study may offer no common standard by which to measure the study (it is 'incommensurable'). The theoretical perspectives will be 'mutually exclusive' and this, claims Lerman (1989; 1996), will lead to a lack of logic or consistency in the research. He further argues against combining two or more theories by claiming that '… the assumption of complementarity leads to incoherence' (1996:133).

Lerman's (1996) assumptions should be considered with care for the following reasons. Firstly, it depends on how the theoretical perspectives are to be used as to whether and how 'mutual exclusivity' might impede the productive theorization of classroom teaching and learning (including tutor-mentoring support systems). Secondly, basing a tutor-mentor programme on only one theoretical perspective could be detrimental to the recognition of the value of tutor-mentoring as a method of student support by higher education institutions. Thirdly, by excluding one or other perspective, in-depth analysis of the data would be difficult and probably lead to unbalanced results. This rationale is based on the proposition that while the socio-cultural perspective situates learning in communities of practice, and the cognitive perspective places dominance of the individual and the mind as foremost in the acquisition of knowledge, both perspectives can be combined to bring about a holistic theoretical perspective which is of special importance to the objectives and aims of higher education. Lastly, while 'incoherence' is a real danger, this can be avoided if there is an overt and honest attempt to synthesize the two perspectives and work with them in ways that will ensure coherence while not claiming that they assert precisely the same with regard to learning (Schoenveld 1999). I suggest that combining cognitive and socio-cultural perspectives is neither 'incommensurable' nor 'incoherent' as claimed by Lerman (1989 & 1996) but is instead a logical, consistent and necessary approach if there is to be in-depth analysis and understanding of how teaching and learning can take place in the classroom to the best advantage of the students, tutor-mentors and lecturers.

Schoenveld (1999) argues in favour of using two or more theoretical perspectives in single research studies by observing that the merits of each perspective can be utilised by the researcher if he or she takes them into account and combines them in such a way that they complement each other. Drawing from two or more perspectives in a way that enables coherent progress in the research process allows the development of a more robust theoretical framework than if only one perspective was used. This point of view is supported by Adler (1998:176): '… learning is, after all, not a unitary phenomenon, and thus not amenable to one all-embracing theory'.

This chapter provides an overview of theoretical perspectives relevant to tutor-mentor programmes in general and emphasises the acquisition and participation metaphors (see footnote 5) as they relate to the study.

2.3 Theoretical perspectives

Learning is complex and many schools of thought have developed in order to try and understand how it takes place. Behaviourists, psychologists, social scientists and educationists, have searched for reasons why and how humans learn and how optimum learning can be brought about. For example, theories and arguments abound as to whether people learn best as individuals or as part of a community; whether cognitive psychology is an improvement on behavioural psychology. Claims are made that constructivist theories are primarily philosophical whereas situated learning theories are strongly empirical (Anderson, Reder & Simon 1996). Theoretical perspectives are thus multiple, overlapping and sometimes conflicting. Finding a 'one fits all' theoretical perspective for this study was therefore impossible because of the complex nature of the problem being dealt with. Human beings, with their plethora of lives, philosophies, cultures and societies, cannot and should not be cast into a single mould. Learning, with all these human complexities, cannot be explained using a single theoretical perspective. By using only one theory the study would be restricted to that particular point of view (Cobb 2007) and in my view would not lead to trustworthy and valid conclusions, nor allow honest solutions to the problems mentioned in paragraph 2.1. I thus decided to adopt a multiple theoretical framework that would incorporate aspects relevant to education and to mathematics education in particular from a multiplicity of theoretical perspectives; what Gravemeijer (in Cobb 2007:29) terms a *bricolage*. By using a *bricolage* of theories (see footnote 4 of the previous chapter) it becomes possible to include many perspectives that will provide greater insight into the theoretical framework of the study.

It is hoped that this approach will enable the reader to understand the philosophy on which the study is grounded because 'the usefulness criterion focuses on the manner in which different theoretical perspectives might contribute to the collective enterprise of developing, testing and revising designs for supporting learning' (Cobb 2007:9). This statement affirms the aim of the FP tutor-mentor programme for supporting mathematics IT students at MSA through 'pragmatic solutions in practical situations' (Cobb 2007:9).

In this chapter there is a brief description of theories relevant to learning and therefore to this thesis. Learning theories are crucial to studies concerning education and anyone involved with students should recognise the essential role they play in the design and structure of curricula.

There are many overlaps, and aspects of more than one theory (a *bricolage*) are relevant. A number of cognitive and socio-cultural learning theories are discussed with particular reference to the design and structure of tutoring and mentoring programmes at higher education institutions. Particular emphasis is placed on theories that recognise the holistic nature of cognitive, social and emotional development in relation to developing a personal and group identity within a socio-cultural milieu.

Categorisation of learning theories is not simple because there is no universal agreement as to what constitutes a learning school (Leonard 2002:vii). This assumption echoes Vygotsky's (1978:79) view that the application of child development theories to educational processes is problematic because of the lack of clarity on basic issues in the relationship between learning and development. With this in mind, the literature search and review concentrated on dominant learning traits applicable to tutor-mentor programme philosophies in general and the underpinning of this particular study in particular. The study follows Moll's (2002) argument that constructivism is a broad term that covers both cognitive and social learning theories and with which the participation perspective is integrated (Lave & Wenger 1991). This approach provides a context and a framework for the study. The literature review is thus broadly based and includes a brief analysis of each theory's relevance to the study. Although this study has not attempted to posit a new theory it shows how aspects of known theories may be used to design and structure tutor-mentor programmes. It is evident that cognitive and socio-cultural theories play an essential role in supporting the aims of tutoring and mentoring programmes and the presuppositions of this study.

2.4 A *bricolage* of developmental and learning theories

Advances in psychology led to various schools of thought regarding the development of the human mind and learning, greatly influencing education and pedagogical practices. According to the behaviourists, behaviour is determined by habits learned from our past life-experiences and by stimuli in our immediate environment (Passer & Smith 2008:10-11). A more modern behaviourist school of thought is that of cognitive behaviourism 'which proposes that learning experiences and the environment influence our expectations and other thoughts, and in turn our thoughts influence how we behave' (Bandura in Passer & Smith 2008:10). It can

be seen therefore, how ideas about learning have a bearing on the development of learning theories in that they have encouraged research into the intricacies of how people learn and influenced modern ideas on learning and therefore teaching, and continue to do so.

2.4.1 *Gestaltism*

The *gestalt* theory of Wertheimer, Kofka and Kohler (Jordaan, Jordaan & Niewoudt 1975:16) took an opposing view from that of many of the early theorists. They claimed that 'a structured, meaningful whole develops from the separate elements' and only after the whole has been experienced can the separate elements be analysed. One of *gestalt* psychology's fundamental principles is that where the elements of experience, our perceptions, are organized into wholes the whole becomes greater than the sum of its parts (King 2008:179; Passer & Smith 2008:11-12). The *gestalt* theory led to an interest in cognitive psychology but this was put aside as behaviourist theories gained more dominance. From the 1950s, however, there was a renewed interest in determining what cognitive processes were involved in enabling humans to reason and make decisions, solve problems, form perceptions and mental images, and construct and understand language (Passer & Smith 2008:12). One of the results of this interest in cognitive processes was the development of the theory of social constructivism which '*maintains that what we consider "reality" is largely our own mental creation*, the product of a shared way of thinking among members of [different] social groups' (Gergen in Passer & Smith 2008:13, emphasis in original). Gergen's view appears largely individualistic: an individual learns from the group and in doing so remains part of the group while preserving his or her uniqueness. This seems to fit with the *gestalt* argument that, by using the phenomenological method which, according to Jordaan et al (1975:17) 'is a form of introspection' which through attempting 'to apply the Gestalt principles to man's [*sic*] higher mental processes such as thinking and learning', can enable the person to be considered as a complex whole. It would seem, therefore, that through a shared way of thinking the group as a whole, and each individual in the group, learn and develop cognitively, thus incorporating individual (cognitive) and social (social constructivist) learning. This idea fits well with acquisition and participation perspectives on learning and cognitive development.

2.4.2 Holism

Holism,[6] was a word coined by General Jan Smuts to explain his evolutionary philosophy of a 'progressive and ascending scale of wholes' (Smuts in Copley 2000:5). There are concepts embedded in Smuts' philosophy which are valuable because of the emphasis on the person as a 'whole' or complete being 'acting in the world' and 'the world acting on (influencing) the person` (Lave & Wenger 1991:49). Although coming to similar conclusions, Gunter (1980) sees education, and one therefore presumes learning, 'as a concrete human phenomenon' that is situated in the phenomenon of education itself. In this way of thinking, what may not be present in the minds and actions of any individual or group of individuals nonetheless appears as a phenomenon when seen from the the point of view of society as a whole. He views phenomenology (holism) as reality and therefore education (learning) as part of that reality: a 'phenomenon is that which reveals itself in itself' (Gunter 1980:3). If this idea is placed into the domain of conventional social constructivism, it would appear that all 'cultural artefacts, knowledge, practices, institutions, indeed everything' can be regarded as '"relative to" and "constructed by" this-or-that culture-specific form of life, language, game, paradigm, conceptual framework, interpretive community, or whatever' (Moll 2002:19). This may be 'construed as anti-realist': that is, 'there is no reality outside of our constructive descriptions of the world' but Hacking (in Moll 2002:25) argues that 'social constructivism … does not suggest that everything, and in particular all objects (like rocks, lips, children's minds), are socially constructed in their entirety.' He (Hacking in Moll 2002:23) posited that the 'non-social domain of forces ... also need to be taken into account in understanding how, and to what extent, things are socially constructed.' The dual coding theory posited by Paivo (1986b:53) states: 'Human cognition is unique in that it has become specialized for dealing simultaneously with language and nonverbal objects and events,' showing the holisim of the human mind as it processes verbal and nonverbal functions at the same time in a social setting (i.e a teaching and learning situation). The idea of human beings learning in a social setting is supported by the theory of '[h]olistic learning which emphasizes the interconnectedness of the individual's body, mind, emotions and spirit' (Leonard 2002:85) and therefore 'draws on the life experiences and unique qualities of the learner in order to enrich the learning process and make it meaningful' (Leonard 2002:85).

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[6] 'Holism' From the Greek work *holos* meaning 'whole' (Smuts 1926 in Copley 2000: 5).

The world, according to Gunter (1980), is not 'a separate and independent existence in abstraction from man [sic]' … 'but is permeated with humanity' so that '(m)an [*sic*] and world … form a unity of mutual implication.' While the realist philosopher claims that the world can exist independently of man and the idealist claims that man can exist independently of the world, the phenomenologist (holist) sees man and the world as interdependent. There is, therefore, 'an unbreakable relationship between man and world' (Gunter 1980). Wenger (1998:47-56) concurs, stating that: 'The process of engaging in practice always involves the whole person', that it is a complex, active process by members of a shared community. Wertheimer et al's (Jordaan, Jordaan & Niewoudt 1975; King 2008) *gestalt* and social constructivist theories tie in well with this concept, as do aspects of humanism as explained below (Elvin 1977; Jordaan et al 1975; Leonard 2002; Passer & Smith 2008).

2.4.3 Humanism

Humanism as a philosophy advocates equal concern for all members of a society (or community) while recognising individual needs and differences in potential as the 'essence of democracy' (Elvin 1977: 118; Leonard 2002: 4-5). Passer & Smith (2008:11) explain humanism as an emphasis on, among others, 'free will, personal growth, and the attempt to find meaning in one's existence.' Maslow (Passer & Smith 2008) posited that every human being has 'an inborn force toward self-actualization, the reaching of one's individual potential' which can, however, be throttled by an unsupportive environment. 'The importance of personal choice and responsibility, personality growth, and positive feelings of self-worth' (Passer & Smith 2008:11) are emphasised as are the concern that one human being should have for another and the right to be an individual and develop one's potential. From the above discussion it is evident that humanism is closely linked to the concept of holism and the *gestalt* (Leonard 2002:79) and that these theories interlink. Some principles inherent in each of these theories are discussed below.

2.4.4 An eclectic position

Bricolage and its practical implications is an essential feature of this study and the ideas discussed above. The *gestalt* theory (Jordaan 1975; Leonard 2002; Passer & Smith 2008) is based on 'the German word for shape or configuration and is a way of describing how humans perceive the world as a meaningful whole rather than as isolated stimuli'; where the

'whole is greater than the sum of the parts' and 'where, whatever occurs to an individual human, shapes that individual and influences all aspects of that person' (Cohen, Manion & Morrison 2000:20; Leonard 2005:79-80; Sturman 1999:103; Vrey 1979:11-13). These influences cannot be separated from the individual and are in keeping with, and connected to, the concept of the theory of holistic learning. This idea is integral to the formation of tutoring and mentoring support systems and is evident in the *bricolage* of learning theories proposed as a framework for this study. The *gestalt* theory opposes that of behaviourism which is not concerned about meeting individual or human social needs through education. Instead, *gestaltism* favours a holistic approach (Cohen, Manion & Morrison 2000; Leonard 2002) to the way humans learn and is therefore in keeping with the key idea of this study. However, because, in concurrence with Gunter's (1980) view that a purely phenomenological theory of education is poor in concrete content and empirical findings, and therefore bland, this study integrates constructivist and socio-cultural learning theories and thus attempts to bring together the cognitive and socio-cultural perspectives on teaching and learning in the domain of tutor-mentoring.

I realise that incorporating the relevant theories may cause some confusion as each of the schools proposes basic principles on which they build a theory and interpret human behaviour, development and learning. It would seem, therefore that an eclectic[7] (Jordaan et al 1975:20) position must be taken if there is to be a multi-theoretical framework into which one can build a sound foundation for a tutor-mentor programme. In this way, theoretical bridges can be forged and a 'whole developed from the parts'.

The idea of two main metaphors[8] informing learning, that of acquisition and participation (Sfard 1998), is especially applicable to this study and as Sfard (1998:5) says, 'they are what makes our abstract (and scientific) thinking possible' and 'keep[s] human imagination within the confines of our former experience and conceptions'. To favour some theories or metaphors over others may result in important concepts being discarded. Therefore, an

[7] Eclectic: selecting from various sources; attached to no particular school of thought (Jordaan et al 1975).

[8] Metaphor: originally used as intellectual tools for better understanding and memorization, systematic conceptual mappings or mind mappings are now recognised as the primary source of all human concepts; a notion of conceptual transplant that provides a means for explaining the processes that turn old into new (Sfard 1998:4).

attempt will be made in this study to logically integrate and reconcile the theoretical and metaphorical concepts relevant to this thesis and to the MSAFP tutor-mentor programme in particular. I want to show how acquisition and participation metaphors can link together as parts of a greater 'whole' (see the discussion on '*bricolage*' in 2.4). As new discoveries are made and thinking develops beyond the obvious, new ideas are propagated but they are built on the ideas and developments of the past. The following statement is particularly pertinent (Sfard 1998):

> *The idea that new knowledge germinates in old knowledge has been promoted by all the theoreticians of intellectual development, from Piaget to Vygotsky to contemporary cognitive scientists. The notion of metaphor as conceptual transfer clearly compliments this view in providing a means for explaining the processes that turn old into new.*

In accordance with this statement, Sfard's (1998) argument for the use of two metaphors is considered appropriate for this study, and together with Falchikov's (2001), Moll's (2002) and Cobb's (2007) approaches and arguments for using multiple learning perspectives, is the theoretical cornerstone of this study.

2.5 Pedagogical pragmatism

Pedagogical theory must be practical, dynamic and in touch with reality if the desired outcomes are to be successful (Elvin 1979:133). The following discussion looks at a number of developmental, cognitive, social and socio-cultural learning theories that have been posited over time. They underpin the research study, giving it relevance and validity. The discussion develops the idea that constructivist and socio-cultural theories have their place and are important to a better understanding of cognitive development; that learning is limited if tutoring and mentoring programmes do not recognise that social participation is essential in the full ontological development of the person. It should be noted that constructivist theories are about how the individual learns through 'sense-making' (Leonard 2002:166) whereas socio-cultural theories are about how individuals learn by becoming part of a community of practice through legitimate peripheral participation (Lave & Wenger 1991). I would go further and suggest that socio-cultural participation is essential for successful learning outcomes.

2.6 The impact of acquisition and participation metaphors on learning theories

The following section looks at how acquisition and participation metaphors (Sfard 1998) impact on teaching and learning in the context of this study. It presents the merits of theories grouped under the two metaphors and considers their contributions to the process of building peer tutor-mentor programmes as an integral part of higher education institutions' learning-support curricula. A short description of each of the various theories and intellectual concepts or movements that follow the acquisition and participation metaphors approach to learning and teaching and which are pertinent to this particular study follows. A selection of theories and philosophies relevant to the principles and aims of tutor-mentor programmes in general are described and discussed. This will include but not necessarily be restricted to the following:

Acquisition metaphor: Piaget's *developmental learning theory* (Berg & Theron, 2005; Cobb 2007; Moll 2002; Vrey, 1979), Bandura's *social learning theory*, now known as *social cognitive theory* (Bandura 1989; Cobb 2002; Leonard, 2002), Vygotsky's *social development / socio-cultural theory* and the concept of the *zone of proximal development* (Bergh & Theron, 2005; Cole & Wertsch 2006; Falchikov 2001; Kozulin et al, 2003; Vygotsky 1978).

Participation metaphor: Lave and Wenger's *situated learning theory* and the concept of *legitimate peripheral participation* (Anderson, Reder & Simon 1996; Bruner 1990; Greeno, Moore & Smith 1993; Greeno 1997; Lave & Wenger 1991; Leonard 2002), and the *community of practice theory* which presents a different perspective on socio-cultural learning theories (Wenger 1998).

All these theories and intellectual movements have value in forming a framework for this research study and for tutoring and mentoring programmes in general. All play a role in the organisation and overall effectiveness of well-designed tutoring and mentoring programmes. It should be noted that although not considered the main theoretical foundation of the study, aspects of *gestaltism* (or phenomenology) (Jordaan et al 1975; Vrey 1979; Leonard 2002), humanism (Leonard 2002) and holism (Smuts 1926 in Copely 2000; Leonard 2002) will be incorporated where relevant. It should also be noted that although these theories are

interwoven, some have more influence than others on the design and methodologies of tutor-mentoring programmes.

Various theories are included under the umbrella of constructivism: Piaget's '*schemata*' (Leonard 2002; Vrey 1979), Bandura's *self-regulated learning theory*, his *social learning theory* (later renamed *social cognitive theory*) and the theory of *shared cognition* (Bandura 1989; Leonard 2002). Vygotsky's (1987 in Cole & Wertsch 2006) social development and socio-cultural learning theory together with his zone of proximal development (ZPD) are discussed in the following section

2.6.1. Acquisition metaphor

Constructivist theories developed as a refutation of behavioural theories with the basic premise 'that students build more advanced knowledge from prior understanding' (Smith, DiSessa & Roschelle 1993). A good definition of constructivism is given by Smith et al (1993): 'all learning involves the interpretation of phenomena, situations, and events, including classroom instruction, through the perspective of the learner's existing knowledge.'

Constructivism carries with it the idea that learning should be learner-centric and not teacher-based. It is, according to Leonard (2002:37), a 'minimalist approach to teaching with the goal of producing in the learners the most learning for the least teaching'. In this approach the learner is actively engaged in his or her own learning. Being learner-centred it can be seen as individualistic in that the individual is developing cognitively. One of the reasons for using student tutor-mentors in and outside the classroom is to encourage each individual student (tutor-mentors and tutee-mentees) to develop cognitive self-reliance. Whatever is learned from or in the group is for the benefit and development of the individual.

The terms constructivism and constructionism refer to a range of theories or intellectual movements. Moll (2002:6) contends that the context in which the term is used frequently implies dissimilar epistemological and ontological suppositions. Understanding that knowledge is constructed and that the idea of constructivism may be used in many different ways recognizes that constructivism does not, according to Moll (2002:8) necessarily refer 'to a particular, or even conceptually related, set of theoretical notions and/or objects' such as, for example, "behaviourist" or "psychoanalytic"' but may be applied to a wider field. In light of

this, the intention in this thesis is not only to have a framework on which to base the study but to validate the significance of including constructivism as a tool in the development of a tutor-mentoring pedagogy with valuable implications for higher education teaching and learning.

It is thus necessary to be clear as to what is meant by 'constructivism', how it informs educational practices, the implications it has for these practices and the context in which constructivism is used in this study. The metaphor of constructivism as used in this study therefore needs to be clarified. According to Moll (2002:11):

> *"Constructivism" or "constructionism" or, indeed, any notion of the construction of knowledge, does not have, nor should it have, only one particular meaning. Rather, it is important that, in any educational project, concepts are used within their own coherent theoretical framework. A quick review of some of the ways in which the idea of "construction" works in the study of human beings will help make the point that "constructivism", if not clarified, will simply confuse.*

For this purpose, the following sections reflect on cognitive and social constructivism in more detail.

2.6.1.1. Cognitive constructivism

Piaget (in Leonard 2002) first postulated the idea that knowledge was not received solely from parents or teachers but was actively constructed by the child in his or her own mind. Piaget's work on cognitive development was a great advance in understanding how learning takes place and was the foundation of cognitive constructivism which is the 'umbrella' under which subsequent similar theories were formulated (Falchikov 2001:86-88). Although there are some important differences between the various cognitive and social constructivist theories, one of which is acceptance of the extent to which social factors play an important role in learning and development, there are also key commonalities which together assume a 'mind' (Vygotsky 1978) which develops through the restructuring of concepts or schema according to Piaget's theory of the development of a child's thought processes (Passer & Smith 2008:416). According to cognitive constructivism 'the individual mind is the unit of analysis for learning' (Brodie 2007). After testing Piaget's theory on children from different cultures around the world, Berry et al (in Passer & Smith 2008:419) came to a number of important conclusions including the following: 'the general cognitive abilities associated with Piaget's four stages occur in the same order across cultures … cognitive development within

each stage seems to proceed inconsistently … culture influences cognitive development', and perhaps most importantly, 'cognitive development is more complex and variable than Piaget proposed.' These deductions, as well as various challenges to some Piagetian claims by more recent research, have led neo-Piagetians to modify Piaget's theory on development and learning. However, Piaget's basic ideas on children's cognitive development have been and remain influential in many areas of child development and learning (Becker in Passer & Smith 2008:419). Piaget held the view that children adapt to the world through assimilating information from the environment and that assimilation of information brings about changes (accommodation) in previously understood concepts. Thus new schemas (concepts) are based on previous ones (Moll 2002). According to Piagetian thought, the mutual influence of assimilation and accommodation brings about equilibration which is 'the overall interaction between existing ways of thinking and new experience' and underpins developmental change within the system (Siegler 1995). Thus for Piaget, development was 'the formation of ever more stable equilibria between the child's cognitive system and the external world' (Siegler 1995). Equilibration can only take place, however, if consolidation or internalisation of information occurs and this cannot happen unless there is meaning attached to the thought or action; only then can knowledge be consolidated in the cognitive structure (Piaget in Passer & Smith 2008; Siegler 1995; Vrey 1979). The importance of meaning in the process of equilibration cannot be overemphasised.

Bruner's (1990) views correspond fairly closely to those of Piaget although he emphasises the symbolic use of language (or formulae) by means of which 'generic concepts can be contained or represented in the cognitive structure' (Vrey 1979:279-285,304). Ausubel (1968) and Ausubel & Robinson (in Vrey 1979) posited a 'cognitive theory of meaningful verbal learning' whereby meanings are subsumed during assimilation which causes significant changes in the meaning of whatever has already been assimilated. Of note is that learning in this case is verbal, presuming a 'conversation' between the learner and some other person; that learning takes place through participation between person and person and between person and artefact (Cole 1990:91). Ausubel's theory is similar to those propounded by the *gestaltist* and field theorists on cognitive structure and the transposition theory whereby transfer of knowledge takes place through a person's perception of the relationship between known principles and the presently occurring situation. The important thing to recognise is that despite variations in the ideas of these theorists, all acknowledge that whatever is assimilated or internalised has meaning and is therefore meaningful for the learner (Vrey 1979:304).

Therefore, if learning is to take place, whatever is being presented must be meaningful for the person to whom it is presented. This is a very important argument for tutor-mentors to understand if they are to be successful in their teaching.

Importantly, Piaget acknowledged, in principle, the equal role that society in general and the community in particular plays in the construction of knowledge (Cole & Wertsch 2006:1; Falchikov 2001:87). This perspective is evident in many of his writings as seen in the following examples:

> *There are no more such things as societies qua beings than there are isolated individuals. There are only relations … and the combinations formed by them, always incomplete, cannot be taken as permanent substances* (Piaget in Cole & Wertsch 2006:1).

> *There is no longer any need to choose between the primacy of the social or that of the intellect: collective intellect is the social equilibrium resulting from the interplay of the operations that enter into all cooperation* (Piaget in Cole & Wertsch 2006:1).

Vygotsky's affirmation (in Cole and Wertsch 2006) of 'the centrality of the active construction of knowledge' may be seen in the following quotation, showing that 'the realization of this complementarity of active individual and active environment is to make co-constructionism the basis of theorizing: there is both *an active child* and *an active environment'* (Wozniak in Cole & Wertsch 2006:2, emphasis in original).

> *Activity and practice: these are the new concepts that have allowed us to consider the function of egocentric speech from a new perspective, to consider it in its completeness … But we have seen that where the child's egocentric speech is linked to his practical activity, where it is linked to his thinking, things really do operate on his mind and influence it. By the word things, we mean reality. However, what we have in mind is not reality as it is encountered in practice.*

Cole and Wertsch (2006:2), however, offer 'a *third* (essential) factor in the process of co-construction: the accumulated products of prior generations, culture, [and] the medium within which the two active parties to development interact' (emphasis in original).

There has been much debate over the relationship between Piaget's and Vygotsky's ideas but Cole and Wertsch (2006:1) argue that the 'cardinal difference between them are their views

concerning the culture, in particular the role of mediation of action through artifacts, on the development of mind'.

2.6.1.2. Social constructivism

Social constructivism is a modern perspective on cognitive processes maintaining 'that what we consider as "reality" is largely our own mental creation' (Passer & Smith 2008:13) and is the product of a shared way of thinking of members of a social group. We therefore perceive and interpret events and situations in a way that reflects our group's belief system, philosophy of life, and cultural mores and values. Vygotsky (1978) coined the term 'mind in society' to explain his theory of social learning. This is based on the social constructivist idea, emphasising the development of the individual within a social group, of the social group as a 'mind' and the repository of all accumulated knowledge: the 'mind in society'.

Cultural-historical psychologists such as Dewey (1938) and Vygotsky (1978), worked on the assumption that there is a close connection between the environment that is inhabited by humans 'and the fundamental, distinguishing, qualities of human psychological processes' (in Cole & Wertsch 2006:2). Historical data presents us with evidence that human environments are immersed in and imbued with the achievements of previous generations. This is best explained in Dewey's (in Cole & Wertsch 2006) words:

> *We live from birth to death in a world of persons and things, which is in large measure what it is because of what has been done and transmitted from previous human activities. When this fact is ignored, experience is treated as if it were something which goes on exclusively inside an individual's body and mind. It ought not to be necessary to say that experience does not occur in a vacuum. There are sources outside an individual which give rise to experience.*

It does not appear that Dewey is denying the active role that the individual plays in cognitive development but is simply emphasising the importance of cultural factors in such development. Vygotsky (in Cole & Wertsch 2006:3) emphasized the role that mediation, particularly language, plays in developing the mind. In his view 'the development of mind is the interweaving of biological development of the human body and the appropriation of the cultural/ideal/material heritage which exists in the present to coordinate people with each other and the physical world' (Vygotsky in Cole & Vertsch 2006). What we do and think in the present is always linked in some way to the past through our use of artefacts, 'replacing some

functions with others' as we recreate and reorganise 'the whole structure of behaviour' (Vygotsky in Cole & Vertsch 2006). Cole and Wertsch (2006:4) assert that 'all psychological functions begin, and to a large extent remain, culturally, historically and institutionally situated and context specific' and because of this, an action is usually socio-culturally situated. This is an important idea with regard to tutoring and mentoring programmes which are by inference all of these things.

Examples of theories based on Vygotsky's social development and social constructivism theories (Vygotsky 1978; see also Falchikove 2001: 88; Leonard 2002:174; 177; 178; 205) are those of Lave & Wenger (1991:48) and Bruner (1990:105); the socio-constructivist theory of Doise & Mugney of the Geneva School (Leonard 2002:178); and the socio-cultural theories developed into a computer model by Dillenbourg and Self (Leonard 2002:178). The latter theory is based on Vygotsky's ZPD which is not in itself a theory but an explanation of a process of learning and is discussed later in more depth (Crook 1994; Falchikov 2001:88; Kozulin 2003:178; 246:11; Leonard 2002:178; 205; Passer & Smith 2008:420; Vygotsky 1978:84-86).

2.6.1.3. Socio-cultural theories as relating to cognition

Vygotsky's (1978) social development or socio-cultural theory is particularly relevant to this study in that it 'is an attempt to define human cognition in relation to the social interaction of the individual within his or her culture' (Kozulin 2003:1; see also Leonard 2002:177). The socio-cultural theory proposes that learning and development is situated in socio-cultural environments and cannot take place without social interaction (Kozulin 2003:121). From this it is assumed that social interaction is essential for learning to take place and, if properly organized, learning will result in cognitive development. Social interaction thus plays a fundamental role in the development of all cognitive abilities, including thinking, learning, and communicating (Leonard 2002:177; Vygotsky 1978:90). The ability to observe and interact with others and to 'appraise self-performance in the context of the culture and society one lives in is also critical to self-control and self-maintenance as well as to the maintenance and survival of the entire culture' (Vygotsky 1978:90). One may assume from Vygotsky's statement that being an integral member of the society, or community, into which one is born, is taken as a prerequisite for development and learning; an essential *gestalt* of development and learning without which learning cannot take place.

An interesting study was done by Murphy-LeJeune (in Alred, Byram & Fleming 2003:112-113) in which she interviewed fifty foreign students. The students claimed that adaptation to a foreign culture depended on an individual's personal capacity 'to change one's behaviour under the pressure of outside events in an effort to overcome strangeness in the (new) environment.' Learning to adapt to the local way of life (to live like the indigenous, local community) and to become part of a new society is a process of social construction and, according to the study, implies 'a step towards greater independence or emancipation' (Murphy-LeJeune in Alred et al 2003:113). This appears to fit with Vygotsky's theory as discussed above and appears to show that a willingness to change will make the adaptation process quicker and easier and help foreign students 'to "fit" into the new given framework' (Murphy-LeJeune in Alred et al 2003:112) and not stand out as noticeably different. From this it may be implied that in order not only to be accepted but to feel acceptable, students need to construct a personal social environment which is part and parcel of their 'new' environment but without discarding or losing their own personal and cultural identity in the process. Assimilation and accommodation, or learning, thus takes place through a process of change in a new social environment, either quickly or slowly depending, one supposes, on the person's willingness to accept the new culture (equilibration). It can happen that one culture is replaced by another but whether the 'new' culture will entirely, partially, or even at all, replace the old depends on the depth of ownership and feeling the person has for his or her original culture and its norms and values. Most researchers do not argue for discarding the mores and values of one culture in order to adapt to a new society since cultures are not silos from which one desires partially or (better) wholly to escape in the process of adaptation and learning. A subtle student, or anybody, would possibly manage to move between worlds; or at least partially integrate them; a talented *bricoleur*, for example. However, social and emotional conflict may occur as a result of opposing societal norms and values. This can lead to poor cognitive functioning if an individual has to spend an inordinate amount of time in striving, for example, with dissimilar worldviews and modes of behaviour. It is important therefore, to employ teaching and learning strategies that take note of socio-cultural and cognitive differences (Falchikov 2001:85-89). Principles of Vygotsky's theory recognise that 'full cognitive development requires social interaction' (Falchikov 2001:88) and to do this, students need to be able to adapt to the new situation without losing their own cultural identity in the process.

Socio-cultural theorists recognised the importance of language (particularly speech), in the development of the child, seeing it 'as an organiser of behaviour' playing a pivotal role in

cognitive development (Crook 1994:38). Speech may be considered a tool enabling humans to accomplish things by communicating with each other. Taken to its logical conclusion, if humans are able to affect and regulate others through speech then they must be able to internalise and organise their own thoughts thus developing such human values as self-regulation, self-control, and responsibility for self (Crook 1994; Falchikov 2001; Vygotsky 1978). Although these are cognitive functions, they can only be learned through social interaction with other humans, mainly by means of speaking. They are not innate characteristics but must be taught and interpreted through communication within the socio-cultural group. Problem-solving experiences such as 'reasoning, remembering, attending, classifying and so on … are organised within a social experience and are supported by the resources of speech' (Crook 1994:38). Through participation in the social life of the community children are 'exposed to a set of interpretative practices that may be appropriated' (Crook 1994:38). In this way, children learn to become problem-solvers as interpreted by their social group within that socio-cultural setting. 'Cognitive achievements,' says Crook (1994:38) 'arise as the consequence of entry into particular communities of practice'. We see here the introduction of participation theory into what is essentially a constructivist viewpoint but the theories as said earlier are intertwined and difficult to extricate and so will emerge in unexpected places. Wertsch (in Landsman 1991: 71-86) defines a socio-cultural perspective on cognition as follows:

> *The basic goal of the socio-cultural approach to mind is to create an account of human mental processes that recognises the essential relationship between these processes and their cultural, historical and institutional settings.*

This definition allows for the idea that a person's cognitive abilities are essentially the outcome of encounters with culture in a societal setting. The idea of culture being part and parcel of societies is indisputable. A child who is born into a society will grow and develop in the traditions and ethics of that society through the medium of its culture. Society organises its life and therefore the lives of its individual members via social interaction. But any society, and hence its culture, is dynamic. It changes and develops over time as its members discover and learn new knowledge and pass on this new knowledge through social interaction thus either enabling or constraining cognitive activity (Crook 1994:33). Knowledge, says

Cole (1990:91), is 'culturally mediated'[9], develops historically over time and evolves from practical activities such as the development of tools for practical (such as a pen), and symbolic (such as mathematical symbols), use.

A concept central to understanding the role of socio-cultural interaction in learning may be found, according to Crook (1994:33) in mediation or psychological mediation as developed by Vygotsky in the 1920s. According to this view, higher mental processes or functions include all the voluntary and reflective processes of thinking, remembering and reasoning associated with human mental activities (Falchikov 2001:88-89). These activities are not behavioural in nature; that is, they are not stimulus-response reactions such as animals have, but come about because human beings are able to turn inward on their environment, act creatively upon it and thus effect profound changes in their relationship with it (Crook 1994:33). The ability to mediate ideas and information shows that human beings are able to effect the changes necessary not only to survive but to make life more comfortable and to develop mentally. To do this it is necessary to participate in the activities of the group but in order to exchange ideas, mediational devices are needed. Historically, as expressed above, these mediational devices were artefacts such as physical tools and the development of language for communication. Advances in human cognitive development of such magnitude could only happen in a socio-cultural setting as part of vibrant community and social interaction and not independently without social and cultural input. People need each other for support, encouragement, guidance, accountability and to learn from and in this way become 'mediators'. In short, cognition, being social, uses mediational tools such as shared speech for social interaction and is therefore socially located (Crook 1994:36-37).

In Crook's (1994:48) view the eminence given to social interaction in cultural theory is most clearly expressed in Vygotsky's (1978:86) concept of the ZPD. This was designed to deal with two educational issues (Crook 1994:48): the first was the attempt to deal with the problem of how to test a child's understanding in a domain of learning; the second was trying to understand what takes place in a child's mind during the processes of instruction; 'how learning is organised between people' (Crook 1994:49). The ZPD model gives some insight into resolving these issues. Firstly, Vygotsky showed that there was a 'gap' between the

[9] Mediation: interaction between human and human and human and object (artefact) by means of a tool such as language and mathematical symbols (Crook 1994).

'actual developmental level as determined by individual problem-solving' and 'potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers' (Vygotsky 1978:86). If this concept is followed through it will lead to 'assessment that focuses on *potential* to learn and on teachability' (Crook 1994:49, emphasis in original). Secondly, the relation of the ZPD to issues of instruction comes from how best to organise productive collaboration either with adults or 'more capable peers' (Crook 1989:49; Falchikov 2001:88-89). A child's ability to independently manipulate various functions[10] that have already matured within the ZPD shows the actual level of development of that particular child who is able to solve problems independently of assistance (Vygotsky 1978:86). According to this way of thinking, learning is a dynamic and on-going process throughout life as a person moves into and out of the ZPD. This idea is important to the process of learning and therefore of teaching because children with equal levels of mental ability develop cognitively at different rates and not, as Piaget (in Passer & Smith: 416-417) suggested, at a set rate according to their age. Vygotsky showed that when assistance is given to children by the teacher or more knowledgeable peers (tutor-mentors) some children grasp concepts quicker than others. This is particularly true of mathematical concepts, showing that the mental age of children differs and therefore the course of learning varies quite considerably (Vygotsky 1978:86). The difference in the child's ability to solve problems with or without assistance is dependent on whether he or she is in or out of the ZPD and is the difference between the actual (without assistance) and the potential (with assistance) ability to solve problems. It is acknowledged that variables such as ill health could affect the child's learning but when they are taken into account the above findings should remain true (Vygotsky 1978:86). A legitimate criticism of this concept, however, is that the knowledge level of the most knowledgable person in the room will probably constrain the level of learning within the room during that period of teaching. It is therefore important to ensure that all persons teaching (lecturers and tutor-mentors) have a higher level of knowledge than the students being taught. Despite these criticisms, however, understanding the concept of the ZPD is essential for quality teaching and learning. Understanding the concept of the ZPD has

[10] A functional system is a unit of knowledge made from individual concepts that become related and intertwined in the mind of the learner. The inexperienced learner will have many 'loose' concepts that have been assimilated but have not as yet been related to each other (accommodated) or intertwined (equilibrated) whereas a more experienced or knowledgeable teacher or peer would have developed a great many functional units (Crook 1994).

significance for tutoring and mentoring programmes in that if tutor-mentors understand it they will be better equipped to teach because they will understand the individual student's knowledge base and what prior knowledge there is on which to build.

It is generally accepted that the internalization of cultural mores and values together with socialization occurs in the ZPD (Vygotsky 1978:84; 1987:47). According to Perret-Clermont et al (in Resnick, Levine & Teasley 1991:41) up until the 1970s it appears that no systematic empirical investigations had been made 'of how experimentally induced variations in the social environment affect observable cognitive processes' or of the possibility of 'causal links between individual and social factors'. The question of why this aspect of research into learning was neglected or not even considered as relevant is intriguing because if one goes back to the ancient philosophers such as Socrates, Plato and Aristotle one sees the value and importance they placed on societal influence on the cognitive development of individuals, and of individuals on society (Breasted & Hughes-Jones 1927; Weech 1951). Socrates, and following him, Plato and Aristotle, held that the State (Society), made up of citizens (individuals), could only be 'saved and purified' by improving the minds of individual citizens through education. In this way the mind (in society if one considers Vygotsky's argument) being educated, would be able to recognize what was virtuous and right and behave accordingly (Breasted & Hughes-Jones 1927:230; Weech 1951:132). Since ancient times the importance of the influence of social groups, which are 'more than the mere sum of individuals', on the development of the individual has been recognised and one of the major outcomes of the development of sociology as a science has led to this *gestaltic* way of thinking being included in many fields including that of education. The necessity of educating the 'whole person' and not concentrating only on the cognitive or the psychosocial aspects is clearly important and so it is necessary to construct meaning within a social context (Perret-Clermont et al in Resnick et al. 1991:41- 58).

In summary, Crook's (1994) reasons for asserting that cognition can be said to be socio-cultural can be reiterated. Firstly, higher mental functions are entrenched in a framework of rituals, conventions, technologies and practices which were formed in a socio-cultural history (that is, in particular ways of talking and behaving); secondly, acquiring new knowledge takes place through participation in supportive social interactions, all of which construct meaning through the use of tools. Vygotsky (1978:57) proposed that 'all cognitive functions are first experienced on the inter-mental plane before they exist on the intra-mental plane' (Crook

1998:50). Since a child is not born as ‘an empty vessel waiting to be filled’ but has personality and will at birth, Vygotsky’s statement should be incorporated eclectically in the *bricolage* of theories advocated by this study.

2.6.1.4. Language in constructing meaning

In order for the construction of meaning to take place, individuals within a social group must communicate with one another. This presupposes that humans are social by nature and that children growing up in a specific social group will grow into the intellectual life of the people around them because there is constant communication within the group. As communication in this manner presupposes language, language must then be considered an instrument or tool through which humans communicate with one another and construct their reality in a social environment (Cole 2006; Falchikov 2001; Leonard 2002; Vygotsky 1978). Learning thus takes place within a social context via historical and traditional concepts that includes words and symbols. The developing child learns to ‘mediate what is already understood mentally within him or herself (he or she ‘owns’ the information) with the new information that is being presented from outside’. Knowledge and learning become internalised when, for example, situated knowledge becomes conceptual understanding, cognitive activity takes place and an individual is enabled to think or reflect in his or her own mind (Crook 1994).

As an outcome of the above discourse it is suggested that social interaction via tools such as language, enhances the learning process by constructing meaning. This is pertinent to the support given by tutor-mentors who communicate with students they are tutor-mentoring on the same level and often in the vernacular of the students, thus enabling the student to make sense of the information and so construct meaning.

2.6.1.5. Social constructivist perspective on learning

Humans need to be in a socio-cultural environment where they can communicate with and learn from others in the community. The socio-cultural perspective implies that because human beings are ‘[e]mbedded within a culture each of us encounters ever changing social settings that shape our actions and values, our sense of identity, our very conception of reality’ (Passer & Smith 2008:13). A person’s behaviour, way of thinking, emotions, opinions, belief systems and world view, are all influenced and shaped by the social environment and culture into which they

were born. We 'learn' our culture as we grow and because we are surrounded by these social and cultural influences, our thinking is shaped by the meaning that is given to everything with which we are presented (Passer & Smith 2008:13). Passer and Smith's (2008:13) definitions of culture and socialization explain the importance of these concepts to an individual's learning by giving meaning to everything in that person's environment at that time.

> ***Culture*** *refers to the enduring values, beliefs, behaviors, and traditions that are shared by a large group of people and passed from one generation to the next. All cultural groups develop their own social* ***norms****, which are rules (often unwritten) that specify what behavior is acceptable and expected for members of that group (emphasis in the original).* ***Socialization*** *is the process by which culture is transmitted to new members and internalized by them* (emphasis in the original).

Bandura (1989) supports this concept of learning, arguing 'that human learning is a continuous reciprocal interaction of cognitive, behavioural, and environmental factors' (Leonard 2002:215) wherein the child learns through observation and imitation – thus the term 'observational learning' (Bandura 1989; Leonard 2002). Crook (1994:49-50) supports this, saying that 'the active creation of socially shared understandings (between expert and novice) is an important investment within such instructional interactions' (that is, within the ZPD). Therefore, says Crook (1994:49-50), '[t]utorial initiatives will often need to build upon a mutual foundation of that kind' if internalization of information is to take place and learning is to occur. According to Vygotsky (1978: 57, emphasis in original):

> ***An interpersonal process is transformed into an intrapersonal one****. Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first* ***between*** *people* ***(interpsychological)*** *and then* ***inside*** *the child* ***(intrapsychological)*** *… all the higher functions originate as actual relationships between human individuals.*

From this it can be seen that there is 'a parallel between the external world of jointly-managed problem-solving (tutor and student working together) and the internal world of mental functioning' (Crook 1994:50) showing that interaction is necessary for learning to take place. When students sit and listen without being given the opportunity to ask or answer questions, discuss or argue, social interaction of a sort is taking place because language is being used and they are in the presence of others (Falchikov 2001:88-92). It is, however, one-sided as the lecturer or tutor-mentor is doing all the talking, and relevant thinking may or may not be taking place. Reading is yet another form of using language socially and as a communication tool but because it is usually done silently the lecturer or tutor-mentor does not know what is

taking place in the students' minds. Are the students thinking about what they are reading or are they dreaming? The concept of interaction by observation and imitation is in line with the social learning and community of practice theories as discussed below under the participation perspective.

2.6.2 Participation metaphor

Lave and Wenger argue that 'All theories of learning are based on fundamental assumptions about the person, the world, and their relations'. This seems to firmly fix learning as a 'dimension of social practice' (Lave & Wenger 1991:47). According to the social participation model, there are common, unifying, components within social practice which have diverse effects on the community as a whole and on individuals within that community. Lave and Wenger's ideas appear to have been developed from Vygotsky's theory of social constructivism. It is indisputable though, that through active participation in a social community, of which he or she is an integral part, the individual learns from and contributes to that community and thus 'constructs' knowledge in his or her own mind as well as adding to the community's 'mind'. From this it can be seen that outside influences have a definitive role to play in the learning of the individual and reflect the ideas of constructivist as well as participation theories as discussed in this chapter. The very ideas of adaptation, assimilation and accommodation, for example, support the view that interaction with the surrounding environment must take place if learning is to occur. Whatever one's personal view, it appears that at the heart of all these theories is the idea of constructing meaning

2.6.2.1 Communities of practice

Lave and Wenger (1991:33) first introduced the idea of a community of practice where 'learning is an integral part of generative social practice in the lived-in world' and is therefore placed 'in the context of our lived experience of participation in the world' (Wenger 1998:3). Lave and Wenger named this theory (1991:29) legitimate peripheral participation (LPP); a 'descriptor of engagement in social practice that entails learning as an integral constituent' (Lave & Wenger 1991:35). Wenger later postulated a 'new' social learning theory which incorporates and enlarges on the concept of learning as social engagement that take place in communities of practice. Wenger (1998) places great importance on the way individuals and communities understand and support learning. He (1998:7) suggests that learning is reciprocal

in that for the individual it means engaging in and contributing to the practices of the communities in which they find themselves, and for communities, means that their practices are refined and new members join. Individuals and communities within an organization help to forge and sustain interconnections, helping it to become valuable and effective (Wenger 1998:7).

2.6.2.2 Collaborative learning

The strategy of collaborative learning that originates in Vygotsky's social development theory postulates that '(t)hrough the act of collaboration, learners share knowledge, pool resources, and interact within the learning group to produce deliverables that are theoretically more complete and robust than that which would be created by an individual learner working alone' (Leonard 2002:31). Brodie and Pournara (2005:39) suggest, based on Piaget's theory of '*disequilibrium*' (Falchikov 2001:86, emphasis in original), that it is important for students to interact with one another through cognitive conflict because, in verbalising their ideas, they are forced to reflect on the ideas of others and in so doing, transform their thinking which leads to further learning and the development of new ideas. Although this makes sound pedagogical sense there may be difficulties with introducing such a concept in certain instances because of cultural norms and values which perceive the use of argument as disrespectful and impertinent. Students need to understand the difference between conflictual academic argument, which is helpful in coming to full understanding and getting rid of misconceptions, and argument for the sake of being difficult and contrary. Lecturers and tutor-mentors who understand its value can help students conquer their reluctance to learn through argumentation. The following theory bears on the this discussion as it attempts to explain how 'allegiances' that develop between participants in a learning situation may affect the ability of students to learn under certain circumstances because of the level of 'comfort' in the learning situation.

2.6.2.3 Educational knowledge theory

This line of thought follows Bernstein's classification and framing of educational knowledge theory (in Horton & Raggatt 1982:157) in which he observes that: '[e]ducational knowledge is a major regulator of the structure of experience.' There is, according to this theory, the development of both a horizontal and a vertical allegiance between participants in the learning

situation (Bernstein in Horton & Raggatt 1982:170). This working relationship might be seen as evidence of different levels of allegiance such as that between the person(s) in authority (horizontal) and the learners (vertical); the more knowledgeable learner(s) (horizontal) and the less knowledgeable learners (vertical); and between the less knowledgeable learners (horizontal). Learners may aspire to attain horizontal as well as vertical allegiance with their peers but probably not with the authority figure (Bernstein in Horton & Raggatt 1982:170-171). This notion is significant with regard to the application of Lave and Wenger's idea of movement from the periphery towards the centre and the reproduction of a community of practice and perhaps relates to the success or otherwise of tutoring and mentoring programmes generally.

2.6.2.4 Situated learning

According to Wenger (1998:3), learning should be placed 'in the context of our lived experience of participation in the world' and 'is, in its essence, a fundamentally social phenomenon, reflecting our own deeply social nature as human beings capable of knowing' (Wenger 1998:3). He therefore bases his social learning theory on the premise that humans are 'social beings'. The act of 'being active participants in the *practices* of social communities and constructing *identities* in relation to these communities is', he claims, 'a central aspect of learning' (Wenger 1998:4, emphasis in original), hence his primary focus is on learning as social participation in a community of practice. This fits with Bandura's (1989) theory on social learning (Lave 1993; Lave 1996a; Lave 1996b; Vygotsky 1978). Based on this, Wenger (1998) contends that the social learning theory has 'its own set of assumptions and its own focus' and therefore yields 'a conceptual framework from which to derive a consistent set of general principles and recommendations for understanding and enabling learning' (Wenger 1998:4). Lave's (1993; 1996a; 1996b) theory of situated learning argues that: 'Learning is a highly social, interactive activity that involves a great deal of collaboration and mentoring' (Lave in Leonard, 2002:174).

Lave & Wenger's research (1991) was conducted in work situations in which learners participated with an interactive group of seasoned practitioners. These more knowledgable practitioners provided cognitive coaching and apprentice learning to novices learning a particular skilled craft or trade (Leonard 2002: 32). They (1991) observed that learning, with the guidance and support of mentors, took place almost unintentionally (Collins, Brown &

Holum 1991). Through observation of 'real life' situations, Lave and Wenger (1991) concluded that the transfer of knowledge is closely tied to the social situation in which the knowledge is learned. The assumption was that 'situational learning focuses entirely on the learning experience as a shared, social, almost unintentional learning event' (Lave 1988; Lave 1993; Lave 1996a; Lave 1996b; Leonard 2002:32; Vygotsky 1978; Wenger 1998). This prompted the idea of learners participating in a social interaction process known as a 'community of practice' – that is, in LPP with members of that community (Lave & Wenger 1991:29; 35-37). The theory of 'communities of practice', according to Wenger (1998), assumes a fundamental learning process: that we become what we are because we are actively involved in particular social practices (Wenger 1998). In light of this assumption, learning cannot be confined to the classroom (Elvin 1977; Lave & Wenger 1991:113; Leonard 2002:32) but is a socially complex phenomenon that includes all members of a society where the same beliefs, ideologies and practices are taught, adhered to and participated in. Therefore snce teaching and learning is a holistic social practice undertaken for a common purpose, and since the purpose of the tutor-mentor programme is interlinked with the purpose of the methmatics enterprise, the idea of FP students, tutor-mentors and lecturers interacting as a community of mathematics practicioners, actively involved in a common enterprise (that of teaching and learning) for a common purpose, (to improve mathematical understanding and performance) can be assumed. In light of this, the argument, that tutoring and mentoring are indivisible entities, holistic in form and incorporating all aspects of a person's intellectual and psychosocial being while taking cognisance of the historical and existential worlds of the learners, is a reasonable assumption. The study advocates that these principles should be recognised and applied to tutorial and any other teaching and learning situation.

