INVESTIGATING THE REASONS FOR THE HIGH FAILURE RATE IN THE SUBJECT MATHEMATICS AS PART OF THE NATIONAL CERTIFICATE (NCV) AT PORT ELIZABETH COLLEGE

Ziyaad Dolley

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Supervisor: Prof Hugh Glover
DECLARATION BY CANDIDATE

NAME: ZIYAKA DOLLEY

STUDENT NUMBER: ________________

QUALIFICATION: MASTER IN EDUCATION

TITLE OF PROJECT: INVESTIGATING THE REASONS FOR
THE HIGH FAILURE RATE IN THE SUBJECT
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CERTIFICATE (NCV) AT PORT ELIZABETH
COLLEGE

DECLARATION:

In accordance with Rule G4.6.3, I hereby declare that the above-mentioned treatise/dissertation/thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

SIGNATURE: _______________________

DATE: 09-01-2015
I want to express my gratitude to GOD the Almighty for granting me the ability to complete this research.

I would also like to thank the following people:

- Prof Hugh Glover for his patience and guidance throughout this process.
- My family for their continuous love and believe in me.
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- The students at Iqahiyay Campus for their unselfish contributions.
Over the past years the FET Colleges sector has been plagued by high failure rates in mathematics and science as part of the National Curriculum (Vocational) course. This study sought to investigate the possible reasons for the high failure rates in NCV mathematics at Iqhayiya Campus of PE College.

The purpose of the research was to elicit these possible reasons from students who currently are doing the NCV mathematics course at the Iqhayiya Campus.

This study follows a mixed method design using both quantitative and qualitative results. Quantitative data were gathered by means of questionnaires submitted to students doing NCV mathematics at the Iqhayiya Campus. A Likert scale was used to evaluate the questionnaires. The qualitative data for this study was collected through researcher questions in focus group interviews.

The study concludes with recommendations to the management of PE College, the Department of Higher Education and all relevant role players.

ABSTRACT

Over the past years the FET Colleges sector has been plagued by high failure rates in mathematics and science as part of the National Curriculum (Vocational) course. This study sought to investigate the possible reasons for the high failure rates in NCV mathematics at Iqhayiya Campus of PE College.

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CHAPTER ONE

INTRODUCTION AND OVERVIEW

1. INTRODUCTION
Mathematics is becoming increasingly vital in the world in all areas, but no more so than in vocational education. It is the foundation of all engineering studies. This chapter is an introduction into seeking to establish possible reasons for the high failure rate in the Mathematics for Engineering as a subject of the National Certificate Vocational (NCV) at Iqhayiya Campus, Port Elizabeth College. It provides a background and rationale to the study, problem statement, objectives, and significance of the research, delimitation of the research, research methodology, literature overview and an overview of the chapters.

2. BACKGROUND AND RATIONALE
In 1995, the newly elected democratic South African government began overhauling the Education and Training system inherited from the apartheid government. The establishment of a single National Qualifications Framework (NQF), was the first step in transforming vocational education. The NQF is a set of principles and guidelines providing a vision, a philosophical base and an organizational structure for a qualifications system. It is national since it embodies a national resource representing a national effort at integrating education and training into a unified structure of recognized qualifications. It is, thus, a framework of qualifications that records learner achievement.

The South African National Qualifications Framework (SANQF) recognizes three broad bands in education: General Education and Training (GET), Further Education and Training (FET) and Higher Education and Training (HET). GET starts at grade 0 and ends at grade 9. General Education and Training also includes Adult Basic Education and Training (ABET), which caters for adults who want to finish their basic
education. Further Education and Training (FET) which starts from grade 10 to grade 12, also includes career-orientated education and training (Department of Education (DoE), 2008).

Between 1994 and 1995, more attention was given to the GET while vocational education in the FET phase was put on the back burner. Only after the appointment of a the National Committee on Further Education (NCFE) in September 1996, a report, entitled “A Framework for the Transformation of FET’s in South Africa”, was published in August 1997. This was followed by a Green Paper for FET, a White Paper for FET and the Further Education and Training Act, 1998 (Act No 98 of 1998), in which was ‘set out a broad and long term national framework for the transformation of curricula, learning and teaching, qualifications, funding, quality assurance and new institutional arrangements (DoE, 2008).

In July 2001, a National Landscape Team, established by the minister to oversee the Further Education and Training sector, published the document, “A New Institutional Landscape for Public Further Education and Training Colleges”, which recommended that the existing 152 technical colleges be merged into 50 public FET colleges. The period from 2002 to 2006 saw the merger process of these 152 technical colleges into 50 FET colleges. In 2006 the new Further Education and Training Colleges Act was drafted that supported the vision of a modern, vibrant FET college system that builds a foundation for lifelong learning and is responsive to the needs of the 21st century’ (DoE, 2008).

In March 2006, the NCV qualification and curriculum policy framework was gazetted. The National Certificate (Vocational) at Levels 2, 3 and 4 sets out the minimum requirements for the attainment of the National (Vocational) Certificates. The main aim of the National Certificate (Vocational) qualification was to solve the problem of poor quality programmes, lack of relevance to the need of the economy, as well as the low technical and cognitive skills of the FET college graduates (Department of Education (DoE), 2006).

The National Certificate (Vocational) was introduced to Further Education and Training Colleges (FET) at the start of 2007. According to Papier (2009), learners were given access indiscriminately so that national targets could be realized and the associated funding secured. The course commenced with a country-wide shortage of
text books and many educators were not adequately prepared for the new content and methodology. For many of them OBE was unfamiliar terrain and facilitated learning to fifteen year olds was equally new (Papier, 2009). Schools made use of the opportunity to send those students who were struggling to progress in the GET phase, by channeling them into the FET phase via the NCV programmes at colleges.

According to Papier (2009), figure 1 illustrates the highest school grade achieved by learners prior to enrolling on the NCV programmes in 2007 and 2008, which is an indication of the number of students channeled to colleges in 2007.

![Figure 1: Last school grade passed before coming to College (Adapted from Papier 2009)](image)

Parents from low income households also took the opportunity because of the elaborate bursary scheme offered to learners on the programme (DoE, 2006). According to the policy document, ”Formal Further Education and Training College Programmes at Levels 2 to 4 on the National Qualifications Framework (NQF) of 2011“, the general minimum admission requirements for the NCV course is a grade 9 certificate. Both learners and parents as well as school principals are fully aware of the policy and FET colleges have thus become the “dumping grounds “for school
dropouts. Those learners who cannot progress to grade ten are now being channelled into FET colleges. PE College was no different to this scenario with over 600 students registering for the NCV courses in 2007.