A further development in the idea of situated learning was developed by Collins, Brown and Newman (1989), Collins, Brown and Holum (in Resnick et al 1991) and Brown, Collins and Duguid (1989). According to this theory, historically, teaching and learning has taken place by means of apprenticeship. Children were taught and learned knowledge and skills from their parents and neighbours. They learned by imitation and with assistance from an expert in the particular domain. Collins, Brown and Newman (1989) and Brown, Collins and Duguid (1989) propose a method of teaching and learning that incorporates elements of both apprenticeship and schooling. They call this method 'cognitive apprenticeship' and claim that in using this method the best of both is available to teachers and learners. In this method learners acquire skills and knowledge from through a process of mentoring by experts in

particular domains (see also Leonard 2002:219; Wenger 1998:277). This theory should, however, be applied to higher education situations with reservations as university students are not apprentices learning a trade nor is higher education merely a process of gaining skills and knowledge. There is, however, much merit in the concept (if it is applied carefully) as it fits easily into the role-model theory developed from the social learning theory (Bandura 1989; Falchikov 2001; Lave 1996a; Lave 1996b; Vygotsky 1978) and into the cognitive and social constructivism theories as well as situated learning and participation theories. Viewed in this light it appears that learning through social interaction is beneficial to both the individual and the community and therefore social interaction is fundamental in the development of cognition (Vygotsky 1978: 57).

Anderson, Reder and Simon (1997:5) argue that claims made by researchers such as Lave (1993; Lave 1996b) Lave and Wenger (1991) and Greeno, Smith and Moore (1992) about situated learning with respect to education are overstated, sometimes misguided and even inaccurate and retrogressive. They state that much of what has been demonstrated empirically is ignored by situated learning researchers (Anderson et al 1997:10). While they agree 'that situated learning has served a role in raising our consciousness to certain aspects of learning that were not fully appreciated in education' at the same time they warn that 'in the absence of disavowal from the cognitive science community, misguided practices can have the appearance of a basis in scientific research' (Anderson et al 1997:10).

However, the view that learning is not a purely individualistic enterprise (self-reliant and independent) but is carried out as social participation because 'it takes place within a person's understanding of his or her place in a social process' (Clancey 1995) is accepted as a core argument of this study. It is accepted that individual learners are constantly engaged with the environment around them, while at the same time the world is constantly engaged with the learner (Vrey 1979). Learning therefore, cannot and does not take place in isolation but is a socially constituted phenomenon that incorporates all aspects of a person's being. Since learning is a complex phenomenon made up of many components, one theory cannot cover every argument and there is therefore room for the *bricolage* of theories that this thesis advocates. Thus developing both the situated and cognitive perspectives is a logical and reasonable strategy (Greeno 1997:5).

2.6.2.5 Social theory – issues of identity

According to Wenger (1998:145) '[i]ssues of identity are an integral aspect of a social theory of learning' as the concept of identity is 'a way of placing the person in a context of mutual constitution between individuals and groups' (Strauss in Wenger 1998:282-283). In other words, by belonging to a community a unique personal identity is formed by interaction with others in the community but at the same time a social identity as an integral part of that community is retained (Wenger 1998:146). This is important, because each person is a unique individual with a unique personality and needs, and this should be remembered when tutoring and/or mentoring an individual. It is generally accepted that people learn as they participate in the world around them (communities of practice), connecting with others at an increasingly complex level. According to Lave and Wenger (1991:48), various interpretations can be put on Vygotsky's ZPD, but for the purposes of this study, it is accepted as a social and cultural experience where there are many communities of practice, separate yet interlinked and affecting each other in different ways, and all participating in the larger community of practice. This study supports Lave and Wenger's (1991) view that learning should extend beyond pedagogical and social structuring and should stress 'the conflictual nature of social practice' (used in this study in the sense of effective, dynamic changes). 'Issues of socio-cultural transformation' should be connected 'with the changing relations between newcomers and old-timers in the context of a changing shared practice' (Lave and Wenger 1991:49).

Eckert (in Wenger 1998:282), suggests that adolescents develop social practices 'by which they construct identities in the context of those practices, particularly regarding issues of class and gender.' Linde (in Wenger 1998:282) sees identity as a person's life story that is not only determined by his or her culture but is continually in the process of being reconstructed. Sullivan, an anthropologist, (in Wenger 1998:282), 'analyzes the multiple interpretations that an ethnic community obtains – even internally – thus leading to complex and diverse identities.' Communities of practice focus 'on what people do together and on the cultural resources they produce in the process' (Wenger 1998: 282-283) but at the same time they must remain aware of their individuality and the 'wholeness' of their being. It can be seen from this discussion that cultural diversity is a major factor in the formation of communities and social practices and the formation of communities of practice within the larger community.

2.6.2.6 Socio-cultural situated participation for successful learning

Vygotsky (1978:90) theorized that learning awakens a variety of internal developmental processes in a child that are only able to operate when the child is interacting with people in a social environment that is personal to the child and in cooperation with his or her peers (Kozulin 2003:246). Based on this supposition he came to the conclusion that cognitive skills are the outcomes of activities which are practiced in social institutions belonging to a culture, and patterns of thinking are not, therefore, primarily determined by natural instinct (Vygotsky 1978; Rozycki & Golfarb 2000). Bandura (1989) emphasized the influence that social interaction has on the way people express behaviour (either aggressively or non-aggressively). His (Bandura 1989) social learning theory proposes that expressions of behaviour are learned by example through observing how people express themselves in various situations (see also Brown et al 1989; Bruner 1997; 1990; Collins et al 1991). Thus we learn from one another, children especially so, leading to the idea that because people share a living space they will probably have some influence on one another. This leads into Bourdieu's philosophy of *habitus* (Haenen et al in Kozulin 2003; www.newworldencyclopedia.org).

Haenen and co-authors have summed up the idea of the *habitus* as 'the creation of a learning environment ... conceived of as a shared problem space' within which students participate in finding solutions to problems through 'a process of negotiation and co-construction of knowledge' (Haenen et al in Kozulin 2003:246). It should be understood that *habitus* as a principle (not a theory) is important to the development of ideas in the multicultural milieu at MSA from which this thesis has grown. Bruner's (1990:105) assertion that human actions need to be situated within a cultural domain supports the idea of *habitus*, in that people construct realitites as social realities as they negotiate and share ideas with others in a 'shared problem space' (Haenen et al in Koxulin 2003 246). Bruner (1990:105) maintains that 'both mind and the Self [his emphasis] [are] part of that social world'. Following this line of thought, he suggests that learning therefore takes place in 'communities of learning and thinking' and that the 'learning child is …participating in a kind of cultural geography that sustains and shapes what he or she is doing, and without which there would … be no learning' (Bruner 1990:106). This idea, based on principles such as learning through vigorous involvement in activities and problem-solving, either singularly or as part of a group, are in agreement with Bourdieu's idea of *habitus* or social space (Panosky in Kozulin et al 2003:414-430) and Wertheimer et al's concept of the *gestalt* (Leonard 2002:79).

The concept of *habitus* may explain why peer tutoring is sometimes more effective in a social context, for example in a classroom tutorial 'community of practice', especially in multicultural or cross-cultural situations, than in isolation The idea of *habitus* as used in this case study should, therefore, be understood in a very broad sense. It encompasses every situation in which a person has ever found him or herself, from birth to the present. It is taken as given, therefore, that a person's *habitus* will colour his or her interpretation of experiences and events. As Gordon (in Vrey 1979:11) put it, 'the very genesis of the self is to be found in the process of communicative interaction.' This concept is important when considering the formation of a personal and group identity.

2.6.2.7. Developing a personal and a group identity through socio-culturally situated participation

The discussion that follows refers to the need, when developing tutoring and mentoring programmes, for recognition of the holistic nature of the student, and of the importance of the *gestalt* (Wertheimer et al in Leonard 2002:79) and the person's *habitus*, past and present, as expressed by Haenen et al (in Kozulin 2003: 246). The study recognises that students live, work and learn together in social-cultural milieus and that student bodies are becoming more multicultural and international (Crosling & Webb 2002). In light of this, higher education as a sub-system of the larger society, endeavours to increase interaction between diverse individuals and promote 'understanding, tolerance, and friendship among all nations, racial and religious groups' (Article 26(2) Universal Declaration of Human Rights in Singhal 2007; see also Monash Directions 2025). According to Singhal (2007:95), it also recognises that students' traditional socio-cultural *habitus* has instilled within them certain mores and values which influence their belief system, thinking and lifestyles. 'Higher education is especially influential when its social milieu is different from students' home and community background and when it is diverse and complex enough to encourage intellectual experimentation and recognition of varied future possibilities' Singhal (2007:95). However, because educational environments are a microcosm of society, the problems and issues that face society are often reflected on higher education campuses (Singhal 2007:96). Students' traditional enculturation can then make it difficult to become acculturated into campus society. Thus, to a greater or lesser degree, traditional enculturation (Gupta in Alred et al 2003:161), together with knowledge gained through personal experiences accumulated over the years and many other powerful influences in the contemporary world, make for common experiences for young

people that either help or hinder the process of acculturation into a new environment (Gupta in Alred et al 2003:163). The concepts of enculturation and acculturation are discussed in more detail later.

When developing tutoring and mentoring programmes it is important to recognise these factors and bring together an understanding of the complex nature of a person as a complete or holistic being with his or her own traditional background and understanding with understanding how the needs of higher education students can best be met. To do this, perceived advantages and disadvantages of separate tutoring and mentoring programmes and their overall value are considered against the need for integrated, holistic programmes that consider the holistic needs of individuals living and working in communities of practice as suggested by Wenger (1998).

2.6.3 Linking the acquisition and participation metaphors

According to Leonard (2002:39), constructivism focuses on the self-direction, autonomy, and growth of the individual through the learning process. The constructivist learning environment is based primarily on the learning theories of Piaget and Bruner (Leonard 2002:37-39) and 'build(s) information in a team-based manner that emphasises learner knowledge and collaboration' (Leonard 2002:39). One should be aware that both social and cognitive constructivism focuses on the learning and knowledge acquisition of the individual whereas situated learning speaks about knowledge belonging to the community through the legitimate peripheral participation of individuals (Brodie 2005; Lave & Wenger 1991). Learners 'acquire knowledge, share knowledge, and structure the knowledge … with the instructor acting as a guide, co-collaborator, and coach' (Daloz 1986:XIX). Wadsworth (1996) corroborates Piaget's genetic epistemology, that humans have an innate desire to be active, creative and learn new things from the surrounding environment and that the learning process of individuals is, therefore, by nature self-directed. Although the social aspect of learning is clearly evident in this approach, it is also clear that a person will learn whatever he or she desires to learn although society will have an effect on what, and even how, the individual learns.

2.6.3.1 Cognitive development

Piaget developed a theory of hierarchical (genetic) cognitive development where a person's intellectual development goes through various phases or stages he called schemata (Vrey 1979: 153; Leonard 2002: 79). This theory is not averse to more socially oriented theories as can be seen in the following explanation of the meaning of Piaget's terminology. The meaning of the term 'genetic' or 'hierarchical' as used by Piaget (in Leonard 2002) refers to the person's developmental processes, while the development of an individual's 'schemata' or 'cognitive structures' occurs through ongoing interaction with the environment . In other words, there must be social interaction for schemata to develop. According to Bergh and Theron (2005:70):

> *During these phases the cognitive processes, together with the emotional experiences, form categories of information (cognitive structures) or "schemata" which can change in quantity and quality. As thought processes become more complex, individuals' ability to adapt to the environment and to organize information also progresses through the mechanisms of assimilation and accommodation.*

2.6.3.2. Accommodation and assimilation

According to Piaget's theory (Leonard 2002), accommodation is the process by which changes in the child's cognitive structure are made so that he or she is able to make sense of new events occurring in his or her environment. Assimilation is the process whereby the learner interprets events in the environment and places them 'within the context of already existing cognitive structures' (Leonard 2002:1, 11). Assimilation takes new information and experiences and integrates them with existing mental processes, while accommodation changes the cognitive processes so as to organise and manipulate the new experiences (Bergh & Theron 2005:70; Vrey 1979:291-292). These two processes work together throughout life to increase the cognitive growth and maturation of a person, intellectually, socially, morally and emotionally. Thus, according to Piaget (Vrey 1979:109-110; 277-281), both assimilation and accommodation are essential to the full development and well-being of the person. If cognitive development occurs as it should, thinking-patterns change and develop from concrete to abstract (Bergh & Theron 2005:70). Schaie (in Bergh & Theron 2005) extends Piaget's model by categorising young adults into an 'achieving period' when they are capable of solving problems and making decisions. At the same time, cognitive development does not consist of events isolated from the everyday occurrences of life (the '*gestalt*' or '*habitus*')

since along with cognitive development should go psychosocial development as people learn to adjust to the social norms of society and are secure in the continuity of their relationships.

When Piaget's model is examined it can be seen that social and emotional interaction with the environment was an integral part of his theory although he concentrated on the development of cognition in the individual. However although it may be that he did not go far enough in recognising (or stating) the holistic nature of a person and, therefore, the essential part environmental interaction plays in the full development of the individual this, according to Falchikov 92001:88) was not actually so. While Vygotsky's socio-cultural learning theory appeared to challenge Piaget's cognitive learning theory by claiming that human cognition and learning is not an individual phenomenon but can only take place in a social and cultural milieu (Bergh & Theron 2005:66; Epstein 2002; Kozulin et al, 2003:1; Page & Loots 2005; Perret-Clermont, Perret & Bell in Resnick et al. 1991:41), the social-constructivist theories of Piaget and Vygotsky actually complement each other (Falchikov 2001:88).

According to Bergh and Theron (2005:66), Vygotsky 'pioneered the concept of social learning in human development' thus generating the idea that social learning was essential for human development: that is, 'that learning is internalized through interaction with other people'. This stance was affirmed by Swartz, de la Rey and Duncan (2004:69) who state that Vygotsky 'focused on how the artefacts of culture, beliefs, values, traditions, and skills of a social group, are transmitted from generation to generation': the 'enculturation' and 'acculturation' concepts as expressed by Gupta (in Alred et al 2003:155-173). According to Gupta (in Alred et al 2003:161-163) 'the transmission of cultural material and the immersion in cultural systems brings about "enculturation"' and occurs 'when cultural material is acquired within one's "own" culture.' 'Acculturation' on the other hand is 'the outcome of an individual's experience of a changing cultural context' when 'the culture change that occurs is specifically due to a contact, direct or indirect, with other cultures' (Gupta in Alred et al 2003:163). Researchers such as Bandura (1989), Elvin (1979) and Vrey (1979), amongst others, have put forward similar ideas. This idea takes on meaning when considering the effects of living in a multinational and multicultural society and is especially helpful when developing tutoring and mentoring programmes for international, multicultural higher education students.

Vygotsky's social learning theory is supported by Mwamwenda (1996:96) who points out the possibility that Piagetian ideas may suit non-African methods of child-rearing but may differ quite extensively from traditional African practices. If this is not recognised as a point of concern, it may cause some problems when educating the African child. He contends that:

> *cognitive abilities cannot be defined out of context. … The value that the West attaches to Piagetian concepts may not be the same as the value the vast majority of African people would attach to them. As a result, the way in which 'Africans' and 'non-Africans' are likely to relate to these concepts may differ significantly and may affect their corresponding child-rearing practices.*

This idea is significant when considering the concept of multinationalism and multicultralism at higher education institutions and certainly holds true for example, for many foreign students who, while 'culturally and socially situated' (Kozulin 2003:2) and studying at liberal, western universities are yet also part of another culture and social system. It is possible that personal and social conflict can arise as a result of this, as was experienced by a few MSAFP students as we shall see in chapter 5. The contention of this study is that psychosocial as well as cognitive needs of students from socially and culturally diverse backgrounds must be recognised and catered for if they are to achieve their cognitive potential. Thus while tutor-mentors should see themselves as guides who challenge and support students on their cognitive journey, they should also recognise how the personal aspirations, relationships and values of a student's life may play a decisive role in either enhancing or inhibiting his or her movement within the learning paradigm (Daloz 1986: X1X). One may see, therefore, that learning is not a purely constructivist or purely participative event but incorporates both perspectives and consists of many facets as a holistic enterprise.

In recent years there has been a move away from the exclusivity of theories based on a psychological approach to learning. Rather, educationists began increasingly to realise that human beings are part of a complex social community where learning is a mélange of interactivity between all members of a community and where, according to Murphey-Lejeune (in Alred et al 2003:113), the process of social construction expands, rather than totally changes, the personal environment by opening up 'one's potential universe'. This 'maturing process,' according to Murphy-Lejune (in Alred et al 2003), happens wherever one may live and adds weight to the following assumptions.

2.7 Human development in social and socio-cultural learning milieus

In discussing the nature of human development, Bergh and Theron (2005:65) suggest that:

> *In contemporary societies, human development should also include acquiring the attitudes, values and behaviours that individuals need in order to cope more effectively with and to adjust to fast and continuous changes in their social and work life, for example to help improve race relationships and to be more self-sufficient and entrepreneurial in job and career choices.*

Bergh and Theron's assertion (one presumes they are speaking about current life situations and not the past) gives a sense of contemporary relevance to the arguments already expressed. However, the necessity should also be a recognised to acknowledge the traditional and historical social and cultural backgrounds from which students come and to which they return at various times. The optimization of learning must of necessity recognize past as well as current social and cultural influences on the life of the student: thus the assertion that pedagogical theory must be practical and 'be in vital contact with reality' (Elvin 1979:133) to achieve successful learning outcomes.

Elvin's inference (1977:31) that understanding the societal and cultural setting of schools - and universities, homes, and neighbourhoods from which students come and their influence on students' behaviours (psychosocial and academic) reemphasises Vygotsky's and other like-minded researchers' theories on learning being a social activity. This concept gives weight to the contention of the present study that by understanding the present and past social situations of students, further understanding and valid conclusions may be formed which could then play a significant role in attaining desirable learning outcomes. From this, it may be assumed that the practical working out of socio-cultural learning theories together with participation should therefore be evident in the practice of any tutoring and mentoring programme.

According to Lave and Wenger (1991:52-53), when there is an explicit focus on the individual as a 'person-in-the-world' active in a 'socio-cultural community' it will be because 'learning as increasing participation in communities of practice concerns the whole person acting in the world.' Participation as part of a community is a process crucial to the 'opening up' of a person to the world and the development of cognition (Vygotsky 1978:75).

Bourdieu's definition of learning as *habitus* further 'emphazise[s] the integration in practice of agent, world and activity' (in Lave & Wenger 1991:50) and can be described as:

> *those aspects of culture that are anchored in the body or daily practices of individuals, groups, societies and nations. It includes the totality of learned habits, bodily skills, styles, tastes, and other non-discursive knowledges (sic) that might be said to 'go without saying' for a specific group.*

It may be argued, therefore, 'that practices are generated from an under-lying structure, the *habitus*' (Bourdieu in Wenger 1998:289). According to this interpretation, a person's learning and explanation of the world is built on the basis of his or her personal '*habitus*' or 'social space' (Panosky in Kozulin et al 2003:414-430; Grenfell 2008; www.newworldencylopedia.org). This idea is given further credence by advocates of Vygotsky's socio-cultural approach to learning who propose that recognition should be given to the fact that individuals are situated in social, cultural and historical contexts (Panosky in Kozulin et al 2003:403; Elvin 1977:31; 33). Lave and Wenger (1991:29; 39-43) further express this idea in their use of the concept of LPP whereby learning is viewed as a socially situated activity.

The encultured memory, which is akin to Vygotsky's (1978) *Mind in Society* may be further explained by the word '*meme*' which was a term coined by the biologist Richard Dawkins (1989 edition) to explain how cultural information is propagated from one person to another. He claims that cultural information is spread from brain to brain 'just as genes propagate themselves in the gene pool by leaping from body to body via sperm or eggs' (Dawkins 1989) and by imitation. Dawkins explains the concept of 'meme' as deriving from the way in which genes are handed on through propagation, thus enabling the 'memes' to 'move from one mind to another as tunes, ideas, catch phrases, clothes fashions, ways of making pots or of building arches' (Dawkins 1989) and one may add, stories, beliefs or ways of viewing the world. There are 'many ways' of propagating information from one mind to another according to Dawkins (1989) but all the 'ways' appear to be through oral communication and imitation. With the passing on of social, cultural and traditional information comes the affirmation, both to teacher and learner, of the acceptance of the recipient of the 'memes' not only as a fully fledged member of that society but as one who has been entrusted with the safe-keeping of its cultural and traditional memories. Dawkins' theory lends substance to the previous discussion on the idea of reproducing society as a community of practice that is influenced by the *habitus* of all participants and which is ever

reproducing itself through the passing on of its 'memes'; that society at large and the community in particular is responsible for passing on its culture and accumulated knowledge. The idea of communities being the repository of and having responsibility for the transference of society's culture and knowledge and that transference of knowledge is situated within a socio-cultural milieu.

2.7.1. Situated cognition affecting learning practices

Brown, Collins and Duguid (1989) in their paper on *Situated cognition and the culture of learning* argue that '[m]any teaching practices implicitly assume that conceptual knowledge can be abstracted from the situations in which it is learned and used' and as a result the effectiveness of the practices is greatly limited. They argue that 'knowledge is situated', because it is 'in part a product of the activity, context and culture in which it is developed and used' (Brown et al 1989). As has already been stated (see also Brodie 2005), learning takes place in a socio-cultural milieu and cannot be taken out of that milieu and isolated as a thing on its own. Collins, Brown and Newman (in Resnick et al 1991) propose that a cognitive apprenticeship approach to teaching and learning will ensure the inclusion of both constructive and participatory perspectives and that this will respect 'the situated nature of knowledge'. In doing this, there will be no separation between 'knowing and doing' and knowledge will be regarded as something integral to and part of the situation in which it is learned and used. Therefore, argue Brown, Collins and Duguid (1989), 'learning and cognition' are 'fundamentally situated'. The situated nature of cognition is what, according to Brown et al (Collins, Brown & Newman in Brown, Collins & Duguid 1989), makes knowledge usable and robust and therefore of value to education. They suggest that:

> *Approaches such as cognitive apprenticeship that embed learning in activity and make deliberate use of social and physical context are more in line with the understanding of learning and cognition that is emerging from research.*

After Lave (1988; in Resnick, Levine & Teasley 1993; 1996b) and Lave and Wenger (1991) posited the theory that cognition, which is usually related to the individual, can be linked to the social construct of situated or socio-cultural theories of learning, the idea that knowledge is socially constructed gradually became more established and accepted (Boaler 2000a; Lerman 1996; Sfard 1998). Since students consider themselves to be in different situations or socio-cultural situations when in the classroom and out of it, the influence of these different

environments must be taken into consideration as far as teaching and learning is concerned. As Boaler (2000b:2) argues, the classroom community and the social and cultural processes that stem from that community influence the 'students' production of knowledge in different situations'. Since the student community frames its activities according to its culture (the way in which it, as a student community, sees the world) the cumulative wisdom of the community as well as the insights and experiences of individuals within the community will be reflected in the way it uses conceptual tools which is itself part of its culture. When students are actively engaged in learning a concept, they are involved with the subject matter within a cognitive and a socio-cultural context. This being so, '[a]ctivity, concept and culture are interdependent,' as all three are reflected in the learning situation (Brown et al 1989:33). Students and tutors as communities of FP mathematics practitioners are bound by intricate, socially constructed webs of beliefs and values and should be viewed from this perspective in order to understand what is being done or what it is they do (Geertz in Brown et al 1989) giving insight into the value of peer tutor-mentoring in the learning situation (Goodlad & Hirst 1989).

Lave's (1988) studies comparing school learning and learning through everyday activities illuminate the meaningfulness and purpose (or not) of learning for students inside and outside a formal classroom situation where certain codes of behaviour are expected by the community of practitioners. In the formal lecture situation the lecturer is often visibly in authority with little interaction from students or tutor-mentors. Much less learning may perhaps take place in this rather unnatural situation than outside the less formal tutorial classroom situation where there is freedom to participate in an informal relaxed manner thus perhaps precipitating more meaningful learning (personal observations 2008; informal interviews with students, tutor-mentors and lecturers 2008).

2.8 Implications of learning theories for tutor-mentor activities

In light of the above discussion, successful academic intervention programmes need to be underpinned by supportive learning theories and concepts that will ground the programme and give it validity (Glaser & Strauss 1967). Planners of tutor-mentor programmes at higher education institutions where academic validity is important are particularly obliged to ensure a solid theoretical framework for their programmes. The present research project is an attempt

to provide such grounding, and thus guarantee of validity, for the MSAFP tutor-mentor programme.

From evidence gathered during the study, it became clear that although aspects of various theories are important, the main emphasis should be on those that fall under the acquisition and participation metaphors, the most important of these being cognitive constructivism (Piaget in Leonard 2002) and socio-cultural constructivism (Vygotsky 1978; Kozulin 2003; Bruner 1990: 105); social participation (Lave & Wenger 1996); situated learning (Lave & Wenger 1991) and communities of practice (Wenger 1998). The concepts of the LPP (Lave & Wenger 1991), *habitus* (Bourdieu in Wenger 1998:281,284, 289, 296) and the ZPD (Vygotsky 1978) are central to the construction of the ideas expressed in this study. The study is therefore situated within a framework of theories that emphasise learning within a socio-cultural participative milieu. Tutoring and mentoring support programmes are recognised as fitting within this domain.

2.9 Conclusion

This study looked at tutor-mentoring as a holistic support strategy which takes into consideration the the cognitive and socio-cultural aspects of a person's life in a vibrant and diverse community of practice (Maitland 2007). Developmental and learning theories are so interlinked that no single theory was considered sufficient on its own as a foundation on which to build a dynamic tutor-mentor programme. Parts of theories were found useful – some more so than others – but overall, constructivist and participation perspectives that incorporate the concepts of *habitus*, holism and *gestaltism*, together with the process of learning that takes place in the ZPD, seemed to make the most sense in helping tutor-mentors fulfil their mandate; that of supporting and challenging their tutees and mentees in a vibrant and trusting relationship (Daloz 1986; Lave & Wenger 1991; Hendricks & Hendricks 1995; Biehl 1996). The study is therefore built on a *bricolage* of such theories and concepts.

I proceed in the next chapter to observe the impact that masification access has had on student enrolment and the rise of multinationalism and multiculturalism at higher education institutions and MSA in particular. The impact of multinationalism and multiculturalism on

MSA and FP students' academic performance and the need for a support system is discussed. An overview of the design, structure and function of the MSAFP tutor-mentor programme will also be provided.

CHAPTER 3

THE MONASH SOUTH AFRICA FOUNDATION TUTOR-MENTOR PROGRAMME

> *Monash University seeks to improve the human condition by advancing knowledge and fostering creativity. It does so through research and education and a commitment to social justice, human rights and a sustainable environment* (Monash University's Statement of Purpose, *Monash Directions 2025*)

3.1 Introduction

This chapter briefly refers to the trends in higher education worldwide, the increase in multinational and multicultural student bodies at higher education institutions in South Africa (Loots 2009) and the implications of this for MSA and the FP in particular. It describes the rationale for initiating support programmes, and the design and structure of tutoring and mentoring programmes in support of the MSAFP IT mathematics students specifically. Opinions are supported by the *bricolage* of theoretical perspectives discussed in the previous chapter, which are referred to but not discussed.

3.2 Multinationalism and multiculturalism in higher education

Multinationalism and multiculturalism at higher education institutions is a worldwide phenomenon (Chang 1999; Crosling & Web 2002; Pokorny & Pokorny 2005) and has been especially marked during recent years as opportunities became available for students from less developed countries to study overseas, or from areas within a country as is the case in South Africa. This phenomenon has implications for MSA and FP students in particular (*Monash Directions 2025*; MSA *General Information* 2008), especially with regard to academic outcomes. I argue that a support sustem that helps students cope with the academic, social and emotional difficulties they encounter is essential. Furthermore, I argue that such a support programme works best as a holistic enterprise within a community of practice of like-minded

people sharing a common purpose. The following section discusses the academic and psychosocial implications of admitting English Additional Language (EAL) students to higher education institutions in South Africa which have English as the language of learning and teaching (LoLT). Since learning in a second language (L2) is considered by many researchers, such as Cummins (2000), Howie (2002) Lemmer (2009a in process) and Setati (2008) among others, as having a major impact on academic outcomes it is given considerable attention.in the following section. The impact of cultural diversity on students will be discussed later in this chapter.

Setati's (2008) research shows a preference for English as the LoLT by most black South African parents and students/learners. She refers to the coveted social and linguistic capital of English-medium education institutions, and argues that not only do 'most black parents want their children to be educated in English' but 'most children want to be educated in English' (Setati 2008:104), and therefore, 'teachers and learners who position themselves in relation to English are concerned with access to social goods and positioned by the social and economic power of English'. According to Setati (2008:103), teachers and learners with this point of view 'do not focus on epistemological access but argue for English as the LoLT'. Howie (2003:1) suggests that the level of students' proficiency in English is 'a strong predictor of their success in mathematics' and therefore 'becoming proficient in English is a solution to improving L2 learners' mathematics performance'. It is therefore understandable that parents and students place such importance on English as the LoLT, and the relationship of this to an increased number of EAL students into English higher education institutions According to Cummins (2000) Lemmer (2009a) EAL students Research by Bergh and Theron (2005), Chang (1999), Crosling and Web (2002), Gupta (2004), Howie (2003), Maitland and Manson (2006), Pokorny and Pokorny (2005), Setati (2008) and others all appear to support this argument. As greater numbers of EAL students register at higher education institutions institutions innovative support programmes have had to be introduced to deal with academic shortcomings and social concerns (Crosling & Webb 2002; Loots 2009; Powell 1997). These issues are dealt with in Chapters 4 and 5.

Britain and the United States of America have well-established mentoring and tutoring programmes which have been developed over many years in order to deal with issues relating to the influx of EAL learners into education institutions (Goodlad & Hirst 1989; Jaworski & Watson 1994; Powell 1997). South Africa, on the other hand, has only become an attractive

destination for foreign students and Africans in particular, since the demise of the apartheid system in 1994 (Rutherford & Matlou 1998; Goodlad 1998). Higher education institutions have therefore only recently begun to develop their mentoring and tutoring programmes. The need for a post-matriculation, pre-university or academic development or foundation year has become more evident as higher education institutions have become more international and multicultural (Crosling & Web 2002; Loots 2009; Pokorny & Pokorny 2005). Even in countries where English is the primary language of learning and teaching (LoLT), such as in Nigeria and Botswana, many people speak English only at school and only in the classroom, conversing in the vernacular at all other times (focus group and informal interviews 2008). Consequently, when such students study at an institution such as MSA, where English is the LoLT, they can have difficulty in understanding and in expressing themselves fluently in academic English. This has an impact on learning, including mathematics (Maitland & Manson 2006) and the result of struggling with a subject such as mathematics (in which a student is competent) because of language issues, can affect self-esteem and possibly cause other psychosocial problems. A cycle is then established and perpetuated unless academic and psychosocial support is given.

LoLT places EAL students at a disadvantage and can set them back in their studies as they struggle to cope with language-related issues (Bergh & Theron 2005; Crosling & Web 2002; Getis, Getis & Felmann 2008; Gupta 2004; Howie 2002; Lucas et al 2006; Maitland & Manson 2006; Miller 2008; Setati 2008). Recent research supports the use of students' home languages as the LoLT in the classroom as being preferable to learning in a second language (Adler 2001; Moschkovich 1996; Moschkovich 1999; Moschkovich 2007; Setati & Adler 2001; Setati 2008; Setati in Keitel, Adler & Vithal (Editors) 2005)). However, in the South African context, Setati (2008) and Howie (2002) argue that because English is viewed as a means of cultural assimilation and a unifying social factor, it is preferred as the LoLT by parents, teachers and learners. According to Reagan & Ntshoe (in Setati 2008:104), '(t)he political nature of language is not only at the macro-level of structure but also at the micro-level of classroom interactions' and 'can be used to exclude or include people in conversations and decision-making processes'. Thus using the home languages of learners as a resource tends to be seen as a threat to the development of multilingual learners' fluency in English and therefore a possible threat to a 'common, unified society' (Setati 2008).

The difficulties that EAL students face when learning in a second language such as English are widely recognised. Lack of fluency not only leads to academic shortcomings but also to psychological stress, and this can lead to social and emotional difficulties which further affects academic confidence and successful outcomes. This can become an on-going cycle of distress and failure (Bergh & Theron 2005; Crosling & Web 2002; Gupta in Alred et al 2003; Lucas et al 2006 and Maitland & Manson 2006). Recognising the need to deal with this problem has given impetus to investigating ways and means of supporting the educational needs of EAL students in many countries where English is the LoLT but where there is significant multilingualism amongst the students. This is the case in the United States (Moschovich 1999), England (Halliday in Monaghan 2006), Australia (Crosling & Web 2002), and more recently, South Africa (Setati 2008; Barwell, Barton & Setati 2007).

It has therefore become increasingly important to identify specifically what international students need in order to integrate or become acculturated in an unfamiliar environment (Crosling & Web 2002; Gupta in Alred et al 2003) so that the needs of EAL students can be met. This requires a fuller understanding of the impact of internationalisation of higher education institutions on education, and the need for more cross-cultural studies. The following section deals with the effect of cultural diversity on pedagogical practices at higher education institutions.

3.2.1 The effect of cultural diversity on pedagogical practices

'Cultural diversity' is a commonly used term and one with which many people are familiar. It is descriptive of a heterogeneous community of people consisting of many different social groups. Within such communities, there are multiplicities of national and cultural traditions and languages. At the same time, recognition and acknowledgment is given to the right of individuals to establish their own cultural and personal identities within the cultural group.

People are cultural beings and are shaped by their environment through processes of socialisation (Berger & Luckmann in Alred et al 2003:2-3; Astin 1993). Educationists therefore need to be aware of the development of cultural identities within their learners. However, because people are social beings they develop through interaction with others within a social community. As has been pointed out in Chapter 2, this is the view of, among others, Vygotsky, Alvin, and Lave and Wenger. Among other requirements, learners need security in

order to function cognitively and psychosocially at their best. Acceptance by the group and being part of the group are important because groups tend to favour 'insider members of their groups over outsider members of other groups' (Tajfel in Alred et al 2003:3). However, people socialised in a specific group tend to believe that the mores and values of the group are natural and normal, and this can make for problems when they move away from their group. According to Alred et al (2003:3), it is when people step outside of their own narrow life experiences and begin to question the authenticity of their group's beliefs and behaviours, without necessarily discarding them, and begin to experience and reflect on other conventions, values, belief systems and behaviours that they begin to become intercultural. Social identities are developed on many levels, and identification with in-groups as well as out-groups 'offers different forms of security and different opportunities for experiencing "otherness"' (Alred et al 2003:3). The opportunity to experience new relationships and the ability to reflect and analyse the experiences and to act on insights into oneself is to learn, and this is the true value of the intercultural phenomenon. However, should the student not be accepted into the new community he or she may feel ostracised and unable to cope with problems that may arise. Feelings of isolation and inadequacy may lead to cognitive and psychosocial dysfunction and the need for some kind of academic or psychosocial intervention.

It is, however, difficult if not impossible to focus on the individual in a mass higher education situation where classes are large and lecturers do not always know students individually (Ingram 2010). Nevertheless, it is important that the learning environment is structured so that it nurtures the individual and leads to independent learning (Hunt 2009; Pokorny & Pokorny 2005). Carefully designed and correctly structured and monitored peer tutor-mentor programmes should be considered as a pedagogically sound support system that is part of the social world of learning (Braxton in Loots 2009).

Pokorny and Pokorny (2005) point out that increased student numbers brings with it changes in the nature of student populations and with it the need to realise and acknowledge that students' skills and knowledge base may not be adequate or up to the required standard. According to Pokorny and Pokorny (2005) and Crosling and Web (2002), massive increases in student numbers has a serious impact on student progression, resulting in a significant drop in throughput rates and a decrease in retention rates. Many reasons are proffered for this, such as extremely large class sizes and a loss of personal identity, but one of the most significant is that of language. Many EAL students struggle with English while at the same time trying to

cope with normal first year issues which often leads to feelings of hopelessness and an inability to cope academically and psychosocially (Astin 1993; Crosling & Web 2002; Gupta in Alred et al 2003; Lucas et al 2005; Pokorny & Pokorny 2005). The results of stressers caused by academic and psychosocial factors may lead to long-term as well as short-term academic consequences for the student, the institution and the country. Other studies produce contradictory findings. For example, in the opinion of Chang (1999) cross-cultural education has mainly positive outcomes. He (1999:377) does however, recognise that:

> *Simply mixing students from different racial groups does not necessarily result in positive outcomes. Instead, the potential educational benefits of racial diversity* [and cultural diversity: author's note] *may very well be mediated by specific experiences that are significantly associated with having a diverse student body.*

The differences in the points of view may perhaps stem from differences in belief systems and the cultures in which the studies took place, viz. Chang (the United States), Crosling and Web (Australia), Gupta (the United States), Pokorny and Pokorny (the United Kingdom), Howie (South Africa) and Rutherford and Matlou (South Africa

Many attempts have been, and are being, made to deal with the issues mentioned above and all appear to have had some measure of success (Barwell et al 2007; Crosling & Web 2002; Goodlad 1998; Goodlad & Hirst 1989; Maitland & Manson 2006; Moschovich 1999; Pokorny & Pokorny 2005; Powell 1997; Setati 2008). One of the main challenges of increased access for higher education is to understand the differences in the pedagogical practices world-wide and to be able to integrate foreign students into the life and culture of the university without altering its pedagogy, tradition and culture. This is a difficult problem to solve because the purpose of higher education is that of learning which includes learning from other societies and cultures.

One of the key influences on education and pedagogical practices is that of religious beliefs and customs (Block 2007). These are deeply embedded in a person's psyche and inform her or his world-view. This may affect a student's ability to cope with different cultural mores and values especially when studying in a foreign country that has different ideas about the part that religion plays in education compared with what he or she is used to. A student's cultural and religious background will, therefore, have a profound effect on his or her level of psychosocial comfort and may affect learning and academic performance.

Cultural practices affect the language of learning and teaching (LoLT) and pedagogical practices at higher education institutions, especially in relation to higher education institutions' goals of incorporating internationalisation, cross-culturalism and inter-culturalism into their education philosophies. This applies especially to EAL students. Acculturation is a slow process and is not always accepted by the individual, and may not always be successful (Gupta in Alred et al 2003). Careful attention therefore needs to be paid to the kind of support given and the way in which it is offered so as not to offend cultural norms and values, yet at the same time hold to the norms and values of the institution. An additional factor is that acculturation may not be what the student desires. He or she may want to remain wholly within his or her own culture. However, if learning is to take place and the student is to be comfortable in the new context, then an element of acculturation must occur.

To enable EAL students to make the most of their educational opportunities, higher education institutions must therefore overcome the challenges mentioned above, through well-organised, properly functioning peer tutor-mentor programmes where students support students in all areas of their lives: social, emotional and academic. A pedagogical approach such as this will assist higher education institutions to put into practice the principles and values embedded in the ideals of inter-, multi- and cross-culturalism while remaining considerate of the embedded and encultured mores and values of individual students and the university's own educational philosophy. At the same time, such a support system should encourage acculturation to a degree that is acceptable to EAL students and, while satisfying their emotional and social needs, enables them to realize their academic potential.

3.3 Monash South Africa

Against the background of the above discussion, the following section describes teaching and learning at MSA. This includes a brief history of MU, its aims and policies regarding internationalisation, its reasons for founding the South African campus, its formal offerings and its student demographics. Special attention is given to a description of the tutor-mentor programme for FP students.

3.3.1 A brief history of Monash University

MU, founded in 1958, has become one of the world's foremost research universities and is a leading Australian international higher education institution committed to excellence in innovative research and high quality education. MSA was ranked 69 out of 100 top African universities (http://www.webometrics.info/top100_continent.asp?cont=Africa Accessed 07 February 2010). Considering that MSA is not yet a fully fledged university but a campus of MU and has only been in existence for 8 years at time of writing, this is quite an impressive achievement. Despite the controversies surrounding ranking (matielandSummer2008 *Special Report* Accessed 22 January 2009), it illustrates the high standards of MU and MSA.

There is wide diversity in location, culture and people with the university's current total of eight campuses, the main one of which is located in Melbourne, Australia. There are six campuses in Australia, one in Malaysia and one in South Africa. The university has a centre in Italy and a global network of strategic alliances, partnerships and institutional links, including a joint research academy with the Indian Institute of Technology Bombay in Mumbai, India (www.monash.ac.za Accessed 16 Januart 2009). The institution's website states, 'Monash is a broad-based research and teaching higher education institution with ten faculties: Art and Design; Arts; Business and Economics; Education; Engineering; Information Technology; Law; Medicine; Nursing and Health Sciences; Pharmacy; and Science' (www.monash.ac.za Accessed 16 January 2009). Because of its links with academic and research universities around the world and having campuses and centres on four continents, it is able to 'a vibrant and internationally-focussed learning environment' (www.monash.ac.za Accessed 16 January 2009). 'Graduates from Monash University are highly sought after by industry and the professions and have outstanding achievements in such areas as law, medicine, commerce, government, engineering, arts, education and the sciences' (Professor Richard Larkins in the *Three Year Rolling Plan 2006-2008*:2*).* By the time that it celebrated its fiftieth anniversary in 2008, the university had grown to almost 60 000 students with over 200 000 alumni from more than 100 countries (www.monash.ac.za 16 January Accessed 2009).

Although the main campus of MU is located in Australia, a developed country with a strong Western culture, the ethos and admissions policy of the University is one of racial and cultural inclusiveness and no student or lecturer is ever excluded on the grounds of race or culture. There is, therefore, a multiplicity of races and cultures at all the campuses of the University.

However, while there is a diversity of nationalities on all campuses, some races and cultures are more heavily represented than others depending on the proximity of a particular campus to countries from which its students come. For example, the Australian campuses have large numbers of Asian students while the South African campus is largely made up of African students with the countries nearest to South Africa being most heavily represented (see 1.1.1). One of the attractions of studying at MU is the opportunity to study abroad as an exchange student. Cultural exchange is considered to be a benefit to students and staff as it can provide experiences encountered that are are educationally and personally stimulating and fulfilling. Cross-cultural exchanges are therefore encouraged. With campuses in Australia, Malaysia and South Africa and a study centre in Italy, there are many opportunities for intellectual, social and emotional growth.

Having successfully established a campus in Malaysia in 1998, MU launched another campus in South Africa in 2001. It was envisaged that this would enable African students, in particular, to study at a higher education institution with international study opportunities through the Monash 'Study Abroad' programme. 'Links with other leading universities around the world provide a framework for students and staff exchanges and opportunities to share expertise and resources' (MSA Course Guide 2003 & 2008). The intention is not to entice students away from Africa but rather to educate and enrich students who will then return to their home countries to contribute to their communities and help in developing the potential of the continent.

3.3.2 The establishment of Monash South Africa

MSA was registered as a higher education institution with the South African Department of Education in 2001, with a unique educational profile geared to African conditions and expectations. Of the possible choices in Africa, MU saw South Africa as the most suitable location in which to build a campus (MSA former Pro Vice Chancellor, Professor John Anderson in MSA Course Guide 2003:1). The country has a good infrastructure, easy access to the rest of Africa, political stability and a growing economy. Building began on the new campus in 2000 and was completed in time for the first intake of students in February 2001. The campus is situated on a 100-hectare site in the rural-urban fringe of Ruimsig, 20 kilometres north-west of Johannesburg city. It is close to shopping malls, the main airports

and bus terminals and is located in a growing area with easy access to and from the surrounding region.

MSA registered with the South African Department of Education as a not-for-gain association incorporated under Section 21 of the Companies Act in 2001. The campus is wholly owned by MU, an Australian public university incorporated by Act of Parliament in Victoria, Australia. All courses are accredited by the South African Qualifications Authority (SAQA), and comply with the accreditation requirements of the South African Higher Education Qualifications Committee (HEQC) and the Australian Qualifications Authority (AUQA). The aims and policies of MSA are linked as is shown in the following discussion of them.

3.3.2.1 Aims and policies of Monash South Africa

The education philosophy of MSA is to offer quality international higher education degree programmes that consider the human rights of all people. The stated aspiration of MU is that:

> *by 2008 it* [would] *be established as a leading international university, recognised for its excellence in research and scholarship and as a destination of choice for students from all over the world.* [Its] *campuses in Australia and overseas* [would] *be united by common governance and a commitment to the highest standards but* [that] *they* [would] *also be fully engaged with their local regions and in the case of the* ***international campuses integrated into the higher education systems of their country. Monash … [would] be known for its advocacy of social justice and tolerance and for its integrity*** (Monash Directions 2025:5, emphasis in original).

In addition, by 2025 MU aims to be one of the best universities in the world ranked by reputable indices, to be distinctive because of its research-intensive, international focus that enables the University to address important theoretical and practical challenges, and to develop graduates who have the same goals (*Monash Directions 2025*:2). As part of the overall institution, MSA pursues the same aim.[11] As a private higher education institution, MSA aims to add value to the South African higher education community rather than to compete with established public universities.

[11] Because of this close link, reference will be to MSA only but the aims and policies of the whole institution are implied

To support its claim to be a 'University in the world' (www.monash.ac.za), Monash uses information and communication technologies to connect with its campuses and with the communities it serves. MSA faces challenges in this respect because communication technologies throughout Africa are relatively limited, and this can hamper fulfilment of its aims. These are clearly linked to those of MU because of its satellite status, and the consequent close connection to the main campus in Australia. However, because MSA is based in Africa there is greater understanding of the needs of Africa and its people as well as appreciation for the many challenges facing particular countries. With this more intimate knowledge of the continent and its people, the intention of MSA is to assist the region to meet its social, economic and educational needs. MSA students are therefore encouraged to use the skills they acquire to contribute to the communities and the world in which they live. The University therefore aims to give students an all-encompassing experience in a safe environment where 'community and student life are as important as academic endeavour and achievement' (www.monash.ac.za:4). The University encourages students 'to engage in formal and informal debate with lecturers … and values students' … contributions to the development of a secure and stimulating learning environment' (www.monash.ac.za:4). According to Professor Tyrone Pretorius (MSA PVC & President).

> *MSA is an incredibly diverse community and we work hard at inculcating that international perspective in our students. We want our students, being international, to be part of the global village and see themselves as global citizens. There's a word that we used which we call "ubuntu"; loosely translated it means 'humanity' and it means that I'm only me because of you and you are only you because of me. Thinking of separateness doesn't make us human; it's only by our humane interaction that we become human.*

> *The higher education participation in Africa is extremely low. Often the family would make huge sacrifices to insure that at least one of the family attends higher education. And the difference that that one person makes to that extended family, once he or she completes his or her studies, is significant. There are many areas in which I think Monash can make a contribution and there are many areas in which I think it has already made a significant difference to the lives of people.*(MSA video interview, text version, www.monash.edu Accessed 21 January 2009)

3.3.2.2 Faculties, schools and curricula

Since MSA is an offshore satellite campus of MU Australia, and not yet a fully-fledged university, faculties are all based in Melbourne, Australia. However, each School at MSA has its own Head of School. Ties with Australia are strong but at the same time MSA has to

comply with the demands of SAQA and the National Qualifications Framework (NQF) and be registered as a higher education institution with the South African Department of Education. Curricula for all undergraduate and post-graduate degrees are set in Australia in cooperation with South African colleagues, and have to satisfy the requirements of both the Australian and the South African higher education authorities (www.policy.monash.edu Accessed 19 January 2009; *Monash Directions 2025*; MSA Course Guides 2003 & 2008).

Monash students are selected according to academic merit based on a scoring formula (MSA Course Guide 2003: 10). Students are accepted into the School of Arts with 36 points while 40 points is the minimum for courses in the Schools of Information Technology and Business and Economics. A foundation programme is offered to students who do not wholly meet the entry requirements for the undergraduate degree programmes. (Appendix B; www.monash.ac.za Accessed 16 January 2009. Last update 16 May 2008).

As English is the language of instruction and assessment at MSA, students must be able to communicate on a level appropriate to their academic work. Various English language tests, for example, a pass in the General Certificate of Education (GCE), at A or S Level, a score of 550 in the American Test of English as a Foreign Language (TOEFL), and a score of 6 in the International English Language Testing Service (IELTS) amongst others are considered equivalent to the South African Higher Grade (first or second language) Senior Certificate, and are accepted for entry to the undergraduate programme (MSA Course Guide 2008)

However, because of the introduction of Outcomes-Based Education (OBE) in the South African school system (National Department of Education 1997 & 2002) and the resulting changes to the South African matriculation curriculum and assessment, an alternative admissions test for readiness in English and mathematics, for the FP and entry into undergraduate courses requiring mathematics such as IT was piloted in 2009. It is hoped that pre-testing in these subjects will enable MSA to give students better advice on their choice of study, and that students will better understand their ability to cope with and complete their courses and so reduce the attrition and course-change rate (personal communication with the MSA Deputy Pro-Vice Chancellor: Academic, August 2008).

3.3.2.3 Structure of formal degree programmes on offer

MSA currently offers four undergraduate degree programmes, in Arts, Business and Commerce, and Information Technology. A School of Health and Health Sciences was planned for late 2009 or early 2010 when the Department of Psychology was to move to this School. A School of Education was planned for 2010, with an initial focus on up-grading teacher qualifications teachers. These plans are currently on hold.

Each of the degree programmes provides for some elective choices, and students are encouraged to select these from the range of units offered by the three Faculties. Because of its emphasis on multiculturalism, MSA receives applications from prospective students from around the world. Students who do not meet the requirements for direct entry into the undergraduate three-year programme may register for the FP which serves as an alternative pathway into the degree programme. This is explained below.

3.3.2.4 Alternative pathway into the formal degree programmes

Many students who apply to register at MSA do not qualify to enter directly into the degree programme and have to enter via a different route. The reasons for this may be linked to the diversity of education systems and methodologies on the continent (Zubin 2007). This can result in students not having sufficient points for entry into first-year undergraduate studies. The alternative pathway offers such students, who have academic potential, to take a bridging year to prepare them for undergraduate studies. This option proved popular, and the first intake of Academic Development Programme (ADP) students was accepted in 2002 (www.monash.ac.za Accessed 16 January 2009).

3.3.2.5 Monash South Africa Foundation Programme as an alternative pathway

The first intake of ADP students initially consisted of 45 students, of whom two dropped out almost immediately. The students were admitted into the ADP (FP) on condition that they had completed their GCE Ordinary Level examinations with a C aggregate in English, or had passed the IELTS (International English Language Testing Service) or TOEL (American Test of English as a Foreign Language) and TWE (Test of Written English) examinations. They had to have obtained a C aggregate in Mathematics if choosing Information Technology or

Business Economics. As this was a pilot programme, students were required to do all five subjects offered, without any electives. Continuation of the programme depended on its success in meeting its aims and that of the University. The economic viability and academic success of the programme was monitored over a two-year period. Findings were positive, and it was decided to introduce the programme as a permanent academic offering at MSA. Between 2002 and 2008, numbers increased rapidly and the course came to be seen as a viable pathway for students into MSA degree programmes. The ADP (FP) has since its inception undergone many alterations to its structure and curriculum. Course changes have been made in consultation with the academic staff involved, and devised according to the requirements of undergraduate programmes. This collaboration appears to contribute significantly to FP students' subsequent success in their undergraduate degree studies. Peer tutor-mentoring appears to help ease the way for FP students socially and emotionally, teaches them independence and self-responsibility and enhances their academic study skills. These are all attributes essential for successful undergraduate studies. The tutor-mentors are an invaluable resource as they themselves have been through the FP and are likely to understand the needs of FP students better than the lecturers as they are able to communicate with the students on the same level.

3.4 Monash South Africa Students: profile and needs

Because of its international, multicultural mandate, MSA draws students from all over the world and particularly from Africa, including South Africa. For the purpose of this study, foreign or international students are defined as those originating outside South Africa, and who leave their home countries and enter South Africa on a student visa which has to be renewed annually or at the conclusion of a course of studies. The majority of foreign students intend returning home or moving elsewhere on completion of their studies. Domestic students are defined as South Africans by birth or naturalisation.

MSA's intention is to extend knowledge and build transferable skills in its student body for dissemination throughout the continent thus helping to uplift the lives of ordinary people (*Monash Directions 2025*). However, the social and cultural changes encountered by students can be substantial and sudden, and they may not be prepared for them and as a result suffer

great stress. There is a need to reduce the psychosocial effects of culture shock and the consequent negative effect on academic performance (Laubsher 1996; Megalis 2003; Zubin 2007).

3.4.2 Reducing the effect of culture on academic performance

A study by Chang (1999) indicated that 'a racially diverse student body has a positive effect on educational outcomes through its effects in diversity-oriented student activities and experiences'. Racially diverse activities and experiences can benefit students if multiculturalism is consciously included when planning curricula and activities so that students can experience more complete academic and psychosocial encounters that will enhance personal development. Practical application and successful outcomes of this is however difficult to achieve because of the very diversity of which it seeks to take advantage (Megalis 2003; Mwamwenda 1996; Setati 2008). The majority of FP students are culturally and socially situated at a liberal, western university but are also part of an African culture and an African social system (Professor Tyrone Pretorius 2009). The embeddedness of cultural mores and traditional values and practices may lead to what Gupta (in Alred et al 2003) terms 'culture shock' and may cause social and emotional problems which can lead to academic difficulties for the students concerned. Thus, if the aims of MSA as stated by the PVC (Professor Tyrone Pretorius 17 October 2008) are to be realised and students are to achieve their academic potential and become well-rounded citizens contributing to the needs of their countries, then social and cultural diversity must be recognised and catered for and individuals helped to overcome the negative effects of culture shock (Gurin et al 2002; Scott, Yeld & Hendry in Loots 2009).

The following section looks briefly at the effects of cultural diversity and the needs of FP students in particular.

3.5 Needs of MSA and FP Students

There have always been students with psychosocial problems and academic difficulties. However, the growing social and cultural diversity of the student body appears to have led to

an increase in the variety of problems encountered by students as they struggle to find their niche in the larger MSA student body (Maitland 2007). This is especially noticeable with FP students who often lack understanding of where they stand in relation to the larger MSA community of practice. Communities of practice at universities are very specific and tend to isolate and categorise students and staff into hierarchies which are often difficult to break into. One FP student remarked: "We feel so alienated; we feel like we don't really belong; like we're not proper students because we're ADP." It appears from remarks such as these that FP students struggle to find their identity as full university students and feel as though they "don't belong" (informal interviews 2008).

Wenger (1998:263) considers education as being a power for transformation as 'identity' and a sense of 'belonging' ('exploring new ways of being') are established. He posits the view that '[e]ducation … becomes a mutual developmental process between communities and individuals, one that goes beyond mere socialization' (Wenger 1998:263). Therefore, in order to 'belong' and develop a MSA student identity, new students need to become part of the already established communities of practice and in addition, must form their own communities of practice. Diversity and discontinuity are often a cause of anxiety and added stress for students as they struggle to find their identity within the student community (Lucas et al 2006).

3.5.1 The effect of diversity and discontinuity on learning

The diversity of backgrounds of MSA students may create sources of discontinuity such as differences in social skills, language and culture, all of which makes communication difficult. Ethnic differences, skin colour and racial discrimination all play a part in causing discontinuity in the lives of MSA's non-South African students. While older, more experienced students may have less difficulty with fitting in the FP students may feel disconnected from reality and suffer distress as a result. Emotional and social problems and academic difficulties often follow (Maitland & Manson 2006; Maitland 2007). The opinion of the FP lecturers formed through classroom observation and counselling of students, tends towards believing that most students eventually become assimilated into the group culture, or the community of practice, of the class, the FP and the university. However, assimilation into the community is an evolutionary process and differs from person to person in time and extent. A fairly high level of assimilation is thus considered necessary if learning is to take place and it is evident that if a

student remains aloof from the culture of the institution, authentic learning cannot and does not take place.

Issues which affect assimilation into the group culture are varied and are discussed more fully later but tend to confirm many of the findings of Gupta and other researchers (Gupta in Alred et al 2003: 155; Bergh & Theron 2005; Crosling & Web 2002). For example, as discussed earlier, English is the LoLT at MSA and therefore many students are studying for their degrees in a second language. Lecturer expectations and modes of teaching may be very different from what they are used to, as many Moslem and African schools appear to be more authoritarian in their style, method of teaching and discipline (Boyle 2009; Sifuna 2000). Home-life is inclined towards paternalism and is also authoritarian so that students, especially female students, find it very difficult to break through encultured 'absolute' obedience and submissiveness to authority figures (Mwamwenda 1996; Swartz et al 2004). As a result of this, African students often struggle to use these new freedoms of expression which add further stress (Lucas et al 2006; Maitland & Manson 2006; focus group and informal interviews 2008). When these factors are taken into consideration, the needs of MSA and FP students in particular, are seen to be many and varied but all seem to have in common the fact that students from outside the country encounter cultural and traditional differences when they first come to the University. These can cause psychosocial stressors that have an impact on a potentially able student's ability to cope academically (focus group and informal interviews 2008).

To counteract the effects of cultural and racial diversity, culture shock and other challenges and problems arising from these phenomena (Megalis 2003), practical solutions needed to be considered and implemented. Analyses of cross-cultural encounters and the knowledge gained from such analyses can allow for interventions to be integrated into higher education programmes. This needs to be a deliberate action on the part of the curriculum developers, as it will not happen by chance. It is hoped that through these interventions, cross-cultural encounters can become positive learning experiences for the students (Barwell et al 2007; Crosling & Web 2002; Moschovich 1999; Maitland & Manson 2006; Maitland 2007; Pokorny & Pokorny 2005; Powell 1997). Cross-cultural experiences are of no real value if students are unable to benefit from them, and for this reason it was believed that participation in the FP tutor-mentor programme as a community of practice would facilitate students' acceptance into the MSA student community.

The following section discusses communities of practice within MSA and in particular how the FP and the FP tutor-mentor programme provides pedagogic support for FP students as a community of practice within the greater MSA community of practice.

3.6 Communities of practice within Monash South Africa

MU and its network of satellite campuses and education hubs may be seen as a community of practice because it fulfils the required 'set of relations among persons, activity, and the world, over time and in relation with other tangential and overlapping communities of practice' (Lave & Wenger 1991:98). However, the diversity of the student population has, according to the MU Discussion Paper 2007-2010 (2006:17), the 'potential for confusion and intra-campus conflict.' With regard to MU, while curricula are not necessarily deliberately intercultural, the university can be said to be a community of practice because of the shared participation of its diverse staff and student body in an activity system in which the participants have a common goal and understanding of what they are doing and why they are doing it (Maitland 2007). This spirit of understanding and cooperation is evident at MSA, and because the 'potential for confusion and intra-campus conflict' (MU Discussion Paper 2007-2010 (2006:17)) is acknowledged sources of conflict and confusion are dealt with and defused immediately they are noticed, thus maintaining the unity of MSA as a community of practice. Within MSA, there are many interlinked communities of practice of which the FP is one (Maitland 2007), and although the concept is not always understood by members of the MSA community, the principles inherent in it are mostly, if inadvertently, practiced.

Figure 3.1 illustrates the interlinking of the academic communities of practice within and with the encompassing MSA community of practice.

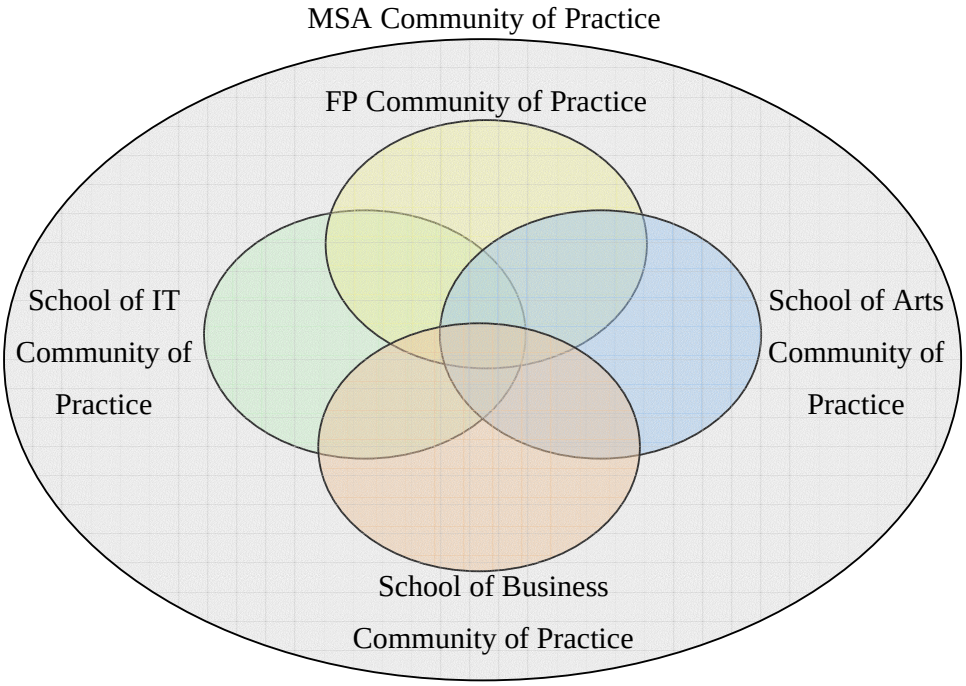

Figure 3.1: The interlinking of MSA communities of practice

It should be noted that there are many more communities of practice such as Management, the Board of Studies, Finances and Administration, Human Resources, Advancement (which incorporates student services and student recruitment) and Facilities (responsible for maintenance, gardeners and cleaning staff), and others. All are essential to the efficient running and life of the greater MSA community. However, while it is acknowledged that these non-academic communities are indispensable to the life and function of the University they have not been included in the diagram (Figure 3.1) or the discussion because this study is concerned with academic performance and the FP in particular. The holistic nature of the MSA community of practice is illustrated in Figure 3.1 through interlinking and overlapping circles connecting each academic community of practice with the others. The diagram illustrates the connectedness of the communities and their containment within the greater MSA community. While it is important to recognise the independence and uniqueness of each community's *raison d'être*, working together for the same purpose in cooperation with one another will achieve the aims of each community and MSA more effectively than if each worked in isolation. Recognising the MSA higher education community of practice as holistic

(Wenger 1998) and accepting that each community and each individual within that community has a role to play in effecting the aims of MSA and the FP is essential. The FP as an alternative pathway and feeder into the MSA degree programmes must therefore be recognised as an essential and functional part of the whole MSA community of practice. It cannot be isolated from the MSA academic community and adequately fulfil its purpose and function.

3.6.1 The Foundation Programme community of practice

The FP tutor-mentor programme is made up of four distinct yet integrated parts (the participants) which together comprise a community of practice within MSA that is unique to the FP. Figure 3.2 illustrates the connections between participants in the FP tutor-mentor programme.

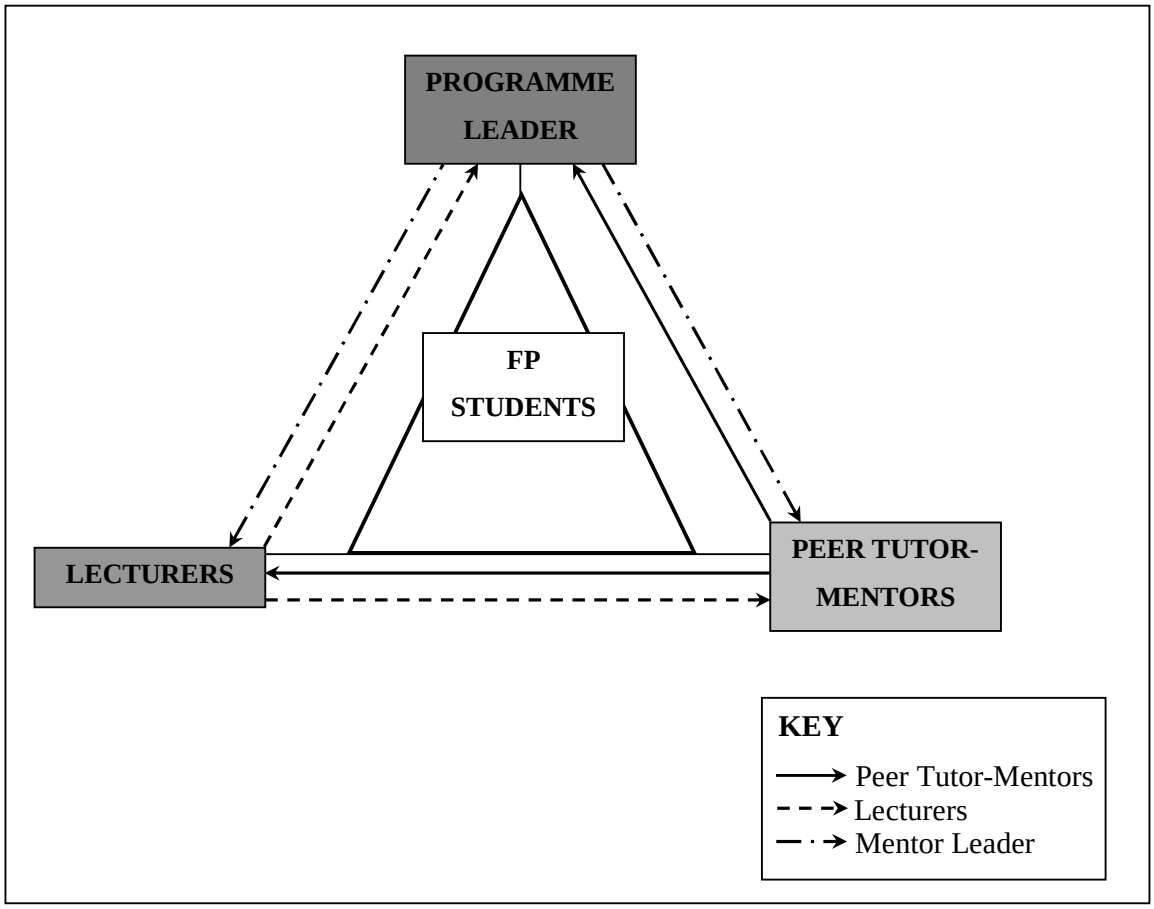

Figure 3.2: Participants in the FP tutor-mentor community of practice

(Source: Maitland & Manson 2006

Figure 3.2 illustrates the holism of the FP as a community of practice. The diagram shows the interlinking of all participant groups in the tutor-mentor programme who make up and contribute to the FP community of practice as a whole. Apart from the tutor-mentor leader who works with all participants, each part of the FP community is made up of numbers of smaller communities of practice. Each subject community consists of lecturers, students and tutor-mentors who work together for the same purpose. Thus, the FP mathematics students, their lecturers and the FP tutor-mentors form a mathematics community of practice, which, while being part of the FP community of practice, which in itself is part of the greater MSA community of practice. The FP mathematics community is a unique group with a distinctive common purpose which is to help FP students who participate in the tutor-mentor intervention to improve their mathematics performance so that they can register for a degree in IT.

Participants in the FP tutor-mentor programme are currently registered FP students, past FP students who serve as peer tutor-mentors, FP lecturers who mentor the tutor-mentors, and a tutor-mentor leader who oversees the programme. Each of these is a necessary component of the programme as each individual functions as a link in the team network or community of practice that the teaching and learning are situated in. The holistic nature of the individual is kept in mind throughout and there is commonality as well as diversity (Stone 1981:89) in the communities of practice that make up the tutor-mentor programme. While the programme is dynamic, since educational and individual needs are continually changing, it has retained its basic character and purpose. The FP may thus be considered a community of practice because all activities are situated and contextualised within a set of circumstances that have a particular purpose (Lave & Wenger 1991:33; Maitland 2007:4) and are all working towards the same set of goals. However, it is necessary that students develop an individual, and a common student, identity. This is true for the students, tutor-mentors, the lecturers, and the tutor-mentor leader. The FP mathematics students are typically representative of this idea of commonality along with diversity and individualism, and for this reason the study was limited to FP mathematics students.

In the following section, the aims and common characteristics of tutoring and mentoring programmes are discussed.

3.7 Aims and characteristics common to tutoring and mentoring programmes

Many higher education institutions have acknowledged the need for support programmes (Goodlad 1998) and a number of institutions have introduced tutoring and/or mentoring programmes into the curricula of faculties at their institutions. Examples include Stellenbosch University (Page, Loots & du Toit 2005), the University of the Western Cape (http://www.wwc.ac.za/- Accessed 26 January 2009), the University of the Witwatersrand (http://www.students.wits.ac.za Accessed 26 January 2009) and others. All have established different models of tutoring and/or mentoring programmes, and appear to have had a fair measure of success. Most in-depth research has however, taken place in developed countries such as the United States of America (Powell 1997; Gupta in Alred et al 2003) and Great Britain (Goodlad & Hirst 1989).

Powell's review of more than fifty publications covering research into the evaluation of a variety of North American tutoring and mentoring programmes (October 1997) isolated four key elements in the literature and gave a list of additional relevant documents that offer significant insight into understanding the characteristics, strengths and weaknesses of tutoring and mentoring programmes. Powell grouped the tutoring and mentoring programmes under broad developmental and learning perspectives; a valuable resource for further research. However, none of the reviewed programmes were from the developing world but were all based in the United States of America. The programmes were therefore socially and culturally situated. Powell's findings are not however irrelevant to situations outside the United States but because of the high level of technological development of North America and the educational resources available compared to the paucity in the developing world, ideas and methods should only be transferred to developing nations with great care and forethought. The need for tutoring and mentoring programmes as educational support systems for use in the developing world is unarguable. However, since education is an integral part of a people's culture and bound into its traditions, it cannot be transferred across cultures without careful consideration. Organisers should thus be aware of the possibility of socio-cultural clashes if programmes are forced on institutions and students without sufficient pre-thought and consultation. However, while due recognition should be given to cultural and traditional boundaries, there is a vast amount of knowledge and expertise that can be useful, and indeed

essential, to the well-being of students in and from developing nations without diminishing or detracting from socio-cultural mores and values.

Examples of accounts of the development of peer tutoring and mentoring programmes by students for students in tertiary and secondary education include among many other examples: *Mentoring and tutoring by students* (Goodlad 1998) and *Peer tutoring: a guide to learning by teaching* (Goodlad & Hirst 1989). A South African perspective that refers more specifically to higher education institutions are: *Perspectives on a South African tutor/mentor program: the Stellenbosch University experience* (Page et al 2005) and *A student-student mentoring scheme for freshman students at the University of the Witwatersrand* (Rutherford & Matlou in Goodlad 1998).

Many studies attest to the efficacy of tutoring and/or mentoring programmes but tend to keep the practices of tutoring and mentoring separate. Emphasis is placed either the academic or the psychosocial aspect (what is deemed most important for the purpose) and examples are numerous: Goodlad (1998), Loots (2009), Page et al (2005), Powell (1997) and many others. The MSAFP tutor-mentor programme places emphasis on both aspects and incorporates this into its training programme (Maitland 2008). A selected reading of the literature revealed that successful tutoring and mentoring programmes have clear aims and purposes but that many are constructed without a clear theoretical framework. A few examples will suffice as other programmes may be accessed from the Internet (Daloz 1986; Hendricks & Hendricks 1995; Van Wyk & Daniels 2004). Powell (1997) was one of the exceptions in the literature studied as her report gave explicit information about the theories underlying the tutoring and mentoring programmes. Building a tutor-mentor programme within a theoretical framework gives substance to the programme because the theory will inform the activities and give purpose to the desired outcomes. Also, it would make sense that the education policies set by higher education institutions are consistent with how people learn and because the policies are informed by theory they can be consistent. Added to programmes informed by experience the policies might have more impact. Tutor-mentors and lecturers would then perhaps have a better understanding of why the activity is carried out in a certain way and why certain principles are ensconsed in the practice (see Dickoff et al 1968 for further information on theory building in a situation-producing practice).

Although peer tutoring and mentoring are merely one aspect of the teaching and learning paradigm more frequent use is being made of the practice in higher education. An example of a successful tutoring and mentoring South African programme is that of *IkamvaYouth* (http://www.ikamvayouth.org/about. Accessed 02 February 2010). There should be unity in the diversity of any tutor-mentor programme (Stone 1981:160) so that the programme's participants function as a composite whole with the same purpose in mind. Proponents of tutor-mentor programmes argue that if properly organized and based on a sound theoretical foundation, participation in these programmes produces successful outcomes, especially if tutor-mentor programmes are recognised as an integral aspect of learning (Dickoff et al 1968). An examination of successful tutoring and mentoring programmes showed an intuitive understanding and acceptance of the influence of socio-cultural and cognitive learning theories on the practices of tutoring and mentoring (Fingerson & Culley 2000; du Toit 2005; Loots 2009; Page et al 2005; Powell 1997; Wilmore & Bratlien 2005 and many others).As seen previously, social and cognitive constructivism focus on learning and knowledge acquisition of the individual whereas situated learning focuses on knowledge belonging to the community (Sfard 1998). However, when the different perspectives are brought together community participation in teaching and learning is evident, supporting the supposition that a sound theoretical framework is essential to the construction, management and outcomes of tutoring and mentoring programmes as holistic endeavours. Recognition of the value of community involvement, whoever, whatever and wherever this community may be, as for example in the *Leon and Lorraine Watson North Carolina Scholarship Program* (http://www.elon.edu/e-web/studfents/multicultural-resources, Accessed 28 December 2009), is formative and essential. Recognition and implematation of these principles appeared to be a tacit if not open acknowledgement of the role that cognitive and socio-cultural theories play as the foundation of good tutoring and mentoring programmes. These theoretical approaches are strengthened in the findings of the thesis and provide information about their proven value thus making the argument for tutor-mentor programmes stronger.

In order to understand the basic premise of this study, that the FP tutor-mentor programme is a holistic enterprise made up of equal parts of a whole in which participants work together to fulfill a common purpose, it is necessary to understand the place and function of each part of the programme. Each part will therefore be discussed separately. The following aspects of tutoring and mentoring programmes are discussed:

1. A brief definition and description of peer tutoring
2. A brief definition and description of peer mentoring
3. Characteristics of the FP tutor-mentor programm.
4. FP mathematics lecturers as a community of practice
5. FP mathematics tutor-mentors as a community of practice
6. FP mathematics students as a community of practice
7. Tutor-mentoring of FP students
8. Tutor-mentoring as a teaching and learning support tool (academic and psychosocial)

3.7.1 A brief definition and description of peer tutoring

Peer tutoring services are programmes that provide supplemental instruction for students who are experiencing difficulties with their coursework or who want to improve their performance. It is carried out by a more experienced and knowledgable peer. Subject tutoring is either individualized or small-group instruction in or out of a classroom situation. In the context of this study peer refers to a more experienced and knowledgable undergraduate student who tutors the FP mathematics students. There is some dispute among academics about the qualifications needed by such a person and many do not consider that peer tutoring should be incorporated into a teaching programme. Despite such arguments, peer tutoring is seen as a system of instruction in which students help each other and learn by teaching (Goodlad & Hirst 1989:13) and is a useful description of a support system that has proven successful over many years and in diverse situations and therefore gives credence to its *raison d'être* and the idea embedded in the MSA FP tutor-mentor programme.

Peer tutoring has many advantages in that it ' make(s) learning more efficient and pleasurable for those who are *taught* (*tutee*s), but it can also increase significantly the learning of the *tutors* who help professional teachers' (Goodlad & Hirst 1989:13, emphasis in the original). Peer tutors are not intended to take the place of the lecturer but rather to support her or him in offering flexibility in teaching and learning methods, particularly in mixed ability classes or multicultural classrooms (Goodlad & Hirst 1989:13). This is relevant to the FP students at MSA. The use of peer tutors can, according to Goodlad and Hirst, 'reconcile traditional and progressive approaches to education, making it possible to combine intellectual structure (the strength of the former) with a socially pleasant experience (the attraction of the latter) by allowing for a relaxed atmosphere in which students can work effectively' (Topping in

Goodlad & Hirst 1989:13). It also gives the tutors an opportunity to care for other people which brings the mentoring aspect into the programme and is a reason why the programme is considered holistic.

3.7.2 A brief definition and description of peer mentoring

Mentoring can be divided into three types:

1. educational or academic mentoring which aims to help the mentee improve his or her overall academic outcomes
2. personal development mentoring that supports people during times of personal or social distress and provides guidance in decision making
3. career mentoring that helps mentees to develop the necessary skills for entering or improving their careers

(http://mbhs.bergtraum.k12.ny.us/mentor/what.html Accessed 27/01/2005).

The tutor-mentor FP programme at MSA is primarily concerned with the first and second types of mentoring as these are important to the academic and psychosocial wellbeing of the FP students. For the purpose of this study, academic or educational mentoring is considered as tutoring. The third aspect of mentoring is not neglected in the programme however, and students are often guided and counselled with regard to preparation for undergraduate studies by the tutor-mentors.

There are many disagreements about the meaning of mentorship and the role it should play in a person's life. The concept has a long history which many see as going back to the era of Greek mythology (www.gse.uci.edu/MentorTeacher/Chapter 1. Accessed 20 October 2005). Homer's *Odyssey* describes the relationship between Telemachus, the son of Odysseus, and Mentōr his trusted advisor as one of support and guidance: a confidant, loyal friend, teacher, coach and role model. Historically, a mentor is seen as all of the above. One needs, however, to understand the idea of mentoring for the 21st Century. When a word is used loosely, it can take on many meanings, all of which may be legitimate. However, in terms of this study, because of the context in which the term is used, the concept of mentoring has a specific meaning. It may be useful to define it partly in terms of what it is not (Biehl 1996:28; Maitland 2008). It is not:

1. psychiatric counselling or treatment
2. psychological counselling
3. matching students or prescribing relationships
4. discipling (in the religious sense)
5. apprenticeship (as in learning a trade)

Although any and all of these can be, and sometimes are, incorporated into mentoring programmes, the FP tutor-mentor programme does not consider these more specialised characteristics to be in the realm of tutor-mentors' or even most lecturers' capabilities and they are not, therefore, included in what is expected from a peer tutor-mentor or a lecturer.

Unofficial or unintentional mentoring takes place as a spontaneous act between two people and is common in any institution (Collins, Brown & Holum 1991; Elvin 1977; Lave 1996a). The official FP tutor-mentor programme is made up of participants who are peers in the sense of being older and more experienced students who have themselves been through the FP, the FP lecturers and the tutor-mentor programme leader. Students are sometimes referred to MSA counsellors who are employed by MSA specifically for the purpose of psychological counselling of students and staff, but this study is concerned only with the FP tutor-mentor programme. With this in mind, the following are considered attributes that are essential for a good mentor in the FP tutor-mentor programme. They include but are not limited to:

1. being a good listener and knowing when not to talk
2. being a friend
3. having a willingness to care for and help a person in need
4. recognising that no one is perfect and that we all have faults
5. having empathy, recognising when a person needs professional help and being able to advise that person without giving offence
6. being a role-model and having moral and academic integrity
7. having practical life experiences relevant to the mentee, such as being of a similar age, having been a student in the FP and having gone through similar experiences
8. following the agenda set by the mentee around goals, problems and other issues
9. regarding a long-term commitment to the tutor-mentor programme as a high priority
10. having an acceptable level of maturity for their age, and a willingness to help the student in his/her growth towards maturity

11. having attributes such as respect for others and high personal standards
12. being self-responsible

Although the concept of mentoring in this study covers the social and emotional needs of FP students, it is limited in extent. It should be noted that, although mentors are trained to deal with difficulties, they are never expected to take on the role of a professional counsellor but rather to recognise when a student may need professional help and to recommend this to the mentee. There are definite lines of authority within the programme to which the mentor and mentee have immediate access. Mentoring is thus a professional relationship that develops between two people. It is purposeful and lasts for as long as the mentee needs the mentor's help, and can be broken off and re-started at any stage of the relationship. If these characteristics are carefully analysed , it can be seen how closely they should link to tutoring, as a good tutor considers all the above qualities of mentoring as essential and infuses them into is or her tutoring; neither one is complete without the other. These principles are incorporated into the FP tutor-mentor programme so that all participants are recognised as being part of a community.

The ensuing sections describe the characteristics of FP tutor-mentor programme at MSA.

3.7.3 Characteristics of the FP tutor-mentor programme

A unity of purpose evolves through academic and social participation and in the process of working together in a common enterprise a group identity develops and a community of practice is formed (Lave & Wenger 1991; Lave & Wenger 1996). The programme as an academic and psychosocial learning support tool, functions as an intervention wherever and whenever needed by FP students. It has relevance to MSA's diverse student profile and its international and multicultural policy. There are no prescriptions as to how the programme is managed by individual lecturers and tutor-mentors but the overall philosophy and principles of the MSAFP Tutor-Mentor Policy (Maitland 2008) are adhered to. Participants in the programme have particular identities and fulfil distinct functions within the FP and MSA. The programme is open to all FP students. There is no charge for the service and students are free to participate according to their needs. Students are not forced to participate although lecturers might suggest that a student makes an appointment either with him or herself or has consultations with the subject tutor-mentor. Tutor-mentors are obligated to help the lecturer

for one hour during tutorial classes so that the lecturer is free to deal with the more complicated problems brought up by students. Also, because the lecturer is in the classroom, should the tutor-mentor be unable to cope with a situation the lecturer is able to intervene. The tutor-mentors are not therefore left entirely on their own although they and the lecturer may be busy with different students and different problems. Currently, tutor-mentors are only allowed to work for two hours a week for which they are paid. Arrangements may be made with the lecturer to work both hours in the classroom or one hour out of class time. The decision is left to the lecturer and the tutor-mentor so that the programme works to the advantage of all participants in a particular subject group. The reason for the two-hour limit is so that tutor-mentors do not neglect their own studies. However, many tutor-mentors give freely of their own time to the students, especially over weekends or in the evenings when lecturers are not available.

The FP tutor-mentor programme is well-utilized by most (more than 50%) FP students especially when help is needed with assignments and when tests and examinations approach. Of all subjects, mathematics appears to give the most trouble to students and because they have to pass the subject with 60% in order to register for the IT and Business degrees, athematics students are very aware of the need to obtain good marks (see Appendix B). For this reason, the mathematics tutor-mentors are probably the most in demand and therefore more tutor-mentors are allocated to this subject than to others. Although the mathematics teachers sometimes use FP students who are top achievers as peer tutors in the classroom, this is at their discretion and is not part of the programme.

3.7.4 FP mathematics lecturers as a community of practice

The FP mathematics lecturers are involved in a common enterprise to promote conceptual and procedural understanding, tutor students about mathematics problems, continuously and formatively assess students, reflect on teaching methods, and continually develop the mathematics curriculum in accordance with undergraduate requirements. They also regularly mentor the mathematics tutor-mentors. The lecturers work together as a team in a formal and informal community of practice which strives to enhance the teaching and learning of their subject.

3.7.5 FP mathematics tutor-mentors as a community of practice

Mathematics tutor-mentors are chosen because of their high achievement in mathematics, for their enjoyment of the subject and for their keenness to share their knowledge and help and support FP students. The students who become tutor-mentors form close bonds with their lecturers during their FP year and become part of a strong group who share a passion for mathematics and a desire to pass on their enthusiasm. It is not difficult, therefore, for a community of practice to form. It is notable that as new tutor-mentors join the community of practice, they are quickly drawn in from the periphery to become part of the 'master' class of tutor-mentors. While Lave and Wenger (1991:31 & 61) argue against the use of apprenticeship as an overarching term for all learning, they do see 'learning as increasing participation in communities of practice' which ' concerns the whole person acting in the world' (Lave & Wenger 1991:49). Taking this idea further, the practice of tutor-mentoring can be considered an apprenticeship type of learning. The new tutor-mentor, or apprentice, learns and practices the craft of tutoring and mentoring, becomes more experienced and knowledgeable with teaching and mentoring from the lecturer and tutor-mentor leader and a great deal of practice slowly moves from the periphery into the centre as a master tutor-mentor. Since the FP tutor-mentor practice is hands-on and functional, 'the traditional connotations of the concept of apprenticeship' may be broadened 'to one of changing participation and identity transformation in a community of practice' (Wenger 1998:11).

3.7.6 FP mathematics students as a community of practice

FP students' learning of mathematics is situated within a particular milieu, the MSA campus, which identifies them as part of the broad MSA community of practice. As part of the FP community, the mathematics students share common goals and intentions which provide a common identity with which they can relate as individuals. A shared purpose has the effect of drawing the students together as a cohesive body desirous of achieving a specific objective: that of passing mathematics with at least the minimum percentage required for further studies. Since they remain together as a unit throughout their FP year, and because they have the same or similar interests, they tend to socialize with the same group outside of the classroom (informal interviews). Over time, they form a strong identity with the FP mathematics community and an identity as a MSA student. They thus develop a feeling of belonging to two communities. The idea of community therefore grows in strength throughout the year and

makes for a strong support system which appears to carry on throughout their university careers and even beyond (Focus Group interviews, 2008).

3.7.7 Tutor-mentoring as a teaching and learning support tool

As the primary purpose of the FP tutor-mentor programme is to improve the academic performance of FP students, academic tutoring in weak areas must take place. However, because there was a strong conviction that tutoring on its own would not produce the desired purpose because of psychosocial issues that often accompany academic problems, mentoring was incorporated as a key component of the tutoring programme. Tutoring and mentoring are, therefore, interlinked interventions. Recognition of the *gestalt* (influences from outside) and the holistic nature of a person were an essential element in the construction of the tutor-mentor programme. It was in accordance with these principles that in attempting to fulfil the needs of the whole person, mentoring was incorporated as a non-negotiable, equivalent part of the MSAFP tutor-mentor programme.

Considering the various needs of the MSAFP students and the mandate of the FP, a mentoring programme for FP students was devised and instituted in 2004. However, soon after the programme was introduced, it became evident that two distinct complementary features had developed: a mentoring and a tutoring aspect. Within a short time, the mentors were tutoring the students and using the mentoring skills they had been taught. This was an unexpected, yet interesting and exciting development, which encouraged further study and reflection on the *raison d'être* for a FP supportive intervention at MSA. A theoretical framework was formulated and radical changes made to the mentoring programme and policy. The programme changed its emphasis and tutoring and mentoring were integrated, becoming known as the MSAFP Tutor-Mentor Programme (Maitland 2004, revised 2008). A pre-service tutor-mentor training programme was developed and introduced and all current and prospective tutor-mentors are required to attend the programme's workshops. The course material was set out in such a way that tutor-mentor candidates learn the characteristics of good tutoring and mentoring and the philosophy and principles underlying the programme. Since the FP courses are dynamic and change as needs change, tutor-mentors are encouraged to attend refresher workshops throughout the year and to act as mentors for new tutor-mentors. This process is very akin to Vygotsky's (1978) ZPD, Collins et al's (1989) and Brown et al's (1989) concept of apprenticeship as well as the role-model theory (Bandura 1989).

3.8 Conclusion

In this chapter, trends in higher education worldwide and the establishment, structure and policies of MU and MSA are described. The FP as an alternative pathway into undergraduate studies was presented, its holistic nature as a community of practice within the greater MSA community and its aims and characteristics described, and the role of each group of participants in the FP tutor-mentor programme explained. Problems arising from the diversity of culture were exemplified (Orfield & Kurlander 1999) as was the lack of preparation for higher education among FP students (Maitland & Manson 2006). Tutor-mentoring as a psychosocial and academic support programme was seen as a way of dealing with students' needs and tutor-mentoring as a supportive teaching and learning intervention for FP mathematics students was discussed.

The following chapter describes the design and methodology of the empirical enquiry.

CHAPTER 4

RESEARCH DESIGN

4.1. Introduction

This chapter presents the research design of the study. All research requires decisions with regard to sampling, instrumentation, data collection and the methods of data analyses (McMillan & Schumacher 2001). In planning the study, certain methodological decisions that determined various aspects of the study were made: the research design and method of research; the research context and participation sample; choice of appropriate instruments; rigour-validation; reliability and trustworthiness; data collection; data analyses and ethical considerations. The chapter describes the research design, methodology and analyses used in the study. It explains why a modified sequential transformative mixed method design strategy (Creswell 2002:564-576; Creswell 2003:213-215; 559-600) was considered the most appropriate for the purpose.

4.2. Research design

The research design was chosen based on the research questions. The study consisted of two phases: Phase 1 was a quantitative study and included a dependent variable (Test 2 maths scores), an independent variable (the intervention) and an explanatory variable (the Test 1 maths scores). Phase 2 was a qualitative exploratory case study and involved semi-structured questionnaires, focus group interviews, individual interviews, observations, spontaneous conversations and artefacts.

The creation of the research design required looking at the overall issues as well as paying attention to details (Creswell 2003:xix). Creswell (2003) likens this to a *mandala*, a precisely-created symbol of the universe, in which each element interrelates as parts of a whole and shapes a complete study (Creswell 2003:xix). The choice of a research design depends on its fitness for the purpose, its focus (Bordens & Abbott 2005:158; Charles 1988:94; Cohen

Manion & Morrison 2000:104; Opie 2004:104) and determines the methodology (Cohen et al, 2000:73). A case study approach allowed for a comprehensive study of the FP tutor-mentor phenomenon as it is practised at MSA, and located the study within a natural, not a contrived, setting (Bell 2005; Cohen et al 2000; Fraenkel & Wallen 1996; Leedy 1993; 1997; Neuman 1994; 2000; 2006; Opie 2004; Rug & Petre 2007; Yin 1994; 2009). The case study focused on a real situation (the FP tutor-mentor intervention programme), with real people (the participants in the programme). The situation under investigation was therefore authentic and not contrived. It aimed at providing a picture of the MSAFP tutor-mentor programme as a feature of the social activity of teaching and learning (Neuman 2000) in a particular setting (the MSAFP) and the factors that influenced the situation (Opie 2004:74). The case study allowed for an in-depth study of the relationship between the tutor-mentor phenomenon and mathematics performance (Neuman 2000:72) and provided understanding of the relationship between the tutor-mentor phenomenon and the context of the study.

4.2.1. Rationale for choosing a mixed method research design

The rationale for the choice of the research design was based on the need to be able to combine a quantitative (Phase 1) and a qualitative (Phase 2) approach. Since all methods of research have their limitations, in order to overcome some of the problems that would have been evident had only one method been used, the concept of 'convergence across quantitative and qualitative methods' developed by researchers such as Campbell and Fiske, and Jick and Siber (in Creswell 2002:561) was used. In this way, a number of problems were overcome: for example, biases inherent in one method neutralized and even cancelled the biases inherent in the other method, and the results from the one method informed and helped develop the other. Multiple approaches and techniques provided different insights that allowed deeper understanding of the phenomenon of the tutor-mentor intervention which was under investigation. Quantitative and qualitative approaches were used as complementary approaches, with the quantitative findings informing and supporting the richness of the qualitative findings by adding statistical evidence. In this way, a more comprehensive investigation of the problem was possible.

Since the purpose of the investigation was to explore and explain the hypothesis, that participation in the FP tutor-mentor intervention improved mathematical performance, the study used an explanatory and an exploratory design. The data collection procedures were

independent of each other and are presented as phases. Visualisation of the different phases in the data collection process is seen in Figure 4.1. The separation of the research process into phases is somewhat artificial, but has been done for purposes of clarification. Sometimes qualitative and quantitative data gathering ran concurrently; at others they ran sequentially.

The quantitative data was collected from the results of Test 1 that was given in March 2008 at the beginning of the first semester, and from Test 2 in November 2008 at the end of the second semester. The quantitative research was quasi-experimental because of non-random selection of the participants. They could not be randomly assigned because of the circumstances of the research. Statistical analyses of the processed quantitative data were integrated with the findings of the qualitative data.

The qualitative data were collected at the beginning of the second semester. The methods included purposeful sampling and thematic analysis in which similar codes were aggregated to form major themes. Thematic analysis was used to analyse the data (Charles 1988; Creswell 2002; 2003; Yin 1994; 2009). The qualitative data were obtained from the following sources: semi-structured questionnaires, open-ended focus group interviews, formal and informal interviews with tutor-mentors, mathematics students and lecturers, classroom observations, spontaneous conversations and artefacts including photographs. The analysis and findings were guided by the theoretical perspective that provided a framework for the narrative. Analytical reflection on the data took place during qualitative data gathering and the final analysis concluded after both phases were completed. The findings of the two sources of data were integrated to determine whether the quantitative data supported the findings of the qualitative data and vice versa.

A quantitative component was included in the study so as to objectively evaluate the tutor-mentor programme as an intervention strategy and to determine if participation in the intervention improved the mathematics performance of the FP students. This was the surmise, but it needed to be tested. However, as I also wished to discover how lecturers, tutor-mentors and students valued the tutor-mentor intervention from their own view-points and experiences, a qualitative approach lent textual depth to the quantitative findings. Although quantitative methods are objective and reliable, they do not reveal the feelings and opinions of the subjects. Qualitative methods on the other hand, are subjective and while they reveal feelings and opinions, because of their subjectivity they are often biased and therefore

unreliable as evidence. However, if the two approaches are combined in a mixed method approach, the strengths of both are utilised which helps to balance the weaknesses inherent in each (Creswell 2002:565). More generalisable conclusions can then be reached, as rich data is added for the analysis and findings.

A further reason for using a mixed method design was the need to approach the problem holistically based on the initial premise that people are holistic beings who are influenced in many ways by many factors and therefore one should not consider only the intellect or the psychosocial aspects of a person's being, but should rather consider all aspects relating to the person-in-the-world (Vrey 1979). Thus while the quantitative study dealt with the intellectual aspect (the test scores) and the qualitative study dealt with the value aspect (the why and how), integrating the two aspects enriched and corroborated the findings of both approaches.

Fourth level abstraction towards a situation-producing theory was developed. Figure 4.1 is a diagrammatic model indicating how the mixed method strategy was developed in line with the needs of the study.

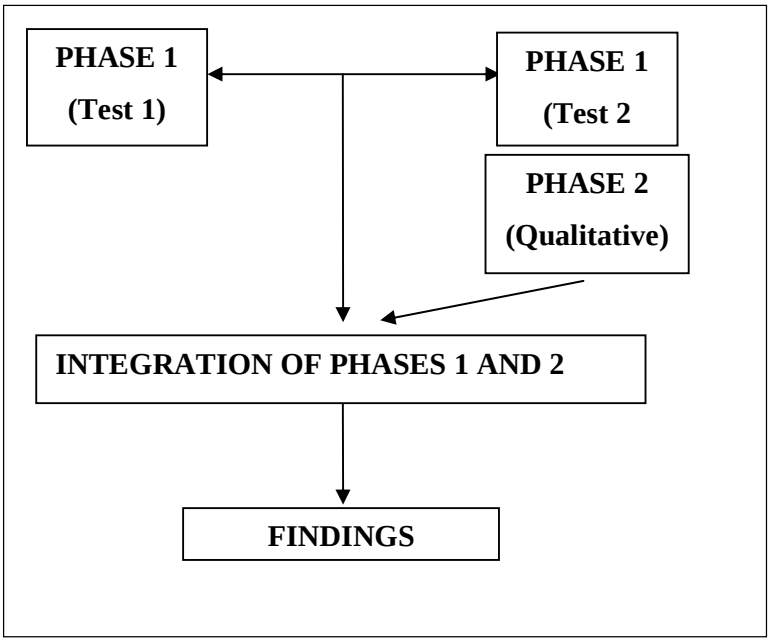

Figure 4.1: The integration of Phase 1 and Phase 2

4.2.2 The modified sequential transformative strategy

Neither the quantitative nor the qualitative approach was weighted more heavily than the other. The qualitative data was rich with personal experiences while the quantitative data gave objective support to the opinions expressed by the participants in the research study. Since the aim of the study was to support the hypothesis, that participation in the FP tutor-mentor intervention improved mathematical performance, I used a modified sequential mixed method design. The decision to discuss the quantitative before the qualitative research design and methodology was arbitrary. It has no significance regarding the priority or importance of either group of data over the other. It does not indicate that the data were triangulated or that it was integrated as it was collected. The strategy was based on Creswell (2002:564-565 & 572), Creswell (2003: 211-214 & 217), Cohen, Manion & Morrison (2000:112-115) and Opie (2004:72), A description of the study site follows.

4.3 Background

The research was carried out *in situ* and situated in the context of the MSAFP, focusing on the mathematics students as voluntary participants in the research.

4.3.1 Description of site

The location of the study was chosen for convenience, ease of access and financial viability. Since it was conducted on the MSA campus, no additional administration or travelling costs were incurred. A further advantage of doing an *in situ* study was the pre-knowledge on the part of the participants about the purpose of the tutor-mentor programme and its function within the MSAFP. This meant that little time had to be spent in information sessions and the study could be implemented fairly quickly. In addition, the University's resources were available, and included access to and retrieval of assessment data stored on campus as well as physical resources including the library, technical resources, and rooms for interviews.

Since all data gathering took place in the natural setting of the MSA campus, the research was conducted in an environment that was familiar to the participants. Spaces commonly used by the students, tutor-mentors and the lecturers, such as the FP mathematics classrooms and a

room used for group study sessions, enabled a comfortable and relaxed atmosphere while collegial relationships between participants encouraged a natural, non-intimidating situation. The circumstances of the interview were therefore not contrived or unnatural. The only unfamiliar experience was that of having an audio recorder on the table during the focus group interviews, but because it was small and unobtrusive it was soon ignored. Although the interviews were directed by my questions, I allowed a fair amount of leeway and did not restrict the interviewees to a set list of pre-determined questions (see Appendices C, D & E). Being able to use my own office at any hour of the day and over weekends provided the freedom to schedule interviews at convenient times. Ethical requirements as laid down by MU were adhered to and are described in paragraph 4.3.2.

4.3.2 Participants and procedures

The participants in the research were the FP mathematics students, the FP mathematics tutor-mentors and the mathematics lecturers. The FP mathematics student participants were divided into two groups: an intervention group (**I** Group) and a control group (**C** Group). Since the research was conducted at MSA, I applied for and was granted ethical approval by the *Standing Committee on Ethics in Research Involving Humans* (*SCERH*) of MU, Australia - Reference Number 2005/918 before beginning the pilot study in 2006. This approval includes the present study and was given for a period of five years to 2011. The time may be extended if the study needs to be pursued for a further period. All data capture and storage was conducted strictly according to MU Australia's *Human Research Ethics Committee's* (*HREC*) guidelines and injunctions. Full details of participant selection are given under the descriptions of Phase 1 and Phase 2.

Table 4.1: Participants in the study

Phases of Study	No. of IT Students	No. of Tutor-mentors	No. of Lecturers	Total No. of Participants
Phase 1	**142**			**142**
Phase 2	**142**	**10**	**5**	**157**

Table 4.1 indicates the number of participants and their role in the different Phases. 142 student participants took part in both Phase 1 and Phase 2. Phase 2 included the student participants as well as 10 tutor-mentors and 5 lecturers: 157 participants in total.

Different procedures were used to collect and analyse the data, and two different methodologies and methods of data collection were employed. These are described at 4.4 and 4.5 below. Lastly, the quantitative and the qualitative data were integrated, interpreted and final conclusions drawn.

4.3.3 Researcher role

I was employed by MSA to teach Geography and Environmental Science, and to mentor and oversee special projects for the FP of which the tutor-mentor programme is one. My function as coordinator of the tutor-mentor community of practice brought me into daily contact with all participants in the study. My position allowed extensive access to the participants for the collection of quantitative data during Phase 1 and qualitative data during Phase 2. This meant that as a researcher, I was not an objective, authoritative neutral observer. Consequently, personal bias, values and assumptions are part of the reported findings. Open and honest relationships were developed between the researcher as the agent of analysis and interpretation and the participants. The imbalance of power between students and lecturer which is characteristic of educational situations as described by Gunter (1980) was therefore reduced as much as possible. This allowed entry into the world of the students, and effective participation in a common frame of reference. There was no perceived difficulty entering the frames of reference of either the tutor-mentors or the lecturers, and experiences and opinions were assumed as freely shared.

Identifying biases, personal values and interests regarding the research topic and process, explaining how entrance was gained to the research site and how ethical issues were dealt with was crucial for the trustworthiness of the research findings. These were identified and acknowledged (Creswell 2003:184), since failure to do this would have affected the analysis and interpretation of the data and led to invalid and unreliable conclusions. This was particularly important because of a possible predisposition to a particular outcome and a subconscious search for the results I wished to find (Charles 1988:3:216; Opie 2004:103, 118). Awareness of the strong possibility of biases in the qualitative section of my research

was another reason why I chose to add a quantitative element to the research design, giving a more balanced outcome to the study.

4.4 Phase 1: The quantitative research design

The following terminology is referred to throughout the discussion. Test 1: the pre-test is equivalent to the March 2008 Test 1. Test 2: the post-test is equivalent to the November 2008 Test 2. Group **I** is equivalent to the intervention group. Group **C** is equivalent to the control (non-intervention) group (see 4.3.2 and 4.4.3.1 for an explanation of the naming of and division into the two groups).

4.4.1 Hypothesis and null hypothesis stated

The hypothesis and null hypothesis were formulated prior to the study, based on observations of FP students' mathematical performance over a number of semesters. These are stated as follows:

Hypothesis: Participation in the tutor-mentor intervention programme improved the mathematical performance of FP students at MSA.

Null hypothesis: No relationship exists between participation in the tutor-mentor intervention and improved mathematical performance of the FP students at MSA (Charles 1988: 322; Creswell 2002: 241).

The purpose of the quantitative study was to support and retain the hypothesis, that participation in the tutor-mentor intervention improved the performance of FP mathematics students at MSA and to reject the null hypothesis (Charles 1988: 244).

The intention of the Phase 1 statistical tests was to support the hypothesis that improvement in the mathematical scores of participating students did not happen by chance but because of students' participation in the tutor-mentor intervention. A level of significance (alpha level) was set at $\alpha = 0.05$ (Creswell 2002: 242).