In January of 2010, the Mail & Guardian stated: “Dismal pass rates were recorded in the Further Education and Training (FET) colleges sector last year, with the lowest rates achieved in Mathematics and Science.” The ANC National executive committee released a document which was tabled in response to the results, wherein they strongly criticize the FET Colleges, by saying: “they had failed South Africa in the country’s efforts to create jobs”. The article also quotes the director of the Centre for Education and Policy Development, as stating that “FET colleges tend to admit many students from schools in a bid to increase student numbers. Yet exam results indicate that those who already have a matric certificate tend to do better, whereas those without matric tend to drop out or fail”. (Dibetle, 2010:4).

In February 2011, the Business Day South Africa reported that the “Department of Higher Education and Training is withholding the 2010 exam results of all 50 colleges, leading to speculation that they were too poor for public release.” The article also stated that in 2008, only 7, 59% of candidates passed and in 2009 the pass rate increased to 9, 6%. At level three of the National (Vocational) Certificate, only 9,56% of candidates passed in 2008 and 12,4% in 2009 (Blaine, 2011).

In September 2010 the Higher Education and Training Minister, The Honorable Blade Nzimande conducted a summit which brought together education experts from all sectors of education to discuss ways of improving the status and effectiveness of South Africa’s FET sector, “which has been characterized by low pass rates, poor planning and financial mismanagement”. He emphasized that “South Africa’s Further Education and Training Colleges need a radical overhaul in order to become colleges of choice that provide quality foundation programmes focusing on mathematics and science” (Department of Communication, 2010:3).

The recent announcement by the Honorable Nzimande to increase FET college bursaries to R1 235bn for needy, academically capable students, has seen enrolments increase exponentially. This increase in numbers is slowly coming to pass with over 500 new students registering for the NCV course in 2013 at PE College, Iqhayiya campus alone.
It is clear that high failure rates in FET colleges are a reality of great concern. It is thus imperative that the knowledge and understanding of the reasons for students' failure be researched so that it can enable lecturers, seniors, managers, student support and government to try and eradicate these obstacles that negatively influence the understanding of mathematics and impact on the quality of teaching and learning.

3. National Certificate Vocational (NCV) at PE College.

All the National Certificate Vocational (NCV) courses in the engineering field, offered at PE College, are offered on a full-time basis over a period of three years at levels 2, 3 and 4 on the National Qualifications Framework. The curriculum for the engineering qualification is comprised of both theory and practical work. The practical component is offered in a real workplace environment, which is set up at the college in the form of a simulated workplace.

There are currently four Engineering Studies programmes offered at the Iqhayiya Campus. The four programs are Engineering and Related Design, Electrical Infrastructure Construction, Civil Engineering Construction and Mechatronics. In order to obtain a qualification in any of the four Engineering vocations, a student is required to take a total of seven subjects whereby the following fundamental subjects are compulsory for each course.

- Language which must be in the language of teaching and learning
- Mathematics
- Life Orientation

Mathematics is fundamental because it enables creative and logical reasoning about problems in the physical and social world and in the context of mathematics itself. In today’s world, we are bombarded with data that must be absorbed, sorted, organized, and used to make decisions. The underpinnings of everyday life, such as making purchases, choosing insurance or health plans, and planning for retirement, etc., all require mathematical competence. Business and industry need workers who can solve real-world problems, explain their thinking to others, identify and analyze
trends in data, and use modern technology’ (National Council of Teachers of Mathematics, 2005:8).

Today’s students must master advanced skills in mathematics, science, and technology to stay on track for college and for promising careers. Mathematics teaches ways of thinking that are essential to work and civic life. Today, most professions and industrial careers require the basic ability to work with mathematics and have an understanding of mathematical theory. Employers expect their employees to solve problems which are not typical and require the use of mathematical skills to identify, pose and solve problems creatively and critically.

4. PROBLEM STATEMENT
This crisis of student failure in mathematics is not something new in education. Most recent statistics indicate that South Africa does not have a good track record when it comes to performance in mathematics and science. According to the Trends in International Mathematics and Science Study (TIMSS) report of 2011, South Africa, Botswana and Honduras demonstrated low performances at both the Grade 8 and Grade 9 levels. Their national scores were among the bottom six countries with an average scale score of 39 (2.5) with South Africa achieving a score of 352 (2.5). Although this was an improvement to the score of 285 in 2002, South Africa’s performance is still at the low end.

This low performance and high failure rates in the GET band of the South African education system continues within the FET sector and in particular the Mathematics for Engineering Studies at FET colleges countrywide. This study will focus on a particular FET college in the form of PE College. The study will further concentrate on Mathematics for engineering studies as presented at the Iqhayiya Campus.

A graphic representation of the pass percentage from 2007 to 2012 for each level at Iqhayiya Campus is represented in figure 2.
The pass percentage does indicate an improvement in the pass percentage yearly at all levels. However, the average pass percentage for Level 2 and Level 4 only calculates into an average percentage of 48% while Level 3 calculates into an average percentage of 38%. This reciprocates into a high failure rate of 52% for Level 2 and Level 4 and an even higher failure of 62% for Level 3 from 2007 up to 2012.

The National Certificate (Vocational) curriculum was designed to be responsive to the skills development needs in South Africa. The low performance and high failure of students in Mathematics raises the strong concern that we will not be able to meet the demand for quantity and quality of engineering students which is in strong contrast to the goals of the NCV – Mathematics curriculum. It is therefore vital that we as a nation address these high failure rates through identification and seeking possible solutions to the problem that will upgrade the quality and satiate the shortage of skilled South African citizens.

Based on the background given and in particular the deep concern about the high failure rates in NCV mathematics at PE College, the focus of this study was developed.
5. **THE RESEARCH QUESTIONS**

The primary question in this study is

*What are the possible reasons for the high failure rate in NCV mathematics course, as perceived by the level 2, 3 and 4 students at the Iqhayiya Campus, Port Elizabeth College?*

The following subordinate questions are asked:

- *What are the possible recommendations that can be made to improve the pass rate of NCV mathematics students?*

6. **SIGNIFICANCE OF RESEARCH**

The recommendations of the research are aimed at contributing to a better understanding of the reasons for failure and, if acted upon, can improve the performance in not only the NCV Mathematics, but also of Mathematics in general. This study will also serve as a basis for other relevant research that may contribute to producing learners who are more equipped with the necessary technical skills that would allow them to make a more positive contribution towards the economic growth of the country.

The results of this research will be presented to the various stakeholders such as the Lecturers and Management of Port Elizabeth College, the Department of Higher Education, as well as Student Representative Counsel (SRC) of PE College.