The hypothesis and null hypothesis were constructed from the main research problem (see 1.2). The sample was divided into Group **C** (control) and Group **I** (intervention).

4.4.2 Rationale for combining experimental and correlational research designs

Combined experimental and correlational research designs were the statistical methods used for this study because it was felt that this method controlled sufficiently for maturation, history and regression and for all the simple sources of invalidity as well as bias (Bordens & Abbott 2005:302-305; Huitema 1980; Tuckman 1978:132).

The quasi-experimental design used in the study has all the characteristics and advantages of a true experimental design and allowed the researcher to identify and demonstrate cause-effect; whether relationships existed between variables; and whether they are causal relationships. Using this strategy required a manipulation of the independent variable (the suspected causal variable), holding as many unrelated variables constant as possible, and randomizing the effects of any remaining extraneous variables across treatments (Bordens & Abbott 2005:302). However, because of the educational setting of the research (Charles 1988:246) subjects could not be randomly assigned to either Group **C** or Group **I**. This required the use of a quasi-experimental design. The quasi-experimental, non-equivalent design took advantage of a pre-existing condition in which participation or non-participation in the tutor-mentor intervention represented the independent variables (Bordens & Abbott 2005:16; 302; Charles 1988:245; Cohen et al 2000:209 & 214). The link between cause (participation) and effect (improved scores) was demonstrated when the independent variable was manipulated to produce a change in the dependent variable (Charles 1988:247).

Although holding variables constant reduces the generality of findings, randomizing the effects of the variables across the intervention can produce error variance that obscures the effects of the independent variables (Bordens & Abbott 2005:302). However, by combining an experimental and a correlational design, such difficulties were effectively dealt with. Adding a correlational dimension to the analysis allowed the independent variable with the two outcomes a relationship, but did not attempt to manipulate the variables.

The correlation design used was an analysis of covariance (ANCOVA) where the final score is the dependent variable and the initial score is an explanatory variable (Bordens & Abbott

2005:97, 302-305). *Ex post facto* research was therefore considered a feasible method of investigation because the effect (or dependent variable) was examined retrospectively to establish whether there was any association (covariance) between the dependent and independent variables and to establish what meaning this had for the hypothesis (Bordens & Abbott 2005:99; Cohen et al 2000:206). This fits well with the combined correlational and quasi-experimental design as outlined above.

Thus, in order to assess any differences in the scores that might have occurred because of participation in the tutor-mentor intervention, the Test 1 and Test 2 scores were compared against each other for each student. Mitchell and Jolley (in Cohen, Manion and Morrison 2000:145) pose three important questions that researchers need to consider when comparing two groups:

1. Are the two groups equal at the commencement of the intervention?
2. Would the two groups have grown apart naturally, regardless of the intervention? (Not possible to predict but can be supposed based on the findings).
3. To what extent has the initial measurement error of the two groups been a contributory factor in differences between scores?

These questions were kept in mind when comparing Group **C** and Group **I**.

The complexity of the investigation suggested a number of possible statistical analyses. It was supposed that a correlative and possible causal relationship existed between the independent variable (participation in the intervention programme) and dependent variable (Test 2 scores). The hypothesis of the study was based on the assumption that participation in the tutor-mentor programme produced improvement of the final mathematics scores. However, as already discussed, although the design required randomization in order to test whether specific use of the tutor-mentor intervention improved mathematical performance, since it was carried out in an education situation randomization was not considered ethical and therefore not performed (see Davies, Williams & Yanchar 2008). (An explanation for non-randomization of the sample is given in 4.4.3.2).

4.4.3 Selection of sample

The study sample was selected from the entire FP population and consisted of all IT mathematics students. Entry requirements for enrolment in the FP differ for international and South African students. Requirements relevant to the selection of the study sample are as follows.

Compulsory minimum scores for enrolment in the FP:
International students: a minimum of a "C" average (60%) overall; minimum of "C" average (60%) for maths to enrol in Business or IT stream
South African students: A minimum of 30 points (likely admission score is 28 – 29)
(Leeway is allowed for students wanting to enrol in IT and who have the right subjects)

Compulsory minimum scores for enrolment in IT mathematics stream:
Entry score: 28
Likely admission: 26-27
English requirements:
International students: a minimum of a "C" symbol (60%)
South African students: minimum score (3)
Mathematics requirements:
International students: a minimum of a "C" symbol (60%)
South African students: Higher Grade score (3) Standard Grade score (4)
Bonus points – English and Maths:
Score (4) or more: score + 2 bonus points

Entry requirements for enrolment in the School of IT
All FP units must be passed in order to gain entry into the relevant undergraduate programme at the university. Students intending to enrol for either the Bachelor of Computing (B.Compt) or the Bachelor of Business Systems (B.BusSys) degree are required to pass both English and mathematics with a credit (60%). (www.monash.edu.au/pubs/2009handbooks.undergrad/it-courses.html, see Appendix B).

Since the mathematics students enrolled in the FP IT stream had fulfilled all the MSA entry requirements, and because I believed they were highly motivated to improve their

performance, I considered them as ideal subjects for the study. All the FP IT maths students (n=142) were part of the entire study (Phase 1 and Phase 2).

Closed questions from a semi-structured questionnaire (Appendix F), administered as part of Phase 2, were either 'yes' or 'no' responses and were used to verify how many students out of the total sample of 142 IT mathematics students had participated in the tutor-mentor intervention, and to match students' names with scores. This information was confidential and for the researcher's use only. The sample participated in the study without duress as required by the ethics agreement with MU.

4.4.3.1 Division into two groups

The participants were divided into Group **C** (n = 63) and Group ***I*** (n = 79). Random allocation was not possible because of the practical and ethical considerations previously referred to. Adherence to the FP entrance mathematics requirements for the IT stream (Appendix B) presupposed that the students were similar in mathematical knowledge and conceptual understanding at the start of the course. In light of this, it was assumed that there were no significant differences between the two groups at the initial stage of the study. The decision about the compilation of Group **C** and Group ***I*** respectively depended on the students' choice whether to participate in the intervention or not (self-selection).

4.4.3.2 Explanation for non-randomization of sample

The study was carried out in an education situation and therefore it was not possible to have complete experimental control in selecting, assigning or manipulating conditions regarding the allocation of the mathematics students into groups. Although randomness was assumed based on the theory underlying the tests (Charles 1988:245) because the study was carried out in a real education situation in the MSAFP mathematics programme, there were constraints that affected randomizing the study that could not be ignored. I did not therefore consider randomization as an ethical way of selecting the sample for this study (Davies et al 2008; Charles 1988:246). Certain factors that might have affected participation and non-participation in the tutor-mentor intervention should be considered:

Non-random sampling factors:

(i) students who were good or thought they were good at mathematics may have opted out of the programme

(ii) students who were struggling with mathematics may have felt that they could not devote time to something extra and therefore have chosen not to participate in the intervention

(iii) students wanting to achieve a distinction or high distinction, or those wanting to improve, might have opted for the programme

(iv) to withhold the intervention from students who could possibly benefit was not only impractical, as the university wanted as many students as possible to improve their performance in order to enrol for one of the IT degrees, but also unethical as the intervention could not be refused to students who wanted to participate in order to improve their performance

(v) political issues also needed to be avoided. These might have occurred if apparently arbitrary decisions (random selection) had been made concerning who would and who would not participate in the intervention (Huitema 1980:141).

4.4.3.3 Presumptions concerning non-randomization

Although the participants were purposively selected, I presumed that the validity of the design was not compromised prior to the start of the study because participation in the intervention was voluntary and the samples selected themselves with no pressure or influence from anyone other than themselves. I recognise that this may have been a problem if a true experimental design was used, but for the following reasons I did not consider it to be so when using a quasi-experimental design. The equivalence of the two groups on a number of control variables such as age, standard and level of education was ascertained beforehand, thus establishing 'that the possible selection bias existing between the two groups was not strongly relevant to the comparisons made in the study' (Tuckman 1978:143). I considered, therefore, that in all respects, Group **C** and Group **I** were exposed to similar conditions except for the intervention; that the data collected from the two groups were comparable; and that differences between Group **C** and Group **I** were not caused by chance fluctuations

To overcome the problem of non-randomization, I chose to use a non-equivalent control group quasi-experimental design, and a modified sequential strategy was included in the design. This was to partially address confounding variables that would mask any causal

inferences drawn from the data, such as the setting of the study, students' prior mathematical knowledge or conceptual understanding, and differences in the ages and maturity of the participants.

Experimental statistical methods require randomization for accurate predictions of outcomes. However, bearing in mind that I was working in a real situation and that the circumstances were not contrived, the analysis of covariance (ANCOVA) and the Homogeneity of Regression Slopes Test leading to the Johnson-Neyman Technique were the preferred methods of testing. The difficulty of non-randomization was largely overcome by using the Johnson-Neyman statistical technique even though randomization was not present (Huitema 1980). It is recognised that by allowing voluntary, self-selection participation in the tutor-mentor intervention, and by choosing not to randomly select the samples for the study, certain bias may have occurred but I believe the compromise was worth making because of the reasons stated earlier. The results obtained should therefore be regarded in that light. In choosing to use a quasi-experimental, non-equivalent design because of the constraints mentioned above, and despite the possible shortcomings, I could not have logically chosen to do otherwise.

4.4.4 Data collection

Data collection comprised the Test 1 scores at the beginning of semester one (March 2008) and Test 2 scores (the final examination) at the end of semester two (November 2008) that were written by the sample. Empirical data was thus gathered in two stages (Test 1 and Test 2), after both tests had been marked and moderated and the scores captured by the FP lecturers on the MSA data base.

4.4.4.1 Description of Test 1 and Test 2

The construction of Test 1 and Test 2 took place as follows. Test 1 tested only the small section of the work that had been done up to that point in time (March 2008). It was worth 40 marks and was made up of mostly short-answer questions. The test assessed basic set theory, number line work, and work with functions and relations. Test 2 differed in content and difficulty in that it was the final examination, in November 2008, and covered the students' acquired mathematical knowledge over both semesters. Test 2 was worth 100 marks and was

made up of multiple levels of difficulty and ranged from procedural to application. Test 2 was therefore more challenging. I was not involved in setting either of the tests.

The scores for Test 1 were collected and graphed (Figure 5.1) and used as a baseline against which the Test 2 scores could be measured and documented graphically (Figure 5.2) using the pre-test – post-test with non-equivalent groups (Table 5.1, Table 5.2).

The tutor-mentor system was not in places before Test 1 and therefore, for the purpose of this study, all students were considered equal as far as mathematical knowledge was concerned at that point. This gave a reasonable standard baseline from which to measure the effect or non-effect of the tutor-mentor intervention on Test 2. The Test 2 scores thus distinguished between students who had made use of the intervention and the scores of those who had not made use of it. The maths scores of Group **C** and Group **I** were analysed using the baseline as the measure of improvement.

4.4.4.2 Administration of Test 1 and Test 2

Test 1 and Test 2 were administered to both Group **C** and Group **I** under regular examination conditions as determined by MSA. Test 1 was internally moderated. However, Test 2 was internally and externally moderated. Only I, as the researcher, knew which students were in either group. I was not involved in administering, marking or moderating Test 1 or Test 2.

4.4.5 Data analysis

The Test 1 scores of MSAFP IT mathematics students were compared with respect to a specific variable, the Test 2 scores, to see whether there was a statistically significant difference between the results of the two groups of mathematics students. Participation or non-participation in the tutor-mentor intervention represented the independent variable while the Test 2 scores represented the dependent variable. The Test 1 scores represented the explanatory variable.

As I wished to discover whether there was any significant difference in the results of the Test 2 scores for the two independent samples, Group **I** and Group **C** were compared for significant differences (Appendix A). The arithmetic means were calculated for four sets of

data: the Test 1 and Test 2 scores within each group while testing for a difference between the Test 2 scores between the groups.

4.4.5.1 Non-equivalent control group design

The non-equivalent control group design used in this study showed Test 1 and Test 2 as the within-subjects factor and with intervention verses no intervention as the between-subjects factor. The statistical tests consisted of an independent variable (the tutor-mentor intervention), the dependent variable (Test 2 scores) and the explanatory variable (Test 1 scores).

The model (Table 4.2) shows $\mathbf{O_1}$ and $\mathbf{O_3}$ as the intervention (Group **I**) observations, $\mathbf{O_2}$ and $\mathbf{O_4}$ as the control (Group **C**) observations and **X** as the intervention that applied only to Group **I**. Non-randomization is evident in the parallel rows separated by a dashed line, ($n_I + n_C$) indicating random self-selection of the students to participate or not. Table 4.2 is a slight modification of Charles (1988:251), Cohen et al (2000:209), Opie (2004:90) and Tuckman's (1980:141-142) models.

Table 4.2: A quasi-experimental non-equivalent control group design

Group	Explanatory Variable	Independent Variable	Dependent Variable
I	**Test 1 — O_1**	**X**	**Test 2 — O_3**
C	**Test 1 — O_2**		**Test 2 —- O_4**

I: Intervention Group

C: Control Group

X: The Intervention

I Group sample: n = 79

C Group sample: n = 63

Total sample (**I** & **C**): n = 142

Group **I** (O_3 – Test 2) was exposed to the independent variable (**X** the tutor-mentor intervention)

Group **C (**O_4 – Test 2) was not exposed to the intervention.

The dashed line shows that Group **I** and Group **C** were not connected through random selection.

The statistical tools used in the quantitative data analysis are discussed in the ensuing section.

4.4.6 Statistical tools used in data analysis

Both descriptive and inferential statistical tools were used in the analysis of the data.

4.4.6.1 Use of descriptive tools in data analysis

The descriptive tools used in data analysis included the Test 1 and Test 2 scores of Group **C** and Group **I**, group means, group medians, standard deviations and correlation coefficients. The descriptive tools included graphical representation. By using a variety of methods, it was possible to describe how Test 1 and Test 2 scores of both Group **C** and Group **I** were distributed.

The effect of the intervention (**X**) was assessed by comparing the gain scores (Test 2 minus Test 1 scores) of the two groups on the dependent variable. Non-equivalence of the groups was evident because Group **I** was self-selected to participate in the intervention while Group **C** was self-selected by default. However, a non-equivalent control group design was not entirely appropriate because firstly, Group **I** was made up of volunteers who chose to participate in the intervention. It is true that Group **C** can be said to have volunteered not to participate in the intervention; all students had the option to take part in the intervention and Group **C** students chose not to. Secondly, this design did not provide for variables such as attitude, personal reasons why students chose or chose not to participate in the intervention, indifference to the opportunity, or any other confounding variable that would bias the findings. Selection bias was therefore assumed because the study compared volunteers with non-volunteers, and this created the possibility of an effect on the dependent variable.

Since Group **C** and Group **I** had not been randomly assigned, Test 1 provided the basis for initially comparing the two groups (Tuckman 1978:142). Although Test 1 scores could not prove that participation in the intervention caused an improvement in the mean scores, it did show that the Test 1 scores of Group **C** were higher than that of Group **I**. The opposite was

true for the Test 2 scores, where Group **I** obtained higher scores than Group **C** Table 5.1, Table 5.2).

The results of Test 2 suggest that the intervention was successful in raising the scores of Group **I**. However, because the plotted scores were skewed, statistical analyses relating to the normal curve could not be accepted as the best measure of central tendency and the standard deviation could not provide the best measure of spread. In addition, the distribution of the scores of the graphs showed a number of outliers (scores that were either extremely high or extremely low and were far outside the overall pattern of the data, and these had to be accounted for. For these reasons, the interquartile range was used as a descriptive measure of spread.

The median, which is the measure used in this statistical method, is not as sensitive to extreme scores as the mean and can therefore be used as a measure of location instead of the mean. The interquartile range was thus used as a measure of dispersion instead of the standard deviation. Consequently, although the interquartile range is a relatively simple measure of spread, because of its resistance to the effects of skewness and outliers, it was used as a description of the spread (measure of variability) for the data.

4.4.6.2 Use of graphical representation as a descriptive tool

Frequency graphs were used as a graphical method of representing the Test 1 and Test 2 scores of Group **C** and Group **I**. The graphs show the changes that occurred in the Test 1 and Test 2 mean scores of Group **I** and Group **C**s. The graphs also allow a comparison between the groups regarding changes in the Test 1 and Test 2 mean scores. Although the differences seen on the graphs were probably the result of the tutor-mentor intervention and not chance occurrences, it did not prove that the intervention was the cause of the improved scores or that there was a cause and effect improvement in the scores because of the intervention. It simply showed that there was an association between the variables. It did however indicate that further investigation would be worthwhile.

4.4.6.3 Use of inferential techniques in data analysis

The use of inferential statistics allowed the hypothesis to be tested, enabling conclusions to be drawn and inferences made from the study sample to the FP population. It also allowed for testing for a relationship between the scores. The following inferential techniques were used: ANCOVA, the Homogeneity of Regression Slopes Test; and the Johnson-Neyman Technique.

(a) Explanation of ANCOVA technique

The ANCOVA statistical tool was used to test whether the Test 2 scores were the same for Group **I** and Group **C**. The large differences between the Group **C** and Group **I** Test 1 means initially caused interpretation difficulties because of non-randomization of the sample but these difficulties were largely overcome by using the ANCOVA (Huitema 1980:129). However, because the problem under investigation was an educational and therefore an ethical issue, I accepted as inevitable the limitations of the statistical method used (Davies et al 2008). (The implications of non-randomization are explained in 4.4.7).

The ANCOVA, as a general linear model, allowed for an experimental, non-equivalent research approach that suited the study's research design. The ANCOVA as an inferential, interpretive tool was used to analyse the degree of change in scores between the groups since there was a covariate (see the complete calculation in Table 4.3 in Appendix A). ANCOVA examined whether, if the pre-test scores are held constant there a significant difference between the post-test scores for the two groups. The answer to this was found by looking at the regression lines of the two groups and evaluating whether the regression line for Group **I** was significantly elevated over the regression line of the Group **C**. ANCOVA assumes that the slopes of the regression lines are equivalent (i.e. that they are the same for each group, and should be homogenous (parallel)) and this assumption needed to be tested (Table 4.4 Appendix A) before doing the ANCOVA.

The decision to use the ANCOVA was made after the data were gathered. The aim was to observe whether a difference was present between the Test 2 scores of the two groups. However, since the Test 1 scores of the two groups were gathered as well, I wanted to incorporate it into the analysis as a covariate. The Test 1 scores gave an indication of the initial ability of the students within each group, such as their pre-knowledge, which could be a threat to validity. ANCOVA treated this potentially confounding variable as a covariate (that

is, neutralized) instead of as a dependent variable (a variable to be researched), and also minimised the potentially confounding effects of non-randomization. While testing for a difference between the Test 2 scores between groups, the dependence relationship between Test 1 and Test 2 scores within each group was kept in mind.

Use of the ANCOVA statistical test was appropriate since two groups were of interest, Group **C** and Group **I**. The ANCOVA tested for this difference in the Test 2 scores, incorporating baseline conditions. Thus, even though randomization of the groups had not taken place because of the quasi-experimental design where both Test 1 and Test 2 scores for Group **I** and Group **C** were considered, ANCOVA seemed the most appropriate technique to use.

The full ANCOVA summary table is given in Table 4.3 in Appendix A.

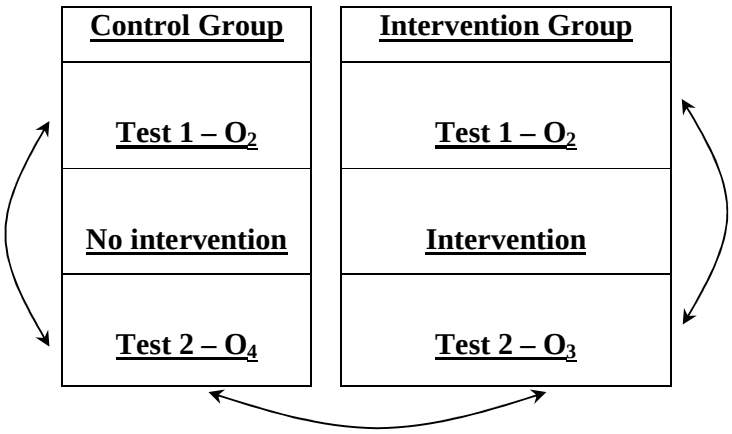

Figure 4.2: Dependence relationships between Test 1 and Test 2 scores.

Figure 4.2 shows the dependence relationship between the Test 1 and Test 2 scores within each group while testing for a difference between the Test 2 scores.

The ANCOVA was used to test if the intervention had an effect (by comparing the scores) and bearing in mind that there was a covariate: the Test 1 scores. However, one of the assumptions for the ANCOVA to be performed is the homogeneity of regression slopes (Huitema 1980:67-68; 270).

The Homogeneity of Regression Slopes Test was used to test for homogeneity of the regression lines and is discussed next.

(b) Homogeneity of Regression Slopes

As mentioned earlier, in order to use an ANCOVA, the regression slopes should be homogeneous but according to Huitema (1980:67-68, 270) it is not unusual for this requirement not to be met and for the regression lines to be heterogeneous (converge or diverge). The Homogeneity of Regression Slopes Test (Table 4.4 Appendix A) was therefore used to test for homogeneity of the lines. This test (Table 4.4 in Appendix A) revealed that the regression slopes in the study gradually converged (Figure 4.3 below).

Figure 4.3 refers to the convergence of the regression lines in relation to Table 4.4 (Appendix A) and Table 4.5, the Johnson-Neyman Technique bounds (Appendix A). The graph is inserted here and again in Chapter 5 for easier reference.

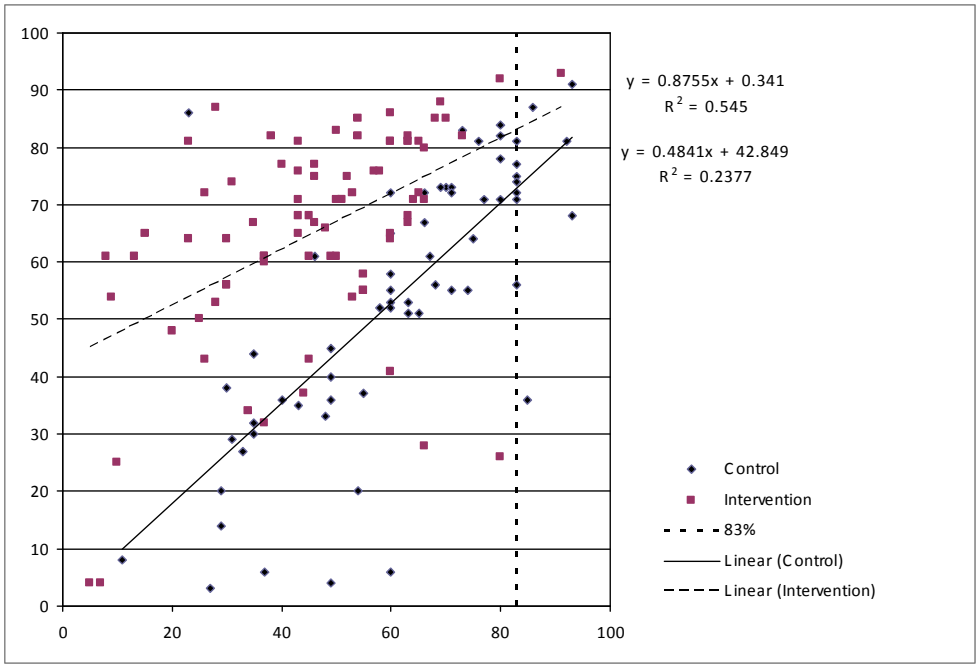

Figure 4.3: Convergence of regression lines

Figure 4.3 illustrates the scatter plot for Test 1 versus Test 2 scores for Group **C** and Group **I** respectively, and the corresponding regression slopes.

The heterogeneity of the regression lines in relation to Table 4.4 (see Appendix A) indicated that further testing was necessary to overcome the problems indicated in the previous paragraphs. The Johnson-Neyman Technique (Table 4.5 see Appendix A) was used because of the heterogeneity of the regression slopes. Heterogeneity could have occurred because of non-randomization. In the interpretation of the findings, non-randomization of the groups was taken into consideration.

Furthermore, ANCOVA assumes a randomized experimental, pre-test – post-test design in which:

1. participants are randomly selected from a defined population
2. participants are randomly assigned to the intervention
3. (a) pretest scores are obtained before the intervention, or
   (b) early performance measures are obtained
4. ANCOVA calculates on Test 2 scores observed at the end of the intervention period
5. Test 1 mean scores or early performance measures are used as the covariate
6. a conditional statement concerning differences among Group **I** population means is made (the differences between the adjusted (Test 1) means measured at the end of the intervention period represents an effect that is independent of the differences among the participants observed during early trials) (Huitema 1980: 127).

Since these assumptions were not fully satisfied because of ethical reasons, it was appropriate to use the Johnson-Neyman Technique (Table 4.5 Appendix A) to overcome the problems associated with heterogeneity of the slopes and non-randomization (Huitema 1980: 270).

The Johnson-Neyman Technique is discussed in below.

(c) The Johnson-Neyman Technique

The Johnson-Neyman Technique was used as an inferential tool to answer the following questions:

1. What are the values on X on the graph associated with non-significant intervention effects?
2. What are the values on X on the graph associated with significant intervention effects?

Table 4.3: Johnson-Neyman Technique bounds

Summary stats			
	Control	**Intervention**	
Sample size	63	79	
Sample mean	61.11	46.23	
A	0.0739		
B	-12.3587		
C	1542.38		
XL_1	83.0078		
XL_2	251.3551	Bounded above by 100	

Table 4.3 summarizes the Johnson-Neyman Technique statistical test, and refers to the heterogeneity of the regression slopes (lines) scatter plot (Figure 4.3) and the XL_1 and XL_2 bounds. A complete summary of the Jognson-Neyman Technique bounds is given in Appendix A.

With reference to the heterogeneity of the regression slopes scatter plot, the Johnson-Neyman analysis identifies the region of non-significance as 83% through 251% using $\alpha = 0.05$. If a specific point on X is selected that falls in this non-significance region, it can be concluded that the intervention made no difference. However, if a point below 83% is selected the test shows that the intervention was effective, which was the case.

The limits of the region of non-significance on X were calculated as follows:

$$XL_1 = \frac{-B - \sqrt{B^2 - AC}}{A}$$

$$XL_2 = \frac{-B + \sqrt{B^2 - AC}}{A}$$

Where XL_1 and XL_2 = limits of non-significance regions

The values for A, B and C are (Table 4.5 Appendix A):

$A = 0.075$ $B = -12.359$ $C = 1542.38$

$XL_1 = 82.995$ $XL_2 = 251.476$

Since the data were bounded at 100%, the interpretation was made favourable in terms of what was observed. However, since the slopes of the lines remain the same throughout, the ANCOVA was not the appropriate technique to use over any region. This is why I moved from the ANCOVA to the Johnson-Neyman Technique.

(d) Conclusion on use of inferential tools

Although the appropriate test to perform was the ANCOVA based on the experimental design, since the ANCOVA assumes homogenous regression slopes, which I did not have, even though there was a significant result it could not be used conclusively. However, by using the Johnson-Neyman Technique it could be concluded that Group **I** was superior to Group **C** between 0% and 83% and this was important for the findings. From 83% to 100%, the result was inconclusive.

4.4.7 Validity issues

It is accepted that non-randomization, or differential selection, of subjects is inherent in quasi-experimental research and may affect the internal validity of the study (Charles 1988:252; Davies et al 2008). It is also accepted that factors other than the intervention, such as history and maturation, especially development in mathematical and abstract thinking over the year (Charles 1988:252), may have accounted for improvement in performance. These factors have, however, been accounted for.

Despite these potential problems, the quantitative component of the study may be considered as having internal validity because the results of the quantitative study appeared to validate the hypothesis: that the Test 2 scores of the FP mathematics students improved because they participated in the tutor-mentor intervention. The smallness of the study allowed control over possible influences such as cheating in tests that may have caused doubts about the validity of the data thereby influencing the integrity of the study. The internal validity of the research

was further confirmed by using an integrative strategy, and lastly, because quantitative research data is considered relatively unbiased it was considered a good indicator of how much influence participation in the tutor-mentor intervention had on the Test 2 mathematics performance of the FP students.

As far as external validity is concerned, many studies, such as those of Collins, Brown & Newman (1989), Goodlad (1998), Jaworski and Watson (1994), and Loots (2009) have promoted the use of tutors and/or mentors to improve the performance of higher education students. However, this study does not attempt to generalise the findings since they may not be suitable for every situation. Motivation, for example, varies from person to person and even within an individual at different times. However, relatability (Opie 2004:5, 74) of the findings to foundation or first year students may be appropriate and can be considered (Charles 1988:253).

Phase 2 of the study is discussed in the following section.

4.5. Phase 2: The qualitative research design

Qualitative techniques were used in Phase 2 investigation to record what people said, to document events, and to observe certain behaviours that would illuminate understanding of the phenomenon under study (Merriam 1997:29-31).

Firstly, by using qualitative procedures, the dynamics of the classroom experience - the interaction between the various participants – could be captured with no interference to the normal classroom activities of the participants. Furthermore, this part of the research needed to be done *in situ* because this captured and gave insight into the experiences of the students as they worked in the classroom with the tutor-mentors and the lecturers. Observation of relationships between the study's participants allowed insight into the way students, students and tutor-mentors, and tutor-mentors and lecturers, interacted with one another and how these relationships affected teaching and learning and the development of a mathematics community of practice.

Secondly, the qualitative methodology provided comprehensive descriptions of the phenomenon of the tutor-mentor intervention being studied, and gave insight into the subtle as well as the more noticeable factors that interplayed within the context of the study. The qualitative aspect of the research design focused on the relationships that developed between participants in the tutor-mentor programme and were of particular interest, giving insight into the responses made by the tutor-mentors in the focus group interviews, to the responses given in the questionnaires by the students and to comments made by lecturers during interviews and after observation. A number of unexpected responses prompted further investigation and added to the richness of the data.

The subjective experiences of individual participants were emphasised in this component of the study because of the need to gather personal, human interest stories. Graphs and tables explain the qualitative data more succinctly while actual comments taken directly from the data are interjected throughout the discussion and, together with photographs, add personal human interest to the accounts.

Three important factors were included in the qualitative aspect of the study: (a) the type of research questions that needed answering, (b) the amount of control there was over the actual events and (c) the focus on contemporary as opposed to historical phenomena. As far as (c) is concerned, although this investigation is a contemporary study (2008), it is retrospective in some ways (cross-sectional according to Creswell 2003:174-175) because different respondents were studied at different points in time. Although similar questions were asked each time, the questions were put to a different set of individuals (a different sample of the population) at different times. Different responses to the questions revealed different points of view, experiences and perceptions. Furthermore, by extending the timeline, many different perspectives on the intervention programme could be gathered. The participants had enough time to experience the intervention, or lack of it, and to mature and expand their viewpoints. This would not have been possible had the interviews and observations taken place early in the year.

4.5.1 Selection of participants

Three groups of information-rich participants were selected for Phase 2: mathematics students; tutor-mentors; and lecturers. All participants interpreted the tutor-mentoring programme according to their personal experiences and own points of view.

4.5.1.1 Student participants

All the IT mathematics students in the FP were chosen from the total FP population. The number was 142 (see Table 4.1). These students wished to pursue a degree in IT and needed to meet the requirements for entry into the degree programme. The group however can be further defined: 79 participants took part in the tutor mentor intervention; 63 did not take part in the tutor mentor intervention. These choices were due to individual factors including need for additional help with mathematics; motivation; and personal circumstances. The total sample of students were thus divided into two groups: those who volunteered to participate in the tutor-mentor intervention (79 self-selected), and those who did not participate (63 declined) to.

4.5.1.2 Tutor-mentor participants

All the maths tutor-mentors (n=10) participated in Phase 2. Seven acted as tutor-mentors for the first time in 2008; the other three had been mathematics tutor-mentors in previous years and were considered by lecturers, peers and students to be experienced and knowledgable. All the tutor-mentors had themselves passed the mathematics FP at MSA. Moreover, they had participated successfully in a tutor-training programme, and were employed as accredited and salaried tutor-mentors. Therefore, they had personal experience of the mathematics FP firstly as students and subsequently as tutor-mentors.

4.5.1.3 Lecturer participants

All the mathematics lecturers in the maths Foundation Programme (n=5) participated in the study, because of their interest in the effectiveness of the tutor mentor programme and their rich experience in teaching. The lecturers were involved with the tutor-mentor programme as subject specialists and as mentors to the tutor-mentors. The lecturers had perceived an

improvement in attitudes and performance of mathematics students since the commencement of the tutor-mentor programme, and were keen to have further evidence of the effectiveness of the programme and to glean ideas to improve their own involvement.

4.5.2 Relationships between participants

Figure 4.4 indicates the relationship between the three groups of participants who took part during Phase 2 of the study.

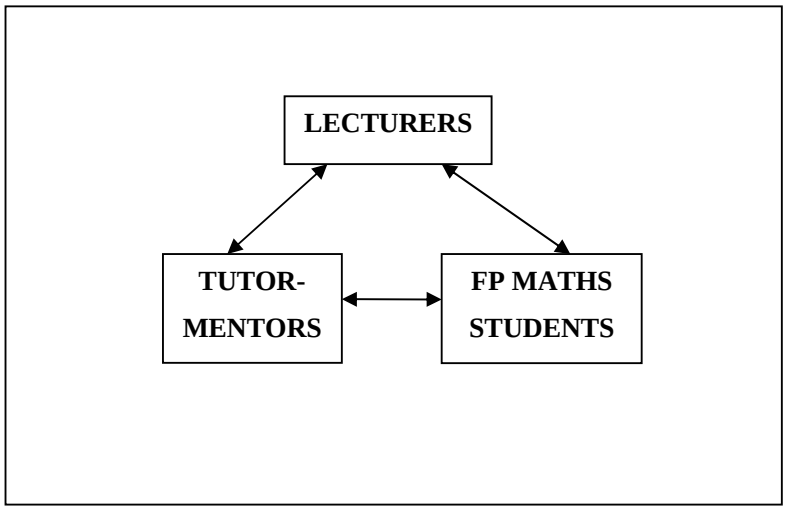

Figure 4.4: Participants in the FP tutor-mentor mathematics community of practice

Figure 4.4 identifies the participants in the FP mathematics community of practice and their mutual relationships. The strength of the programme depends on maintaining these relationships.

The mathematics lecturers liaise frequently and regularly with the tutor-mentors and are responsible for mentoring them to ensure their well-being and that of the community of FP mathematics practitioners. The tutor-mentors are responsible to the lecturers and to the tutee-mentees with whom they work. They sometimes form close professional relationships with the lecturers and are encouraged to form professional relationships with the students. The FP mathematics students are the focus of the tutor-mentor intervention and the *raison d'être* for the tutor-mentor programme. The relationships they form between themselves as students and

with the tutor-mentors and the lecturers depend on what they want from the relationship. Whether the support they require is academic, social, emotional, or two or three of those offered. The mentor leader is not included in this discussion because she was an observer and not a participant in the study. Her role in mentoring all participants however, is an important aspect that is not ignored.

The development of a close relationship among all members of the tutor-mentor programme is encouraged. In this way the programme leader, tutor-mentors and lecturers develop a horizontal collegial relationship, whereas a vertical relationship is evident between the students and lecturers and the students and tutor-mentors. The strength of these relationships helps to build confidence in the students, and indicates that their academic as well as their psychosocial welfare is taken seriously and that they are not left to struggle on their own. A common purpose forms a tightly-knit community of practice. An important consideration in planning and maintaining the tutor-mentor programme was to ensure that the programme is not dependent on any one person; should anyone leave the programme, it must be able to carry on without interruption. This is an important consideration because of student and lecturer population dynamics.

4.5.3 Qualitative data gathering procedures

Data was obtained by the following data-gathering techniques: semi-structured questionnaire; focus group interviews; observation; spontaneous conversations; photographs and other artefacts. An interview schedule was used during the interviews, so that I covered all topics that I wished to explore. This is shown in Appendix C. The schedule was used flexibly, and did not restrict me from using probing questions, following up points, or allowing participants to digress from a particular topic or question.

4.5.3.1 Semi-structured questionnaire

A semi-structured questionnaire (Appendix F) was chosen for the study, and was administered by a neutral person. The qualitative purpose of the questionnaire was exploratory. It gave students the opportunity to express their opinions about the tutor-mentor programme, and supplied qualitative data in the form of comments. The questionnaire was used to parallel the research sub-questions and together with the interview schedules,

provided a basis for the interview questions. There was no attempt to elicit causal relationships from the questionnaire, since, according to Bell (2005:137-144) and Opie (2004:95-110) this is difficult to prove by the use of a semi-structured questionnaire All 142 student participants completed the questionnaire.

The questionnaire was also used in Phase 1 of the study to match the names with the quantitative data. Although students were assured of anonymity with regard to their responses, they were asked to write their names on the questionnaire for the purpose of cross-checking with the quantitative data. All 142 students complied with this request so it was simple to cross-check with the quantitative data.

Dissemination of the questionnaire was not difficult to organize but required the cooperation of the lecturers and the availability of the administrator. The lecturers made the collection of the questionnaire easy to arrange and manage so that there was the least amount of disruption to the normal routine of the classes. They also checked that students had written their names on the questionnaires. The administrator, too, was most cooperative in being available at the set times.

4.5.3.2 Focus group interviews

An interview schedule was used to gather data from the tutor-mentors in the focus group interviews (Appendix E). The interview questions paralleled the research sub-questions and together with the interview schedule provided a basis for the interview questions. Bell (2005:156-171) is of the opinion that as long as ethical issues are remembered, the correct protocol maintained and focus group interviews are conducted with honesty and integrity and with respect for the participants, there are no hard and fast rules. The purpose of the interviews was explained to the participants, and, although a conversational atmosphere was maintained, the interviews were approached seriously with the intention of gathering useful information in a short time.

All ten tutor-mentors attended the focus group interviews which were conducted over three weeks. There were three focus group interviews: four participants in two focus groups respectively and two in the third. The tutor-mentors had been invited to participate in the focus group sessions at arranged times suitable for everyone. All the interviews were held in

my office. I had asked the tutor-mentors if they were comfortable at being audio recorded and although they felt a bit embarrassed at the idea, they were happy to oblige. Refreshments were provided. The good relationships that had developed between the members of the focus groups were a contributory factor in their willingness to share their experiences, opinions and ideas. The audio recorder caught all the conversation, and because it was unobtrusive its presence was soon forgotten as the conversations quickly became animated. All respondents were asked similar questions which brought breadth of information, and helped cross-check the data for reliability.

The focus group interviews allowed the participants to interpret and express their views about the tutor-mentor situations they had experienced. Ideas were exchanged on a subject that was of mutual interest and not only helped increase their own understanding of where they fitted into the tutor-mentor mathematics community of practice but also emphasized the social situatedness of the research data and the 'human embeddeness' (Cohen et al 2000:267) of the research. The interviews were also important as a means of checking the consistency of the other forms of data gathering. The tutor-mentors' responses added rich data through their intimate knowledge, insight and understanding of the student participants and through their personal experiences of the tutor-mentor phenomenon. The tutor-mentors thus provided historical information unique to their personal situation in the programme. The information they provided was valuable and supplemented the data by filling gaps left by the other data gathering procedures. These focus group interviews allowed me to engage personally in the collection of the data and to explore complex issues in detail and through prompting and asking probing questions, clarification of the data was facilitated.

Their relationship with me as the programme leader was such that they were comfortable talking about the programme and their experiences, and they appeared at ease when offering opinions and suggestions. Importantly, because it was a natural situation for the tutor-mentors to be in, I perceived no feeling of obligation to try to please me by saying what they thought I might like to hear. Their easiness in the interview situation allowed them to contribute freely to the conversation and to speak their minds with little need for prompting.

4.5.3.3 Individual interviews

The individual interviews were from the informal interview questions (Appendix D) and usually comprised individual conversations with the five lecturer participants. These mainly took place in the shared office of the lecturers or in my office. The convenience and familiarity of these venues made conversation easy. Individual pre-arranged interviews were more productive and elicited more information than the occasional group meeting. Interviews took place during the semesters when lecturers were actually teaching, were interacting with their tutor-mentors and the students, and aware of what was happening in their tutorial classes. Furthermore, congenial interpersonal relationships and passion for their subject made it easy to talk to the maths lecturers and to obtain information without contriving situations which may have made them feel uneasy or discomforted. Professional and affable relationships allowed the lecturers the freedom to be frank in voicing their opinions. I thus considered the data collected from the lecturers reliable, valid and trustworthy.

The purpose of the interviews with the lecturers was to probe the same issues as those put to the tutor-mentors and to the students, but made use of the lecturers' knowledge of their students and the tutor-mentors in a classroom situation. Furthermore, what I have termed reflection conversations were held with the lecturers as soon as possible after classroom observations had taken place, to discuss what I had observed and whether lecturers thought any changes needed to take place to make the tutor-mentor – student contact more beneficial. Lecturers were asked to assess their use of the tutor-mentors and whether they thought all participants in the tutorial class had made profitable use of the time and opportunity (see Appendix C, Appendix D). We discussed my findings and talked over various issues that arose as a result of my and their observations. These conversations were a useful source of information, and kept the lecturers informed about the study.

4.5.3.4 Observation

Observation lies at the centre of all case study research because it allows the researcher to capture information *in situ*, and enables the case to be seen through the eyes of the participants, providing 'unique example(s) of real people in real situations' (Cohen et al 2000: 181-183). Case studies allow the effects of causes to be observed in real contexts by 'recognizing that context is a powerful determinant of both causes and effects', and that the

whole is more than the sum of its parts (Cohen et al 2000; see also Flyvbjerg 2006 and Yin 1994). Although observation is a key area of a case study, in this study participant observation was only possible during class times because that was the only time that students were together in one place with the tutor-mentors present and helping them.

Two forms of observation took place in the study: observation of the regular mathematics tutorial classes and of the tutor-mentors teaching a class for tutor accreditation after their training had been completed. Field notes and photographs were used to document the observation.

Regular mathematics lecture observations: In this study I observed hour-long mathematics' tutorial classes over one semester. Although I took on the role of observer-participant where I interacted with the participants, I limited my role within the group. My intention was to maintain as much objectivity as is possible in a case study, and by keeping my distance to reduce the possibility of influencing the outcome of the research, which could have happened if I had immersed myself in the group by taking on the role of lecturer or tutor. The nature of the student – tutor-mentor interaction could best be seen through observing what happened in the classroom between the participants (students, tutor-mentors and lecturers). As stated by Bernard (2000:376), 'when you want to know what people actually do ... there is no substitute for watching them' as case study observations catch the dynamics of a situation as it unfolds. Three steps were involved in the arrangements regarding the observation sessions: obtaining permission from the lecturers; informing the students and tutor-mentors before the sessions; and time allocated for me to explain the purpose of my observation. These steps are discussed in more detail as follows.

Before the observations, I requested permission from each lecturer to go into their classes to observe, and explained my function and purpose to them. They were asked to run the tutorial classes as usual except for introducing me and the reason for my presence. I assured the lecturers that I was not in any way assessing their knowledge or performance, and that I was only interested in having my questions answered regarding holistic[12] interaction in the classroom, primarily between the students and the tutor-mentors.

[12] Holistic used here means 'working as a unit'

The lecturers had previously informed the students that I would be joining the class at his/her invitation, and had briefly explained why I would be there. The students were therefore prepared for my visit and accepted my presence without disruption to the normal routine. Although some limitations might be expected with this approach, I hoped that if the students knew why I was in their class this would prevent their feeling that I was intruding and disrupting their class and wasting their teaching time.

The tutor-mentors had already been briefed on my research. They were aware of the intention of the observation and had no reason to question my presence. Although the lecturers had already explained my presence and intention to the students, before starting the tutorial class each lecturer invited me to speak to the students which I did very briefly. I assured them of anonymity and that there would be no criticism of any kind either of themselves or the tutor-mentors; that I was there to observe how they, the tutor-mentors and the lecturer worked together in the classroom; and that I might ask a few questions. The lecturer then immediately proceeded with the tutorial class. I placed myself in an inconspicuous position where I could observe without distracting the students or the tutor-mentors. There was thus a social distance between me and the participants. In addition, I limited eye contact with the participants. As a result, as the students, tutor-mentors and lecturers became involved with the work, my presence was either forgotten or ignored which helped in creating a normal rather than a contrived classroom situation.

Notes were made of the interactions between the students and the tutor-mentors. I noted how interaction took place; how students worked together on the problems set by the lecturers; which of the students asked for help from the tutor-mentor or lecturer when having difficulties with a problem or wanting to confirm a solution; how tutor-mentors and lecturers moved around the room; whether and how often tutor-mentors referred to the lecturer or asked for clarification; and the kind of relationships that was evident between the participants. In addition to the notes, I used the flexible interview questions (Appendix D) that I had adapted for the specific purpose from the Flanders Interaction Analysis Categories (FIAC) (Cohen et al 2000:21; Opie 2004:126-128). I also used the opportunity to cross-check responses from the questionnaire and interviews.

Tutor-mentor training evaluation observations: Tutors at MSA were required to participate in a tutor-training programme to acquire accreditation as tutors. The final part of the training was

to teach a tutorial class under the observation of a qualified subject specialist (a lecturer) and a trainer. They were then contracted for one year, and paid a small salary. The purpose behind this training was to ensure high quality tutoring. Before the observations took place, the trainer reviewed the purpose of observation and evaluation and went over the observation/evaluation form with the tutor-mentors so that they understood what was expected of them. The tutor-mentors were reminded about what constitutes good teaching practice, including lesson planning. They then prepared a lesson after consultation with the lecturer.

The time and venue of the observation was arranged by the tutor-mentor with the lecturer, and the trainer was informed. An observation/evaluation form was given to each of the observers who completed it as the lesson progressed and did not interrupt the lesson, remaining as unobtrusive as possible during the assessment process. As soon as possible after the observed lesson, the tutor-mentor and trainer, and the lecturer if available, discussed the lesson. The tutor-mentor was given the completed observation/evaluation forms in order to write his/her own comments about the experience. Further discussion with the trainer took place once this was completed, and the tutor-mentor added the form to his/her portfolio of work. The portfolio was handed in for assessment by the trainers and if satisfactory, the tutor-mentor was given accreditation as a Monash tutor (not tutor-mentor[13] and is explained in the footnote). All the tutor-mentors employed in the FP were trained and accredited Monash tutors.

Although mentoring was included as a small part of the official MSA tutor training, a more comprehensive mentoring workshop was given to the FP tutor-mentors covering mentoring aspects only. This workshop is compulsory for all tutor-mentors teaching FP students, and although they were not officially assessed or evaluatedthey participated in role-playing and attended regular feedback sessions where they were able to share their mentoring and tutoring experiences with the group and with any lecturers who were able to attend.

The completed observation/evaluation forms were an important part of the data collection, and contributed valuable information to this study. The information gathered from this source reaffirmed the value of developing good relationships within the tutor-mentor mathematics

[13]. Mentors are not formally trained or officially recognised by MU or MSA. Mentors in the FP are trained by the FP mentor leader. The term ‘tutor-mentor’ is specific to the FP.

community as active participation in the intervention was encouraged and seemed to promote optimal teaching and learning. The observations were significant in adding richness to the qualitative data and confirming the evidence collected through the other means of data gathering.

4.4.3.5 Spontaneous conversations

This is perhaps one of the most important methods of recording observations and collecting information. Unexpected encounters that one comes across without planning elicits unexpected insights into the phenomenon being studied. In my situation, this was important because I wanted to gather anecdotal information in addition to the planned more formal sessions with the participants. Observing tutor-mentors working in the library with a group of mathematics students, sitting with a student on the stairs explaining some mathematical concept, helping students with an assignment during breaks between classes, were opportunities too good to miss and added richly to the data as supplemental, spontaneous information. This facilitated the generation of thick descriptions and made an accurate explanation and interpretation of events possible instead of relying on my own inferences.

Spontaneous interviews were informal and conversational. Much of the data were collected through casual conversations and when individuals or small groups of students approached me for information or counselling as their mentor. This was an excellent way to gather information without pressure because it was spontaneous. However, there are some issues to be aware of. Firstly, as a result of the lecturer-student relationship there are constraints. Secondly, cultural forms creep into the conversation because culture is an integral part of a person. Questions and answers cannot, therefore, be neutral and will be 'couched in the cultural repertoires of all participants' (Cohen et al 2000:268). This is especially true in a multicultural context such as at MSA. Thirdly, participants are bound to couch their questions and answers according to their own world views, 'indicating how people make sense of their social world and of each other' (Cohen et al 2000: 268). Fourthly, when conversational exchanges took place in passages or *en route* to lectures for example, it was important to jot down information as soon as possible. I therefore acquired the habit of carrying a jotter and pencil wherever I went so as not to miss opportunities of engagement with participants. If these factors are kept in mind, despite the problem of a possible lack of objectivity and not

having assurance that the whole truth was revealed, much useful information was captured in this way that was of value to the research.

4.5.3.6 Artefacts

The mathematics course content (Appendix B) and teachers' guides were a useful source of background information as they gave insight into the change in the difficulty levels between the Test 1 and Test 2 mathematics assessments and in the didactic methods used by the teachers compared to the tutor-mentors. Copies of both mathematics tests were kept by the lecturers in their personal files. Test 1 was kept by the students for revision purposes, while Test 2 was retrieved after the examination and stored in the FP's confidential archive. The original questionnaire, interview questions, audio recordings, photographs, responses and transcriptions were stored in the office of the researcher and/or on a computer hard drive.

Photographs were taken during observations of tutor-mentors, students and lecturers at various times. They were a valuable source of information in that they illustrate how participants engaged with one another as a community of practice in various teaching and learning situations.

4.5.4 Transcribing the qualitative data

The focus group interviews were transcribed by a tutor-mentor who acted as my research assistant and who had no association with the mathematics students. This was to prevent bias during transcription. The interviews were transcribed directly from the audio recordings, and checked by listening to the recordings and reading through the transcriptions. They were found to be an accurate record of the focus group interviews. All transcriptions were double-checked and supplemented from notes and comments made during the spontaneous and individual interviews and observations. Final collation of the data was done after the transcriptions were checked for accuracy. They were then coded and categorised into themes.

4.5.5 Data analysis

Data were analysed from transcriptions of the semi-structured questionnaires (Appendix F), focus group interviews (Appendix E), interviews with lecturers (Appendix Appendices C &

D), from field notes and photographs taken during two sets of observation sessions, and from spontaneous informal conversations (Appendix D). Thematic analysis as suggested by Boyatzis (1998) was used to develop the categories, or themes, during the process of data analysis with reference to the research questions and the central phenomenon of the study. The 'constant comparative method' of developing categories (Glaser & Strauss 1967; Lincoln & Guba 1985:344-351; Merriam 1997:179) was followed, as this seemed the best method of extracting information in order to delimit and saturate the categories. The inductive process focused on the data, examined it for overlaps and redundancy, and collapsed the data into codes. Similar codes were then combined to form a single idea or theme. The coding was used to define units of meaningful information, and grouped according to the commonality of the information.