7. **DELIMITATION OF RESEARCH**

The study is limited to one Further Education and Training College, which is Port Elizabeth College and therefore cannot be generalized but needs to be more widely researched for a deeper understanding.

8. **RESEARCH METHODOLOGY**

A brief explanation of the research design, population and sampling is given below. A detailed description of the research methodology used in conducting this study is given in Chapter 3.
8.1 RESEARCH DESIGN

Tashakkori and Teddlie (2010) refer to use of mixed methods research as methodological eclecticism. Methodological eclecticism is the selecting and then synergistically integrating the most appropriate techniques from a myriad of qualitative and quantitative, and mixed methods to more thoroughly investigate a phenomenon of interest.

The selection of methods, and their application, is always dependent on the aims and objectives of the study, the nature of the phenomenon being investigated and the underlying theory or expectations of the investigator (Babbie and Mouton, 2001).

For many decades social research has been dominated by either qualitative or quantitative research methods. This study will try and make use of both quantitative and qualitative approaches. The emerging term for such an approach is deemed a mixed methods research.

According to De Vos, Strydom, Fouche & Delport (2010), mixed methods study can be described as one in which the researcher uses multiple methods of data collection and analysis. The study will aim to make use of a combination of closed questionnaires and interviews. Making use of statistical techniques to analyze the data generated through the questionnaires and an interpretative approach to analyze the data generated through the interviews.

In view of the above, the following data collection methods have been identified for this study:

- A Likert scale questionnaire to identify, confirm and rank various reasons for failure in Mathematics
- A focus group interviews, based on the results obtained from the questionnaires, to try and probe the underlying reasons and causes for the failure in Mathematics.
8.2 POPULATION
The target population comprised of NCV students currently doing the Levels 2, Level 3 and Level 4 Mathematics course at the Iqhayiya Campus of Port Elizabeth College in 2013.

8.3 SAMPLING AND DATA COLLECTION PROCEDURE
The sample for this study constitutes about 600 students enrolled for the Level 2, 3 and 4 for the Mathematics (NCV) course at the IQH Campus of Port Elizabeth College.

All ethical issues were considered on the administering of the questionnaires and in conducting the interviews. The researcher first explained the objectives of the research to the participants and how it would assist in addressing the problem in the NCV mathematics. Participants were given the assurance that there would be no intimidation and that they would be free to withdraw from the research at any time. The participants were assured that all information would be strictly confidential and that all participants would remain anonymous. Participants would also have free access to all findings.

The researcher was granted permission to distribute a questionnaire and to conduct the interviews by the campus manager of IQH campus of Port Elizabeth College. A record of consent to participate in the research was issued to all participants. When the questionnaires had been completed, the researcher collected questionnaires and counted the number of returned questionnaires against the number distributed. Out of the 600 questionnaires that were distributed, a total of 190 were completed and returned. The low return of questionnaires can be contributed to the fact that the questionnaires were issued post a major student strike, hence the poor attendance of students.

After the analysis of the questionnaire, three groups of 3 students each were selected from a list of under performers to participate in the interview sessions. The focus group interview questions were based on the findings produced from the questionnaires. After the focus group interviews, an analysis will be done in conjunction with the questionnaire results. A detailed description of the findings and recommendations is given in Chapters 4 and 5.
9. LITERATURE OVERVIEW

There are many reasons for poor performance in mathematics, but the researcher has restricted the reasons to eight categories. These categories are student perception of mathematics, quality of teaching, quality of learning, student confidence and motivation, language, curriculum implementation, admission policy and nature of final examination and internal assessments.

These categories in no particular order are further divided into the following subcategories:

Student beliefs of the usefulness of mathematics

1. Relevance of mathematics
2. School mathematics versus NCV mathematics
3. Practical mathematics

Quality of teaching and learning

1. Lecturer preparation
2. Lecturer explanation
3. Lecturer interaction

Quality of physical resources

1. Resources accessibility
2. Quality of resources
3. Effective use of resources
4. Effective use of education aids
Student motivation and attitude

1. Attendance
2. Emotions
3. Length of period

Language

1. Home language
2. Mathematical terminology
3. Peer assistance

Curriculum implementation

1. Time frame
2. Level of difficulty
3. Content

Admission requirements

1. Competency test
2. Prior mathematical knowledge
3. Bridging course

Nature of final examination and internal assessments

1. Value of ICASS assessments
2. Relation between ICASS (internal) and final examination (external)
3. Duration of final examinations

The literature review in chapter three examines these reasons in more detail.
10. **OVERVIEW OF CHAPTERS**

Chapter One includes background and explanation of the rationale behind the study, a discussion of the problem statement, research objectives, and delimitation of research, an outline of the research methodology and research design and a literature overview.

Chapter Two will provide in depth study of the relevant literature.

Chapter Three will focus on the research design, which includes the data collection instruments used to obtain the research objectives.

Chapter Four will discuss the analysis of the data.

Chapter Five will discuss the results and the appropriate recommendations.

11. **CONCLUSION**

This chapter provides a brief outline of the manner in which the study will be conducted.
INTRODUCTION

This chapter deals with the literature review which seeks to provide an overview of the key knowledge related to the factors that impact on the high mathematical failure rate offered in courses in the vocational sector.

Although very little has been written about the reasons for the high failure rate in mathematics in the Vocational Education and even less in Further Education and Training Colleges in South Africa, it seems reasonable to argue that the reasons for failure in mathematics courses in senior and secondary and early undergraduate years could be very similar, given the similar age of students and similar nature of the content to be learned.

The South African studies that could be sourced include one which investigates the factors that contributed to the poor performance of FET college learners in the NCV courses between 2007 and 2008 by Papier (2009), while the other deals with reasons for failure in a mathematics course for undergraduates offered at a University by Paras (2001). Both articles provide possible key reasons for high failure and served as a foundation for the framework of possible reasons for the high failure rates in NCV mathematics at PE College.

The following list of collective reasons for failure from both articles was formulated. They are listed in no particular order of importance as:

- The quality of teaching and learning.
- Excessive workload due to long syllabus and assessment requirements.
• The gap in student’s mathematical knowledge is too large.
• Language barriers experienced by students where the language of teaching and learning is not their home language.
• Interaction strategies by lecturers are inadequate for effective learning.
• The lack of student self-esteem, motivation, discipline and the absence of a culture of learning and taking of responsibility.
• Inadequate academic preparedness with regard to mathematical and language skills.
• Course content has not changed to coincide with admission policy.
• Lack of appropriate library resource facilities, computer internet access and appropriated selection and recruitment practices.
• The cognitive demands of certain subjects being inconsistent with the levels to which they were assigned.
• Administration overload associated with assessments.
• Progression and certification criteria set too high
• Imbalance between theory and practical input of programmes.

On the basis of these reasons and the researcher’s own personal experiences, which includes twenty years of teaching at a high school and six years of teaching NCV mathematics at all levels, it was decided to develop a set of possible reasons that seemed very likely to be linked to the high failure rate in mathematics as part of the NCV course at Port Elizabeth College. These reasons will be further expanded through the literature survey from which a framework was established that will serve as the theoretical basis for this study.
2. POSSIBLE CATEGORY REASONS

2.1 Student motivation and attitudes
Motivation can be defined as an internal state that arouse, directs, and maintains behavior (Woolfolk, 2008). Simply stated motivation is that which drives students’ thinking in a given situation. Human beings are said to be either extrinsically or intrinsically motivated. Intrinsic motivation is said to be derived internally. Extrinsic can be what is experienced outwardly. Intrinsic motivation is seen as internal reward, while extrinsic motivation is incentive or reward that a person experiences after completion of a task or activity (Ryan & Deci, 2000).

The rapid development in science and technology as well as the widening influence of mathematics on all areas of economic life accentuates the significance of mathematics. On the one side mathematics, therefore, is acknowledged as essential for individuals’ lives and career choices. On the other side mathematics, ever since it became part of the school curriculum serving to develop cognitive skills, has always been viewed as a problem area for pupils’ school lives. The fact that pupils’ having trouble in mathematics cannot be only related to its being a subject of numbers but can also be related to pupils’ mathematical ability, motivation and attitudes, along with teachers’ mathematical ability, knowledge and teaching styles (Ruffins, 2007).

When students enjoy learning, they are more likely to show interest in, value, and put effort into achievement, to perform well and to persist in their studies. When students don’t enjoy learning, they are less likely to show interest in and put effort toward achievement, and more likely to perform poorly and even drop out (Ryan, 1995).

Tella (2007), states that the issues of motivation of students in education and the impact on academic performance are considered as important aspects of effective learning. However, a learner’s reaction to education determines the extent to which he or she will go in education. The impact of motivation on education of mathematics cannot be undermined.

Students who are thus positively motivated will more than likely attend classes more regularly than those who are more negatively motivated. Research studies have investigated the relationship between attendance and grades (learner performance).
Silvestri (2003) has found for example a significant and strong negative correlation between the number of absences and course grades. Le Blanc (2005) also suggests that the relationship between attendance and grades does exist whether or not an attendance policy is enforced or not.

Attitude can be defined as an expression of favour or disfavour towards a person, place or thing. A person’s attitude also influences his emotion and behaviour towards that person, place or thing. Attitudes can be seen as more or less positive. A positive attitude towards mathematics reflects a positive emotional disposition in relation to the subject and, in a similar way, a negative attitude towards mathematics relates to a negative emotional disposition (Zan & Martino, 2008).

2.2. Student’s beliefs about the usefulness of mathematics

According to the dictionary definition, the term belief is described as a feeling that something is good, right or valuable. In the context of this research, it can be defined as the student’s belief on the perceived usefulness of mathematics. As mentioned previously there exists a link between student motivation and student belief.

Boekart (2002), states that students who have established unfavourable beliefs have low motivation while on the contrary those students who have established favourable beliefs are highly motivated.

Students have beliefs on how important it is to learn mathematics and which factors influence success when they try to learn mathematics. These beliefs are thought to have a major influence on the amount and type of effort students put in trying to learn and solve mathematics.

Students mathematics-related beliefs are the implicitly or explicitly held subjective conceptions students hold to be true, that influence their mathematical learning and problem solving (Leder, Pehkonen and Torner, 2002).

Over the years there has been an increase in the research on students’ beliefs about what it means to do or to know mathematics (Cobb, 1986; Schoenfeld, 1989; McLeod, 1992; Gillespie, 2000; Leder, Pehkonen & Torner, 2002; FitzSimons, 2002). The rationale for this research on beliefs is the assumption that beliefs of students influence their actions and achievements.
Kilpatrick, Swafford & Findell (2001), states that in order for students to develop a positive belief about mathematics (productive disposition), requires frequent opportunities to make sense of mathematics, to recognize the benefits of perseverance and to experience the rewards of sense making in mathematics.

According to Leder et al (2002), student belief about mathematics and mathematics learning can have a substantial impact on their interest in mathematics, their enjoyment of mathematics, and their motivation in mathematics classes.

Achievement in mathematics is usually linked to self-belief in competence which in turn is related to attitudes towards mathematics. This suggests that when students experience success in mathematics, it normally leads to an increase in motivation and attitude towards mathematics (Peixoto & Almeida, 2010).

Gillespie (2000), found that students failed to link the mathematics they were learning to its application in their vocational courses. Mathematics is a part of everyday life and work. People handle money, buy things, do handwork at home (measure areas to paint and so on). Altogether, mathematics is not only the basis for technology, economy, work and everyday life, but a part of our culture (FitzSimons, 2002).

Although Mathematics, according to the literature is a very important subject, students do not often see the link between mathematics and their everyday life and work. Thus, this study will try and evaluate if students at Iqhayiya Campus are aware of not only the importance of mathematics in their vocational education but also in their everyday lives.

2.3 Quality of teaching and learning

Quality teaching and learning can be defined as a process through which trained teachers make use of various teaching approaches in well-managed classrooms and schools and skilful assessment to facilitate learning and reduce disparities (Unicef, 2000).

Quality teaching could also be understood as teaching that produces learning (Fenstermacher & Richardson, 2005). In other words, there can indeed be a task
sense of teaching, but any assertion that such teaching is quality teaching in the new OBE system, depends on the level of achievement of subject and learning outcomes.

The effects of the quality of teaching on student achievement have been well documented (Bloom, 1984; Black & Wiliam, 1998; Martinez & Martinez, 1999; Schmoker, 2006). Put simply, the teaching effectiveness research has shown that positive teacher behaviours produce positive student outcomes (Martinez & Martinez, 1999).

It is well known that teacher activity has a direct effect on a student’s motivation. Almost all activities of the teacher which are done in classroom have a negative or positive effect on the student’s motivation to learn mathematics (Khamis, Dukmak & Elhoweris, 2008).

Aunola et al, (2006) states that teacher goals may influence child motivation and attitudes not only through their teaching practices, but also through the message they send out about learning in general.

The implementation of the Outcomes Based Education approach requires hard work and thorough preparation on the part of the lecturer. “Effective maths teachers are well prepared, highly organised and logical in their coverage of the syllabus” (Cowan, 2006:7).