The first task, therefore, was to group the data into common segments that formed meaningful or potentially meaningful units of information. The segments needed to be heuristic[14]; so that hidden meanings could be extracted. These units served as the basis for defining the categories and in this manner, themes or categories became evident and were grouped according to their relation to the research questions. Analysis of the data was organised in this way by a process of segmenting, labelling and encoding the information to form descriptions and broad themes, and to form a link between the qualitative and the quantitative data. Throughout the process, as I moved back and forth between the data and related the study to the literature, I was careful to search for any 'disconfirming evidence' as suggested by Yin (1994 & 2009) that would negate any of the interpretations. The data were thus organised into units by reading and re-reading the transcriptions and the notes made during the observations, informal and spontaneous interviews. The units thus served as the basis for defining the categories. The photographs were used to add richness to the data by showing the interactions between the participants in pictorial form.

It should be noted that because the questions posed to the participants were deliberately designed to elicit information relevant to the research questions, I already had an idea of the categories that would emerge during the process. Anomalies that were not related to the research questions were eventually discarded if they could not be inserted into a relevant category. Thus, together with the intuitive component of category construction, the process

[14] Heuristic: able to stand on their own without needing any further information to be understood.

was informed by the purpose of the study's and the investigator's orientation and knowledge. The meanings were explicated by the participants themselves.

Since my intention when collecting the qualitative data was to record students' and tutor-mentors' opinions, ideas and overall understanding of the tutor-mentor programme as an intervention strategy, I did not attempt to record the length of pauses or the time taken to complete tasks during the tutorial sessions as I felt this was not necessary for the purpose of the research.

Direct observation as a participant gave insight into the behaviour of the students and the tutor-mentors that would have been unavailable to me if I had only transcribed taped interviews or questionnaires. I was able to make inferences through, for example, body language, without the 'filtering effect of language' (Rugg & Petre 2007:110-112) because my presence was accepted by the lecturers, the students and the tutor-mentors. Observation was, therefore, a significant additional source of interesting information that added to the richness of the data. All field notes taken during observation of the tutorial classes were typed up immediately, coded and filed for later interpretation and analysis.

4.5.6 Data gathering issues

Conducting the interviews and conversations were not problematic. This was possibly because of the pre-discussions that had taken place with all the participants, and properly arranged times and venues. All the focus group interviews were audio recorded without interruption although some of the voices were difficult to hear because the person spoke very softly or because of accents that were difficult to understand. This did lengthen the transcription times of the audio interviews, as parts of the recordings had to be replayed a number of times. When it was impossible to hear what the interviewee was saying, I went back to the person and asked for clarification. Probing for further information and asking for clarification of statements are recognised as important characteristics of interviews (Brown & Dowling 1998) and were a feature of the interviews and conversations in this study so that notes were available to help with the transcribing.

One of the difficulties of audio-recorded interviews without the use of video recordings is that people's facial expressions and body language are not available. However, this limitation was

partly overcome by meticulous notes made during the interviews that indicated actions such as gestures, frowns, smiles, nodding heads and so on**.** This made it easier to understand the tone of voices and perhaps better understand what the speaker was trying to express. Probing for further information and asking for clarification of statements as expressed above added to the quality and richness of the data gleaned from the interviews.

The tendency for interviewees to offer answers that they think the interviewer might prefer, and to try to please me because they like me and want to say what they think I want to hear, is, according to many researchers, for example, Fraenkel & Wallen (1996), Merriam (1988), Neuman (2006) and Yin (1994 & 2009), a limitation that is difficult to prevent. This is especially so when the participants know each other well and have very good relationships with one another. Another aspect that might be considered a limitation is that, because students are comfortable talking to me the conversation, the interview really 'is a social, interpersonal encounter, not merely a data collection exercise' (Cohen et al 2000:279). This possible limitation was minimised by my effort to be as neutral as possible, non-judgmental and observant of physical gestures and facial expressions, controlling the flow of information without stemming enthusiasm or dominating the conversation with too many interruptions, and allowing a collegial atmosphere.

In order to circumvent as many of these limitations as possible I followed the advice of Brodie (2005:67) by offering support to the interviewees, in this case the lecturers and the tutor-mentors, by making positive comments such as "that's interesting" or "that was a good way to solve that problem". Furthermore, through expressive body language, facial expressions and tone of voice, I attempted to show my interest in what they were saying. This proved very helpful as the interviewees were relaxed and comfortable in the interview situation. These strategies were an important aspect of the interviews because by showing that I was really interested in their opinions, descriptions and points of view, further sharing of information was encouraged.

4.6 Conclusion to Phase 1

The Phase 2 findings confirmed the Phase 1 findings.

4.7 Integration of the data

The quantitative and the qualitative data were brought together by means of a sequential transformative strategy procedure. This method enabled cross-checking of the data, and confirmed the accuracy of the findings. Merging of the data was done during the interpretation phase of the study when the two methods were integrated. The data from the quantitative and the qualitative sections of the study were analysed separately and the two methods integrated to make the final conclusions. This was the cross-checking that confirmed the findings and was supported by the theoretical perspective that guided and best served the purpose of the study.

Fourth level abstraction towards a situation-producing theory (Dickoff et al 1968) was developed through a process of layering the analysis by representing the data using interconnected themes. Interconnecting the themes showed the sequence of each set of events as they occurred as a process from the first to the fourth level of abstraction (Creswell 2002.274). In the process, the research problem led to a study of the tutor-mentor programme as the central phenomenon. The process included a sequence of activities that included actions and interactions by students, tutor-mentors and lecturers in the FP IT mathematics classes at MSA. Data were coded and categories (themes) developed. Interrelation of the themes led to fourth-level abstraction and towards a situation-producing theory for tutor-mentoring at MSA (Creswell 2002: 449; Dickoff et al 1968).

According to Wellington (2000:201) '[v]alidity refers to the degree to which a method, a test or a research tool actually measures what it is supposed to measure.' Opie (2004:68) suggests that 'it makes sense to think of the validity of the *relationship* (Opie's italics) between a claim and the result of a data-gathering process, rather than the validity of these things on their own.' According to this way of thinking, if the study is considered reliable and has integrity then internal validity can be accepted. However, if the findings of a study are to be applied

outside its own boundaries, so that it can be applied 'beyond its own research content' (Opie 2004:70), then it needs to have external validity, and the extent to which this can be applied adds to the extent of the external validity. Opie (2004:70) does, however, say that it is impossible to claim a hundred percent validity because there is always an element of the unknown. This brings in the assertion by Lincoln and Guba (1985:290) that qualitative research that is trustworthy should be credible, transferable, dependable and confirmable and that '[t]hese four concepts are extensions or adaptations of the "traditional categories of internal validity, external validity, reliability and objectivity"' (Opie 2004:71).

A number of the strategies that Sturman (in Opie 2004:71-72) suggests can enhance the credibility of case study research used in this case study. Data gathering procedures are explained and the data is presented transparently and in ways that enable ready analysis. Negative instances are reported and biases are acknowledged. Fieldwork analyses (the ways in which data have been handled when first obtained) are explained. The relationships between claims and supporting evidence are clearly expressed and my own primary data is distinguished from secondary, or others', data). Interpretation is distinguished from description; I have not tried to pass off a problematic statement as an established fact. I kept notes of spontaneous conversations and activities during observations. Furthermore, a sequential transformative strategy procedure was used to check the quality of the data by cross-checking and this gives further credibility to the study.

4.8 Conclusion

This chapter has described the research design for Phase 1 and Phase 2 of the empirical investigation. The following chapter focuses on the findings of the quantitative and qualitative analysis respectively; the integration of the findings; and discussion thereof.

CHAPTER 5

PRESENTATION OF FINDINGS

5.1. Introduction

Chapter 4 presented the research design of the empirical inquiry according to two phases: Phase 1, the quantitative phase; and Phase 2, the qualitative phase. In this chapter, the findings are presented and discussed. The chapter is organised under three main headings: the findings of Phase 1; the findings of Phase 2; and the integrated findings.

5.2. Phase 1: quantitative findings

The sampling strategy used in this study was directed by the criterion of suitability: that the strategy was fit for the purpose for which it was being used. Since convenience sampling was used for the case study, the findings do not claim to represent any group apart from the sample group: the mathematics group of the 2008 FP at MSA. Given that I only investigated the effect on students' mathematics performance through participation (or no participation) in the tutor-mentor intervention, I make no claims for the success or otherwise of the tutor-mentor intervention in the wider FP population. For this reason, the parameters of generalizability may be considered insignificant (Cohen et al 2000:103) while the quantitative findings can claim to be relatable to similar programmes and education situations.

The findings of Phase 1 are presented in three parts: descriptive statistics; graphic representations; and inferential statistics, and are discussed under these three headings.

5.2.1 Descriptive statistics

The descriptive statistics include the following: a comparison between Group **I** and Group **C**'s mean scores, correlation coefficients, variability and gain scores which are linked to the hypothesis.

5.2.1.1 A simple comparison of the Test 1 and Test 2 scores

In Table 5, a comparison of the descriptive statistics between the Test 1 and Test 2 mean scores of Group **C** and the Test 1 and Test 2 mean scores of Group **I** is tabulated along with other values.

Table 5.1: Comparison of Test 1 and Test 2 mean scores showing the degree of change

		Control Group **C**	Intervention Group **I**
Test 1	Average	(O_1) 61.111	(O_3) 46.228
	sd	20.028	18.618
Test 2	Average	(O_2) 53.841	(O_4) 65.228
	sd	23.750	18.486
Change		-7.270	19.00
		0.738	0.488

sd: standard deviation

A comparison of the mean scores of the two groups as illustrated in Table 5.1 shows that the *Group **C*** mean score had decreased by 7% whereas the Group **I** mean score had improved by 19%. The difference between the Group **I** Test 1 and Test 2 mean scores appears to suggest that participation in the tutor-mentor intervention improved the performance of the Group **I** over a period of a year. In comparison, the difference between the Group **C** Test 1 and Test 2 mean scores did not show an improvement over the same period. A positive correlation for both Group **C** (0.738) and Group **I** (0.488) was noted.

Rather than just comparing gain scores (the Test 2 minus the Test 1 scores for Group **C** and Group **I**), and taking into account that randomization had not taken place, the Test 1 mean scores for each group were compared to assess the pre-intervention equivalence of the groups. Definite conclusions could not be drawn simply by observing the means, however, since any differences could have occurred through either natural variation or the intervention.

Table 5.1 shows that the standard deviations of both groups stayed approximately the same. However, the standard deviation about the mean increased for Group **C** whereas it decreased slightly for Group **I**.

Although Table 5.1 shows there was little difference in the standard deviations of both Group **C** and Group **I**, a change was observed in the sample and was further supported by the results of the interquartile range as a measure of spread (measure of variability). Although a comparison of gain scores appeared to support the hypothesis that participation in the tutor-mentor intervention improved the performance of the FP mathematics students, I still needed to test to see whether the intervention had an effect. The results of Test 1 were an indication of the strengths of the students and of who required additional support. Therefore, the comparison of the means of Test 1 and Test 2 for both Group **C** and Group **I** appeared to support the hypothesis.

Table 5.2: Measure of spread (measure of variability)

		Group **C**	Group **I**
Test 1	Median	63.000	48.000
	I.Q.R.	30.000	25.500
Test 2	Median	56.000	68.000
	I.Q.R.	36.500	21.500
Change		-7.000	20.000

I.Q.R.: Interquartile Range

A comparison of the median scores of the two groups (Table 5.2) shows that the Group **C** median score had decreased by 7%, while the Group **I** median score had improved by 20%. The reduction in scores from 63% to 56% for Group **C** compared to an increase in scores from 48% to 68% for Group **I** supported testing to confirm the hypothesis: that is, that the differences in the median scores was the result of participation in the tutor-mentor intervention and not of chance occurrences.

A comparison of the mean scores of Test 1 with the mean scores of Test 2 for Group **C** and Group **I** respectively showed that Group **C** means decreased by 7% whereas Group **I** mean scores showed an increase of 19% (Table 5.1). Comparison of the mean and the median scores showed almost identical results, which further supported the hypothesis. The following section deals with the graphical representations and strengthens the hypothesis that participation in the tutor-mentor intervention had an affect on the performance of the mathematics students.

5.2.2 Graphical representation

The frequency graphs plot the frequency of the actual scores. Regarding the distinction of scores, the graphs show the changes that occurred in the Group **C** and Group **I** Test 1 and Test 2 scores, and how Group **C** and Group **I** compared with each other regarding changes in the Test 1 and Test 2 scores.

5.2.2.1 Comparison of Test 1 scores of Group C and Group I

Figure 5.1 compares the frequency of Test 1 scores of Group **C** and Group **I** before the tutor-mentor intervention was offered. The Group **I** line (the solid line) lies to the left of the Group **C** line indicating that Group **I** seemed weaker than Group **C** before the intervention.

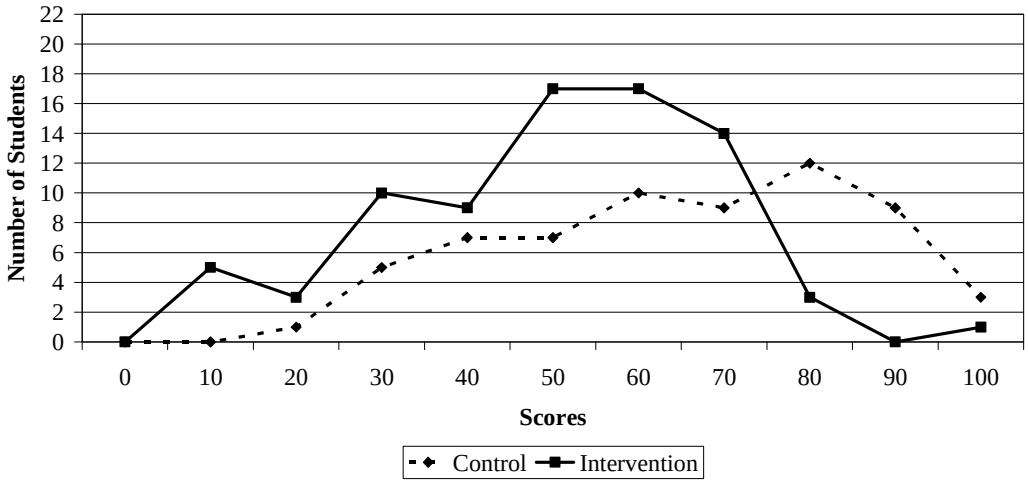

Figure 5.1: Comparison of the Test 1 scores of Group C and Group I

5.2.2.2 Comparison of Test 2 scores of Group C and Group I

Figure 5.2 compares the frequency of Test 2 scores of Group **C** and Group **I** after the intervention had been offered. Both lines on the graph are strongly skewed to the left. Although the graphs of both groups have a similar shape, the Group **C** line (dashed line) is more erratic while the Group **I** line (solid line) has a smoother curve. The Group **I** line shows a greater number of students had higher scores for Test 2 than for Test 1 (Figure 5.1).

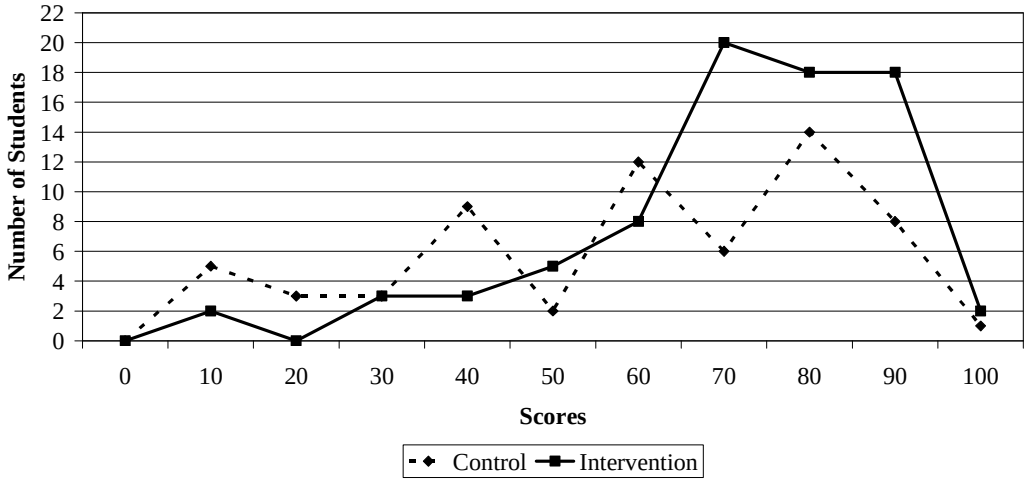

Figure 5.2: Comparison of the Test 2 scores of Group C and Group I

5.2.2.3 Comparison of the Group C scores for Test 1 and Test 2.

Figure 5.3 compares the frequency of the Test 1 and Test 2 scores of Group **C**. The Test 1 line (dashed line) is fairly smooth whereas the Test 2 line (solid line) is more erratic. The graph shows that while some students obtained higher Test 2 scores, others obtained lower scores. A comparison of Test 1 and Test 2 scores shows an increase in the number of lower scores, while it appears that the higher scores remained relatively similar. It is apparent from the Test 2 scores that a number of students decreased their scores.

As shown by the frequency of scores in Figure 5.3, the performance of many of the Group **C** students deteriorated. This suggests that non-participation in the intervention may have led to their inability to maintain or improve their scores. A number of students did manage to improve their scores, but not significantly.

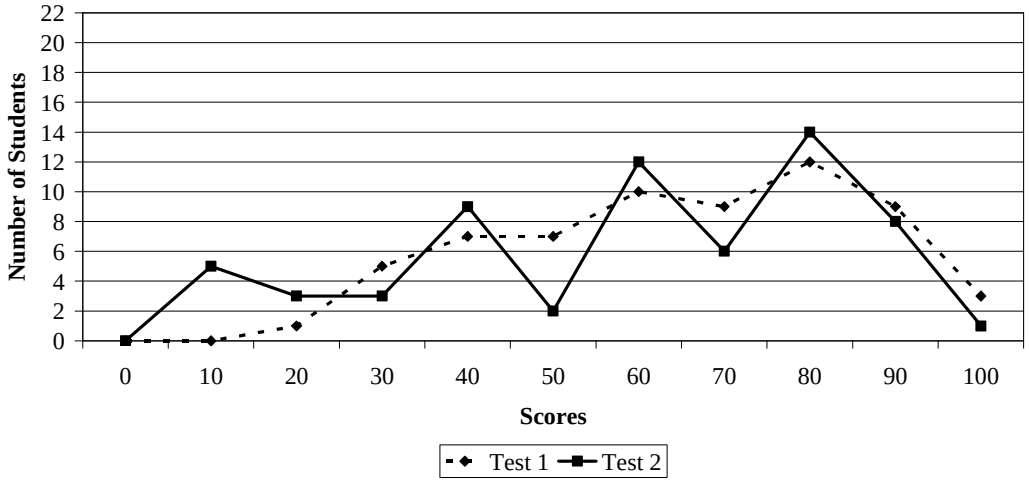

Figure 5.3: Comparison of the Group C scores for Test 1 and Test 2.

5.2.2.4 Comparison of the Group I scores for Test 1 and Test 2.

Figure 5.4 shows the frequencies of the Test 1 and Test 2 scores of Group ***I***. The graph is left skewed for both tests, and this is more prominent in Test 2. This indicates that a larger number of students achieved higher scores for Test 2 than for Test 1, which indicates a general improvement in mathematical knowledge and understanding. This is what would be expected if the hypothesis was true and the null hypothesis disproved.

As the semester progressed, mathematical concepts built onto previous concepts and higher levels of mathematical knowledge and skills were needed to solve problems. The mathematics thus became progressively more difficult. Figure 5.4 shows that understanding of this content appeared to improve in students who participated in the tutor-mentor intervention. This is shown by the reduction in the number of Group **I** students who failed Test 2 (8 students failed Test 2 compared to 27 who failed Test 1) and the increase in the number of students who improved their performance to above 70%. In contrast, Figure 5.3 shows that Group **C** students, who did not participate in the tutor-mentor intervention, either remained at the same level of performance or worsened with the increased mathematical conceptual difficulty.

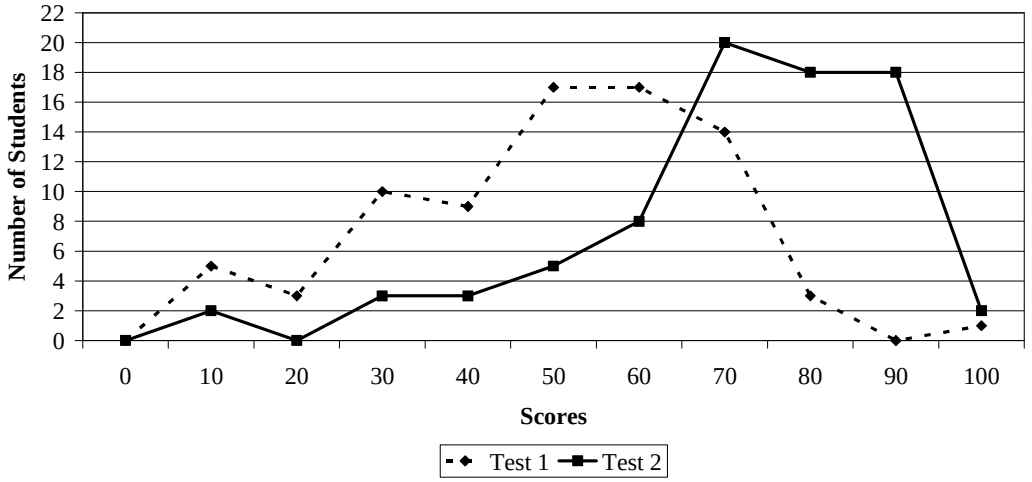

Figure 5.4: Comparison of the Group I scores for Test 1 and Test 2.

5.2.3 Conclusion of the descriptive statistics

The observations in the previous section support the hypothesis that participation in the tutor-mentor intervention improved the mathematical performance of FP students. The graphs in Figures 5.1, 5.2, 5.3 and 5.4 compared the frequencies of observed scores of Group **I** to those of Group **C** and are representations of the change in the students' performance over the two semesters in 2008.

In view of the hypothesis, and drawing on Figures 5.3 and 5.4, it is notable that there was an increase in the number of Group **C** students who either maintained or decreased their scores whereas many students in Group **I** improved their scores. For example, 66 students in Group **I** achieved above 60% in Test 2 (Table 5.2) whereas only 35 students achieved above 60% in Test 1. This showed considerable improvement in the performance of many students in Group **I**.

Of the Group **C** students, 43 students scored above 60% for Test 1, while 41 students achieved above 60% for Test 2. The difference between Group **C**'s Test 1 and Test 2 scores showed that few students improved their performance, while some deteriorated in performance (see 4.4.6.1) As a further example, of the three students in Group **C** who achieved above 90% in Test 1, one maintained a score above 90% for Test 2 whereas the scores of the other two students decreased by 16% and 25% respectively (confidential MSA data).

Although it would appear that there was very little difference in the Test 1 and Test 2 scores of Group **C**, or that many Group **C** students maintained their scores, the difference in the complexity of Test 1 compared to Test 2 should be taken into account. The improvement in performance as seen by the increase in Group **I** gain scores seemed to confirm the hypothesis that participation in the tutor-mentor intervention had a positive effect on the Test 2 scores for that group, and that the differences resulted from participation in the tutor-mentor intervention and not by chance and motivated for testing the hypothesis.

The observation that most of Group **C**'s scores remained about the same or worsened, whereas most of Group **I**'s scores improved, suggests that over the year, as mathematical concepts became conceptually more complex and higher levels of mathematical knowledge and skills were required, conceptual understanding did not develop in some students as easily as in others. This suggests that participation in the tutor-mentor intervention helped improve the performance of Group **I** mathematics students.

The difference observed between the Test 1 and Test 2 mean scores suggests that the intervention had an effect and that the difference was not due to measurement error. Thus, although this simple comparison does not allow the null-hypothesis to be rejected, it does suggest that Group **I** improved their performance by participating in the tutor-mentor intervention. The question remains as to whether the observed improvement was due to the intervention or to natural variation. However, the difference observed (see Table 4.3 Appendix A) was high, and supported further testing to see if participation in the intervention had an effect on the scores.

While it appeared that the differences between the Test 1 and Test 2 scores of Group **C** and Group **I** as illustrated in Figures 5.1-5.4 supported the hypothesis, that the intervention had a positive effect on the Test 2 scores, this could not be assumed and had to be tested. Furthermore, due to the size of the difference needed to assume statistical significance being unknown, further testing of the hypothesis was necessary and therefore, the ANCOVA test was carried out.

The aim in using the ANCOVA and Johnson-Neyman techniques had been to determine whether the observed changes were due to natural variability or to the intervention, while interpreting the Test 1 scores as a covariate. The interpretation of these tests provided

significant results in that the intervention was seen to be responsible for the changes observed because all other factors were constant. This supported the hypothesis.

5.2.4 Findings of the inferential statistics

Inferential statistics were used to test the hypothesis and included the ANCOVA and the Johnson-Neyman Technique. An interpretation of the findings of these techniques follows.

Test 1 of Group **C** and Group **I** was compared to assess the equivalence of the groups. In this sense, 'equivalence' pertains to the extent of randomisation performed before a statistical analysis can be carried out. Deliberate statistical randomisation was not done in this study, as it would have been unethical to limit students in the use of the tutor-mentoring intervention. It would also have been inappropriate to force students to participate in the intervention if they did not choose to. Thus, Group **C** and Group **I** were entirely self-selected. This resulted in not being able to use certain statistical tests because randomisation is an initial requirement for these tests. Therefore, because the groups were not equivalent (non-random), I used the ANCOVA as an appropriate tool for the experimental design and linked with it the Johnson-Neyman Technique to account for the lack of statistical equivalence between the samples. Since the ANCOVA incorporates covariates, possible differences in Test 1, resulting from factors such as students' pre-knowledge, ability or background, could be incorporated as well.

An examination of Tables 5.1 and 5.2 showed that the Test 1 mean score for Group **C** (O_1 = 61) was higher than the Test 1 mean score for Group **I** (O_3 = 46). After the intervention, the Test 2 mean score for Group **C** (O_2 = 54) was lower than the Test 2 mean score for Group **I** (O_4 = 65). However, the Test 2 means (O_2 versus O_4) could not be compared to evaluate the intervention because the groups were not equivalent. If the groups had been equivalent, the Test 2 means could now have been compared to evaluate the intervention. However, this limitation was largely resolved by using the Johnson-Neyman Technique which determined that the intervention had a differential effect on the groups.

In contrast, the Test 2 means could be compared as they were. However, this does not take into account differences between the Group ***C*** and Group ***I*** Test 1 means. Table 4.3 (see Appendix A) shows the adjusted means after the 'group' effect was factored out (for example, the initial difference between group ability and selection bias). In reference to Table 4.3, in

relation to ANCOVA, the initial means refers to the Test 2 means prior to adjusting based on the Test 1 means, since the Test 1 means were not equivalent. The gap between the adjusted means became larger because the ANCOVA factored out the effect of the group and random variability. What remained after the factoring out was the effect of the intervention.

The Homogeneity of Regression Slopes Test (see Table 4.4 Appendix A) was used and showed that the regression slopes were not homogeneous. There are various reasons why heterogeneity or non-parallelism of the regression slopes may have occurred, and these are not discussed in this analysis[15]. Also, since students chose their groups through voluntary participation and were not randomly assigned, a bias could have been introduced which could in turn have resulted in low control over the testing procedure and therefore the outcomes. Furthermore, non-randomization could potentially have resulted in non-equivalent Test 1 means.

The following factors regarding the use of the ANCOVA test were taken into consideration when interpreting the data and the results. All the assumptions of the test were not met: that is, the homogeneity of the regression slopes and random selection of the sample participants due to the practical and ethical issues stated earlier.

Figure 5.5 illustrates the scatter plot for Test 1 versus Test 2 scores for Group **C** and Group **I** respectively and the corresponding regression slopes.

[15] For further information regarding non-parallelism of regression slopes, the reader may refer to Huitema 1980.

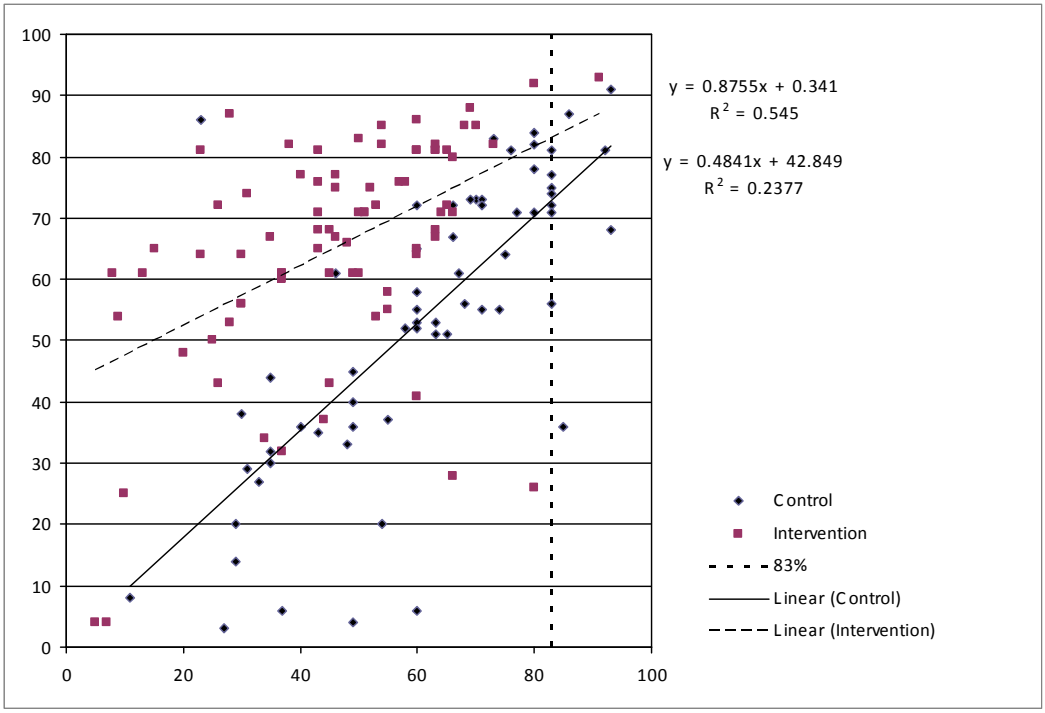

Figure 5.5: Scatter plot for Test 1 versus Test 2 scores and corresponding regression slopes

Figure 5.5, showing the corresponding regression slopes on the scatter plot is included here for convenient reference. The graph is bounded by 0 and 100 because the minimum mark that could be attained was 0 and a maximum possible was 100.

At the 95% confidence level, the means of the Test 2 scores were compared using the Test 1 scores as a covariate. This result was significant with a *p*-value of 0.007. The corresponding test statistical value was $F = 7.56$.

Since homogeneity of regression slopes is an assumption of the ANCOVA, this was also tested for (see Appendix A). Unfortunately, the regression slopes were found to be significantly different (see Figure 5.5). A *p*-value of 0.007 was desired (the corresponding *F*-test statistic was 7.56). Consequently, the Johnson-Neyman Technique was used to determine if the intervention had an effect (see Table 4.5 Appendix A).

5.2.4.1 Findings of the Johnson-Neyman Technique

The following paragraph refers to the graphs (Figures. 5.1-5.5) and is included here because it has reference to the Johnson-Neyman Technique bounds (see Table 5.3 Appendix A). Because there are two sample-participant groups with two different means, and a measurement error was introduced into the covariate Test 1 (*X*) on the graph (Figure. 5.5), the scores were spread around the regression lines, there were outliers, and the correlation between Test 1 (*X*) and Test 2 (*Y*) were not perfect. Some scores are far out but this is normal with real data and can be caused by many unknown variables, such as students who did not feel the need to study for the second test because their marks were acceptable in the first test. The correlation coefficient, r, gives an indication of the strength of the linear relationship between the variables (Test 1 (*X*) and Test 2 (*Y*) mean scores) and the coefficient of determination r^2 tells us what percentage of the variability in Test 2 (*Y*) can be explained by the variability in Test 1 (*X*). Table 5.3 shows the bounds obtained from the Johnson-Neyman technique.

Table 5.3: Findings of the Johnson-Neyman Technique

A	0.074	
B	-12.359	
C	1542.38	
XL_1	83.008	
XL_2	251.355	Bounded above by 100

XL_1 and XL_2 are on the horizontal axis (Test 1 scores) (see Figure 5.5).

Table 5.3, which summarises the important information from Table 4.3, shows that the intervention for X $\leq$83.0078 (Figure 5.5) was effective and that Group **I** improved their performance because they participated in the intervention.

Between 83 and 100, no distinction can be made between the two methods (I used 100 rather than 251.355 since the scores are bounded above by 100). Since the target students were the mathematically weaker ones, who obtained lower scores, I was not overly concerned about not

being able to extend the result all the way to 100% because I wanted to target potentially failing students.

The findings show that many of the Group **I** students showed an improvement in Test 2 whereas many of the Group **C** students showed little if any improvement and many of their scores actually decreased. My aim in using the ANCOVA and the Johnson-Neyman statistical techniques was to determine whether the observed changes were due to natural variability or to the intervention while interpreting the Test 1 scores as a covariate. Significant results were interpreted in that the intervention was seen to be responsible for the changes observed because all other factors were constant.

5.2.4.2 Results of inferential tests

The results of the ANCOVA (see Table 4.3 ANCOVA Summary Table in Appendix A) and the Johnson-Neyman Technique (see Table 4.5 Johnson-Neyman Technique in Appendix A) confirmed the hypothesis, and allowed the null hypothesis to be rejected. The results of the tests are summarised in the following paragraph.

Since the p-value (0.007) is higher than the α (<0.05 level of significance) the H_0 can be rejected at 95% confidence This is an acceptable level of confidence, therefore the null hypothesis of equal means between Group **C** and Group **I** can be rejected and the findings accepted as reliable. Furthermore, since $F = 7.557$ the H_0 can be rejected because the critical value is $F_{0.05} > 3.90$.

The results of the inferential tests were therefore highly significant. The hypothesis, that students who participated in the FP tutor-mentor intervention improved their mathematics performance, was confirmed. The null hypothesis could be rejected at this high level of significance.

5.2.5 Conclusion to Phase 1

In light of the findings of Phase 1 of the study, I argue that participation in the tutor-mentor intervention made a positive contribution to improved mathematical understanding and performance of Group **I**. There is, however, no guarantee that if the tests were to be repeated

the scores would be consistent over time. Internal validity threats, such as circumstances at the time of testing, growth in maturity and the experiences of students, would be bound to creep in and this would affect the correctness of the inferences taken from the data. It would, therefore, be difficult to generalize beyond the groups which took part in the study although the findings may be relatable to similar groups and similar situations. Although I attempted to control for unrelated variables, threats to internal and external validity may not have been sufficiently allowed for. Thus, a categorical conclusion that the academically stronger students achieved much better scores in Test 2 than in Test 1 as a result of the intervention is not permitted because they might have done so without taking part in the intervention. For example, improvement might have come through students' maturation or diligent application to their studies. Therefore, although the Phase 1 findings strongly indicate that students improved their mathematics performance because they participated in the intervention, no definite conclusion could be reached as to whether these students would have improved their scores if they had not taken part in the intervention or whether it was by chance or some unknown variable.

However, evidence of improved mathematical performance by Group **I** suggests that there was a relationship between participation in the tutor-mentor intervention and an increase in the scores of Group **I**. It can be argued, therefore, that participation in the tutor-mentor intervention contributed to an improvement in the performance of the 2008 FP mathematics students at MSA.

Phase 2 of the study is discussed in the ensuing section.

5.3. Phase 2: Qualitative findings

This section discusses key thematic areas identified through the responses and actions of the participants in the course of qualitative data gathering. The material is organised as follows for greater clarity: discussion on interlinking themes that emerged from the data; interpretation of findings; conclusion to Phase 2.

5.3.1 Interlinking themes that emerged from the data

The first theme deals with *Learning maths in a multicultural mosaic*. The second theme deals with *Hurdles to success*. The third theme deals with *Participants' perceptions of the tutor-mentor programme*. The fourth theme deals with *Forging communities.* The fifth theme deals with *Active partnerships in a holistic enterprise*. Finally, the sixth theme deals with *Was it worth it*? *The value of the tutor-mentor programme to the individual.*

Figure 5.6 illustrates how the themes overlap and interlink with one another showing the holistic nature of the study and the tutor-mentor programme. The model starts with the purpose of the tutor-mentor intervention, which is to improve the mathematics performance of FP students at MSA, and ends with the outcome; fulfilment of the purpose. The journey is told through the accounts of the participants and although each theme has a different focus, none stands alone. As the themes are unfolded through the stories, they reveal how active participation in the tutor-mentor intervention made improved mathematics performance possible and a reality for many students.

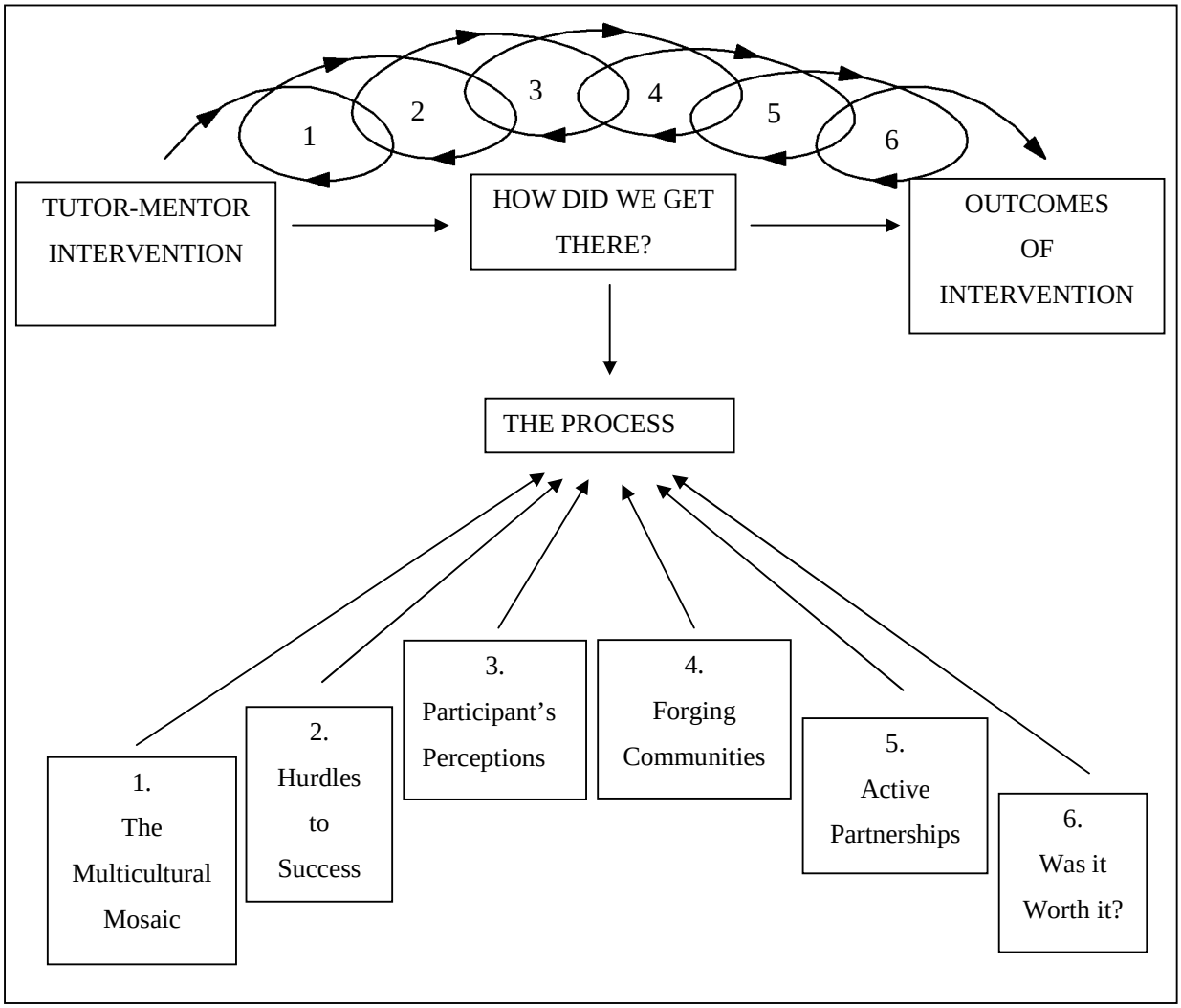

Figure 5.6: Interlinking and overlapping themes

Figure 5.6 shows how the six themes interlink in overlapping spirals starting with the purpose of the tutor-mentor intervention, leading to and through each following theme until the desired outcome is reached. The model shows the intervention strategy as a process that links each successive theme with the previous theme and with minor themes subsumed within the major theme. The process starts with a description of the situation in which the students find themselves on arrival at MSA. It then proceeds to the next theme with the events that cause psychosocial and learning problems for FP students and explains why there is a need for a tutor-mentor intervention programme. The next theme describes and explains students', tutor-mentors' and lecturers' perceptions of the tutor-mentor programme as an intervention

strategy. The fourth and fifth themes present the holistic nature of the programme. The fourth shows that developing good relationships between all participants in the tutor-mentor programme is essential for forging strong communities of practice. All participants work together as a team in a holistic enterprise of like-minded individuals to help students overcome the hurdles that prevent them from achieving their potential. The fifth theme demonstrates that in order to accomplish this purpose, all participants need to be actively involved to make the intervention work efficiently and for it to be successful. Lastly, the question is asked as to whether participating in the programme was worthwhile. Did all participants benefit in some way? Was the intervention successful in reaching the desired outcomes? Did it add value to each person in the mathematics community of practice? The interlinking and overlapping circles represent themes that are not discrete but that inform each other. By interlinking and overlapping the themes that emerged from the data, increasingly broader levels of abstraction led upwards towards a fourth level of abstraction and pointed towards a situation-producing theory of tutor-mentorship at MSA.

Narrative description of the findings was used for this section so as to intertwine the stories that students, tutor-mentors and lecturers told in their responses to the various methods of qualitative data gathering. The photographs were an additional source of enrichment showing participants in action during tutor-mentoring encounters.

My purpose in including participants' experiences in the form of stories is to provide personal information that illustrates the problems encountered by FP students and the subsequent need for a tutor-mentor support programme. The accounts of participants' experiences are arranged in themes which often overlap and interrelate (see Figure 5.6).

5.3.2 The findings

The six themes are discussed under appropriate headings, and link directly to the interview schedule (Appendices C, D), the semi-structured questionnaire (Appendix F) and the purpose of the study.

5.3.2.1 Learning mathematics in a multicultural mosaic

The first theme deals with learning mathematics in a multicultural mosaic. The awareness of students, tutor-mentors and lecturers of the multicultural mix at MSA and their perceptions of the effects of this on teaching and learning mathematics in a multicultural milieu, are discussed.

As an international institution, multiculturalism is a fact of life at MSA. The African countries of South Africa, Botswana, Zimbabwe, Zambia, Kenya, Nigeria, Malawi and the Democratic Republic of the Congo are the most heavily represented, but students of other nationalities such as Turkey, India, China, Europe, Argentina, and interestingly from British Antarctic Territory, make for a multicultural mix that is both interesting and challenging.

According to a number of students, the geographical location of the institution is a factor in choosing to attend MSA. Jane[16] remarked: "It's very easy to get here [from Zimbabwe]. A lot of us take the bus. It's okay. The border is slow but it's okay. Sometimes my Dad does business in Johannesburg so he brings me and my friend or fetches us, sometimes both. It's better than flying." Brenda, a Zambian student, usually travels by air: "But it costs a lot so I only see my family like at Christmas. Yeah, that's not so nice." Students and tutor-mentors responses responded similarly when asked at focus group sessions and during informal interviews why they decided on MSA as their university of choice. Chifundo acted as spokesperson for the Botswana mathematics students and commented:

> *Even though we all travel together to Monash, we have to get to the National Stadium in Gaberone on our own. I live in Francistown. One student lives far away, like in Kule. That's near Angola. Yah! It's far to come but that's okay because we want to come to school* [Monash]. *Also, we get to know the other students before* [arriving at the university].

Alpheus, also from Botswana explained:

> *I need to get my degree so I can start working and support my younger brother so he can also come here. My parents couldn't afford to keep me at school for another two years so when I got the opportunity with the Government bursary I took it.*

[16] Jane: all names used in the thesis are pseudonyms to protect the privacy of the participants.

Gerapetse's reasons for electing to join the FP were slightly different.

> *I was interested in IT and I did very well in maths for O level, so the Government gave me a bursary to come here* [MSA]. *But my English wasn't so good so I didn't have enough points for first year, so I came to the ADP* [FP].

The students had similar stories to tell as to why they decided to register for the FP. Afew examples will suffice.

> *I got sponsorship from the Government to study IT and, uhm, I could skip two extra years of school. I, uhm, preferred to come to ADP than, uh, uh, stay and do A Levels at school* (Tshepo).
>
> *Yeah. Me too! But it's also near home, so I can go back home for weekends, uhm, and it's international. I like that I can study in Australia if I want to* (Kagiso).
>
> *I want to study at a [sic] international university so I can go work anywhere and get rich!* [Laughter]. *But I needed to do ADP first because my English is not so good* (Brian).

The Botswana students usually travel together *en masse*. Most of these students are sponsored by the Botswana government which organises their travelling and other details. However, arriving *en masse* by coach has some problems for the Botswana students as well as the university staff. Kefilwe, one of the tutor-mentors who is a residence committee member and from Botswana, explained:

> *The coaches arrive late at night there are not many staff members or tutors to help organise the students, direct them to the right residences and give them a meal for the first night as well as meals the next day. Sometimes it gets chaotic and students end up in the wrong room with strangers. They get cross with us because, well, maybe they're just tired but if the buses arrived earlier it would help.*

Stanford, from Zimbabwe, had different reasons for choosing to study through the FP at MSA:

> *I wanted to study information technology but I couldn't do this at home because I could only go to university in Zim if I did A Levels. I didn't want to spend another two years at school so I decided to come here. So I cut one year off my time and yeah, I got a bursary from my Mom's company, she works in the States, so the dollars means the fees here* [at MSA] *are small in comparison* (to what he would have to pay at home or in the USA).

A selection of comments from a few of the students and tutor-mentors provide insight into some of the problems confronted by new students at MSA as they encounter multiculraism and multilingualism in South Africa.

When asked how they felt about the cultural diversity at MSA, most students found the experience of meeting people of other cultures "interesting but I like it that we have our own group [Botswana]. Our language, Tswana, is the same as South Africa, so we don't have problems with getting around like some of the students, like, um, like students from DRC." Eric, from the Democratic Republic of the Congo (DRC), had a different story to tell:

> *I came from far. I had to take a bus and fly. I also had to stop, ah, what you say, change planes three times. Now I'm okay but first time I was scared. I was not knowing what to expect. Then when I came here* [to Monash] *my English, eish, it was not so good. So I try to talk English but it is difficult.*

A student who had arranged for transport on arrival at O.R. Tambo International airport was left stranded:

> *I didn't have any South African money and didn't know where to go to get some. I tried the restaurants and some shops at the airport but they refused to change traveller's cheques so I was really stuck. Then a lady gave me some money to phone Monash. I asked for her number, you know, so I could pay her back but she said not to worry. She said she had kids of her own and hoped if they were stuck somewhere someone would help them. That was a nice experience, a nice introduction to South Africa, hmm.*

There was laughter among the tutor-mentors in one of the focus groups when asked whether they preferred to socialise in English. Itai's reply was quite definite: "No. I would rather socialise in my own language". Joshua's remark: "When someone speaks in my language I immediately understand what he is saying" was followed by various other comments such as:

> *I don't care actually, but I would rather speak English in a crowd. It's more friendly; it's friendlier and more polite."*
>
> *When you first arrive it's nice to have someone from your own country, but eventually you meet up with people you're more comfortable with.*
>
> *We are two Gabonese but she is staying on campus but I prefer my Gabonese community because that's where I feel more comfortable. I can talk to them in Ibira, we eat the same kind of food so we take turns cooking and cleaning. They're mature actually, not like the students. Most of them have jobs and one guy is doing honours at another university, so I can work. I don't get interrupted all the time. I don't really want to move because here* [at MSA] *there is no one except for that one student; no Gabonese people here. Since I moved*

> *into the community with the other Gabonese I have to travel quite far to school but it's better for me.*

Gender and cultural practices were apparent in this last comment. Itai elaborated on the fact that he did not feel comfortable socialising with a woman student: "We Gabonese are quite traditional and anyway, I don't particularly like her. I mean, she's okay, she's a nice person but I don't want to socialise with her." Bhuti pointed out that he has "this problem because there is no other person who speaks the same language as me. Sometimes I'll speak Portuguese". Bhuti comes from an area of India where Portuguese is spoken as well as indigenous languages and as there is no one who speaks his home language at MSA. He "even speak[s] English to Ranier [who comes from Mumbai]". When asked if this did not make him feel very lonely, he replied "At times. I've always been lonely. That's why I end up speaking English." A number of tutor-mentors commented on the aspect of loneliness caused by having few or no compatriots with which to socialize. Others had no complaint because "there's no reason to feel lonely because there's just too many Zims and we mostly know each other from home" Kevin, a Zimbabwean, commented:

> *Sometimes I feel lonely. The people here don't know me as I am. My friends in Zim, they know me. When I'm at home with friends I grew up with, when I say something, they know what I mean. Here, the people in South Africa, you tell them, no, I don't want to go but they don't listen. When I don't want to go, I mean what I say but they don't understand. When I first came here, I felt totally as if I was alone. But now I'm okay. I've got friends.*

Tinei agreed with Kevin: "When I first came here I also felt totally as if I was alone." One of the more mature students when he arrived on campus, Tinei said that he had travelled quite extensively but all in West Africa. "In West Africa you feel like one. You feel as if you're in your native country, even if you're in a foreign country. Leaving that, um, region, coming to a different region, I felt really out of place. It was very nice when I found out that someone from West Africa was living in my apartment".

Many tutor-mentors were part of the first intake of the FP when national groups were still fairly small so it was more difficult for them to find fellow nationals among the students than for the more recent arrivals. Marco, from Mozambique, mentioned that he had to "write his own notes and ask questions, then go to Mrs N. to make sure I was right." Pearl, from Botswana, had "lots of people from my country in South Africa and on campus so I had no problem with fitting in socially". Asked what they do to make themselves feel comfortable at

Monash and in South Africa, Dean replied that because there were “lots of people from my country, walking up to the shops, greeting people in my own language; not really much of a change.” Many tutor-mentors and students agreed that “xenophobia was a big problem” and complained that “South Africans are unfriendly and taxi drivers and bus drivers are rude. They refuse to speak English” and this “makes getting around difficult”. Many students commented that “We feel uncomfortable and even scared sometimes when they [South Africans] speak in their own languages and like, ask questions like, ‘Why do you come here?’ ‘What do you want here?’”