According to Watson (2006:3), “The roots of underachievement are within the normal practices of teachers just as much as they are within the systemic mechanisms. Ways to raise achievements are to be found at the heart of practice in classrooms”.

This research aims to explore whether the NCV Mathematics lecturers at PE College, Iqhayiya campus, are considered by their students to be delivering quality teaching. The research will explore student’s perceptions of the lecturer’s preparation, lecturer explanations as well as the lecturer and student interaction and how they see these factors impacting on their learning of mathematics.
2.4 Quality of Physical Resources

Quality learning requires willingness and effort on the part of the learner, a supportive social surrounding, and opportunity to learn through the provision of time, facilities, and resources. These features of learning add greatly to the probability that teaching will be successful (Fenstermacher & Richardson, 2005).

Hedges and Greenwald (1996), concluded that there is quite a strong relationship between economic resources and educational results. They concluded that global resource variables, such as per-pupil expenditure, are important, as are also more specific categories of resources, such as smaller schools and smaller classes. They also concluded that variables that attempt to describe the quality of teachers, such as teacher ability, teacher education and teacher experience show very strong relations with achievement.

The research will explore the extent to which the Iqhayiya campus and its mathematics lecturers go to provide sufficient facilities, time and resources (opportunities) to accomplish the quality learning that is sought.

Not only should lecturers prepare learner-centred and activity-based lessons, but lecturers need to make sure that students have access to the information which they will need in order to do the tasks, solve the problems and acquire the requisite skills, knowledge, attitudes and values. Lecturers should also be very active in supporting and facilitating the learning which takes place, using all of his or her ingenuity to ensure that all students are involved in the learning process.

“Throughout history, the abstract nature of mathematics has inevitably led teachers to make use of resources or teaching aids of various kinds to help pupils understand mathematical ideas and the underlying principles of numerical calculations” (Gates, 2001:123).

Resources or teaching aids are an essential part of teaching and learning mathematics but it is more the availability or the effective use of such resources that is problematic. Resources can be primarily used for demonstration purposes, but
when such resources allow for individual use, then the potential for learning increases exponentially. "Clearly resources are not imbued with mystical powers that guarantee the user will achieve enlightenment; it is all about how a resource is used and what the teacher's intentions are when deciding to use a particular resource..." (Ollerton, 2009:150).

There are many mathematical resources available that can enhance the teaching and learning of mathematics, such as the use of pictures, posters, models etc. “However, the ever-increasing power and ease of access of computer technology continues to have a significant impact on learning, teaching and assessment of mathematics throughout higher education establishments worldwide” (Kahn & Kyle, 2002:62). Such computer technology should include personal computers with relevant mathematical software, projectors and the use of internet for both lecturers and students.

Studies conducted by Williams & Wavell, (2001) on the impact of School Library Resource Centres (SLRC) on Learning, indicates that an effective SLRC can contribute to the development of a variety of skills associated with acquisition and handling of information. Further studies by Lance, Rodney & Hamilton-Pennell (2000), have also provided a strong statistical correlation between the provision of an effective Library Resource Centre (LRC) and academic achievement.

According to the researcher Iqhayiya campus is devoid of a proper state of the art LRC. The research therefore aims to explore what influence the lack of an effective LRC as well as the ineffective use of physical resources by lecturers could have on the progress of students in mathematics at PE College.

2.5 Language
The Language of learning and teaching (LOLT), refers to the language medium in which learning and teaching, including assessment, takes place.

Research on the association between mother-tongue education and scholastic achievement, points to a good correlation between the two (Myburgh, Poggenpoel
and Van Rensburg, 2004). It has been found that children perform better in school when the school effectively teaches the children’s home language and, where appropriate, develops literacy in that language (Cummins, 2001). By contrast, when children are encouraged to reject their home language, the development of that language stagnates and their personal and conceptual foundation for learning is undermined.

According to Myburgh et al. (2004), where learners do not speak the language of instruction, authentic teaching and learning stagnate. It can be purported that such a situation largely accounts for the school ineffectiveness and low academic achievement experienced by students in Africa.

The official Language of Teaching and Learning (LoLT) in schools and FET colleges is English. Most of the learners in FET colleges are isiXhosa home language speakers. In all FET colleges in the Eastern Cape educators are required to teach mathematics to learners and students in the English language which is not their home or first language.

According to Setati and Adler (2001), learners need to be able to use their home language at any given time and be able to move from informal discussion in their home language to formal mathematical discussion in English. According to Setati & Barwell (2008), an increase in home language usage in the classroom can assist with mathematical reasoning.

Mathematics performance and language are inextricably intertwined. “Students’ understanding of mathematics is dependent on their comprehension of both the academic language of mathematics as well as the instructional language used to teach it” (Molina, 2012:11). Lee (2006:2), states that the misunderstanding of mathematical language can be “a barrier” to students’ learning of mathematical ideas. This is mainly because of the fact that mathematical language is very technical. “So, unless students know about the way that language is used in mathematics they may think that they do not understand a certain concept when what they cannot do is express the idea in language”.

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Zevenbergen, (2001:48) writes: “In the past, mathematics has been seen to be a discipline that is devoid of language, yet it is now clear that it is very language-based” Zevenbergen also implies that the social and cultural background of the student, deeply influences his or her level of understanding and use of language which in turn determines whether or not such students are likely to perform well in mathematics.

Students who, for example, come from a predominantly working class environment would encounter a form of language in their environment that is different to the form of language than those who come from a more middle class environment.

Based on the personal data captured during the administering of the admission test, almost ninety per cent of the students enrolled for the NCV course at PE College are from the so called poorer areas in and around the Nelson Mandela Metro. Almost all of these students are Xhosa speaking with English as their second or third language.

2.6 Curriculum implementation

The term “curriculum” is used in many different ways, both in practice and in the literature. Senk & Thompson (2003) refers to the curriculum as the mathematical content of the textbook or instructional materials.

The mathematical content specified in a set of instructional materials can be viewed as the intended curriculum. The mathematical content actually presented in an individual classroom can be viewed as the enacted or implemented curriculum. The mathematical content actually learned by the students can be viewed as the achieved or attained curriculum.

Porter and Smithson (2001) distinguished the intended from the assessed curriculum (represented by high-stakes tests), and the enacted (implemented) from the learned curriculum (the content that students learn).
According to Tarr, Chavez, Reys, & Reys (2006), there are many forces that influence each of the above mentioned curriculum and, in turn, student opportunities to learn.

In the context of this research we focus primarily on the forces that influence the learned curriculum and more specifically, what the effect of curriculum materials (content) and the cognitive demands of the curriculum can have on student achievement.

Curricular materials involve the resources and materials that teachers have to consider as they plan and carry out their lessons and how this affects student achievement. This does not include policy documents or the teacher’s beliefs about mathematics as these form part of the intended and implemented curriculum respectively.

According to Tarr et al (2006), there is a growing body of studies which provides evidence that curricular materials (content) influences teacher decision making and positively or negatively affects student learning. Variation in the implementation of curricular materials is cited as a factor that is likely to contribute to student learning. As Kilpatrick (2003) argued that two classrooms in which the same curriculum is supposedly being ‘implemented’ may look very different; the activities of teacher and student in each room may be quite dissimilar, with different learning opportunities available, different mathematical ideas under consideration, and different outcomes achieved.
The discussion on the influence of the level of difficulty or cognitive demands of the standard based and conventional curricula can be viewed through the lens of mathematical instructional tasks. According to Doyle (1983), tasks influence learners by directing their attention to particular aspects of content and by specifying ways of processing information.

According to Stein, Remillard & Smith (2007) all mathematical tasks are viewed as placing high-level cognitive demands on students when they appear to engage students in the process of active inquiry and validation and encourage them to use procedures, formulas or algorithms in ways that are meaningfully connected to concepts or understanding. Tasks that encourage students to use procedures, formulas or algorithms in ways that are not actively linked to meaning are viewed as placing lower-level cognitive demands on students.

Students who performed the best on project-based measures of reasoning and problem solving were in classrooms in which tasks were more likely to be set up and enacted at high levels of cognitive demand (Henningsen & Stein, 1997). It is also worthy to note that Higher-achieving countries implemented a greater percentage of high level tasks in ways that maintained the demands of the task (Stigler & Hiebert, 2004).

Finally the literature notes that the success of students in the high-achieving school was due in part to the high cognitive demand of the curriculum and the teachers’ ability to maintain the level of demand during enactment through questioning.

2.7 Admission requirements

According to the policy document, Formal Further Education and Training College Programmes at Levels 2 to 4 on the National Qualifications Framework (NQF) (2011), the general admission requirement for the NCV course are:

(a) A Grade 9 Certificate; or

(b) An Adult Education and Training (ABET) NQF Level 1 Certificate; or

(c) A recognized equivalent qualification obtained at NQF Level 1; or
(d) An approved bridging programme designed for the specific purpose of access to NQF Level 2; or

(e) An RPL assessment programme, which meets the basic requirements for access to NQF Level 2.

In addition to the admission policy, students who want to enroll for the NCV course must undergo a Competency and Placement Test (CAP) at registration.

The CAP test at present focuses on the fourteen learning fields of the NCV programme and is a competency and career placement test. The test assists colleges to identify prospective NCV level 2 learners and to assess whether they would be able to cope with English (first additional language) and Mathematical literacy at NQF level 2, by testing their NQF level 1 competencies in the aforementioned subject. The test comprises pre-knowledge of the aforementioned subjects at Grade 9 level which is at NQF level 1.

According to Burdman (2011), universities and now colleges have used placement exams to determine whether to deem students “college ready” or assign them to a bridging course. However more and more research reveals that these tests have little correlation to student’s future success. Researchers, such as Burdman, have warned that the traditional use of placement tests actually constitutes a barrier to student achievement.

Belfield and Crosta (2012), have found that in general up to one-third of students were found to be ‘severely miss-assigned’ using placement test results, and that error rate could be cut in half by using high school grades instead of test scores.

Previous research suggests that students who enrol in mathematics bridging courses value the bridging courses not only as a means of ameliorating prior difficulties with mathematics and improving their mathematics learning but as a means to facilitate their transition to university (Gordon & Nicholas, 2013).

The other admission requirement for the NCV course is a minimum grade 9 certificate. This raises the issue of prior mathematical knowledge. Substantial research has validated the important role that prior knowledge plays in students’
academic success (Marzano, Gaddy and Dean, 2000; Smith, Lee & Newman, 2001). Teaching that undermines student prior knowledge is deemed to fail.

This study aims to establish to what extent student’s prior mathematical knowledge gap influences achievement in the NCV mathematics course at PE College.

2.8 Nature of Final examinations and Continuous Assessments

In education, the term assessment refers to the wide variety of methods that educators use to evaluate, measure, and document the academic readiness, learning progress, and skill acquisition of students.

According to Chambers & Timlin, 2013, it is common to describe assessment as having three branches, each with its own purpose.

• Formative assessment which contributes to learning through providing feedback.
• Summative assessment demonstrates the extent of a learner's success in meeting the assessment criteria used to gauge the intended learning outcomes of a module or programme.
• Diagnostic assessment is intended to improve the learner's experience and his/her level of achievement.

According to Oloruntegbe & Omoifo, (2000) what is termed assessment in many schools today is summative, final, administrative, rigorous and content-driven rather than formative, diagnostic, private, suggestive and goal oriented, as such can be regarded as grading.

Summative assessment entails the focus on final examinations by teachers, parents and students. Surprisingly, formative assessment is geared towards the consolidation of students’ performance in the final examinations rather than inculcating students with problem solving, critical thinking, and life skills.

Economists place great stock on information as a signalling device. For a student, whose objective is to get through the assessment tasks successfully, feedback from
continuous assessment ought to provide him/her with signals about how well he/she has mastered the material. Unintended consequences arise when the information from continuous assessment does not correspond with the desired learning outcomes (Nicol & Macfarlane-Dick, 2006).

Thus, for instance, CASS tasks, set by the lecturers, may not support the outcomes set by the national curriculum standards. Weak assessment gives students wrong signals that could influence their learning strategies, their examination effort and their future planning.

To be technically sound, assessments must be both valid and reliable. An assessment is valid when it is used for the purposes for which it is designed, allowing appropriate interpretations of the results. A reliable assessment provides test scores that consistently measure a student’s knowledge of what is being tested.

Assessments used in standards-based systems should meet a third criterion, alignment, the degree to which the assessment accurately reflects the standard being measured. If different items (or test) truly measure the same concept, then it would be expected that the results of individual responses across these items would be highly correlated. (Moskal, Leydens & Pavelich, 2002).

Pennycuick (2000) revealed that the practice of continuous assessment has a significant relationship with students’ academic performance in mathematics. Gipps and Stobart (2003), posit that continuous assessment is democratic in nature in that it is used to encourage and motivate the students and make the assessment a positive experience. In support of this, Adeyegbe (2004), pointed out that continuous assessment encourage students to learn better, motivate them to study, reveal specific areas of learning difficulties and provide feedback to the students and teachers.