The main issues related to the diversity of languages and having to communicate in English (Maitland & Manson 2006). This initially seemed more a social than an academic problem. However, many of the comments relating to the diversity of languages were made by tutor-mentors, most of whom had been at MSA for at least two years and some as long as four years, so their level of basic interpersonal communicative skills (BICS) as distinct from cognitive academic language proficiency (CALP) (Cummins 2000) was well developed. Moreover, they had matured emotionally and socially over time. Most FP students, though, were still adjusting and although they may have had an adequate level of BICS, their CALP development was still far from adequate (informal interviews with lecturers).

As a rule, FP students live in university residences or townhouse complexes owned or rented by the university. Although in theory social mixing with students of other cultures did not appear problematic for most students, actual experiences were sometimes “difficult, 'specially when you share apartments.” “It’s okay,” commented Vimbai “but it can be, well, not very pleasant. Some people cook weird things that um, smell, um, well, not nice, a bit, um, strong, you know.” Portia’s opinion was more emphatic. “Yeah, it’s okay [to live with people of other cultures] but they must realise they need to respect our culture too and yeah, Vimbai’s right, like, like weird cooking smells, like sheep’s head. Eish! You have to get out.” Vimbai commented that “traditional clothes are really interesting. Um, the res. cultural evening was a nice experience. The students and the staff and even some of the lecturers wore traditional clothes and we ate some other [traditional] food. We enjoyed that. It was um, that was interesting and fun.” This revealed a particularly feminine perspective on the meaning of multiculturalism for many female students. However, when these opinions are juxtaposed against earlier comments about differences in cuisine and styles of cooking, conflicting feelings about the reality of living daily with cross-cultural encounters become evident.

According to John, there appeared to be a difference of opinion among students as to what constituted inconsiderate behaviour and this "seems different for people from different countries. Respecting other people like keeping down [noise], 'specially when we're trying to work. Eish! You ask them to tone it down and they usually oblige, for like a few minutes, then it goes up again. I moved out." Marcus was more outspoken and became quite agitated at "the mess students leave the place in. There are bins all over the place but eish, they just throw stuff down, like cigarette butts, [sweet] papers, yeah, and it's a mess. Even the library, there's a rule that they can't eat in the library but they don't care. They eat over the keyboards and throw stuff on the floor and nobody stops them. Yeah, I don't know if they're like this at home. It, it really freaks me out. They've got no respect." When asked who 'they' were he named a number of students and their countries but was quick to add that he was "not saying they were the only ones, just the ones I've seen." I have observed this myself when in the library and generally around campus. When students are asked why they eat in the library they say "it's because we only have a certain time on the computers then we get automatically logged off and locked out so we have to eat and work at the same time." When asked about littering there was an almost universal reply: "we're giving the cleaners a job." There was quite a lot of conflict between students who enjoyed a quiet, clean environment and those who were unconcerned about this. Eric complained that

> *I have to clean the keyboard before I can work on the computer; and pick up stuff like cans and sweet papers lying around. It's impossible to work on a keyboard that's sticky and dirty. So I lose a lot of my time on the computer because I have to clean it first. My Dad bought me a laptop. Now I can go work in my room or somewhere quiet.*

This problem was reiterated by many students who were irritated by the situation and wondered "why they [the library staff] don't do something about it. It affects our work."

It seemed from these comments that the practicalities of living together, whether with students from their own countries or with those from other nationalities, appeared stressful for some students and supported the findings of Lucas et al (2006). Evidently, despite the assurances of "being happy to meet other people and live in res" some students found their ability to cope with the reality of living in constant close contact with other students problematic.

Other students, however, found the situation quite congenial and used the experiences of living in a multicultural environment as an opportunity for learning. A number of students

commented that they actually enjoyed meeting people of different cultures and traditions who held different world views to that of their own. Thabo, with a number of interjections from his three room-mates, remarked that,

> *You learn a lot from being with other people. It's interesting to see how people are different. But I'm lucky. I share [an apartment] with students I know from home. Actually we were at boarding school together, so it's easy for me. But yeah, I like to see what they [students from other cultures] do. Sometimes it's funny; no, not really funny, more like sad, actually, where they come from, uh, from like, like Somalia. You get to see what some of them have to live like, you know, like running from cattle raiders and stuff. I think I've learnt a lot from this [experience]. Yeah. Sometimes when they're quiet in class, when we work in groups, then we need to talk, and some of them, they don't say anything; you get frustrated but if you remember where they're from you get to understand their problem.*

Marco, a tutor-mentor had no problem with multiculturalism as "some of my family are Christian and some are Moslem and we all get on well. I like learning about other people and I suppose I'm quite accepting when people are different."

However, the common practice amongst foreign students of comparing South African customs with their own sometimes led to frustration and was part of the 'culture shock' experienced by new students that Rhinestone (1986) talks about. Thus, while for most students the idea of multiculturalism sounded good, even advantageous in theory, the reality of the experiences encountered by some caused apprehension and a lack of confidence in their ability to interact socially with people of other cultures. Since cross-cultural adaptability is essential for social interaction in a multicultural society, students who were unable to adapt quickly encountered problems with assimilation and accommodation which resulted in psychosocial and cognitive difficulties. It appeared that not only did students' social experiences and their ways of dealing with these experiences differ, but similar experiences affected students in different ways. What upset or worried some students were of no concern to others, showing how personal their reactions were to similar experiences and the different coping mechanisms students used to deal with them. Thus while many students were unaffected, a number of students, confronted by cultural experiences considered too radical and outside of their own value systems, experienced culture shock which affected their academic studies to a greater or lesser degree. Anita found the cultural adjustment very difficult.

> *I'm a Christian, Ma'am, and my family is quite conservative. I feel very uncomfortable when students are swearing and drunk around me. I keep to myself a lot but then people think I'm*

> *unsociable. I'm not. I don't like to go to parties because of drinking and drugs and, and other stuff that goes on, so I only have a few friends. When I first came to the ADP, sometimes I couldn't concentrate on my work because I worried about what they are thinking about me. My marks were quite bad at the beginning because I was unhappy and not concentrating but now I have got Christian friends and we formed our own study group so my marks have improved quite a lot now.*

These possible sources of cultural conflict slowed the period of emotional and social adjustment for some students, adversely affecting their academic studies. Rinesmith's (1986) observation that no matter how well prepared foreign students are before leaving home, their experiences may not match their expectations, was especially true for many FP students who had to relearn simple, everyday practices such as choices of food, the correct proprieties of conducting inter-gender relationships and what was considered acceptable language so as to fit comfortably into the university community.

However, a study done by Walton (2007) at MSA on how undergraduate IT students adapted and coped with intercultural experiences seemed to parallel the experiences of Itai and Marco who had "no problems living on a multicultural campus. Maybe (because) we were older when we came to the ADP; although we both moved out when we went into first year, we could cope better." The only real issue these tutor-mentors had as FP students was their lack of proficiency in English which, according to Marco, they considered the "biggest problem for us because it affected our maths." From numerous conversations with lecturers, tutor-mentors and students it seemed that many of the problems encountered by students on and off campus related to their lack of proficiency in English which was considered one of the major hurdles to improvement in mathematics.

5.3.2.2 Hurdles to success

The second theme exemplifies the obstacles that cause complications in the lives of the students and which can become a barrier to optimum learning.

Apart from the normal challenges of university life with which Foundation students are confronted, other challenges increased stress in many students, especially during the first few weeks. Ngoni mentioned feeling uncertain about how South Africans would accept him.

> *Zambians don't have problems with other people, maybe because we don't have that many foreigners, but we read a lot about xenophobia in our newspapers at home. I wasn't so worried about the campus because students tend to accept each other I think ,but, um, I admit I was quite scared of getting around like the shops, town, yeah.*

When asked how these feelings affected him personally, he appeared to be more concerned about off-campus issues such as

> *using taxis to get to the mall [and] walking to the shop to buy groceries. It does bother me and yeah, it does sometimes affect me personally, like if I have to go to the bank, then I think, maybe someone will rob me. Yeah, that worries me. Then I don't concentrate* [on his studies] *because I'm worried.*

One of the 'hurdles' raised by many students and the tutor-mentors was that of learning to cope with living in a big city as opposed to a small town or village. Itai enlarged on his previous remarks about language and the problem of travelling from his place of residence to MSA.

> *Getting around is difficult and expensive, also the taxi drivers! I can't speak any local language. I come from Gabon and we speak French and Ibira. The drivers are rude. They won't speak English even when they hear your accent. Then they don't go straight to Peter Road* [where MSA is situated] *they go their own route so sometimes it makes you late for class, umm, and when you first come you don't know the sign language, you know, with your finger. So you can't get around much. I still use taxis but I leave very early so I can be on time and if I'm early I go work somewhere quiet.Fortunately when I first came* [to MSA] *one of the tutor-mentors told me about the taxi system and what signs to use.*

Many students found experiences such as this quite daunting and stressful but were adamant that "having someone of my own age to ask about stuff like transport" was very supportive and "helped relieve my stress." It seems, therefore, that the availability of a knowledgable and experienced peer, who was able to guide, direct and support them, was important for the students' psychosocial welfare. Psychosocial discomfort sometimes had unfortunate academic consequences as evident from Pindile's account of her experience. She commented on how the unreliability of transport affected her emotionally and academically.

> *The* [MSA} *bus is always late and I was always late. I started getting bad headaches and I couldn't sleep, and I couldn't concentrate in class. Not sleeping made everything worse because not sleeping made my headaches worse. I didn't know what to do so I asked Portia [a tutor-mentor] and she told me who to go see about transport. It was nice having someone my own age to ask about things.*

Her experience was echoed by a number of students who mentioned various other stressers such as loneliness which caused emotional and social problems and prevented them from functioning academically but that having someone of or near their own age helped them through the settling-in period as exemplified by the following remark.

> *The* [FP] *mentor was great. I was very lonely 'cause I didn't know anyone and I'm quite shy. I couldn't work 'cause I was too homesick and I cried a lot. She was in ADP last year and she said she was also homesick so she knew what it was like. She helped me a lot.*

An inability to cope with stressers sometimes prolonged the adjustment period as seen by the following comment. "It seemed like I was having one problem and then another problem came. It never seemed to end. It was almost the whole semester before I felt like I knew what I was doing." An inability to form friendships and establish relationships also affected the formation of an MSA and FP identity which resulted in psychosocial and learning problems for a number of students. Toko, a tutor-mentor, remarked:

> *It was very difficult to know something. I didn't know anyone and I couldn't understand the girls in my apartment. They were all talking their own language. I felt very lonely and very homesick. You remember Ma'am? It took quite long to find someone, to get a friend. Class was okay but everyone seemed, you know, to know what's going on except me. It was difficult. I didn't do well in my classes the first weeks. Afterwards* [when she had made friends] *it was better, then I could work. I wish we had tutors like the students have now. We look after the new students, um. I think that's one reason why I wanted to be a tutor. Even then, sometimes even in the second semester they still come ask us about things.*

Perceptions about the high level of violent crime in South Africa (Gilbert 1996; Hoffman & McKendrick 1990) appeared to have been reinforced in some students through unfortunate experiences that affected them as students and became hurdles to learning that were difficult to overcome. Ranier and Adarsh from India were accosted by a group of young men on their way home from the supermarket when Ranier had his wallet and groceries stolen. Adarsh and Ranier spent quite some time in my office going over the events and its affect on them emotionally and academically.

> *I didn't see them coming, Ma'am but Adarsh did. He just dropped the shopping and ran. He didn't say anything he just took off. I didn't know what was happening until the one guy grabbed my shopping and pointed a gun at me. I gave him everything, everything. I shouted to Adarsh to run but he was already running. I'm so stressed out, Ma'am. I can't sleep. I wake up all the time thinking someone's breaking in. I can't do my work. I want to go home. It's no good here.*

Adarsh also felt vulnerable although not

> *so bad as Ranier. I got away; I saw them coming but he was caught but I still, I worry all the time when we go to school and to the supermarket. We have to walk, Ma'am, and sometimes we finish school late and it's dark, like in winter. Sometimes I, I'm thinking about them* [the criminals] *instead of working.*

Ranier was most badly affected by the robbery and it took quite a long time and a great deal of counselling before he felt able to cope once more. Ishmael, a Nigerian was

> *not concerned about crime until I was caught in the cross-fire, there by the garage, when they robbed the garage. Now I walk on the other side of the road. It did affect my work for a while but I thought, well, it can happen anywhere. I go run on my own. I like the exercise but I've started a running club so we go out in groups and we feel safe but I also go out on my own. It's nice to be alone to think sometimes.*

Stressers such as these examples experienced by students and tutor-mentors are emotional handicaps which often affect learning. All participants in the study were aware of the effect of stress on the emotional and social wellbeing of students. It appeared, however, that the older, more experienced students had learned to cope with many of the stressors and knew how to avoid circumstances which brought them into contact with situations that could cause stress. Most FP students did not have the experience and perhaps the maturity to cope with and avoid stressful events and seemed more vulnerable. Many students came from countries where there was civil unrest or even war but they seemed to find the violence of criminal activities in South Africa more unnerving. Ishmael, one of the first students to undergo tutor-mentor training, had been in the Nigerian army and had been involved in military skirmishes.

> *I came to South Africa to get away from the situation and now I live with the possibility of being involved in some criminal thing everyday. But like I said, you learn to make decisions. Avoid places. It is stressful though, so like I said, I run* [go jogging] *to relieve stress.*

Ishmael was aged about 25 when he arrived at MSA and had a level of maturity unusual for FP students. This together with his military background gave him an ability to cope with stress and he was able to use this knowledge productively when tutor-mentoring the younger students. One of the things he had to learn as a tutor-mentor, however, was how to be less militaristic and more approachable in the classroom. Joseph's comment that "he treats us like soldiers and orders us around like we're on the parade ground" was a lesson well learned, and

Ishmael shared this learning experience with the other tutor-mentors at one of the tutor-mentor workshops.

> *I realised that students couldn't really learn from me if they couldn't feel free to ask questions and make suggestions, so I changed my tactics. I had to learn. I had to learn how to develop good relationships with the students. It was hard for me because my father is a general so I've always had that kind of experience: at home and at school and in the army. When I first came to Monash, to the ADP, Mrs L helped me a lot to catch up because I was very late and Mrs I said I would have to work hard but she trusted me. That was something I had to learn to do with the students. Develop good relationships I mean.*

Students and tutor-mentors comments were sometimes based, not on their own experiences but on observations or events they had heard about and which gave them cause for concern. It appeared that many of the male and a number of the female students became involved with 'partying' which involved heavy drinking and drugs. It appeared that 'partying' also took place on campus and even during the day.

Figure 5.7 is a photograph that was taken during one of my observations of students' behaviour on campus. The blatant openness of this particular behaviour was quite startling as was its acceptance by students and staff. It is apparent that people are unaware of the dangers of this growing habit as one of the lecturers remarked: "What's wrong with it? They just add essence to make it smell nice. It can't do them any harm. My son has one at home."

Figure 5.7: A group of students smoking a hookah

Figure 5.7 shows a group of students one of whom is smoking a hookah or water pipe (also known by many other names such as hubble bubble) during a break between classes. Students deny that there are drugs of any nature in the hookah but it is "well known that many students," according to Gabo "add dagga (marijuana) or tobacco to the water in the pipe" (*Science Daily* Dec. 3. 2009 Adapted from materials provided by Virginia Commonwealth University). Gabo, a residence committee member and tutor-mentor, was most concerned at the number of the FP students who were involved in activities that were detrimental not only to their own health and studies but affected the wellbeing of other students.

> *We try to explain the dangers to them, but they won't listen. They are not supposed to bring alcohol on the campus but they sneak it in with their groceries. Or they get their visitors to bring it for them. It's the same with drugs. But they go buy drugs. It's easy. They get them down the road at the taxi rank or they go to the shopping malls and even on campus, or they get them at parties. Then they scream and fool about, annoying the other students who are trying to study. It used to be only a few but now it's getting worse.*

Alcohol consumption and drug abuse has apparently become quite a problem and difficult to control as the students are expected to act responsibly without much supervision. My personal observation was that a very large number of students smoked cigarettes and from the smell of it, marijuana as well. When approached about this, Catherine remarked that she had "only started smoking cigarettes since coming to the ADP. But I don't do other drugs Ma'am. My parents will kill me if they find out but it's cool and anyway, all my friends do." This might seem irrelevant to learning but lecturers complained about the number of students slipping out of lectures and tutorials to "go have a smoke and then don't come back."

Students, tutor-mentors and lecturers commented on the consequences of lack of sleep on students' concentration during lectures and tutorial classes, and had different reasons as to why this happened. Students complained about the "huge amount of work" and having "too many assignments and tests." Tutor-mentors were sympathetic but emphasised that "this is the reality of being a university student. This is what is expected and they have to learn to manage their time. They want to party then they don't come to class on Monday. Then they expect us to help them when they should've been in class" Lecturers were unsympathetic and saw students "sleeping in class and asking for extensions" as "laziness and a bad attitude." One of the students remarked on the "moodiness of my friend" while another talked about "not being able to concentrate because I'm too tired." When asked about their diet many students and tutor-mentors confessed to "snacking on unhealthy foods like chips." It did appear that this

was more of a problem to the male than the female students who were used to helping with household chores at home. Charles' comment was, however, typical of many of the students: "I'm not used to cooking for myself. My Mom does that kind of stuff. I usually buy food from the Bistro but it, umm, gets a bit expensive, so at the end of the month I umm just have bread and cereal and stuff. Fruit and vegetables" in answer to a question, "no, not really, well maybe a banana like you said Ma'am, and yeah, and peanut butter." (I think this was said to please me rather than the truth). An unbalanced diet would have effects such as poor concentration and tiredness all of which probably led to issues such as sleeping during class. Lecturers, though often unaware of the causes, saw the consequences: "students fall asleep in class; fail to hand in assignments, did not do homework and are unprepared for tutorials." Lecturers also noted that "many of the students started missing early classes and in time (referring to the previous year) one or two dropped out altogether."

The necessity of having on-going support that would be available throughout the year and not only during the orientation period was considered essential by most participants. Fiona explained:

> *Sometimes problems only come later. Anyway, they* [MSA staff] *tell you so much at orientation and in the first lecture and you don't remember everything. Some of the stuff I needed to know was like much later in the year and I could go to the tutor and ask her. I didn't know that at the beginning. I got quite worried when I didn't remember everything. It's too much and everything's new. You can't remember everything.*

One of the issues students spoke about was not having tutor-mentors available right from the beginning of the year. "It was nice when the tutors started coming to class and we knew who they were. They should be there at the first class." As tutor-mentors are also students and have to sort out their own timetables before arranging with the FP lecturers when they would be available to attend tutorials, this is not an easy problem to solve.

a) Language proficiency and its effect on learning mathematics

Of all the obstacles that worried and caused anxiety in many students, lack of proficiency in English, the LoLT at MSA, appeared to cause the most concern. In order to demonstrate the problem, the level of English language proficiency (or lack thereof), I have deliberately written the participants' experiences verbatim. Second to this was the inability of most of the

students and tutor-mentors to speak a local South African language. The Botswana students did not have a problem because they speak Tswana and sound like South African Tswana speakers, whereas the Ndebele speakers from Zimbabwe had noticeably different accents from South African Ndebele speakers. When asked the reason why the lack of English proficiency was a cause for anxiety, answers included:

> *It affects everything; like getting around Jo'burg. Yes, and using taxis, and, um, explaining to some shop assistants, like they pretend they don't understand us, or yeah, because we're black, they start talking a local language and when we say we don't understand they even get abusive. Yeah, and rude.*

They were asked how they responded in those kinds of situations.

> *Well, most times we ignore them, if we can. Um, but sometimes I get mad and tell them they're being rude; then I walk away and go to someone else or to another shop. It's not so bad anymore though. They seem to have got used to the Monash students, especially here in Ruimsig, but if you go to the city, then, eish, you have to watch out.*

Students were obviously upset about these confrontations and put these kinds of remarks down to disrespect for anyone who was different. When I asked about the effect on their studies, most of them shrugged it off, with Mandla saying "it's only really off campus you know, so we don't really have a problem on campus. Everyone is tolerant, well, about language and accents. Some things, eish, well that we try to sort out with the res. committee but they kind of don't do anything. Maybe they try but these people don't listen. Studies, ah" [looked around at the group for other opinions]. Juno spoke up amidst a chorus of replies. "Sometimes, if you felt threatened, like in a taxi or walking, then, yeah, it makes you nervous and takes away concentration for a while but then, you feel quite safe on the campus, so you can forget it and do whatever you need to do." Phindai's reply was slightly different. "I don't let that kind of thing affect me. I've come here to get a degree and I need to work, so I just forget it but I, I think some people can't, that's when you need someone, someone who knows what's going on, knows what to do." Juno commented: "It doesn't make a difference for me, not with maths ′cause with maths you can get involved, you can't think about anything else, just the question, so actually, if I'm worried or anything, I go do some maths." The students found this remark very amusing as Juno was known for his infatuation with mathematics and for this reason did not find his comment applicable to them as a group. One of the students remarked: "most of us, we can't do that. Juno, he's not like most of us you know Ma'am."

Many students had no issues with English as the LoLT, mainly because they had grown up speaking English. Kyle, from Zimbabwe, had attended school in Plumtree:

> *We were taught in English from nursery school. We speak English at home. Actually all my friends do as well and we speak English to each other at home and here at school. I speak Tswana and Ndebele because Plumtree is near Botswana and Bulawayo [in answer to a question] and so do my friends but I'm actually more comfortable speaking English.*

Tendai and Felicia from Zimbabwe also commented that English was their first language (L1) as well as their LoLT "so we have no difficulties with communication. Most students have to talk to each other in English in any case, otherwise we can't understand each other but if we don't want anyone to know what we're talking about, we talk Shona but that's not often." Iris commented, "My Mom works in London and I've got a British passport. I used to go stay with her every Christmas, but now I can't get a visa so I stay here and work in the holidays. But I'm used to mixing with people of different cultures so it doesn't worry me." Felicia observed that "it's not actually getting used to other cultures and languages that's a problem. Actually, the worst thing is trying to understand some of the lecturers and students. Some of them have heavy accents and they're very hard to follow." For other students, however, speaking and writing in English was an issue because it had not been the LoLT in their home schools. Neither Marco nor Itai, two of the tutor-mentors, had a problem with multiculturalism on the campus but both had struggled with English when they first came to Monash. Marco, from Mozambique,

> *spoke Portuguese in school and at home. I can speak other* [Mozambique] *languages but not English, then. I'm okay now, but not at the beginning. When I first came to the ADP I really struggled and went to Miss C.* (at the MSA Centre for Learning and Teaching) *but actually I got the most help from the tutors and Mrs N. I'm comfortable with other cultures even if I can't speak their language. I think you just have to persevere with English if you don't know it well because it affects your studies.*

He and Itai had been accepted into the FP on the basis of their excellent mathematics scores although their English scores were actually below the minimum entry level requirement. They were given conditional registration which was a further stress factor. According to Itai,

> *having no English was a big problem for us in the ADP. It caused a lot of stress because we wanted to do well but the English pulled us down; even our maths, because sometimes we couldn't understand the question. Working with someone else* [Marco] *was good because we could help each other but only in English.*

Students appeared to have more difficulty with language than with cultural issues. The multiplicity of languages on campus was especially problematic for students who found social communication in a foreign language difficult and even more difficult when it came to communicating in subject specific language. Marco's reluctance to try and explain his solution to a mathematics problem to the class in English was expressed by other students, even by those for whom English was their L1. "I only started speaking English when I came to the ADP. Then Mrs N., she says 'Marco, please explain how to do this.' "I couldn't talk. Please, can I write on the board?" 'No, no, you must talk.' "It was horrible actually!" Thus, although communicating in English on a social level was not really problematic for most students, a lack of proficiency in reading and writing academic English and understanding and explaining concepts using subject-specific language was a problem for many students. However, it seemed that the problem was not so great for some of the mathematics students who commented that "we mostly speak English, even when we're explaining to each other, because other languages don't have the specific maths terms, anyway, no problem in maths because terms, formulas are the same in any language." However, others, like Itai, Marco, and Joshua had different stories. Itai commented that he "would rather speak French. We learn in French for 12 years and French has maths language. So, so things are easier to explain in a home language." Marco agreed: "Yes, Portuguese too. I also did my schooling for 14 years actually, in Portuguese. We only spoke English in class at school so you don't get to practice." Joshua agreed with these comments: "Um, we do speak English quite a lot in Nigeria but not so much, I speak Ibo at home and with my friends, so I'm more comfortable [speaking Ibo]. It's easier to express oneself in your home language."

The students made a range of statements such as "explaining and socialising is easier in home languages for the 'aha' feeling", "I resort to speaking Tswana because it comes easier off the tongue", "I say something in English but with a Shona accent", "we speak 'Shonglish' [a mixture of English and Shona] when speaking with Zim friends", "socialising is better in your home language to 'feel' what the expression means. It's our roots", "it's friendlier to speak English so everyone understands", "speaking English makes you feel part of the group", it's more polite to speak English in a group where people have different languages". Many similar comments revealed a somewhat mixed reaction to the question of socialising and learning in English.

While learning mathematics, and other subjects, in a multicultural mosaic was often frustrating for the students, teaching classes of multicultural students was equally challenging for the lecturers and often for the tutor-mentors, especially when English as the LoLT was not the students' or the tutor-mentors' home language and neither knew the other's home language. Gabo, a tutor-mentor, mentioned how difficult it was "to find the right words when you try to explain to someone from, say Angola, and you can only communicate in English." Lecturers said how difficult it was to teach students who were not proficient in English because "You don't really know if they're following you. They say 'yes, they understand' but then you don't know if they're just being polite, at least at the beginning, until they've written a test and you see the marks." Eric, a tutor-mentor, agreed with this, and commented on the difficulty of "explaining maths to someone when, well, I can only talk English to him and he, he's not good at English so it was difficult to explain and I can't talk his language so we struggle a bit". Both tutor-mentors and students commented on the difficulties they had experienced in following and understanding certain of their peers and lecturers. Comments from tutor-mentors such as that from Kedi explained more of the difficulties of teaching L2 students. "Some of the students, they have funny accents, when they answer a question you can't understand what they're saying. It's a waste of time when you don't understand the person and you have to ask them over again and then you still don't understand. I get frustrated sometimes but you have to be patient." One of the lecturers commented how "some of the students talk so softly you can't hear what they're saying which is irritating as you have to keep asking them to repeat themselves or speak up. I find this a waste of valuable teaching time and it does make me impatient." Candace, a student, complained that "he [the lecturer] talks too fast then I lose track of what he's explaining and he gets cross if we interrupt him. Now I just write down my question and ask the tutor afterwards to explain." These comments reveal not only the frustrations felt by the students, tutor-mentors, and lecturers but also the effect these kinds of problems have on teaching and learning.

Lack of proficiency in English of a group of mathematically competent students from Angola was especially problematic for the lecturer who taught them. These students were given coaching to improve their speaking and writing skills, but their English language skills remained very poor. Their mathematics was competent but they struggled with understanding what was required to solve the problem.

> *Their English is terrible. I sit for hours explaining to them. They are very nice boys, very polite, and really want to learn the maths but I can't stop during class to explain; the other*

> *students get very restless; they want to get on and I can't blame them. I try to teach them on their own after class but I can't just wait around for them. I have to get home … I've got other students who also need to consult. Fortunately Marco helps them. He's not one of my tutors but he helps. The Angolan students can do their maths very well when they understand what to do but if they can't understand the question, then they just sit. I've seen them with a dictionary but that doesn't really help their maths.*

In light of this conversation with the lecturer, I approached the English lecturer who also taught these particular students and she threw up her hands in despair.

> *They'll never pass. They simply cannot cope. Actually, I don't think it's fair to accept students like this. We should test them before accepting them. An acceptable level of English for students in Angola, and I suppose other non-English speaking countries, is probably much lower, so we can't just take them without testing them first.*

From these conversations and observations, it was evident that learning mathematics in English L2 complicated an already difficult subject even further for students, tutor-mentors and lecturers. Mathematics has its own universal symbolic language which is universal, and is therefore understood by everyone, so for many L2 students setting out a solution was often not a problem but understanding what the question required often was. In light of this, developing students' proficiency in English can be seen as a key factor and a possible solution to improving mathematical performance. However, when asked how they felt about this as an option, students, although agreeing that "it's a good idea" remarked that "it would be too expensive for us. We only get money for a year in ADP. Then we have to go do first year. The bursary is only one year." Thus, while the suggestion seemed an acceptable solution, the number of students who could take advantage of an extra semester to concentrate on improving their proficiency in English would probably be too small to warrant the expense of employing a specialist lecturer. Considering these financial constraints, such a solution was not feasible at the time. The problem of helping EAL students who are ill-equipped to study at a university where English is the LoLT remained, and because it was not possible to allocate time purely for developing proficiency in English, having tutor-mentors who spoke the same home languages as the EAL students as exemplified by the mathematics lecturer's comment, was most beneficial.

The view of an English lecturer was corroborated by the findings of the Alternative Admissions Tests (AARP 2009) pilot study that was administered by UCT for MSA (www.aarp.uct.ac.za Accessed 2010/01/06). The test scores of a sample of FP mathematics

students showed that the majority of students performed below 60% for the mathematics comprehension test (37% raw score) and the reasoning test (54% raw score). In view of the problem that many EAL students have of learning mathematics in English, it is quite informative to read the report on tests carried out on the sample of FP students in 2009. According to the report, students who wrote the test who score between approximately 45% and 60% may struggle to cope with the demands of abstract mathematical thinking, but ought to benefit from some form of extended or augmented academic provision. Writers who score below approximately 35% to 45% raw score on this test are in need of substantial academic support if they are to cope successfully with the demands of abstract mathematical thinking and comprehension. In courses where abstract mathematical thinking is a requirement, either at first year level or further up the curriculum, such students will need to be strongly supported if they are to cope with these demands. The two tests appear to be generating complementary sets of information about writers' ability to cope with abstract mathematical thinking and their ability to cope with quantitative and qualitative logical reasoning.

In light of this, the following should be noted. During my observation of the tutorial classes, all the lecturers whose classes I attended spoke quite fast and often used vocabulary beyond the level of understanding of many of the students. When asked why they spoke so quickly, they replied that "there is just too much to get through." Although the lecturers stopped often to ask whether students understood, there was a distinct lack of response from the students in the tutorial classes. It seemed that many students were reticent to express their lack of understanding, possibly because of their cultural background or the pedagogy used in their previous schools where active, verbal participation was not encouraged. It is very likely however, that learning mathematics as an English L2 student put limitations on their ability to follow and understand the explanation, especially when the concept was difficult or the solution complex and the lecturer was speaking quickly. It seemed that students did not have enough time to digest each step before progressing to the next and were not given time to practise newly learned concepts during the tutorials but had to complete the exercises for homework. As Mandla said,

> *Sometimes I don't understand the lecturer; she talks fast and she's usually in a hurry so we don't get to do some examples; we just copy what she does from the board. Then we have to do homework in our own time and go for consultation if we don't understand. The tutors help a lot when the lecturer's not around, yeah, and it's, umm, easier to find a tutor or someone you know who's good at maths, yeah, and they also talk so we understand you know, like, make sure I know what he's saying. Lecturers, umm, usually aren't around when*

you need them anyway. Or they rush you because they need to go to class or go home so you still don't understand.

Clear communication is essential for learning and the lack thereof may shed light on why EAL students have more difficulty learning mathematics in English as the LoLT than is perhaps necessary. As seen from Mandla's experience, EAL students lack of proficiency in English may cause difficulties in following and keeping up with a lecturer and may explain why many of the underachievers in the FP are EAL students I suggest that if lecturers spoke more slowly and distinctly, and if more time was allowed for assimilation, perhaps students would find it easier to grasp and understand the concept being taught. This view is supported by Ovando's (2000) finding that students who learn through EAL are more likely to underachieve than L1 students.

b) Forming identity in a multicultural mosaic

It was evident that some students found working in multicultural groups difficult. If the lecturer allowed the students to form their own groups, it was interesting to see how the groups were made up; for example, how many multicultural groups there were compared to monocultural groups; who of the students chose to be in a single-gender group and who chose to form mixed-gender groups. One of the groups consisting entirely of Botswana females was asked why they had chosen to work together. Golang remarked, "We like working together because we're friends and also we discuss in our language and that helps". While many students seemed to choose group members based on friendships or because they were of the same nationality, it was interesting to note that this particular group consisted of girls with a similar religious background who go to church together. This gives substance to Tajifel's (in Alred et al 2003) assertion that students need to feel accepted by and be part of a group so that they feel secure in their own cultural identity. However, holding too tightly to the cultural mores and values of a particular worldview may prevent students from reaching outside of their own life experiences and partaking of the multicultural experience. As a result, they may feel ostracised from the university and/or the FP community, thus preventing the development of a new social identity and leading to feelings of insecurity which in turn may give rise to psychosocial and academic dysfunction.

While having a strong cultural, social and/or religious group identity or in some instances all three may be a reason why some students take a long time to settle into the university

environment, it is not the only reason and does not affect all students in the same way. Some students need the security of their cultural, social and/or religious identity in order to function optimally. Many African and Asian students come from profoundly traditional and religious backgrounds, where family bonds are very strong, and where respect for authority and the older generation is firmly instilled (Block 2007; Boyle 2009). It is often these students who feel a need to hold on to the security of their ethos and religious worldview in order to function optimally (Block 2007; Boyle 2009). Rashid, a Pakistani student, was adamant that he "needed the support of other Moslem students, even although they're not from Pakistan, but they understand why I do certain things, like pray and fast, and why I don't drink alcohol. This makes me relaxed so I can work." However, no matter what the students' personal beliefs are, it is evident that for them to be successful in a multicultural environment the needs of individuals as well as the group must be considered. To encourage this outcome, individuals need to be nurtured and programmes structured so that independent learning is realized. In this way, the group and the community benefit.

A number of students elected to group themselves with students of a similar mathematical ability. According to the students, tutor-mentors and lecturers this was a common practice and was especially true of either very strong or very weak students. I noticed that the lecturers sometimes deliberately formed groups of stronger and weaker students. Lecturers pointed out that they often did this on purpose so "that the stronger students help the weaker ones." There appeared to be some resistance to this method by students and tutor-mentors for the following reasons. According to the mathematically stronger students, they did not like this because "it's irritating. I have to wait for them and I want to get finished and they slow me down." The weaker students seemed intimidated by the stronger students, "not because we don't like them but they're so good at maths and I feel stupid when I can't answer questions or discuss. I can see she is cross and this makes me even worse. Then I can't think and I don't want to ask because I look stupid, so I just keep quiet." As far as lecturers were concerned, because students either said they understood or said nothing, they carried on with the explanation, thinking the students understood when in fact they had not. In one of the lessons, I could see that many students were struggling to understand a particular concept. This particular lecturer observed the lack of understanding of the students, and after trying a number of times to clarify the explanation, turned almost in exasperation to ask one of the tutor-mentors, Portia, to explain. There was an almost tangible sigh of relief from the class (which was in itself quite amusing as everyone including the lecturer laughed) but also very telling because the tutor-

mentor spoke in English. However, her explanation was easy to follow because she used simple language and spoke slowly stopping now and again to ask or answer a question. The students were not hesitant to stop her and ask her to explain again when they did not understand whereas they seemed uncomfortable doing that with the lecturer. During the time when students were working on their own or in pairs, the tutor-mentors and the lecturer walked around the class helping individual students. Portia later explained to me during the focus-group interviews that because she had experienced similar problems in her Foundation year she understood the difficulty students had with stopping a lecturer or saying they did not understand "even when the lecturer is approachable and nice." Kabo, one of the students, was quite candid: "It is difficult to understand sometimes because the teachers, they talk so fast and I don't feel free to interrupt when she is explaining. Then we have to hurry to another class. I like to go to my tutor because, umm, she speaks my language and I can ask her and, umm, she explains in my language so I, uh, know, uh, understand better. I'm more comfortable with her; she identitfies with my problem" Bheki made a similar comment:

> *Mr A is very nice but he uses words we don't understand and he has an accent, so then, and then we can't, you know, follow, so we, uh, have to wait for after class and then we forget what we didn't understand. So it's nice to have the tutors there. They can explain in words we understand and sometimes even use my own language. They're near our age; we can relate; it's like speaking the same language even when it's English.*

My impression during the classroom interchanges was that the language expectations of the lecturers were often beyond the language level of the students. Furthermore, the use of culturally specific language and examples by the lecturers were outside the socio-cultural understanding of some of the students. Thus, because the process of learning and development is situated in a socio-cultural environment, the mathematics students and classroom, although the lecturers were making every attempt to explain certain mathematical concepts, their efforts were not always successful. Firstly, the students were not sufficiently proficient in English and secondly the students were not in the same learning culture as their lecturers or peers and so could not interact socially or cognitively at the level of the lecturers' expectations. According to Tshepo (a tutor-mentor):

> *Sometimes students misunderstand the lecturer and the lecturer doesn't realise this. He uses words that the students think they understand but it's not that at all; the lecturer means something else. Even we* [tutor-mentors] *get confused sometimes and then when we help students they say 'oh no, so and so* [the lecturer] *explained like this' and you have to say no, no, it's like this. Then we have to go to the lecturer and ask them to explain to us and the students again because now the students are confused.*

Not fully understanding the lecturer's explanation because of an inability to understand the language he used no doubt caused uncertainty about the correct explanation. However, because students trusted the lecturer's superior mathematical knowledge they were unwilling to accept the tutor-mentor's explanation and their anxiety over what appeared to be conflicting explanations might well have hindered cognitive development if the tutor-mentor had not treated the problem wisely (Greeno 1994; Watson 2004). It was interesting to observe a practical application of Vygotsky's ZPD in that some students were able to grasp the lecturers' explanations, showing that they had probably reached a level of understanding that made the lecturers' explanations cognitively accessible. Each move into and out of the ZPD indicated that the students were progressing to higher levels of cognitive functioning (Cole & Wertsch 2006; Vygotsky 1978). Since the tutor-mentors had already spent a year in the FP and were in their second or third year at MSA, they had developed a level of cognitive functioning that made it easier to grasp the lecturers' explanations and then transfer in a way appropriate to the students' cognitive and social development.

Students' struggles to communicate and understand at a higher academic level is a matter of great concern for the lecturers, and is further supported by Ovando's (2000) finding that students who learn through L2 are more likely to underachieve than L1 students as said earlier. The kind of informal conversation (BICS) as distinct from cognitive academic language proficiency (CALP) (Cummins 2000) was apparent among the FP students. It was evident that although most students could converse informally in English, although some, such as the Angolan students, seemed not to be able to carry even a simple conversation, not many students were proficient in the use of academic language. This was evident even in those students who claimed to have English as their home language. Optimal learning was therefore impossible for these students, and the more unskilled they were with CALP the more they wrestled with higher cognitive mathematical functions that required a great deal of abstract and analytical thinking and problem solving. The tutor-mentor programme with its use of peer tutor-mentoring such as co-tutoring and proctoring, where students are able to communicate their needs in their home language, was an important means of academic and psychosocial student support and was found to be an essential aspect of the student support programme. This brings in the idea of mediation where some students appear to have effected the changes that not only made life more socially and emotionally comfortable but also enabled them to develop cognitively.

All participants, despite enthusiastically agreeing with MSA's perspective on internationalization and preparing students as global graduates and respecting the multicultural diversity of the campus, concluded that the fundamental principle of the right to one's cultural and personal identity was of paramount importance for maintaining a sense of belonging. There was, however, a difference between how the tutor-mentors and the students saw the challenges of multiculturalism. The ability to deal with multicultural issues raised by the mathematics students and the tutor-mentors appeared to correspond with Murphy-Lejuene's (in Alred et al 2003) findings that the ability to communicate with new people, especially those of a different culture and language, largely depended on the level of self-confidence that came from a sense of personal security. It was evident that the FP students were in the process of developing self-confidence, whereas the tutor-mentors had already developed a good measure of self confidence and personal security.

Although students, tutor-mentors and lecturers appeared very aware of the multicultural montage at MSA, all were aware of the social, emotional and cognitive difficulties that living and working in a multicultural society sometimes created for students and the hurdles that had to be overcome in order to reach personal and academic goals.

5.3.2.3 Perceptions of the tutor-mentor programme

The third theme deals with participants' perceptions of the tutor-mentor programme. Although the students are the focus of the programme, the personal qualities of the tutor-mentors and the manner in which they perform their tutoring and mentoring activities are pivotal to the perceptions students, lecturers and outsiders form of the programme. The tutor-mentors are therefore fundamental to the high-quality functioning of the programme, and without them it could not exist. A description of the tutor-mentors, their origin, purpose and practice was given in Chapter 3. Lecturers play a significant, although often overlooked, role in forming perceptions of the programme. In addition to their normal teaching and administrative functions, they also take on the responsibility of mentoring the tutor-mentors and in so doing support the purpose of the tutor-mentor programme. Students' participation in the tutor-mentor programme is entirely voluntary and as recipients the only expectation of them is that they make profitable use of the opportunities afforded them.

Awareness by participants of the problems that occur because of various stressors affirmed the necessity of having some means of support with which students could relate. Vivian commented that

> *the tutor-mentor programme does this* [gives support]. *Tutor-mentors are there when we need help and guidance. Support from another student who has experienced the same kinds of things, problems, as us, they, they managed to be okay with them We look at them and see yeah, they're successful, they dealt with problems like this, so I can too.*

The support of the tutor-mentors as more experienced and knowledgable was thus appreciated by the students because "they've been through the same things and he understands what I'm suffering and can help me more than someone who doesn't know what's going on."

Lecturers' perceptions of the tutor-mentor programme came mainly from the improvements they saw in the performance of students.

> *Some students really struggle with maths. They don't have the background and need a lot of extra help which I can't give them. I see the value of students working in small groups or even alone with a tutor, especially if I see that's, that's a student who's not coping. I make a note of these students and can see the difference in things like attitude as well as test marks. Does the tutor-mentor programme fulfil more than subject specific needs? Well, yes, I suppose so. I don't involve myself in students' personal lives but I know some of them have problems with money, like fees, and I suppose it helps to have a mentor they can ask about these things.*

Other lecturers were more aware of students' emotional and social needs, and mentioned the effect that being unhappy or isolated from the social group had on learning mathematics.

> *I could see that Sophie was miserable. She was withdrawn, didn't participate – even in group work. I couldn't seem to get through to her – it was like a wall between her and what was going around her. You know, caught up in her own thoughts which couldn't have been very happy because she looked miserable. I asked Thoko to see if she could help her because I know she had problems in ADP. It seemed to work because she's coping fine now with the maths and is quite willing to participate in class discussions and contribute to the group. I never asked Thoko what she said but it seems whatever she did or said to Sophie, worked.*

It seemed from similar remarks that lecturers' support for the tutor-mentor programme was more as an academic intervention, although they did recognise that it played a role in supporting the emotional and social well-being of students. Lecturers saw the programme as beneficial to learning mathematics "because tutors can help the students understand difficult concepts." However, one of the lecturers was not convinced of the value of having tutor-

mentors help her/him with teaching during tutorials. “I use the tutor to do things like take the register and sign off homework that’s done but I don’t let them teach. I think they need to be available to the students in the afternoon and weekends. Then they can help them with problems.” From this remark, it seems that this particular lecturer does not dispute the need for the programme but has a different way of looking at how it could be used. There is not a problem with this point of view, as lecturers are free to decide how they will implement the programme and the tutor-mentors were able to practice their tutoring and mentoring skills after hours although the two tutor-mentors concerned were unhappy about “just sitting around the class feeling useless” and eventually stopped attending the tutorial classes and made themselves available to the students exclusively at other times arranged by themselves and the students.

The academic importance of the tutor-mentor programme was acknowledged by nearly all of the participants. As one of the maths lecturers commented,

> *Most of the students come to maths with very little knowledge and they don’t know how to solve problems on their own. Some of them are fine. Students who have done A levels or got high marks for Higher Grade maths don’t have a problem but most of the students have O Level and they can’t cope. So yes, we need the tutors. I couldn’t do without my tutors helping me.*

The tutor-mentors were unanimous about the students’ need for extra help with maths.

> *Even some of them who think they can do it need help. They can do it, yes, when the lecturer explains they can do the example but when they get a problem that’s a little bit different then they see they don’t actually understand, they just know, like, um, mechanica* (Diteko).

While most students confirmed the need for the tutor-mentor programme, it was considered more important “to have a tutor to help you with maths.” Very few students actually spoke about the social and emotional value of the programme, although this aspect was often hidden in the expressions as exemplified by the following remark,

> *I was feeling really hopeless about it* [mathematics] *until Marco explained. He made me think through the question and kept asking me questions like ‘why did you do it that way?’ and ‘what should you do now?’ and, and ‘explain why you did that,’ so he really helped because I began to understand what I was doing and why I was doing it. He made me feel better about myself.*

It seemed therefore, that while teaching and learning mathematics was seen as the main purpose of the tutor-mentor programme by all the participants, there was some understanding and acknowledgement of its value as a psychosocial support intervention as well.

An awareness of the need for the tutor-mentoring programme was therefore clearly supported by all participants, even although there were differing points of view as to its main purpose and how it should be used. The variety of experiences expressed by the participants affirmed the usefulness of the tutor-mentor programme in meeting students' needs and it did not appear to matter whether the programme was used for academic assistance, psychosocial support or both. It was also apparent from the participants' responses that the manner in which support was given varied according to the needs of the students, the requirements of the lecturers and the training and personalities of the tutor-mentors. However, it was clear that acceptance of the tutor-mentor programme by the students largely depended on how well the tutor-mentors applied their training to the actual practice and on the kind of relationships that existed and were developed between themselves and the other members of the tutor-mentor programme community of practice.

Tutor-mentors agreed that a genuine, collegial relationship between themselves as tutor-mentors, and between themselves and the lecturers, was necessary for successful outcomes. Tutor-mentors believed that without this mentoring relationship they could not function optimally as tutor-mentors and maintained that this kind of relationship needed to be characteristic of the programme. Ditso, who tutor-mentors two classes of mathematics students together with Kabo, remarked:

> *We work well together with Mr. J. We have regular meetings with him at the beginning of every week so that we have the whole week to prepare for the next week. He trusts us and leaves us to take the tut for him. Yeah, he's always there but he lets us get on with it. If we're not sure about something we refer to him but he never interferes. We feel that the students know he trusts us and so they trust us too. That is good because at weekends or at night when they need us they know we won't give them wrong advice.*

Kedi, who tutor-mentors with Tessa, also had positive comments to make about their relationship with the lecturer they worked with.

> *Mrs S. is fine. We have two meetings every week with her. We tutor maths and problem solving, she teaches both, but the students are the same, that's nice, we get to know them and they get to know us, so the relationships are good. We talk to them about how they can use problem solving and maths in IT, especially analysing and thinking logically, that's very important, so, yeah, they* [the students] *see us meeting with Mrs S. and how we relate so it builds good relationships. Um, I think, like Ditso said, the students learn to trust us so we*

can help them better. I want them to learn to like maths and problem solving, not be scared of it.

Two tutor-mentors were not so happy with the lecturer they worked with because said one:

She won't let us help in the tuts. So we just stand around. It made us feel a bit, well, not necessary you know, like, why are we here? Yeah, a bit embarrassed 'cause we didn't know what the students were thinking. So we stopped going to tuts. Yeah, we did tell her the reason, [after a question] she said it was okay, she preferred to do her own teaching, but what about the register and signing the homework? So we said why not get one of the students to do the register. We can sign the homework after school. So that's what we did. Umm, but it's not the same, like when we worked with Mrs M.

Apart from these two tutor-mentors, good professional and even friendly relationships were evident between tutor-mentors and lecturers which made working with the students that much easier.

Most students responded positively to the idea of a tutor-mentor intervention even if they did not participate themselves. "I think it's a good idea to have [tutors] because some people, like, don't always understand easily and tutors can, like, help these students. I don't need a tutor ′cause my maths is good but some students do." Daniel's comment that "it saves time unlike you spend a lot of time trying to figure out ways of understanding the topic better" was reiterated by many of the students who made point such as "being able to have a tutor explain concepts slowly", "working at my pace" and "not having to struggle for hours to understand something a tutor can explain to you in half the time". Tutor-mentors reinforced this perception as they agreed that when they were Foundation students, "it was nice having tutors to go to because having a tutor to help with problems saved a lot of time struggling on our own". Vincent agreed with Daniel's point of view as he pointed out the difficulty of always grasping concepts when in a classroom situation. "It really does, as when taught in class you would think you understand when you don't. Getting personal help makes me understand as the tutor works at my pace, and clearly as well, and I can also ask as many questions as I can with comfort."

It appeared that some students found classroom situations somewhat intimidating and there were nods of agreement with Paula's comment that "because sometimes when I'm in a group of people I feel shy to ask questions. So I guess seeing a tutor personally will really help". Thapelo added to this by remarking on the freedom he felt to be "able to ask questions so my

marks have improved. We can clarify where we got stuck. We can understand tutors more than lecturers 'coz they are patient when you don't understand." While these comments emphasised the concept of the intervention as an academic support tool, if they are carefully analysed, mentoring aspects are clearly evident. For example, phrases such as "they explain concepts slowly", "give personal help", "works at my pace", "she's patient" and "gives comfort" reveal an intuitive understanding of the meaning of mentoring and its role in providing academic support to the student. Thus, although the students' comments about mentoring were not always explicit, their use of emotive language suggests that they recognised mentoring as an integral part of the tutoring experience. It would seem, therefore, that the students support the concept of tutoring and mentoring as a holistic enterprise, and that they intuitively understood that they, together with the tutor-mentors and lecturers were actively participating in the common practice of mathematics for a common purpose to improve their maths performance.

Maambo and Simon, two of the tutor-mentors, agreed that from their own experiences and perspectives as former mathematics students in the FP "access to tutor-mentors is actually time-saving. It allows more time for maths because of their availability out of class time when lecturers aren't available." "Umm, I used tutors a lot in ADP. They extend your school hours. My marks improved and my understanding. Yeah, having a tutor made the work easier." Free and frequent access to the tutor-mentors was considered an important aspect of the intervention because "we are always more available than the lecturers and they, even the language we use is understandable and student-friendly." Two issues are being spoken about here: availability and communication. It would seem that for the students, a successful tutor-mentor intervention is one where they have easy and frequent access to the tutor-mentors and lecturers.

Although tutor-mentors are given a general job description based on the requirements of the FP and the rules of the university (MSAFP Tutor-Mentor Policy 2008), the way they function is left largely to the lecturer and the needs of the particular class. The programme is therefore dynamic and not prescriptive.

While lecturers at MSA are obligated to consult with students, they are not obliged to be available at all hours or at any time and students are made aware of this during orientation. Students are, however, free to make appointments with lecturers at other times. The same

obligation is part of the tutor-mentors' job descriptions, but consultation hours are supposed to be limited because of the tutor-mentors own needs as students. Notwithstanding, from the focus group and informal interviews, and from spontaneous conversations with the students and the lecturers, it would seem that tutor-mentors often make themselves available to students despite their own busy work schedules or inconvenience. A short extract from one of the focus group interviews serves as an example of tutor-mentors' willingness to be available to students.