Mata et al (2012) concluded that for good achievers mathematical assessments are likely faced as real challenges which could increase intrinsic motivation, which raises the sense of competence and the development of a positive attitude towards mathematics. Conversely, for low achievers mathematical assessments are likely
experienced as obstacles that produces low self-belief and a negative attitude towards mathematics.

“When teachers’ classroom assessments become an integral part of the instructional process and a central ingredient in their efforts to help students learn, the benefits of assessment for both students and teachers will be boundless” (Guskey, 2003:13).

3. **OPERATIONALIZING CATEGORY REASONS**

In developing a questionnaire for this study, it was necessary to identify certain key elements that would make up the possible category reasons for the high failure rate at Iqhayiya Campus. These elements provided the sub categories which then formed the basis for a number of questions per category. (See Appendix A)

3.1 **Student motivation**

Students who gain access to the NCV course are normally those students who do not want to continue their schooling years after grade 9 or who were not successful in gaining entry to university due to poor matric results. Many of these students are often labelled as the “failures” by their parents, friends and society as a whole.

Those who enrol for the NCV engineering course only have grade 9 mathematics, or have done mathematical literacy up to grade 12. This in turn often leads to the fear, dislike and demotivation towards the subject mathematics.

Such demotivation often leads to lack in concentration during class lectures, a lack of interest in the subject which ultimately leads to a poor attendance.

The research will try to establish whether student attendance, the time spent in class (length of the contact time) and the emotional like or dislike towards mathematics influences the learning of mathematics at Iqhayiya campus.

3.2 **Student’s beliefs about the usefulness of mathematics**

The National Certificate (Vocational) course comprises of two components, namely: a fundamental learning component and a vocational component. The fundamental learning component is essential for the qualification and forms the basis for all other
learning at that level. It comprises of the three subjects namely, English as First additional language, Mathematics and Life Orientation.

The vocational component involves learning experiences in situations relevant to the particular vocational field and it also provides specialization within a particular programme through the simulation of the actual work place environment.

Student who enroll are often under the impression that the mathematical component of the course is not relevant to their vocational component. Students cannot understand the relevance of mathematics in a working environment. They often complain about having to repeat school mathematics and cannot envisage the mathematics as being practical.

The research attempts to explore whether student’s view of lecturer preparation, lecturer explanation and lecturer interaction might be perceived as a reason for poor performance in mathematics.

### 3.3 Quality of teaching

The NCV curriculum is an Outcomes Based Curriculum. The implementation of the Outcomes based education approach requires lecturers to make use of alternative teaching methods. It requires thorough preparation and is very child/student centred.

Many of the current lecturing staff at Iqhayiya are from the previous technical college staff which was not exposed to OBE. The result is that many of the current lecturing staff are not trained in the teaching methods of the OBE.

The research must attempt to establish if lecturer preparation, lecturer explanations and lecturer interaction can affect learner performance in mathematics.

### 3.4 Quality of Resources

The current Library Resource Centre at Iqhayiya campus is not equipped with modern resources to service students at college. The current IT system used in the resource centre does not allow students access to mathematical programmes or software.
The current staff that manages the resource centre is also not equipped to assist students in researching information. Students cannot access the resource centre without prior appointment which makes the process of accessing information a tedious one.

The research wants to establish if the accessibility, the quality and the effective use of the Library Resources Centre at PE College influences performance of Mathematics.

### 3.5 Language

According to the researcher almost ninety percent of the students enrolled for the NCV course are from the so called poorer areas in and around the Nelson Mandela Metro. Almost all of these students are Xhosa speaking with English as their second or third language.

The Language of learning and teaching at the college is only English. Mathematics and mathematical terminology is only taught in English. Textbooks and other resource material are only published in English. Often students who do not understand what a lecturer is trying to explain would ask his or her peer to translate. Perhaps the problem is not the mathematics, but the language.

The research needs to investigate if the use of home language, mathematical terminology and peer interaction affects the understanding and performance of students in Mathematics.

### 3.6 Curriculum implementation

The NCV mathematics curriculum is a one year instructional programme comprising 200 teaching and learning hours per level. During the allocated time frame, students are required to complete five main topics, each with a number of learning and subject outcomes as prescribed by the subject guidelines. The subject may be offered on a part-time basis provided all the assessment requirements are adhered to.
The research aims to investigate if the time allocated time frames, the level of difficulty and the content of the NCV mathematics curriculum can be a factor that influences the performance of students.

3.7 Admission requirements

According to the Formal Further Education and Training College Programmes at Levels 2 to Level 4 on the National Qualifications Framework (NQF), the minimum requirement for entry into the NCV course or an FET college for that matter, is that the student must have completed Grade 9. According to the South African Qualifications Authority (SAQA), grade 9 is at NQF 1.

The NCV mathematics course in comparison with the NCS mathematics syllabus is pitched at a Grade 12 level which according to SAQA is at NQF level 4. This means that a grade 9 learner will experience a gap between NQF level 1 and NQF level 4 in terms of prior mathematical knowledge.

Another requirement of the NCV course is for potential students to complete a competency test. This test is merely a placement test and does not test the student’s true mathematical ability. Student are thus under the impression that their existing mathematical knowledge is sufficient to successfully complete the NCV mathematics course.

The research aims to determine how the student’s prior mathematical knowledge, the administering of a competency test on registration and the possible implementation of a bridging course could affect performance in Mathematics.

3.8 Nature of Final examinations and Continuous Assessments

The Subject Assessment Guidelines for Mathematics provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for Mathematics in the National Certificate (Vocational).

The assessment framework for the NCV qualification consists of two components. The Internal continuous assessment (ICASS) or formative assessments, which assess knowledge, skills, values and attitudes (SKVA’s) throughout the year using
instruments such as tests, projects, assignments, investigations, role play and case studies.

Then there is the External assessment or final examinations. Many of the assignments are open book assignments, which mean students can obtain high marks. This creates a sense of false hope which is often only realised on completion of the external (final) examination.

The research will try to establish if practices of internal continuous assessments and its relation to external assessment can be a possible factor that can influence student performance in Mathematics.

4. Chapter Summary

This chapter provides the literature review for each category and its subcategories. The researcher has used both national and international literature to try and substantiate category choices. In the following chapter the researcher describes the research methods that were best suited for this study in trying to answer the research question:

*What are the possible reasons for the high failure rate in the NVC Mathematics at PE College?*
1. INTRODUCTION
This chapter describes the research methodology used in this study. The scope of
the chapter covers the research paradigms, research design, population, sampling,
data collection methods and procedures, data analysis, and ethical considerations.
As this study makes use of mixed methods research, a brief description of the
research paradigm and its appropriateness is given. This is followed by a brief
categorization of the research design in terms of mixed methods research.