Robert: Some students, they see me all the time. We meet in the library – about three or four students – and we go over any problems they had with homework and, and what the lecturer did in the lecture. Ur. Actually, well, I ur, gave them my cell number.

IM: Robert!

Robert: Yeah, I know Ma'am. You said not to do that and yeah, sometimes they phone like at 10:00 at night.

IM: But that's not fair!

Robert: Well, sometimes, if it's a short question, I help them a little. But I usually tell them to phone me in the morning or come see me in the library.

Students are not unaware or unappreciative of the time given by the tutor-mentors to helping them. As Thabo said, "He's [the tutor-mentor] always obliging. He lives in the same res. as me and if I'm stuck with something he doesn't mind. I had a personal problem the other day and he was okay with that, talking to me about it I mean." Portia explained that "me and Thandi and a couple of other girls, we go every day, we know she's working there. Sometimes she'll say 'Hey girls, can we do this later?' or something but she never says she won't help us. She's great!" The whole idea of tutoring and mentoring as a holistic enterprise and the concept of practioners in a tutor-mentoring being a community of practice who work together for a common purpose becomes meaningful when comments such as these are made. Tutor-mentors' understanding and application of the philosophy and principles of the programme; their ability to see the programme as a holistic enterprise and work within that understanding; and their understanding of the role they play in helping to form a community of mathematics practitioners working together for the same purpose are essential for the fulfilment of the mandate of the tutor-mentor programme as a supportive intervention.

However, a number of students had issues with the availability of tutor-mentors and lecturers who “are not always there when we need them.” “Lecturers go home or lock their office. They tell you to come back tomorrow when they’re not busy. Eish! They have consulting but we have classes, then we can’t go at that time.” Lecturers’ answers to such complaints were that “students know they can make appointments with us if they can’t manage to see us in our consulting times. They can do this after class but they don’t bother then think we have to oblige. Sorry! My life doesn’t revolve around students. I have other things to do.” According to the tutor-mentors, this was one of the things they learned very quickly as Foundation students and now, being in a similar position to that of the lecturers, they saw the value of teaching students that “they have to act responsible. They can’t expect us [includes the lecturers] just to wait around for them.” “Yeah, they have to learn. If they want us [to help them out of class time] they make arrangements.”

A number of mathematically strong students profited from their participation in the intervention with improved performance and distinctions in the final examinations, and a fairly large number of weak students improved their performance from fails to passes and even credits through participation in the tutor-mentor intervention. Students indicated their recognition of the importance of tutor-mentoring as a way of improving conceptual understanding and developing mathematical skills summed up in the following comments: “I understood better.” “My marks improved because every time I approached the questions I knew what steps to take”. “I knew what I’m doing wrong and good so that I can get guidance from the tutors.” These positive responses showed a significant awareness of the value of tutor-mentoring and having tutors available in the classroom and after hours. While the value of academic support came out strongly there was also evidence of valuing the good working relationship between themselves as mathematics students and the tutor-mentors. It is evident that a positive perception of tutor-mentoring as a support system was held by most participants whether actively involved in the tutor-mentor programme or as bystanders looking on.

Not all students felt positively about the tutor-mentor programme, however, and were not averse to stating their points of view succinctly but pointedly. Alex, for example, was adamant that “the teacher explains everything that I want to know. The tutors are not important.” Minki was sure that she was “capable of coping with the work given out.” Matt’s remark that “they [the tutor-mentors] do not avail themselves to us. They do not do their job

period" together with a further comment he made in the questionnaire that "tutors are okay for some people, except when you know more than the tutors!" appeared quite arrogant but he was actually joking. Matt was one of the students who started out well but did not achieve as well at the end, whereas Alex was a strong student from the beginning and remained so. As far as Alex and Minki were concerned, they were confident in their own abilities and found it unnecessary to ask a tutor-mentor for help with mathematics. Alex mentioned his preference for working on his own or with the lecturer, and his comment that "the teacher explains everything that I want to know" and therefore "the tutors are not important" is probably justified in his case. Minki, however, although a fairly strong student at the beginning of the year, did not remain so but did not seem to appreciate this fact. Her final scores indicated that perhaps if she had made use of the tutor-mentor intervention she might have improved in her conceptual understanding and therefore her final scores.

One of the questions put to the tutor-mentors was "What made you decide to become a tutor-mentor?" The answers were revealing and sometimes surprising. For example, Diteko said:

It started, umm, to help out the students, right, uh, I think we saw a need for there to be student-tutors who are basically the same age, almost the same age as the students, more to develop a peer to peer relationship with them and umm because, I mean, us tutors, we, we were ADP students or FP students before so we know exactly the, I mean, uh, what, uh, goes into the programme and um, basically the output that, uh, is expected from the students.

The idea of peers tutor-mentoring peers was mentioned by many participants as being "really valuable because we can relate, also we don't feel shy to ask the tutor because he's our age." "Yes, and he was in ADP too so he knows what we need. Um, he knows what we need to, to pass."

The same question was posed to different focus groups and to individuals in informal interviews. Luke's answer was quite unusual in that he "wanted to be mentored, so I decided to apply to be a tutor. I wanted to work with you because you have been my mentor anyway, and I wanted that to carry on." This was quite a surprising finding, and I asked "Why didn't you just come talk to me about it Luke?" His answer gave me food for thought, and confirmed the need for better explanations of mentoring and mentorship in the training programme. "Well, I thought that was a bit, umm cheeky, when I wasn't going to be in your class anymore, so I thought, well, this way I get to keep you as my mentor and I also get to share

what I've learnt with the new ADP students, kind of 'killing two birds with one stone', you know." It seemed from this conversation that the concept and value of mentoring were understood by this tutor-mentor, and I therefore presented the same question to a number of tutor-mentors and students in similar conversations. Without exception, they reiterated Luke's understanding of the mentoring concept and the valuable part it played in any tutoring situation.

During a focus group discussion, Kedi spoke quite animatedly about mentoring being part of a holistic relationship and as an essential component of the tutoring relationship.

> *Mentoring? Uh, very, very important, as in, I think it's actually, it's not practical to tutor without the mentoring component, yes. Umm, ok, I think as tutors we should build a professional and okay, maybe friendly in a way, relationship with the students. That's, as in, that's when they start to umm, now listen instead of just hear what we are saying and they process information that we give them better if we, there's mentoring involved. As in umm, I think every student has got their own situation, as in their unique, in their way, so I mean trying, umm, I, I think mentoring goes beyond showing. I mean tolerance, empathy, and all those qualities. And then I think if you have i-if you have – if you can understand those qualities, right, then you can be in a better position to tutor somebody. I mean without, without the whole mentoring part as in, we would just be, I mean feeding the students information, but then, we won't know how, I mean, it won't be efficient and effective.*

IM: Somebody said that the reason why he chose to be a tutor was because he wanted to be mentored; so he came to be a tutor so that he could be mentored, and that was quite unusual I thought.

Robert: I think it does, it goes both ways! In some cases, um, I think as, as a tutor you stand in front of the class and you'll be trying to understand the students and the students, some of them will try and understand you as a person in a way. They will try and understand you. So I think if you understand each other then communication between the two of you will be very, um, effective. Yes.

IM: Yes, and then the relationship between yourself and the lecturer? What kind of relationship do you see there?

Kedi seemed a little confused at first but thought through his reply as he spoke.

Kedi: Um, between myself and the lecturer, um, it's, it's a professional relationship, yes. Um ok, most of the time we do focus what's, w-what she expects as in, at the, in, most times she expects me to give her feedback on t-the students and just basically analyse them. Um, tell her exactly what level the students a-are on so, no, I think

again, the mentoring part of it, mentoring between the tutor and the lecturer is also very, it comes in very handy as well, yes.

IM: Okay, so you are saying that you can work better with a lecturer if you have a good relationship with that person?

Kedi: It's important, yes, and this goes for the students also. We work better if we have a good relationship.

The photograph (Figure 5.8) is an example of role-play and collaborative learning during a mentoring training session. Students were divided into groups. Each group was given a problem commonly confronted by FP students, and asked to explain and dramatise the problem scenario and show how they would go about resolving it. As the tutor-mentors had picked their groups and their problem out of a box at the end of the previous training session, they were well prepared and I was able to sit back and enjoy the presentations.

Figure 5.8: Observation of students doing role-play during a mentoring training session

Figure 5.8 shows how tutor-mentors not only enjoyed the sketches being dramatised but were caught up in the whole idea of role playing. The entire group enjoyed this training session and felt they had profited from the experience as different groups had expressed different problems "that we often come across but don't know how to deal with". Tutor-mentors expressed their satisfaction with "being involved in learning about mentoring in a fun way". One of the tutor-mentors commented that:

> *I previously thought about mentoring as a 'whinging' kind of thing. Very serious, but doing this changed my thinking. I see that sometimes if you are helping someone, you actually need to get close to that person in a, a, kind of, um personal way, you know, like not smother the person, but be, um, be friendly, and have the relationship right.*

Another tutor-mentor commented that "the advantage of this kind of training is the opportunity to learn different ways of dealing with a problem. I would never have thought of saying that [talking about a particular solution that one of the group's had come up with]." Yet another commented: "now I know what you were saying about allowing someone into your personal space and the danger attached to doing that. It's easy to think, oh yeah, I can do that, I won't be affected by someone else's problems, but, phew, yeah, actually, when it comes to it, it's different. It can be difficult. I see that now."

One of the lecturers who was present at this session was impressed by the mature way the tutor-mentors "were able to handle the situation [the problem]. I didn't believe it was possible for them to handle some of the problems so well, and so thoughtfully. Their acting was very good. I sometimes forgot they were only acting! Actually, it makes me feel very confident, what the tutors are doing with the students." Thus, through role play tutor-mentors were better able to understand how to manage the sometimes difficult relationships between themselves as the students' peers and role models, but also how to behave as authority figures worthy of respect by the students. From the comments quoted above, it is clear that the strategy of collaborative learning was used effectively in this training session. The discussions that took place between each dramatic sketch were animated and interactive. Ideas flew back and forth between the tutor-mentors, and argumentation and criticism were profitable and positive. It was evident that some students had to grapple with preconceived ideas and misunderstandings about causes of and solutions to psychosocial and learning problems, and that learning took place for these students through a measure of cognitive conflict. Clearly, in verbalising their ideas and being forced to reflect on the ideas of others their thinking was transformed which led to further understanding and the development of new ideas.

Figure 5.9: A mathematics tutorial class being taken by one of the tutor-mentors

Figure 5.9 shows one of the tutorial classes that I observed. They were working in small groups on a problem given to them by the lecturer. One of the girls had asked the tutor-mentor to settle an argument her group was having regarding the correct method for solving a mathematical problem. Although the question was addressed to the tutor-mentor by a particular group, the other groups stopped what they were doing to focus on the tutor-mentor as she explained that the problem they were looking at was based on some previous work they had done and therefore students needed to make sure they understood the previous concept before trying to solve this particular problem. Student participation and interaction is evident as they concentrate on what the tutor-mentor is saying. The foremost group in the photograph were listening carefully to the discussion and asked the tutor-mentor to clarify part of the explanation because their group had come up with a different way of solving the problem. So while they were keen to hear what the tutor-mentor was saying they also had their own ideas and were eager to hear her suggestion but not content to accept the other group's solution without argument. However, the tutor-mentor did not give them the answer but insisted they think through the steps they had to take to come to the correct solution and then offer their solution to the class. She also told them that there "was more than one way to 'kill the chicken'". At the end of the discussion, the students went back to working on the problem, satisfied with the outcome and with a better understanding of what they would need to do to get to the solution. All the students in the class were focused on solving the problem and after wrestling with the question for a while offered their solutions. The tutor-mentor then moved around the class helping individuals and groups as they completed the work. Similarity

between the ages of the students and the tutor-mentor may have been one of the reasons why students were at ease and willing to participate in discussion and argument. Another probable reason for the easiness of the pedagogic situation was the relationships that had already been established between the tutor-mentor and the students in the class.

One of my observations is that it is evident from the photograph that the tutor-mentor was careful to keep an authority distance between herself as the teacher and the students as the learners during the discussion. Once she began moving around the room, the authority gap closed but never altogether disappeared, and interaction became more personal. As students interacted with the tutor-mentor and with one another through argumentation, they discovered and learned new knowledge and were able to pass on their newly acquired knowledge through social interaction of tutor-mentor and students working together which facilitated cognitive activity. Crook's (1994:50) explanation that learning is 'a parallel between the external world of jointly-managed problem-solving and the internal world of mental functioning' is clearly evident in the active participation taking place in the tutorial classroom, as students and the tutor-mentor worked together to solve the problem. Thus the supposition that social interaction and participation is necessary for learning to take place was supported.

In discussing the perceptions of the participants regarding the tutor-mentor programme, it was seen that the usefulness of the programme was acknowledged by most participants. While there were a few students who disputed the necessity of participating in either tutoring or mentoring, this was because they felt no need for either kind of support. This belief was usually held by students who were strong mathematically and who had the self-confidence and maturity to cope with new situations. Although students such as Minki and Alex did not feel the need to participate in the tutor-mentor intervention, a number of these self-assured students accepted that there were students who needed the support of the tutor-mentor intervention "because" as Alex remarked, "some students need help; their maths is not strong". While the tutor-mentor programme was perceived by most of the participants as a pedagogic tool that improved mathematical performance, participants recognised that without developing interpersonal relationships and forming a sense of community the programme would perhaps not be successful in achieving its holistic aims.

5.3.2.4 Forging communities of practice in a holistic enterprise

The fourth theme, the development of a community of practitioners participating in a common enterprise for a common purpose, was a thread running throughout the interviews and discussions, though often by implication rather than directly, and was also evident in the questionnaire responses. The importance of forging a holistic mathematical community of practice in order to improve the mathematical performance of FP students is discussed next. Figure 5.10 is a vivid example of learning as an interactive social phenomenon.

Figure 5.10: Learning as a social phenomenon.

The responses of the participants when asked how they would define 'community' were fairly similar. Some suggestions were offered as examples, "a body of like-minded people", "people with the same religious beliefs or ethnic background", "people who live together", "people who have something in common with one another", "people who live in compounds like Buddhists", "fanatics like those ones in America, you know, like when they all killed themselves when the police came" and many other examples. Asked how they thought communities were formed, replies included, "People are born into a community", "People join a community, like when they join a church or something like that", and so on. It was clear from these replies that participants had a fairly good idea of the concept of community. When asked whether they belonged to more than one community, there was consensus as examples were offered. "Yes, because we belong to different things. Like I belong to my family but I also belong to my church and I used to belong to a youth group." "People can belong to many communities at one time. Sometimes they leave one community and join another one. Like

when I came here. I left my school community and now I'm part of the Monash community". However, when the participants, for example the tutor-mentors, were asked "Do you know what I mean when I say that you, the lecturer and the students are all participating in learning and teaching maths, that you make up a community of maths practitioners?", most of the participants, even the lecturers, did not understand the concept of a community of practice until I had explained it to them. Kedi remarked that he liked "that idea. Yes, I think we are. Actually it makes me feel quite special, a bit, umm, unique? Yeah, unique; it's a nice idea." Kabo agreed with Kedi: "Yeah, it does kind of make us part of something special" When it was pointed out that it was not only mathematics people who can be called a community of practice, Tatenda quickly assured me, "no, no. I understand but it's just that, just that, as a group all doing the same thing for the same purpose, like you said, well that makes me feel worthwhile" followed by Kedi with "Yeah, it does. I feel like I belong somewhere special." Tutor-mentors appeared to have a much better conceptual grasp of the meaning of community as applied to the tutor-mentor programme than either the students or the lecturers. This is perhaps because they had been at workshops where the concept was discussed. Anna offered the comment that "we are all part of the same 'family' and therefore part of the same community." Tatenda agreed and added, "If students want to get the best out of the programme, they need to understand that they must work with us and with the lecturers because we all want the same thing in the end." Forging professional and friendly relationships was seen as essential:

> *It makes everyone feel like they're working together, yeah, for the same purpose. If students improve because we helped them, that makes us feel good; and the students. The lecturers feel good also because they see improvement. So it makes better relationships when you feel like you really belong [to the community]. You feel like people care about you, you know, not just the maths, but about you, personally.*

Assured that the tutor-mentors understood the concept, I then asked them if they thought the students understood the idea of belonging to a special group and working together with the same purpose in mind. Naledi was "not sure. Maybe if we explained what you've just told us it would make sense to them, and maybe that would make them work harder" (turning to Kedi): "What do you think?" Kedi nodded as he said, "We should try and explain the idea to them. They might, they might feel like they should work with us more. If they're special, then, then, we'll try, then we'll come and tell you if it works Ma'am." The next question

referred to the lecturers. “Do you think they understand the concept of a community of practice? It’s quite a new idea.” Anna commented that she was

> *not sure. Some of them maybe but most of them, they just want to teach the maths and go. But I think Mr D knows this, or even if he doesn’t know the term, he kind of does this. He makes us, and the students, feel part of a special group. But I’m not so sure about other lecturers.*

Tessa remarked:

> *I understand more about mentoring fitting with tutoring than before. I like that I can help students understand maths. That I can be there for them when they need help with maths, or anything. I feel good about what I do, so it makes me feel good. I like keeping up with maths. We don’t really do maths anymore. IT uses some things we learned, like for programming we have to solve problems, think logically, you know, if this, then that. So tutoring maths reminds me to do certain things, the reason why I do these steps. Mentoring, well that’s, that fits with tutoring, like I talk to students about what to expect in first year, that they must learn to manage their time; you know, do assignments on time, homework.*

When asked if anyone mentored her as a tutor-mentor, Anna replied, “Actually, Mr D does. He’s always asking me how I’m coping and we talk about other stuff that I’m doing. He’s interested, not just in how I tutor his students but how I am.” Caroline concurred.

> *Yeah, he does. He always has time for a quick word, like when he’s coming down the stairs and I’m going up; even when he’s on his way home, he’ll ask how things are going and really want to know, you know, not just asking, but he really wants to know.*

When the same question was put to the lecturers, as to whether they considered themselves as part of MU, the FP, and a mathematics community, Mrs J, one of the lecturers, remarked, “I don’t really feel part of the Monash community, but yes, the FP, especially with the maths lecturers, but not really part of a maths community if it includes students. That’s for the students, and maybe the tutors. I’m their teacher, not their friend, not in that way.” Another lecturer disagreed, saying, “But yes, I do. I, I, if we consider what we have been saying about what communities are, what we practice, then yes, we work together for the same end. I don’t see how we can do this if we don’t belong [to a maths community]. Students need to know we are part of what they’re doing, so do the tutors”. Further argument ensued with disagreements flying back and forth, but no consensus reached among the lecturers.

Students' opinions about feeling part of the campus communities varied, and with reference to mathematics their views seemed to depend on their liking and aptitude for it and their keenness to improve their performance rather than on applying the concept of community to their personal situations. Constance reminded her friends of how miserable she had been when she first arrived at Monash.

> *You remember. I was the only one from Romania[17]. I think I still am. There was no one to talk to. I tried but, umm, no, I don't feel I belong to Monash, not yet anyway. Not even to the ADP really. Maybe next year will be different. I think the undergrads they don't think of us as students like they are. They treat us, umm, in a way, umm, well. The ADP? No, I get on okay with the people I know, but I don't really know them. I only really know my class and the students who come to lectures a little. I like the tutor and my lecturer, so, umm, yes, I feel like I belong to a maths community, but only the people I know.*

Andrew was adamant that there was no feeling of community between the "ADP and the rest of the University. I think we only know our own group of friends and even some of the students in my own class I don't know. So, no, I don't think I belong to any community really. Just my friends – if you can call that a community."

These comments revealed a fairly good grasp of the concept of community by the lecturers and students, and appeared to show some understanding of how a community of practice functions and why relationships need to be developed in order to participate and fulfil the purpose of the tutor-mentor programme.

The extracts from interviews and conversations confirmed the concept of the tutor-mentor programme functioning as a holistic enterprise where common, unifying components within the social practice are integrated and have diverse effects on individuals within the community and on the community as a whole. Since cognitive functions are learned through interaction with other people and mainly through speech, it seems obvious that by entering into socio-cultural discourse in a particular community of practice, such as the mathematics community of practice, cognitive functions are enhanced through these encounters (Maitland & Manson 2006). The intention or goal of the tutor-mentor programme was thus being achieved through active participation of the members of the mathematics community of

[17] Romania: used as a pseudonym to hide identity

practice, supporting the presumption that learning mathematics improves as the acquisition and participation metaphors intertwine.

Forging personal and professional relationships was seen as essential in constructing a vibrant community of like-minded people that helped to strengthen a personal identity through identification with the group. Having an identity within the group gave participants the assurance of belonging to a special community, as Kabo and Kedi remarked it made them feel "special" and "unique" while knowing and keeping their personal identity as individuals made the group stronger because of the effects of participating in argumentation as discussed earlier. Having a common goal also led to a sense of group identity. It appeared from a few comments quoted earlier that the only obstacle to forging a group community identity was the reluctance of some students and lecturers to see themselves as being an essential part of a vibrant, dynamic practice, where all activities are aimed at achieving the same purpose, that of improving mathematics performance.

The findings of the study supported the idea of teaching and learning mathematics through community or group participation. Many comments indicated that the social interaction of the participants in the study as they carried out the social activity of the practice of mathematics improved the self-confidence of the students in tackling a subject which many had formerly found difficult. Maria was quite open about her experiences as a mathematics student and the change that had taken place in her attitude towards mathematics over the year.

> *I was actually very scared of maths. I used to struggle all the time at school but I wanted to do IT so I had to do it. When I first came I thought I would never pass but working in groups and having a tutor to help really built my confidence. I think, actually, it wasn't that I couldn't do maths; I just thought it was hard. The tutors and Mrs M really helped me a lot because they were patient and explained well. They also made me think about it, you know, why I was doing something, not just using a method. Working in my group was great. We could discuss and no one in my group said I was stupid at maths, so I started to believe in myself.*

Simon's comment was typical of how tutor-mentors perceived the role that tutor-mentoring had on their own lives, and how their self confidence and maturity grew through interaction with others in a community of practice:

> *When I see the students beginning to understand the maths and [understand] that maths is more than just learning formulas and methods then I feel good about tutoring them. I like seeing how I helped them [the students] with the maths but I also like knowing that some of*

them trusted me with their other personal problems. I learned a lot, Ma'am. I think the most valuable thing for me was learning how to mentor someone while I'm teaching them. I know I'm a better student myself now. You can't teach someone about handing assignments in on time and not learning for tests the night before without learning yourself. I think, another thing was, for me, learning to work with other people – not just the students but the lecturers and the other tutors. I realise now that working together you can achieve much more than if you just stay by yourself.

Lecturers' confidence in the practical application of the tutor-mentor system increased as they experienced and saw evidence of what was for most of them merely a theory being worked out in reality. It is fair to say that whereas the tutor-mentors and the participating students were fully committed to the tutor-mentor enterprise, a number of the lecturers and students were not altogether convinced of the need for tutors and/or mentors. However, if the lecturers can be convinced of the efficacy of the intervention and be persuaded through empirical evidence that tutoring together with mentoring improves the performance of students, their opinions may change which would then cause those not at present wholly committed to be included in the mathematics community of practice. Their influence on the thinking of the non-participating students they deal with as lecturers may in turn persuade reluctant students to participate in the programme. This is something that will need to be worked on.

5.3.2.5 Active partnerships in a holistic programme

The fifth theme deals with tutor-mentoring as an active partnership between individuals, either one-on-one or with a small group within the holistic mathematics community of practice. The formation of interpersonal relationships within the mathematics community is essential for successful partnerships to develop, because it is through these partnerships that participation in the intervention can occur. Seeking after knowledge is an essential component of learning and is something all students, tutor-mentors and lecturers presumably desire to do. This presupposes that argumentation can only take place if there is a measure of trust between individuals engaged in the reasoning. The idea of authority in this situation is that of the subject, the mathematics, rather than the person, whether it is the lecturer, the student or the tutor-mentor. If true cognitive conflict is to take place then mathematics, as the true authority in a mathematics classroom, must be given pre-eminence, not any one person in the partnership. If all partners are considered equal in this sense, then the problem is open to exploration by all participants and all are able to speculate and offer conjectures without embarrassment or disrespect. Freedom to participate in problem-solving, participation in

argument, being willing to take risks and be wrong and being able to acknowledge that there was perhaps a better way, is all part of learning. As a mathematics community of practice, lecturers, students and tutor-mentors should thus be free to practice argumentation by using mathematical reasoning to justify any sorts of arguments and in so doing, together come to a satisfactory solution to the problem.

It was difficult for the lecturers to accept that they could, even occasionally, step down from their place of authority in the classroom and become part of the group. As one of the lecturers said, "It goes against the grain. It has never been part of our culture to allow this so I don't know if I can do it. It sounds a good idea but, well, I don't know." "Yes," commented another, "I would feel as if I had no control. As if I'd lost control. Maybe the class would become unruly; maybe I would lose respect if I don't have control." It seemed from the comments made that this was a fairly radical pedagogy and not altogether acceptable to most lecturers. One of the lecturers, however, was enthusiastic about the idea and was able to see the benefits that active participation had for his own, the tutor-mentors' and the students' learning.

> *I've seen how well this works. The tutors told me how much they learn themselves, so I know it works for them. I get a chance to help the slow ones and when everyone's busy there's a kind of hum and I know the students are working. They students help each other, sometime just two of them and sometimes in a group, you know like three or four. Tutoring really works well and the marks have improved.*

Recognition of the tutor-mentor intervention as beneficial, even if they did not participate themselves, was acknowledged by a number of students and is exemplified by Monica's assertion: "I think it's a good idea to have tutors because some people, like, don't always understand easily and tutors can, like, help these students. I don't need a tutor 'cause my maths is good but some students do." Matthew's comment that he preferred "to sit with the tutor on my own; it saves time unlike you spend a lot of time trying to figure out ways of understanding the topic better and my friends don't know any more than me so if I ask them, maybe they tell me the wrong thing" was echoed by many of the students. They mentioned issues such as "being able to have a tutor explain concepts slowly", "the tutor works at my pace", and "not having to struggle for hours to understand something a tutor can explain to you in half the time". Tutor-mentors reinforced this perception as they agreed that, when they were FP students, "It was nice having tutors to go to because having a tutor to help with

problems saved a lot of time struggling on our own". Mark agreed with Matthew's point of view as he pointed out the difficulty of always grasping concepts when in a classroom situation. "It really does, as when taught in class you would think you understand when you don't. Getting personal help makes me understand as the tutor works at my pace and clearly as well, and I can also ask as many questions as I can with comfort."

Although most of the students responded positively to the idea of actively participating in a teaching and learning partnership, there was some indication that the concept of a holistic mathematics community was not fully understood by many of the students as exemplified by Sam's and Brian's comments: "Me and Brian, we work together all the time. I reckon that's a partnership Ma'am? I mean we argue with each other about how to solve something. We go on arguing until we find the right solution" and Brian's comment was along the same lines. "Yeah, we work well together. We don't actually need anyone else, you know, like a tutor or even the lecturer, although sometimes we ask him a hard question, but most times we can do it ourselves. Umm, like I said, we work together and we help each other, and yeah, I guess it's a partnership and because we're working together we're participating." Thus while Sam and Brian both appeared to understand the concept of active participation they did not give the impression that they understood the benefits of utilising all partners in the mathematics community of practice. It was however evident that nearly all participants recognised active participation in the tutor-mentor programme as a way of improving conceptual understanding and developing mathematical skills.

5.3.2.6 Was it worth it? The value of the tutor-mentor programme to the individual

The sixth theme deals with the question of whether students, tutor-mentors and lecturers found the programme worthwhile. Did they find value in the tutor-mentor programme for themselves as individuals? Did participation in the tutor-mentor programme support the psychosocial adjustment and well-being of the FP mathematics students and improve their mathematical performance?

The following comment by Mpho sums up the opinions of many of the students as to the value of the tutor-mentor intervention to them as individuals:

> *I understood better. My marks improved because every time I approached the questions I knew what steps to take. I knew what I'm doing wrong and good because I got guidance*

from the tutors and my lecturer. I never left maths assignments or homework; that is the first thing I always do. I used to hate maths but now it's my favourite subject but that's because I can do it now. Before I couldn't, but the tutor helped me a lot and so did Mr W.

Comments such as these indicate a significant awareness of the value of the tutor-mentor intervention in contributing positively to the psychosocial and academic lives of the students.

Although all of mathematics students filled in the questionnaire, a number did not complete all the questions. I can only surmise the reason for this as I was not present when students completed and handed in the questionnaire. The lecturers and the administrator confirmed that none of the students made any complaint about filling in the questionnaire and handed in the form without comment. Although I had not anticipated or planned for such an event, the non-responses to certain questions offered some interesting possibilities which were explored during the interviews and spontaneous conversations. Some of the most telling of the non-responses referred to the questions on relationships and, as this dealt with the concepts of 'community' and 'community of practice', indicated that many students had no real idea of the importance of developing good professional, working relationships or what it entailed to belong to a community of practice. Some students saw no need for personal relationships between themselves and the tutor-mentors or the lecturers. Precious asserted that "lecturers have a job to do and that is to teach us; we don't have to talk to them about anything, only about maths." Nicolene mentioned that the tutor-mentors were there strictly for the purpose of tutoring mathematics "because tutoring is a business matter ... the tutors are there to help us with maths and nothing else." The reluctance of some students to discuss their personal affairs came out clearly in remarks such that by Collins: "I don't like to discuss my personal life with people I don't know", a natural response of many people who are reticent about their personal lives and prefer to keep private matters to themselves. This was not a poor reflection on the tutor-mentors, the lecturers or the students. It was a personal choice and needed to be respected. Knowing something about the personalities of these students and from conversations with their lecturers and the tutor-mentors helped me understand why these students did not respond to questions dealing with relationships and being or feeling part of a mathematics community of practice. As the mentoring aspect of the intervention is available for those who need it and want to make use of it, it is an individual's prerogative to choose whether to do so or not.

It seemed clear that students took their cue in behaviour towards the tutor-mentors from the way lecturers spoke to and treated the tutor-mentors. If the association between lecturer and tutor-mentor was observed to be good, and if lecturers spoke well of the tutor-mentor to the students and there was obvious respect between lecturer and tutor-mentor then students picked up on this and responded in like manner. The role of the lecturer in the tutor-mentor intervention is thus pivotal to the kind of relationships that develop between the students and the tutor-mentors. The concept of apprenticeship and the ZPD were seen in the interrelationships that develop between the participants as it was through the development of relationships that students were able to be brought into a context where communication and social interaction could occur and optimal learning takes place. The concept of collaborative learning with others more knowledgable and experienced than oneself and where there is continuous reciprocal interaction becomes significant and practical when viewed from the perspective of forming relationships within a community of practice. Reciprocal engagement thus enhances learning for the individual and the community and makes it meaningful.

Although a fairly large number of the FP students commented favourably about forming good relationships with the tutor-mentor and possibly with the lecturer, most did not seem to understand the holistic relationship of the intervention programme or the place that mentoring plays in this relationship. Remarks such as the following were made: “they [lecturers and tutor-mentors] help us all the time with different personal things”, “they [tutor-mentors] are students too so they can help with other things also”, “it is good to form a relationship because if you have a problem you will easily go to them (lecturers and tutor-mentors) for help” “they [tutor-mentors] also help us with everyday life around school”, and Boitemelo’s comment: “We [she and the tutor-mentors] chat about the future, what we want to achieve, at times they give guidance on subject choices for next year. We can use their experience”. I initially found it disappointing that more students did not appear to make use of the mentoring support offered to them, but on further investigation and after conversations with students and tutor-mentors discovered that many of the questionnaire and interview responses indicated that many students did not understand that they were in fact using the mentoring relationship. It thus appeared that students either did not properly understand the concept of mentoring or did not appreciate the value of having a ‘buddy’ on campus who cared about their personal welfare although they were in fact utilizing mentoring as part of the tutoring relationship.

The lecturers and most of the students appeared unaware of the importance of considering the holistic nature of the tutor-mentor intervention, and appeared not to see the value of the intervention as a holistic tool that if used correctly had the potential to compound their efforts. It was also apparent that they did not understand the need for a holistic effort, and saw the part they each played as an individual as somewhat fragmented. The tutor-mentors, however, had a different outlook as seen by Robert's comment during one of the focus-group interviews: "Without developing a good relationship with the student I can't tutor; not properly anyway. Something will be missing and I know I won't be able to get through to the student as well as if we had a good relationship." This comment brought nods of agreement and elicited further comments such as from Kabo: "How can you tutor someone if you don't know them as a person; if you don't know who they are or something about their background?" I found the tutor-mentors' comments enlightening because they gave insight into one of the main reasons why the FP tutor-mentor programme has proved successful.

The principles of *gestalt* and *habitus* should be recognised as a pragmatic solution to learning and solving problems All participants need to understand that they share a common problem space within which students, tutor-mentors and lecturers participate in finding solutions to problems through 'a process of negotiation and co-construction of knowledge' (Haenen et al in Kozulin 2003:246). These principles should be acknowledged by every individual in the mathematics community of practice as an essential function of the tutor-mentor programme as a holistic enterprise. Unfortunately, it appears that many lecturers and students appear to consider only the tutoring aspect of the programme as relevant, and as stated by one of the lecturers, "the students are here to learn maths and they need to do well, so the tutors are important to help me with reinforcing the work". The same lecturer remarked that, "mentoring should be left to the counsellors. If students need that kind of help then they should go to them. I can't waste time on that and I can't waste the tutor's time when I need him to teach the students". The students held similar views as according to Rachel, "we only need tutors to help us with maths. They shouldn't be involved in our private lives. I don't wanna talk to someone I don't know about private things." This appears to me to be a misunderstanding of the principle of mentoring rather than an attempt to ignore its value and place in the programme.

Students such as Rachel and the lecturer Mrs J, quoted earlier, appeared not to understand the positive effect that mentoring could have on academic outcomes and comments. Remarks

such as “I only need maths from them [the tutor-mentors]”, “personal issues should be left out of class”, and “some of them don’t have interpersonal skills, they undermine our intelligence” should be seen as failing to understand the meaning and value of mentoring and the richness of its contribution to the programme rather than belligerency or attempts to deride the mentoring aspect of the programme. The lecturer did not intend to imply that the tutor-mentors were arrogant or that their time was wasted on ‘trivial’ problems. Nor did the students intend to imply that the tutor-mentors were trying to show them up with their superior knowledge, but rather that as a mathematics student he/she felt able to do the work and therefore did not need help. This particular comment was made by only one student and was perhaps an indication of an inability to express him/herself in English as it was not an opinion offered by any other respondent. However, a number of students did seem to dismiss the idea of mentoring either because it was, according to Minkie, “something I didn’t need” or considered inappropriate, because, as expressed by Alex, “I’m good at maths; I don’t have any problems, personal or otherwise”. This opinion again seems to point to a lack of understanding of the purpose of mentoring in an academic environment, and was quite a surprising finding because many students referred either directly or indirectly to the benefit of having personal and individual help, guidance and support, and the value of a positive personal relationship which supposes acceptance of mentoring as part of the intervention programme. Many students, such as Gary, actually said they “talked to the tutors on social and personal matters” while others made indirect reference to the tutor-mentors as being “supportive”, “giving me guidance with subject choices for next year”, “helping me cope with university life”, “giving reassurance when I was homesick”, “building my confidence” and “giving me motivation to work harder”. In conversations with students, a few used the terms ‘mentor’ and/or ‘mentoring’ while others referred indirectly to this aspect of the programme. Students who made positive mention of mentoring appeared to recognise the value of having a good reciprocal relationship with the tutor-mentors. However, because most students used the terms ‘tutor’ and ‘tutoring’ rather than ‘mentor’ or ‘mentoring’ it is possible that there was a lack of understanding or even misconception about the use of the word rather than what role mentoring actually plays in successful tutoring.

According to Maambo, the tutor-mentors understood the value of the dual nature of the programme as something “that students should use because sometimes, problems with work come because there is another problem, like, ah, problems at home, or a problem with a, ah roommate or fees, or something”. Thus, while the tutor-mentors appeared to have a good

understanding of the mentoring role in the intervention strategy, many lecturers did not seem convinced of the need for mentoring and many students appeared to see mentoring as "only for people with personal problems" It is possible that failure to understand the holistic nature of the programme could have detracted from its overall value as a support service for the students.

Students who participated in the programme were enthusiastic and positive in describing their experiences, and many have since registered as trainee tutor-mentors for next year. When asked why they wanted to train as tutor-mentors and become part of the tutor-mentor community of practice, their answers were similar to those offered by the present tutor-mentors. As articulated by Zodwa:

> *I have been helped such a lot this year by my tutors, all of them but 'specially maths. If I didn't have a tutor I would have failed my maths and that would've meant giving up my dream of becoming a computer programmer. Having someone to talk to when things went a bit bad for me was also important to me and I want to be there for other students like that.*

In answer to the question of who benefited from the tutor-mentor programme, it can be said that everyone who participated, whether it was for a long or short period or even occasionally throughout the year, benefitted. Mr N, a lecturer, commented:

> *I actually learned a lot from my two guys. Some of the ways they tutored were quite innovative and the students really seemed to enjoy it when they took the class. They're coming back to work with me again next year and I'm looking forward to getting to know them better and developing our relationship.*

The tutor-mentors were adamant that, as Tatenda said, "By doing this work with the lecturer and the students you get to learn more about maths and ways of expressing maths. I had to sometimes think very hard when a student came up with another way of solving a calculation, but that was good and I learned to listen and not be so sure that I was always right." Kedi remarked, "Teaching maths keeps me in touch. I love maths and we don't do it anymore, so this is a way I can keep in touch. Also, doing maths reminds me of ways to think 'out the box' which is good for writing [computer] programs." From responses such as these, it was evident that the IT tutor-mentors were not only providers of a service to students but also recipients and appeared to benefit emotionally, socially and academically from their participation in the programme.

Remarks made by participating students about the value of the programme for improving mathematical performance were enthusiastic and generous, and can be exemplified by such as that made by Zodwa earlier in this paragraph. It was therefore apparent that the programme helped students in many ways, socially, emotionally and academically, depending on individual needs. The depth of support experienced by students appeared to be linked to how diligently they applied themselves to making the most use of every opportunity by involving themselves in the opportunities offered and by being willing to learn and be taught and to contribute to their own learning through being willing to collaborate in a mathematics community of practice.

5.3.3 Conclusion to Phase 2

Was the tutor-mentor intervention successful in fulfilling its aims as envisaged by MSA and the FP? From the findings garnered from the evidence, I conclude that it was. Because the MSA campus and the FP are the context in which the tutor-mentor intervention and the study took place, a pragmatic as well as a theoretical framework was necessary. In narrating the experiences, comments and opinions of the participants, I have attempted to illustrate how theory and practice are bound together in a holistic enterprise; how the FP mathematics tutor-mentor programme forms a community of practice situated in a particular context. I have used the experiences and views of the participants for this purpose. The general analytic strategy followed the theoretical propositions that led to the case study and linked these to the stories told by the participants in the study. This allowed the study to retain the holistic and meaningful characteristic of the real-life events even though the narrated stories cannot be precise and I had little or no control over the events. Asking ‘how’ or ‘why’ questions supported the quasi-experimental design of Phase 1. As this was an exploratory case study, in narrating the events I established sometimes competing explanations for the same set of events.

5.4 Integration of Phases 1 and 2

Both quantitative and qualitative data were gathered and analysed separately. In this section, I have integrated the results from the analysis of both sets of data to show how the results from

both phases of the study support each other. The direct comparison of the two sets of data thus provided a triangulation of data sources and enabled the integration process. The process of integrating the two phases of the research study is illustrated in Figure 5.10 below.

In Figure 5.11 the use of an upper case 'Q' in the model indicates the equal importance given to the quantitative and qualitative data. The box on the right shows the merging of the two sets of data, the integration of Phase 1 and Phase 2. The last box denotes layering the analysis using fourth level abstraction towards a situation-producing theory of tutor-mentorship at MSA. The findings present supportive evidence for the initial thesis statement of the study.

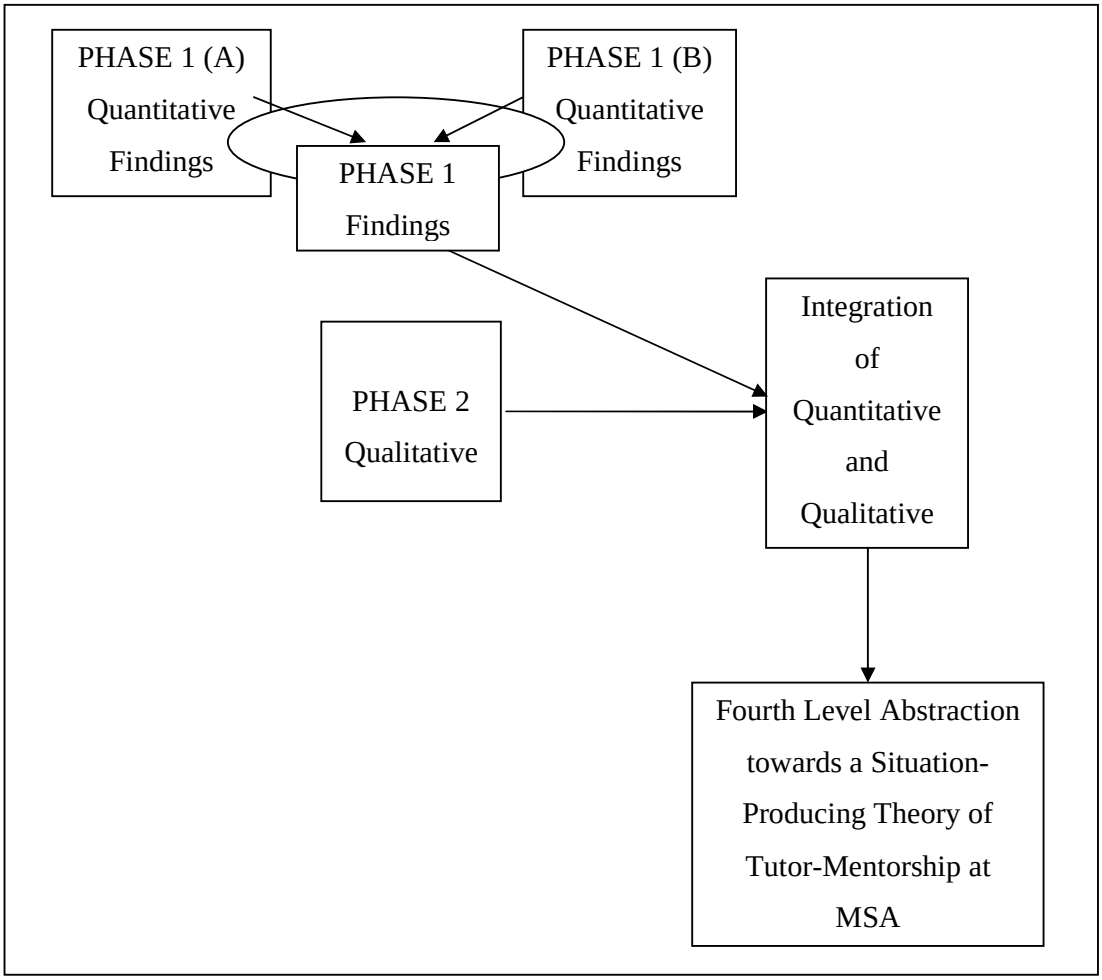

Figure 5.11: The process of integrating Phase1 and Phase 2

The quantitative findings suggested improved performance by objectively showing through statistical testing that participants in the tutor-mentor intervention had improved their

performance and that the improvement in performance was not due to chance. The degree of subjectivity of the qualitative findings provided rich information about the setting of the research and gave insight into the value and worth of the tutor-mentor intervention. I suggest that as mathematical concepts became more difficult, and higher levels of mathematical skills were needed, conceptual understanding did not develop in some students as easily as in others. Because these students did not make use of the tutor-mentor opportunities offered to them, either struggling on their own or giving up, their final performance suffered. The opinions of the students, tutor-mentors and lecturers provided insight into the reasons why the tutor-mentor programme was successful as a support intervention, as the themes identified during the analysis of the qualitative data supported the evidence of the quantitative data. The initial assumptions of the study were therefore supported by both the quantitative and the qualitative findings. When the findings of the two approaches were combined, the results provided a more complete picture of the tutor-mentor intervention process than only one approach would have done. Through integration of the two sets of data, a positive relationship between the findings of the quantitative and the qualitative data analysis was confirmed.

5.5 Discussion of integrated data

Integration of the quantitative and the qualitative findings confirmed the initial supposition of the thesis that participation in the mathematics tutor-mentor programme improved the performance of the FP mathematics students. When the results of the intervention and non-intervention groups were compared there was a clear difference. Students who had chosen to participate in the tutor-mentor intervention because their first test marks were below the required standard (a minimum average of 60% for mathematics) were accepted into the Monash IT degree course of studies because of their improved performance. Many initially failing students passed, which was an important outcome for this group of students. The majority of students in the non-participating (control) group appeared satisfied with their marks and apparently saw no need to make use of the intervention. This attitude was accompanied by deterioration in the performance of many of these students, and as a result they lost the opportunity to enrol for the undergraduate degree of their choice. While the findings show that the majority of students who used the tutor-mentor intervention improved their understanding of mathematical concepts as well as their final marks, it did not indicate

that extremely weak students would have passed if they had made use of the offered intervention. It only suggests that their understanding and marks would possibly have improved as a result of the intervention. This appears to be something of an anomaly, because all students registering for IT had to have obtained a minimum pass in mathematics (Appendix B). On examining the students' registration forms and their English scores, I noticed that the majority of students who had failed to improve despite making use of the tutor-mentor programme had exceptionally poor English language proficiency. The majority of students who were already proficient in mathematics but who wanted to improve their understanding and scores did so, indicating that the intervention served more than the single purpose of getting weaker students through the course and into their desired course of studies.
It was apparent from the questionnaires, interviews and conversations, that the improvement in performance of both weaker and stronger students as seen in the quantitative study can be attributed to two aspects. Firstly, evidence of improved understanding of mathematical concepts was seen in the improved performance of both the mathematically weaker and stronger students who chose to participate in the tutor-mentor intervention. Secondly, it appeared from certain comments that the mathematically competent students in the control group appeared satisfied with their marks and therefore saw no purpose in using the tutor-mentor intervention.

A small number of students in the control group did not use the offered intervention opportunity presumably, from their remarks, because they were resentful at having to do mathematics and were not really interested in improving their performance. The reason for this lack of interest is unclear but seems to stem from resentment at having to take mathematics which they did not accept as being necessary in order to follow their choice of career. For example, Kenneth, who was very weak in mathematics, complained that he did not "see why we need to do maths for marketing and management. Okay, I can see the point for accounts, but my subjects? I want to do IT for Business so, nah! I don't bother with the tutor – even during class. I just want to get it [the mathematics class] over". Other similar remarks followed such as "Yeah. Me neither. I hated maths at school but I passed, enough to get into the ADP [FP] anyway. The Arts students can do IT as an elective without maths, so why do I have to do it just so, just so I can do Business IT? It doesn't seem fair." While attitudes such as these may have accounted for some students' failure to improve their performance as these comments fit the profile of the students whose marks either did not improve or who failed the

course, it may be that these students did not fully understand the implications for their future studies.

The tutor-mentors indicated that through sharing their knowledge and understanding with the FP mathematics students they themselves came to a better understanding of the information that was presented. They commented on how teaching the FP students had led to their own personal study habits improving especially as they realised that they were role models to the FP students. They also mentioned the development of research skills such as selecting and organising relevant information for teaching their tutorial classes. The FP students observed that the tutor-mentors motivated and put pressure on them to perform well which increased their motivation to study and improved their attitude towards mathematics. According to many students and exemplified by Jane, "My tutors helped me to be motivated in my studies and showed me how to study and what I had to do to make it." Other benefits mentioned by FP students and tutor-mentors included improved time-management and increased motivation to group and self-study which they perhaps might not have learned apart from the opportunity to participate in the tutor-mentor programme. It was apparent that past and present tutor-mentors have served as supportive role models and helped students to understand the value of hard work and diligent study. It seems that these attributes were learned through collaborative and participative learning.

The responses of the students, tutor-mentors and lecturers to the questions posed in the questionnaires, interviews and spontaneous conversations provided insight into their beliefs, feelings and experiences and the value they placed on the mathematics tutor-mentor intervention as a support programme. The tutor-mentors were adamant that studying mathematics improved their ability to think logically and analytically and helped them develop academically as well as socially and emotionally. Although not every student participated in the tutor-mentor intervention, all recognised the inherent value in the programme and acknowledged that there were students who needed it and benefited from it even if they did not see the need for it personally. The majority of students who participated in the tutor-mentor intervention improved their performance and were allowed to proceed to register for the first year of the IT degree course. A much smaller number failed to gain entry to the IT course than was originally expected. Lecturers' views regarding the value of the tutor-mentor programme changed after seeing the results of the intervention. Mrs S, a mathematics lecturer, commented, "I really thought they [the students] would fail but it seems

that working with the tutors worked wonders." Many of the weaker students, although they had improved their performance, were denied entry into the IT degree programme because their marks were below the required 60% average entry level. However, mathematically weaker students who did not manage to achieve 60% but passed all the FP units were able to register for an Arts degree and choose IT as an elective. A few students either registered for a third semester in the FP or left MSA.

By using a mixed methods research design and integrating Phases 1 and 2, the findings of the research study used the strengths of both quantitative and qualitative research approaches to offset the weaknesses of both. The objectivity of the quantitative data (numerical scores) compensated for the weaknesses of the qualitative data, while insight into the setting of the study provided richness to the findings through an in-depth analysis of the qualitative data (questionnaires, interviews, observations and spontaneous conversations), and supported the findings of the quantitative data.

Integration of the data supported the findings of the quantitative and the qualitative findings and confirmed that the intervention made a difference to the performance of the participating students who chose to use the programme. The initial supposition of the study, that participation in the tutor-mentor intervention improved the mathematics performance of FP students, was therefore, supported but with a slight twist: the FP tutor-mentor mathematics intervention programme is a positive support programme for students, *if students choose to make use of it*. The quantitative and the qualitative data can, therefore, be said to be trustworthy and relatable to similar situations and supports the *bricolage* of theories put forward in Chapter 2. While the quantitative analysis showed that the intervention students' marks improved quite dramatically because of the tutoring aspect of the tutor-mentor programme, the qualitative analysis indicated an improvement in understanding and a change in attitude towards the subject which probably went a long way in helping the students improve their performance. This supports Kilpatrick, Swafford and Findell's (2001) argument that productive disposition is an important aspect of mathematics proficiency.

What became very clear after analysing the qualitative data is that the majority of students and even the tutor-mentors and lecturers considered the tutoring aspect of the programme to be the major component of the tutor-mentor programme. While the students appeared to realise the importance of developing good relationships with one another, very few seemed to recognise

any actual benefit of mentoring to their mathematics performance. They appeared to see this as more related to "getting along well with the tutor in order to improve mathematical understanding" than as academic and psychosocial support. However, what did become clear was the importance of establishing a mentoring relationship between the tutor-mentor and the lecturer.

The integrated findings support my assumption that, without a solid mentoring relationship between lecturers and tutor-mentors, the programme cannot and will not achieve its highest aims. I refer the reader to Chapter 2 and Chapter 3 where emphasis is placed on the holism of the tutor-mentor programme as a community of practice.

In the process of analysing and integrating the data, I realised that the analysis could be taken a step further than mere description and analysis of the themes, and that the development of a situation-producing theory could lead to a tutor-mentor theory that was not exclusive to the MSAFP but could, with some adjustments, be applied to any tutor-mentor situation.

The following section discusses how such a theory was developed through fourth level abstraction.

5.6 Fourth level abstraction towards a situation-producing theory of tutor-mentorship at MSA

Building a situation-producing theory is a process, the ultimate purpose of which is to provide a guide for action or practice (Dickoff, James & Wiedenbach 1968).

Dickoff et al (1968:425) produced a seminal work originally for the health sciences. Their work highlights the nature and development of theory in a practice discipline, and emphasizes that not only is theory relevant to practice but that practice is relevant to theory and both are relevant to research. Theory and practice are mutually interrelated and interdependent and action is directed towards a specific goal. According to Dickoff et al (1968:433), 'the purpose of a situation-producing theory is to allow for the production of situations of a desired kind.' They (Dickoff et al 1968) emphasize three essential ingredients that are necessary for building

a situation-producing theory: (1) goal-content: conceptualization of the content and of the content as a desirable goal (2) conceptualization of prescriptions: the actions that should be undertaken to realize the goal-content, and (3) a survey list which specifies six activities which an agent or practitioner must undertake in order to bring about situations of the kind conceived as desirable in the conception of the goal.

The interrelationship between practice and theory can be seen in Figure 5.6 by observing the process that interlinked and overlapped the themes, starting with the purpose of the tutor-mentor intervention and ending with the final outcome. In the following discussion, the process of abstraction towards a situation-producing theory is illustrated and the interconnectedness of the four levels of abstraction explained (Figure 5.12).

5.6.1 The process of abstraction

Figure 5.12 illustrates fourth level abstraction towards a situation-producing theory of tutor-mentoring FP mathematics students at MSA, and demonstrates the process of interconnecting the set of events. In the process of building a situation-producing theory, information is extracted and grouped at four levels, from the most basic, uncomplicated data-gathering at level 1 through to the most sophisticated at level 4 (Creswell 2002:273-274). The interconnected set of events shows the process that took place while enhancing the performance of FP mathematics students at MSA. Themes that emerged were connected to build a complex picture of the phenomenon of the FP tutor-mentor intervention and the process involved.

Figure 5.12 thus demonstrates the process of interconnecting the set of events. The explanation describes how fourth level abstraction can lead to a situation-producing theory that is not exclusive to the MSAFP situation but can be used as a theoretical framework for other tutor-mentor programmes that have a similar purpose. As the themes developed and after layering[18] and analysing the data at each level, a fourth level of abstraction was reached. Minor themes were subsumed within the major themes. Layering and interconnecting the main and sub-themes of the qualitative data connected the analysis as a sequence of events, and made the analysis more complex as I worked upward towards increasingly broader levels

[18] Layering means ‘representing the data using interconnected levels of themes’ (Creswell 2002: 273).

of abstraction. By interlinking the themes that emerged from the data, increasingly broader levels of abstraction led upwards to a fourth level of abstraction and pointed towards a situation-producing theory of tutor-mentorship at MSA.

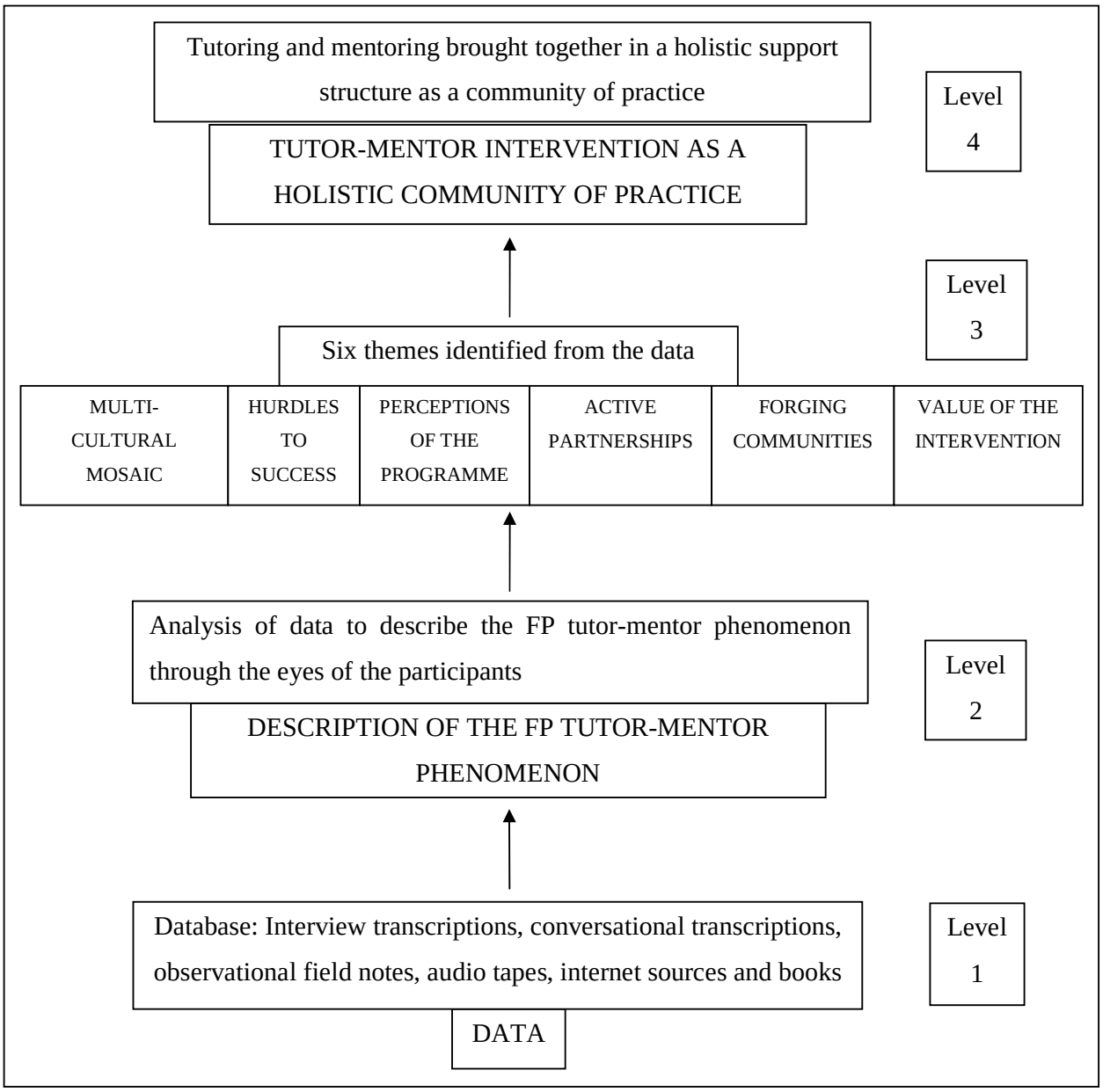

Figure 5.12: The process of fourth level abstraction towards a situation-producing theory

5.6.2 The abstraction of a situation-producing theory

Three factors were essential for a situation-producing theory to be developed. These were:

(i) a central purpose guiding tutor-mentoring in the FP: the tutor-mentoring philosophy underlying the purpose and the purpose reflecting the philosophy

(ii) a prescription for the fulfilment of the central purpose, or a directive to activity: how the purpose was fulfilled; what actions were necessary to take to fulfil the purpose

(iii) realities in the immediate situation that influenced the fulfilment of the central purpose: the matrix in which the action occurred.

After determining the central purpose and developing the prescription, six realities were then considered and organised into six elements characteristic of a situation-producing theory according to Dickoff et al (1968:434-435):

a) Who were the agents or practitioners who performed the activity?
b) Who were the recipients of the activity?
c) In what context or framework was the activity performed?
d) What was the end point or terminus of the activity?
e) What was the guiding procedure of the activity?
f) What were the dynamics or energy sources for the physical, cognitive or psychosocial activity?

Figure 5.13 illustrates the framework or matrix in which the six characteristics of a situation-producing theory are considered. A *bricolage* of theories underlies the framework: participants (practitioners and recipients) engaged (procedures) in a holistic enterprise as a community of practice working together (dynamics) for a common purpose and with a common desired outcome (goal). The matrix consists of individual realities which, while remaining individual, interconnect and interrelate for a common purpose. A short explanation of each reality follows.

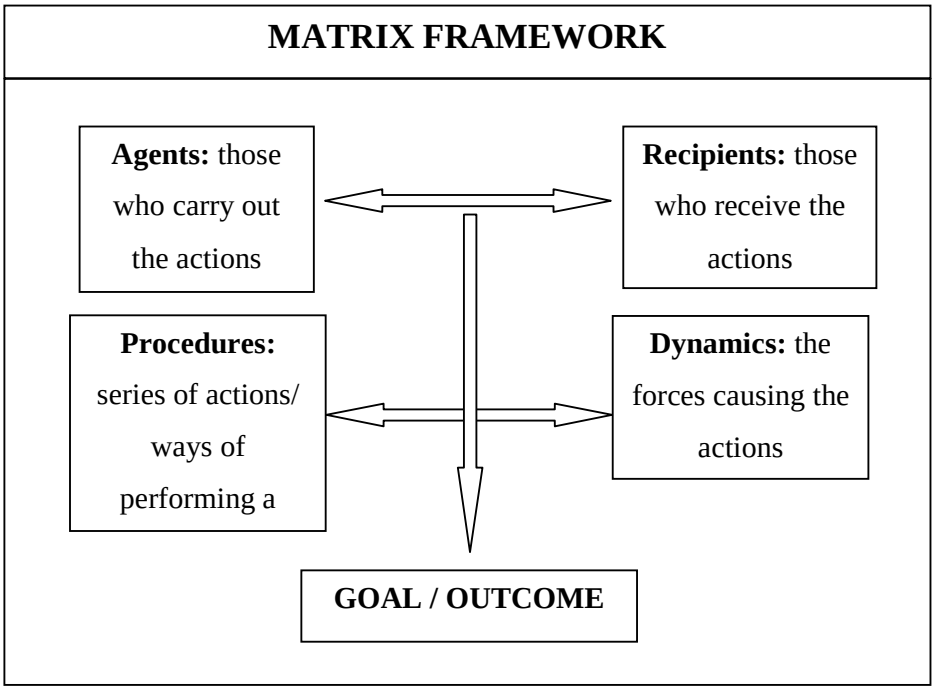

Figure 5.13: Building a situation producing theory in a practice discipline

The framework is the context in which activities took place and includes both physical and non-physical factors. Examples of the physical and non-physical context are MSA and its resources, the FP and its resources, lecture theatres, seminar and tutorial rooms, gardens, the tutor-mentor policy which comprises the underlying philosophy, principles and guidelines of the tutor-mentor programme, MSA policies in general and the communication channels through which agents and recipients are able to connect and interrelate with one another. Other non-physical factors were the different capacities of agents and recipients to share attributes such as knowledge and skills, their willingness to contribute to and ask for assistance and the authority to invite the contributions of leadership and expert support. All these played a part in building a situation-producing theory. Included in the support structure is the *bricolage* of theories described in Chapter 2 which underpins the building of a situation-producing theory. The framework however, was practical and manageable, and enabled the realisation of the goal of the activity. Closely related to these aspects are the aspects of agents, procedure, dynamics and terminus.

The agents included but were not confined to the lecturers, the tutor-mentors, the tutor-mentor leader, the head of the FP, the FP community and the MSA community such as management,

maintenance and so on. While the tutor-mentors, lecturers and tutor-mentor leader played the major role in the procedure, many other agents were also involved. The underlying theory was that of the tutor-mentors and lecturers as partners engaged in a common enterprise for a common purpose.

The recipients were mainly FP mathematics students but also included others such as the tutor-mentors, the lecturers, the FP and MSA communities who all stood to benefit in some way from the action. The underlying theory was that of students engaged in a partnership with an agent, including tutor-mentor, lecturer or counsellor, for a common purpose

The procedures or prescriptions were the series of actions, the steps or activities that were directed at performing tasks aimed at achieving the goal or outcomes according to accepted principles and guidelines as outlined in the FP Tutor-Mentor Policy document (Maitland 2008). To assess whether the actions met the purpose towards fulfilment of the goal, a complete record of the procedure was kept through various means such as tests and assignments.

The dynamics were the forces that caused certain actions to be taken in order to realise the goal. Personal commitment and motivation of all participants (agents and recipients) enabled the goal to be realised. As a result of the activities, and as agents and recipients become more committed and motivated, the community of practice was strengthened.

The goal or outcome was the desired fulfilment of the purpose of the tutor-mentor programme.

5.6.3 Conclusion to the abstraction of a situation-producing theory

While this study has been exclusive to the mathematics FP at MSA, I believe that the abstraction of a fourth level theory has opened up possibilities for the generation of a tutor-mentorship theory that can be applied to any tutor-mentor situation.

It is questionable whether a tutor-mentorship theory can be developed that will cover all tutor-mentoring situations, and it is possible that, if only the exclusivity of each teaching and learning situation and the individual needs of students are considered, it cannot. There are,

however, similarities within each situation and in the reasons why peer tutoring and mentoring are considered worthwhile activities in support of normal teaching and learning situations. Dickoff et al (1968:449) suggest that writers may not be aware of the potential theoretical significance of their contributions. However, every contribution, if combined in a concerted effort, could produce a theory that would benefit the practice of tutoring and mentoring in diverse circumstances.

Much of the existing literature on tutoring and mentoring programmes has emphasised aspects that contribute to the formation of a tutor-mentor theory, and have been fairly extensively covered in the literature. For example, every education institution desires good academic outcomes and all education institutions desire their students/learners to become mature, self-responsible human beings. However, although the aims may be the same, the processes of reaching those aims are often different and not always successful. Therefore, the development of a tutor-mentor theory would enable tutor-mentor programmes to be built on a theoretical foundation that would enhance tutor-mentor functions because the programmes would be built on a solid theoretical foundation. As stated by Dickoff et al (1968:449), a 'situation-producing theory has as its prime function the enabling of man [*sic*] to create or shape reality in a desired direction' and can be considered 'a good one if by following it activity can be brought about persistently, consistently, and extensively to create the kind of reality conceptually specified by the theory as desirable' (Dickoff et al:449). I argue therefore that the situation-producing theory described in this study could be used as a model and adapted to a diversity of tutoring and mentoring situations.

5.7 Conclusion

The final chapter concludes the study, discusses the limitations and makes recommendations for the practical application and transferability of the tutor-mentor programme to other similar higher education situations.

CHAPTER 6

SUMMARY OF THE RESEARCH, FINAL CONCLUSIONS AND RECOMMENDATIONS

"*Education without a vision is like a present without a future*" (The BAS Hebrew School.)

6.1 Introduction

In this concluding chapter attention I focus on a summary of the literature study and the empirical investigation in the light of the problem formulation and aims. I reiterate key findings and make recommendations for the improvement of practice. I propose areas for future research, note limitations of the study, and outline final conclusions.

At the beginning of this study, I formulated the research problem and highlighted the aims of the study. I identified and discussed some major problems in terms of student support for FP MSA students in ways that were relevant to the academic and psychosocial development of the MSA FP mathematics students, tutor-mentors and lecturers. I noted that although poor preparation at school level for post-school studies leads to high first year drop-out and failure rates at higher education institutions worldwide and at MSA in particular, this can largely be overcome through support programmes that recognise and deal with the academic and psychosocial needs of FP and other first year students. Problems in coping academically are sometimes caused by psychosocial issues and are often best dealt with by more experienced and knowledgeable peers who have experienced similar issues.

6.2 Summary of the literature research

In Chapter 2 I discussed a *bricolage* of theoretical perspectives relevant to tutor-mentoring in the MSAFP and explored the evolution of developmental and learning theories in a short historical overview. A *bricolage* of theories comprising the theoretical framework of the

research study was drawn from these theories. Recognition was given to the holistic nature of people, their interdependence with the world and the relevance to this of the *gestalt* theory and holism. These concepts were accepted as essential components of teaching and learning, integral to the FP tutor-mentor programme at MSA. A synthesis of cognitive, social-constructivist and participation perspectives under the metaphors of acquisition and participation were discussed and linked. It was accepted that knowledge is constructed and learning learner-centric and individualistic and that this should inform pedagogical practices. In addition, it was noted that the social and cultural environment influences all aspects of learning. Social-constructivist learning theories were recognised as taking precedence over purely cognitive theories as the importance of learning situated in communities of practice is realised. Social interaction and the presence of the ZPD were therefore seen as fundamental to learning. It was evident that for learning to take place individuals must be able to construct meaning; learning thus occurs in 'communities of learning and thinking' where participation in 'a shared problem space' or *habitus* is situated within a cultural domain. It was seen that the development of an individual's social and personal identity is essential to understanding his or her role in the community and for this to happen common goals are necessary. Learning is thus situated in communities of practice where there are recognised levels of allegiance and active participation and collaboration between individuals and communities evolve. Shared knowledge and active participation in teaching and learning thus improves social and emotional understanding and participation and extends personal spaces. Constructivist and participative perspectives were used to bring the diversity of participants' experiences and viewpoints together 'while situating that diversity in the social context of their participation in communal activities' (Cobb 2007:29). Participation in a common enterprise as a community of practice was thus seen to promote cognitive, social and emotional development in students, tutor-mentors and lecturers. The participation metaphors of teaching and learning were thus considered appropriate and congruent with the idea of tutor-mentoring as a pragmatic practicing partnership of like-minded participants. An eclectic position was taken with the emphasis on acquisition and participation metaphors. From this perspective the FP tutor-mentor programme at MSA can be recognised as an inclusive support unit comprised of separate parts; a composite whole situated within a community of practice that was itself made up of many communities of practice.

Chapter 3 discussed the phenomenon of access to higher education and the effects of multinationalism and multiculturalism on students at higher education institutions. A number

of research studies relating to cultural diversity and cross-cultural experiences of the higher education students were discussed. The selection of research studies related mainly to problems with academic performance associated with the use of English as the LoLT for EAL students. The importance of proficiency in English as the LoLT was emphasised and the necessity of psychosocial and academic support for EAL students discussed. A brief history of MU and the establishment of MSA, its aims and policies, faculties, schools and curricula, and the structure of the formal degree programme were described in order to situate the research study in a community of practice. The need for quality higher education was recognised with a selection of reasons mentioned by students as to why they chose to register for the FP at MSA. A brief description of the FP as an alternative pathway into a degree programme at MSA was given. I described the concept of culture shock and the possible damaging effects of diversity and discontinuity on learning and academic performance. Factors leading to the institution of the MSAFP tutor-mentor programme were described; unpreparedness for higher education and an inability to cope with various psychosocial stresses being among the main reasons for institutiong a support programme. It was seen that in order to improve academic performance, various problems encountered by FP students in particular had to be dealt with in a pedagogically appropriate manner and was the *raison d'être* for the establishment of the FP tutor-mentor programme. The aims and characteristics of a number of tutoring and mentoring programmes as examples of supportive interventions were described. The holistic nature of the MSAFP tutor-mentor programme as a community of practice was discussed, the parts that make up the whole described, and its pedagogic value as a teaching and learning tool for FP mathematics students considered.

6.3 Summary of the empirical investigation

The purpose of the empirical case study was to investigate how participation in the tutor-mentor programme improved the mathematics performance of FP IT students at MSA. Tutor-mentoring was perceived as a holistic programme focusing on the academic and psychosocial needs of the FP mathematics IT students. The FP mathematics IT group was chosen as the focus of the research rather than the entire group of FP students, firstly, because mathematics is the subject with the highest failure rate and students are required to pass it with 60% to register for an undergraduate degree in IT. The gains and losses in scores according to

participation or non-participation in the tutor-mentor intervention were most evident in this group of students. Secondly, the smaller number of students made the study manageable.

A case study using a mixed method research design was used for the investigation with the study taking place in two phases. During the first phase the quantitative data was collected, analysed and interpreted, followed by the second, qualitative phase which added depth and richness to the study. The quantitative and qualitative findings were integrated and used as supporting evidence for each other. The study took place over a period of ten months and was located in the natural setting of MSA.

The findings of the Phase 1 investigation supported the hypothesis that participation in the tutor-mentor programme improved the performance of FP mathematics IT students. The findings of Phase 2 answered the main research question and sub-questions. The integrated findings supported the initial supposition of the thesis that the FP mathematics tutor-mentor programme served the purpose for which it was designed.

Key findings were extracted from the analysis and integration of the Phase 1 and Phase 2 findings.

6.4 Key findings

1. Phase 1 findings supported the initial hypothesis that participation in the tutor-mentor programme improved the mathematical performance of FP students at MSA.
2. Phase 2 findings corroborated the findings of Phase 1 through the experiences of participants in the tutor-mentor programme.
3. The integrated findings supported those of both Phase 1 and Phase 2 and thus the hypothesis of the study
4. The claim for using a holistic tutor-mentor programme to improve academic outcomes was substantiated.
5. Fourth level abstraction towards a situation-producing theory was developed and gave credence to the development of a tutor-mentorship theory at MSA that could be further developed for use in other institutions.

Although tutor-mentor programmes are not part of the formal curriculum of higher education institutions, their contribution to improved learning is recognised and appreciated by most academics. According to my earlier observations, for a programme to be pedagogically sound, it needs to be grounded in a theoretical framework that will provide integrity to its design, structures and function. Based on the discussion in Chapter 2 and the findings in Phase 1 and Phase 2 of Chapter 5, I suggest that that the theoretical framework underpinning the MSA tutor-mentor programme is sound, and because the programme is thus supported, structure is given to the programme. This makes it easier for all concerned in the tutor-mentor programme to work together in a common enterprise for a common purpose. The participants (and others at MSA) are thus enabled to appreciate the pedagogical significance of the programme and the value of their involvement and their contributions.

6.5 Recommendations for improvement of practice

A number of recommendations to improve the practice of tutor-mentoring of foundation students at higher education institutions follow.

1. Strategies to incorporate tutor-mentoring into the curriculum and timetable of higher education institutions are necessary.
2. Thorough training of tutor-mentors and lecturers, to be given before the start of the year, should be a priority.
3. The holistic nature of tutor-mentor programmes as a support intervention must be recognised. This will ensure that tutor-mentors and lecturers are well-prepared and lecturers can organise their subject programmes together with the tutor-mentor(s).
4. The research findings support the use of peer tutoring and mentoring as worthwhile methods of supporting students psychosocially and academically at all higher education levels and at schools. However, Powell's (1997) seemingly confident assertion that tutoring and mentoring programmes *will* be organised in a way that provides academic and psychosocial support and guidance to students is perhaps too sanguine. If desired outcomes are to be achieved then tutoring and mentoring programmes need to:
   (i) be holistic;

(ii) recognise that tutor-mentoring is socially and culturally situated in a community of practice;
(iii) be active communities of practice and have common practical, obtainable goals;
(iv) be accepted by other communities within the boundaries of the greater community of practice;
(v) cover all academic and psychosocial needs of the tutees and mentees;
(vi) be pedagogically acceptable;
(vii) include all members of the community as active participants;
(viii) ensure sufficient and on-going training of tutor-mentors and lecturers;
(ix) ensure students are aware of benefits accruing from participation in the tutor-mentor programme;
(x) be pragmatic and cost effective.

6.6 Areas for future research

If tutor-mentor programmes are to be a practical and financially viable means of improving the outcomes of higher education institutions, then areas of research need to be focussed. The following suggestions are made.

1. Further research needs to be done on the performance of tutor-mentoring programmes as holistic enterprises as opposed to keeping tutoring and mentoring as entirely separate endeavours.
2. A tutor-mentorship theory that can be used by all education institutions should be developed.
3. Larger-scale research on tutor-mentoring programmes that meet the needs of EAL students at all levels of education is necessary.
4. Longitudinal studies, and
5. Follow-up studies with the FP students and tutor-mentors beyond the established two-semester treatment period should be undertaken.
6. Further studies using true experimental research designs should be carried out but with the proviso that such studies do not negatively affect the academic outcomes of participating students.

6.7 Limitations of the study

Possible limitations which could inhibit the trustworthiness, validity and reliability of the findings should be noted.

1. The study was restricted to a specific group of students with similar mathematical interests and did not incorporate all foundation year students or all subjects offered.
2. The need to focus on FP mathematics students and the small number of selected student participants may be thought to prevent 'generalisation' of the research. However, the abstraction of a situation-producing theory points to the possibility of developing a tutor-mentor theory usable for other higher education institutions and even perhaps for secondary institutions
3. Social and gender differences were not taken into consideration.
4. The numerical imbalance between international students (that is, students whose home is outside South Africa, who are in the country to study, and who intend to return to their country of origin upon completion of their studies) and South African FP students may have skewed the findings towards international student responses.
5. Convenience sampling meant that there was a lack of representation from the entire MSAFP student body and from foundation programmes at other higher education institutions in South Africa and abroad.
6. Non-randomization of the student sample caused problems with choosing a suitable statistical test.
7. The mentorship relationship of the researcher with all MSAFP students may have skewed results if students attempted to give answers which they felt were acceptable rather than true. Participant bias is therefore a possibility.

6.8 Reflection

On reflection, were the following questions answered? Can tutor-mentoring be considered essential for quality learning in a higher education institution? Can it provide sufficient and adequate academic support and is it effective in enhancing academic performance? If it is, then why and when should tutor-mentoring programmes as academic support interventions be

necessary and should they be compulsory or voluntary? How can such interventions be initiated and managed? Who should be part of these interventions?

In order to find convincing, pragmatic answers, on-going research is essential. It is not enough to say that a great deal of research has been done on tutoring and mentoring programmes. While this is true, people, education, societies and cultures change. We live in a world where internationalization and integration of nations, societies and cultures is becoming the norm. Developing countries need knowledgeable and skilled workers to advance their economies and improve the lives and welfare of their people. Modern technology has greatly increased the amount of information available and its accessibility, and this, potentially, has made quality learning much easier to obtain (Walton 2007). The claim that individuals are situated in historical as well as social and cultural contexts needs to be carefully considered, for achieving the goal of quality education is often fraught with difficulties. Planners of tutoring and mentoring programmes need to act cautiously and be aware of the dangers of using models that worked well in the past but are not necessarily suitable for the present or future as must be consideration for the uniqueness of individual and community needs, culture and tradition; thus the need for ongoing research in this area of education.

The use of peer tutor-mentors would relieve many overworked and badly resourced lecturers. Its practical application can be of great benefit, particularly to mathematics lecturers in South Africa, who often struggle with very large classes and where English is the LoLT. However, lecturers should not load tutor-mentors with work and responsibilities that morally and contractually belong to them. There should be active involvement by all members of an education institution in the tutor-mentoring programme as a community of practice within the greater community of practice. The implementation of tutoring and mentoring programmes at all levels of higher education was seen as an economical and effective way of achieving desired academic outcomes. In the context of South African higher education, the value of tutoring and mentoring programmes in meeting the needs of students, lecturers and the institutions has interesting possibilities but active involvement by all concerned, academics, students and other interested parties, needs to be encouraged.

Although an experimental statistical method could not be used in Phase 1 of the research study, the use of a quasi-experimental, nonequivalent method was sufficient for the purpose; especially as a mixed method case study design was used. The work of researchers such as

Eisenhardt (1989) and Yin (1994 & 2009) amongst others support this conclusion. Strategic selection of case studies may allow for generalization of findings (Flyvbjerg 2006). In light of this I believe that my findings are valuable and relevant to higher education FP students and can be useful to other institutions.

This study has shown that the most successful students were those who took advantage of and participated in the peer tutor-mentor intervention programme offered to them. The terms tutoring and mentoring were reserved for systematic activities which explicitly used undergraduate students to teach and mentor their peers. Furthermore, the lecturers as professional facilitators were required to oversee the programme; firstly, because the tutor-mentors were themselves students and secondly, because the activity became increasingly more formal and complex.

The saying ‘sit still while I instil’ is no longer seen by most educationists as an acceptable educational philosophy since it does not explain how people learn or how they should be taught. Students need to be participants in their own education and communities need to participate in the education of the young. People are no longer isolated in small enclaves or exclusive communities but are part of a world community. We need to learn from one another in communities of practice, and understand that each person is an individual with his or her own rights. However, at the same time, we need to recognise that we are responsible for and to other people and can learn from others if we are prepared to do so.

The study showed that although much research has been and is currently being carried out on the effect of multiculturalism on higher education institutions many designers and initiators of tutoring and mentoring programmes have not recognised the situatedness of tutoring and mentoring as communities of practice or as integral parts of other communities of practice, nor do they recognise the commonality and individuality of these programmes. The increasing growth in access to higher education, accompanied by multinational and multicultural diversity of university campuses, has led to a need for support initiatives that cater for a wide range of needs. Tutoring and mentoring programmes play a complex academic and psychosocial role in forming communities of practice in higher education institutions and relates to theories of human development and learning in a socio-cultural milieu. In Chapter 2 these were discussed and analysed together with their applicability to the MSA as a higher education institution situated in the southern African region.

Tutoring and mentoring programmes vary considerably, some emphasising the academic and some the psychosocial. Often, the concepts of mentoring and tutoring are considered one and the same. Some programmes emphasize academic tutoring but teach tutors to be aware of possible mentoring problems and to 'be nice'. Other programmes call tutoring 'academic mentoring' but actually mean tutoring with some aspects of mentoring attached. There are probably many other tutoring and mentoring variations not discussed here but the above mentioned will be sufficient to show how the MSA tutor-mentoring programme is considered a better option for the particular situation at MSA and for international and multicultural students in general.

It was apparent from the selection of literature reviewed that little emphasis has been placed on the theory of tutoring and mentoring. Most studies appear to be descriptions of programmes that are in place. Although these programmes can be used as examples on which similar programmes can be based, little serious specific study appears to have been done on theoretical frameworks. Also, previous studies are culturally biased because they are specific to particular cultures and geographic regions. Research studies have generally concentrated on describing the academic and psychosocial difficulties associated with multiculturalism and multiuationalism but have largely neglected the development of a tutor-mentor theory which educationists can use to build tutor-mentor programmes that would help solve problems in an international, multicultural context. Excellent studies have been done in the area of second language LoLT but they are helpful as guides for school educators rather than for higher education. In distinction from this, the philosophy and aim of the MSAFP tutor-mentor programme is to take into account the current trend towards globalisation and the consequent internationalisation of higher education institutions. Increasing access and the resulting multiculturalism of higher education institutions has implications that, if recognised and included in the aims and policies of higher education institutions, would benefit not only MSA but higher education throughout the southern African region and beyond. Because of this ideal, the FP tutor-mentor programme has attempted to avoid exclusivity so that its policies and principles can be used by any education system and in any situation, with minor changes according to specific needs. I believe this aspiration is achievable for the following reasons:

- the tutor-mentor programme is based on universal aspects of learning and developmental theories;

- the tutor-mentor programme incorporates the philosophy of outcomes based education and is not a rigid programme that must be implemented in a prescribed, often unachievable, way;
- because education is dynamic, pedagogic practices must be flexible and change with changing circumstances and situations: the MSA programme allows for this;
- therefore, lecturers (teachers) are allowed the freedom to implement and practice tutor-mentor programmes according to the needs of a particular situation;
- tutor-mentoring programmes should not be tied into one particular culture or race group at the expense of others; and
- the commonality and universality of the needs of all people are recognised.

Final conclusions are formulated on the premise of the problem statement.

6.9 Conclusion

The trend towards increased access to higher education institutions has emphasised the need for support programmes that enhance the learning experience of students and allow students from all sectors of society and different nationalities to benefit from a quality education. Tutor-mentor programmes that offer academic and psychosocial support should be offered to all students as part of the higher education curriculum but especially to EAL students where English is the LoLT. Tutor-mentor programmes as holistic enterprises within a holistic community of practice offered as supportive interventions to students provide academic and psychosocial support and effectively enhance academic performance and reduce the drop-out rate from higher education institutions. To be successful, tutor-mentor programmes must be dynamic and provide for changing needs and circumstances. They need to be professionally organised and managed with initial and ongoing training of tutor-mentors and lecturers. As a means of improving the academic performance of students at higher education institutions, tutor-mentor programmes should be introduced and used with minor changes at all levels of education including schools so that students are ready for the rigours of university study. I suggest that every higher education institution in South Africa have a peer tutor-mentor programme where older, more experienced students help less experienced and less knowledgeable learners in subjects such as language (especially English for EAL learners)

and in science and mathematics. This would not only help hard-pressed lecturers, but would ensure that learners and tutor-mentors learned from teaching one another.

The questions posed at the start of this study have been answered. Can students learn a subject purely from a lecturer in a classroom? Without doubt! But I suggest that much more could be accomplished with the help of well-trained, well-organised, experienced and enthusiastic tutor-mentors who can add value to education and reduce the demands on lecturers by giving them time to concentrate where most needed. Can tutor-mentors make a difference to the pedagogical outcomes of FP higher education students? The answer seems to lie in understanding the idea that for optimum learning, students need to find meaning in what they are taught through actively participating in their learning. Students must therefore be given opportunities to engage with, and learn from others by incorporating well-trained, experienced and knowledgeable tutor-mentors in the classroom. Are tutor-mentors necessary? I argue that this study has shown that if tutor-mentor programmes are designed on a solid theoretical foundation, with careful thought given to why such programmes are needed and how the experience and knowledge of well-trained tutor-mentors can best be utilised, and if programmes are carefully structured in communities of practice, then such programmes, together with their tutor-mentors, will fulfil their *raison d'être*.

Changes in pedagogical practice and the needs of society demand changes to the way tutor-mentor programmes are organised and managed. On-going research is therefore essential so that tutor-mentor programme organisers are informed and respond to current trends. It was seen that most research on tutoring and mentoring programmes concentrated on descriptions of events. These are useful, yet there has still been no tutor-mentor theory that could be used as a framework within which to build programmes.

Based on the findings of the study, it is suggested that programmes similar to the one described in this study be introduced into all higher education foundation/academic development programmes to help prevent the high failure and attrition rates of first year students apparently common to all South African higher education institutions (General discussions at The 14th International Conference on Learning June 2007).

The purpose of higher education is to produce academically sound graduates who are emotionally and socially capable citizens, contributing positively to society, willing to learn

from others, validating the cultural norms and values of their own societies, and knowing themselves as worthwhile individuals with a real purpose in life. If tutor-mentoring programmes are recognised as support tools that are able, if used correctly, to contribute to the holistic welfare of students, then it is logical to assume that higher education institutions need to look carefully at what these programmes have to offer so that they are committed to and supported by all members of an institution from top management to the lowest level. This, I am convinced, will help fulfil the educational mandates of institutions and enable every student to develop and reach his or her academic potential.

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APPENDICES

APPENDIX A

Table 4.3
ANCOVA SUMMARY TABLE

ANCOVA Summary Table					
Source	**SS**	**df**	**MS**	**F**	**p-value**
Adjusted intervention	13939.47	1	13939.47	50.70243	5.27E-11
Error (residual within)	38214.86	139	274.9271		
Total residual	52154.34	140			
				$\mathbf{F}_{0.05}$ =	3.909232
				$\mathbf{F}_{0.01}$ =	6.820778
Adjusted means					
Pooled regression coefficient	0.671604				
Control	48.28031				
Intervention	69.66254				
Adjustment variability on Y accounted for by adjusted intervention effect				0.267273	

Critical Values:

$F_{0.05}$ (95% level of significance) – was used for this study

$F_{0.01}$ (99% level of significance) – not used

Table 4.4

HOMOGENEITY OF REGRESSION SLOPES TEST

Homogeneity of regression slopes test					
Source	**SS**	**df**	**MS**	**F**	**p-value**
Heterogeneity of slopes	1984.03	1	1984.035	7.557012	0.006778
Individual residual	36230.83	138	262.5422		
Within residual	38214.86	139			
		CRITICAL VALUES		$F_{0.05}$ =	3.909729
		CRITICAL VALUES		$F_{0.01}$ =	6.822152
COMPARE P-VALUE (0.0067) WITH α (0.05 OR 95%)	α (0.05 OR 95%) DEGREES OF FREEDOM				
THE α IS MUCH LOWER THAN THE P-VALUE ≈ THE NULL HYPOTHESIS CAN	BE REJECTED				
COMPARE CRITICAL VALUE WITH F	$F_{0.05}$ = 3.90 (4.0) WITH f = 7.557 (8.0)		F (7.557)		
THE CV IS MUCH LOWER ≈ NUL HYPOTHESIS CAN BE REJECTED					

Additional to Table 4.5

JOHNSON-NEYMAN TECHNIQUE

Summary statistics			
	Control	Intervention	
Sample size	63	79	
Sample mean	61.11	46.23	
Sum of squares	24868.22	27035.90	
Intercept	0.34	42.85	
Slope	0.88	0.48	
F	3.91	6.82	
SS	36230.83		
A	**0.0739**		
B	**-12.3587**		
C	**1542.38**		
XL1	**83.0078**		
		Bounded above by	
XL2	**251.3551**	**100**	

Refer to Figure 4.4: Heterogeneity of regression slopes in relation to Table 4.3

(see Huitema 1980:67-68; 270-275)

APPENDIX B

MSAFP IT COURSE OUTLINE

Information Technology Stream	
Semester 1	**Semester 2**
Academic English A	Academic English B
Computer Systems and Word Processing	Databases and Spreadsheet Fundamentals
Mathematics A	Mathematics B
Problem Solving for IT	Understanding University Learning

Please note that the above course outline should be seen as a guideline only as new units may be introduced as and when necessary.

www.monash.ac.za/prospective/courses/degrees_its (Accessed 22 October 2009)

(FP requirements)

MSA Requirements for admission into information technology degree

MSA IT COURSE OUTLINE

The Monash South Africa School of Information Technology presently offers two degrees:

- Bachelor of Computing (B.Compt)
- Bachelor of Commerce in Business Systems (B.BusSys)

(For purposes of this study only the degree of Bachelor of Computing is applicable)

Length of student for the degree is three years full-time or the equivalent.

Foundation Programme students intending to register for a Bachelor of Computing (B.Compt) require a minimum average of 60% for Foundation Mathematics A and B and a minimum score of 5.5 (no band lower than 5 is accepted) for English

MSA course requirements. (Available at www.monash.ac.za/prospective/entry/) (Accessed 22/10/2009).

MSA School of IT course requirements. Available at: http://www.monash.edu.au/pubs/2009handbooks/undergrad/it=course.html. (Accessed 22 October 2009).

Compulsory minimum scores for enrolment in the Foundation Programme:
International students: a minimum of a "C" average (60%) overall; minimum of "C" average (60%) for mathematics to enrol in Business or IT stream.
South African students: A minimum of 30 points (likely admission score is 28 – 29)
(Leeway is allowed for students wanting to enrol in IT and who have the right subjects)

Compulsory minimum scores for enrolment in Information Technology mathematics stream:
Entry score: 28
Likely admission: 26-27
English requirements:
International students: a minimum of a "C" symbol (60%)
South African students: minimum score (3)
Maths requirements:
International students: a minimum of a "C" symbol (60%)
South African students: Higher Grade score (3) Standard Grade score (4)
Bonus points – English and Maths:
Score (4) or more: score + 2 bonus points

Entry requirements for enrolment in the School of Information Technology
"All (Foundation Programme) units must be passed in order to gain entry into the relevant undergraduate programme at Monash South Africa" (Undergraduate Guide 2008: 13).
Students intending to enrol for either the Bachelor of Computing (B.Compt) or the Bachelor of Business Systems (B.BusSys) degree are required to pass both English and mathematics with a credit (60%). (Available at: www.monash.edu.au/pubs/2009handbooks.undergrad/it-courses.html).

APPENDIX C

Flexible interview schedule used for students, tutor-mentors and lecturers

1. What were the experiences of students regarding multiculturalism?
2. How does multiculturalism affect students: psychosocially; academically?
3. What problems were encountered by MSAFP students?
4. What were the needs of MSAFP students: psychosocial; academic?
5. What were the perceptions of tutor-mentors and lecturers' regarding MSAFP students' mathematical knowledge and conceptual understanding pre- and post intervention?
6. What were the perceptions of students, tutor-mentors and lecturers regarding the MSAFP tutor–mentor programme as a holistic supportive intervention serving the psychosocial and academic needs of MSAFP students?
7. What reasons were offered by students, tutor-mentors and lecturers for students' participation or non-participation in the tutoring and/or the mentoring intervention?
8. How important were inter-personal relationships in achieving successful mathematics tutor-mentor interventions according to: students; tutor-mentors; lecturers?
9. Who organised the sessions? How were tutorial and mentoring sessions organised?
    - venues
    - hours worked
10. What kind of relationship / interaction did lecturers have with their tutor-mentors?
    - How the tutor-mentor programme was implemented in their classes?
    - What value did they see in having tutor-mentors present in their classes?
    - What kind of interaction did they notice between the tutor-mentors and the students?
    - What tasks did they give the tutor-mentors to do?
    - When and how much interaction did they have with the tutor-mentors before the classes?
    - What guidance did they give the tutor-mentors in 'teaching' mathematical concepts?
    - How were feedback sessions organised with the tutor-mentors – how often; when; and in what form?

11. What was the function of the tutor-mentors in:
    - Preparing students for tests and exams?
    - Helping students with assignments?
    - Helping lecturers with teaching?
    - Helping lecturers with marking?
    - Consulting with students after hours?
12. How did the students, tutor-mentors and lecturers perceive themselves as participants in the tutor-mentor programme?
    - What role did each one play?
    - How important was each person to the success of the tutor-mentor programme according to the students, the tutor-mentors and the lecturers?
13. How did students, tutor-mentors and lecturers understand the concept of a community of practice?
14. What importance did students, tutor-mentors and lecturers place on forming good inter-personal relationships between the participants in the tutor-mentor programme?
15. How did they view themselves as part of a holistic enterprise?
16. How did participants view themselves as maths practitioners?
    - working together as a community of practice in
    - a common enterprise with
    - a common purpose?
17. How did students, tutor-mentors and lecturers perceive the role of the tutor-mentor intervention in improving the performance of the MSAFP mathematics students?

    [i.e. Did their opinions corroborate the hypothesis of the study? This last point is not a question]

APPENDIX D

Flexible interview questions used for students, tutor-mentors and lecturers during informal interviews

Time: about an hour.

[These questions are not prescriptive. They are a guide and were used with the interview schedule. Questions were enlarged on and not restricted to those outlined here. Any digression fwas used as a lead to something unexpected and possibly worth pursuing. Questions were framed according to the participant being interviewed].

General questions for all participants

1. What are the biggest problems FP students face when they first come to Monash?
2. Describe your experiences as a new student; how you felt; how you coped (or did not); what or who helped you cope; why this helped.
3. What were your first experiences with FP maths? How did you manage and why?
4. What is meant by tutor? What do tutors do? What is their job?
5. What is meant by mentor? What do mentors do? What is their job?
6. Combine the two concepts. What is a tutor-mentor? What should tutor-mentors do? What is their job?
7. Why do we have a tutor-mentor programme for the FP maths students?
8. Who benefits and why?
9. Can tutoring and / or mentoring help improve students maths performance?
10. What pedagogical practices are important in tutoring? (Explain 'pedagogical' and 'practices' to students and tutor-mentors. Lecturers should know – but ask anyway).
11. What kind of teaching methods do tutors / lecturers / you use? Examples.

Students:

1. Why is it important to do well at maths in ADP?
2. How did the tutors teach differently from the lecturer? Describe.
3. How do you think the differences affected your learning maths?
4. How does feeling part of the Monash / ADP / FP maths community affect your learning?
5. How do inter-relationships between you and tutors/lecturers affect feeling part of the maths community?

6. How does feeling part of a maths community affect your feeling of belonging, your identity as a Monash ADP student?
7. How does belonging to a community affect your social and emotional life?
8. In what ways does this make a difference?
9. How does what you experience socially and emotionally affect you learning maths?

Tutors

1. How did you teach differently from the lecturer? Describe.
2. How do you think the differences affected the students learning maths?
3. How important is it for you as tutors to feel part of the FP maths community? Reasons?
4. How do you feel this affects your relationships with the students? With the lecturer?
5. How does this affect your teaching?
6. What kinds of relationships should exist between the various components in this community? Should everyone be equal in this community? Explain reasons.
7. Why is it important **to you** as tutor-mentors that students do well at maths?

Lecturers:

1. What differences (if any) did you see between your teaching and that of the tutors? Describe.
2. How do you think the differences affected students learning of maths (if at all)?
3. How important are inter-relationships between participants for successful tutoring? For successful mentoring? Examples – good and bad?
4. In what ways did inter-relationships make a difference in learning / teaching maths?
5. What do you understand as being a 'community'? Any examples?
6. What makes you feel part of the Monash / ADP / FP maths community?
7. Is there a maths community? Should there be? Why should / should there not be a recognized maths community?
8. If there should be a community of maths practitioners, how can you as lecturers, form a maths community that includes tutors and students?
9. Why is it important **to you** as teachers that students do well at maths?
10. How can the FP tutor-mentoring programme be improved?

APPENDIX E

Flexible focus group interview schedule for tutor-mentors

General questions

1. Why did you choose to study at Monash South Africa?
2. What do you understand about Monash's policy of internationalism and preparing students as global graduates?
3. How does living and studying on a multicultural campus affect you personally?
4. How do you see it affecting FP students?
5. Did (do) you have the same kind of problems as FP students?
6. What kind of problems did you have?
7. Explain how you felt as a new student? Did you feel that you belonged?
8. What made you feel you belonged?
    - What made you feel as if you didn't belong?
    - How did you cope with these feelings?
    - What made you cope better?
9. How secure did you feel as a new student?
    - Did you feel confident in your ability to cope with problems?
    - With communicating with other FP students; lecturers; Monash undergraduates; people in general like taxi drivers and shop assistants?
10. How were your studies affected by your experiences?
11. Who did you go to for help with: emotional; social; academic problems?
12. How helpful were these people?
13. How could they have been more helpful?
14. What kind of assistance would have been most helpful to you as FP students?
15. Why do you think the programme was started?
16. Why do you think peer tutor-mentoring works well?
17. What would you think about the tutor-mentor programme as a peer support programme being extended to include undergraduates?
18. Is it worthwhile?
19. Does it have value?
20. How important do you think it is to have been an ADP (FP) student yourself in order to tutor-mentor?

21. Did having tutor-mentors to help you when you where an ADP (FP) student make a difference?
22. How do you feel about the tutor-mentor programme
    - as an academic supportive intervention?
    - Do you think enough support is being given to struggling students?
23. How are you developing inter-relationships between yourselves and the students so that students feel comfortable asking you for help?
24. What makes a student not ask for help?
25. How approachable are you as a tutor?
26. How are you applying the teaching methods you learned in the tutor workshop? If you are not – why not?
27. I n what way are the teaching methods you use serving the needs of the students you tutor?
28. How do your teaching methods correspond with that of the lecturer?
29. Are you comfortable teaching this way?
30. How do you think you should be teaching (if it's not in line with what you were taught as a trainee tutor?)
31. What do you think you can do about this if it's a problem?
32. How are 'in-class' sessions being organised?
    - In consultation with lecturer?
    - Follows the maths programme?
    - Presented clearly.
    - Time spent explaining new concepts?
    - Lecturer always present?
    - Do you sometimes teach for the lecturer?
33. How are 'out-of-class' meetings organised?
    - Are these meetings profitable?
    - Which is better – 'in-class' or 'out-of-class'?
34. How do you find out if a student's knowledge and conceptual understanding is improving?
35. Do you help students prepare for tests and exams? How do you do this?
36. How are you making sure students understand the value of tutor-mentoring in improving their maths performance?

37. You all enjoy doing maths but how do you as a tutor help students who are struggling with maths find the same enthusiasm and enjoyment as you do?

As a social / emotional supportive intervention

1. How are the needs of the 'whole' person included in your tutoring?
2. How do you recognise social and/or emotional needs?
3. In what way do you deal with students who have social and or emotional needs?
4. How do you deal with a student who has an 'attitude' problem?
5. How do you maintain a professional yet approachable manner when you mentor students?
6. How are you sharing your experiences as an FP student with the maths students?
7. How are you encouraging students to achieve as well as possible in maths?

Specifically tutoring

1. What made you decide/want to be a tutor?
2. Do you find it difficult to tutor in English? To get the concepts across clearly. OR
3. Do students follow you better when you speak to them say in Tswana if they come from Botswana or French if they come from Gabon or the Congo for example?
4. Do students approach you for help?
5. Which do you prefer? Teaching in or outside the classroom; say in the garden or the library?
6. Why the preference? What makes the difference?
7. Do you feel as though you belong to a special group of students – a tutoring community?
8. What makes tutoring special for you personally?
9.

Specifically mentoring

1. Do you think mentoring plays an important role in tutoring?
2. Why do you believe mentoring is/is not an important part of tutoring?
3. Are you mentored? If so, who mentors you?
4. How do you feel about mentoring as an aspect of tutoring?
5. What value do you place on mentoring as part of the programme?

Suggestions for improvement

1. How do you think the tutor-mentor programme can be improved so that more students will participate and benefit from it?

Open discussion: Anything else they would like to talk about or mention.

APPENDIX F

Semi-structured exploratory questionnaire for students

All information is and will remain confidential and anonymous.

Please tic or cross the relevant box and write as much as you can about your experiences in the spaces provided. Extra paper will be provided if you need it.

1. Do you use a tutor to help you with your maths?
    - During class
    - Out of class
2. Please explain why you use a tutor
    - During class
    - Out of class
3. When do you use a tutor OUT of class?
4. Please explain why you do / do not use a tutor out of class.
5. Please describe your experience with the tutor-mentor
6. Does having a personal tutor available help you understand the work better?
7. Please describe what you like best or least about tutor availability.
8. Have your marks
    - Improved?
    - Stayed the same?
    - Got worse?
9. Please explain why you think this has happened?
10. Please comment on how you feel about having a tutor available to help you in the classroom while you are working.
11. Please explain how you feel about having tutors available to help you with homework, assignments and preparing for tests.
12. Do you think tutors are a valuable resource?
13. Please explain what you understand about tutors as a resource.
14. Do you find the tutors helpful?
15. Please describe in what ways you find them helpful.
16. Can you manage without a tutor?
17. Please explain why you can manage without a tutor.
18. Have you ever asked a tutor to mentor you?
19. Please explain why / why not.

20. Please feel free to add other comments about the tutor-mentor programme; either positive or negative.
21. Please offer suggestions for improvement.

Remember that all information is confidential and will remain anonymous.

Thank you for your contribution and for sharing your experiences. It is greatly appreciated.