The research procedures that were used, to answer the research question, are
sketched and a brief explanation is given on how participants were selected.

The data collection procedure and instruments are introduced and described. This is
followed by a brief discussion on the data analysis of this study and a description on
how data was written up. Some ethical issues regarding the research are also
explained.

2. RESEARCH PARADIGM
All research has a philosophical foundation and the researcher must be aware of the
philosophical assumptions that he or she is making in terms of the nature of reality
(ontology) and the nature of knowledge (epistemology). The term “paradigm” is used
to describe these assumptions. Rubin & Rubin (2005) define paradigm as a set of
basic beliefs that deals with principles about the nature of the social world.

Dewey (1931), a popular proponent of pragmatism, states that things do not exist
independently of our consciousness of them, that man creates reality and that reality
are subjective. He is also of the view that knowledge as being constructed in order to
better manage existence and taking part in the world. The role of knowledge is thus to be used in order to bring about change.

Given the problem of reasons for failure that this research is addressing, it was felt that the findings of this research should assist the college leadership and also give attention to the student who are experiencing failure. Given this goal a pragmatic paradigm was seen to offer the best philosophical foundation for this study and one with which the researcher can best identify with. Since truth is tentative, reality is ever changing and the ultimate goal of the research is to improve human welfare (Rorty, 1999).

Pragmatism transcends other paradigms and puts emphasis on the end results of the research. Pragmatism sees no value in any scientific enquiry into phenomena if the ultimate purpose is not to increase human welfare (Pansiri, 2005). Pragmatism thus implies that the researcher must interact with the environment in which the study is conducted (Reason & Bradley, 2001).

The distinctive nature of the Mixed Methods approach and the core ideas and practices on which the pragmatism paradigm stands have been captured in the works of those such as Creswell (2003), Creswell & Plano Clark (2007) and Tashakkori & Teddlie (1998, 2003). These writers, along with others, contrast the Mixed Methods approach with research paradigms that have favored the use of either quantitative or qualitative methodologies, and they have argued that the defining characteristics of the Mixed Methods approach involve its use of:

- quantitative (QUAN) and qualitative (QUAL) methods within the same research project;
- a research design that clearly specifies the sequencing and priority that is given to the QUAN and QUAL elements of data collection and analysis;
- an explicit account of the manner in which the QUAN and QUAL aspects of the research relate to each other, with heightened emphasis on the manner in which triangulation is used;
- pragmatism as the philosophical underpinning for the research.
Pragmatists link the choice of approach directly to the purpose of and the nature of the research question posed. In a pragmatic approach the inductive results from a qualitative approach can serve as inputs to the deductive goals of a quantitative approach, and vice versa. The mixed methods approach associated with the pragmatic paradigm and strategies that involve collecting data in a simultaneous or sequential manner using methods that are drawn from both quantitative and qualitative traditions in a fashion that best addresses the research question (Creswell, 2003).

This study conforms to the pragmatism model in that the inquiry into the reasons for the high failure rate is motivated by the desire to bring about “a controlled change of this reality”. This study aims to improve the current situation for students, staff and the college so as to raise or improve the pass rate of mathematics at PE College.

3. RESEARCH DESIGN

An explanatory sequential mixed method design was used to acquire the data for this study. Firstly it involved the collecting of quantitative data and then seeks to explain the quantitative results with in-depth qualitative data, in two phases.

In the first phase of the study, a Likert scale questionnaire was administered to students at Iqhayiya Campus, PE College doing the NCV Mathematics course at levels 2, 3 and 4.

The second, a qualitative phase, was conducted as a follow up to the quantitative results to help explain the quantitative results. In this exploratory follow up, the focus group interviews, the researcher attempted to extract various meanings from the participants in order to build a deeper understanding of the data results obtained from the questionnaire.

The reason for collecting both quantitative and qualitative data was to enrich the results of the two forms of data thus providing a better insight into the problem. This would not be able if either type of data were collected separately.

Figure 4 also summarizes the explanatory sequential mixed method design used in this study:
4. **POPULATION**

According to De Vos, Strydom & Delport (2010:194), “a population is the totality of persons, events, organization units, case records or other sampling units with which the research problem is concerned”.

In this study the population comprises of Level 2, Level 3 and Level 4 students at the Iqhayıya Campus, PE College doing the NCV mathematics course in 2013.

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*Figure 4: Diagram for the explanatory mixed method design*

(Source: Adapted from Creswell & Plano Clark, 2011:121)
5. **SAMPLING**

‘Sampling is the process of selecting a subset or sample unit from a larger group or population of interest and its purpose is to address the study’s research question’. In a mixed methods research it is possible to have a combined form of random (quantitative) and purposeful (qualitative) sampling (Tashakkari & Teddie, 2010).

In this study, sampling takes place in the quantitative phase as well as in the qualitative phase. In selecting a sample for the quantitative phase of this study, a simple sampling method was used.

According to Tashakkari & Teddie (2010:356), ‘the simple (i.e., probabilistic) sampling scheme is described as a scheme where ‘every individual in the sampling frame (i.e., desired population) has an equal and independent chance of being chosen for the study’.

From the desired population, PE College, the sample that was selected was the students at Iqhayiya campus, who were doing the NCV Mathematics course in 2013. These students included all levels 2, 3 and 4 as well as all vocational divisions such as electrical, civil, and mechanical and mechatronics. Each student at level 2, level 3 and level 4 were issued the questionnaire during the quantitative phase.

The selection of the sample for the follow up qualitative phase as per the research design was that of a purposeful sampling method. In the context of this research, convenience sampling is viewed as” the choosing of individuals that are conveniently available and also willing to participate in the study” (Collins in Tashakkari & Teddie, 2010:358). Those chosen to partake in the second phase were individuals who had also participated in the quantitative phase which is consistent with what is described by Creswell & Plano Clark (2010).

These students were selected from the sample of students who participated in the quantitative phase from each of the three levels. Three students from the level 2, three students from the level 3 and three students from level 4 groups were selected for the focus group interviews during the qualitative phase. These students were selected from a pool of underachievers based on prior academic performance in mathematics. The motivation for the selection was to limit the focus group to those
students who have actually experienced failure in the subject mathematics. However none of these students selected have been taught by the researcher at any level.

6. **DATA COLLECTION**

In collecting data from students for the quantitative phase, self-constructed questionnaires were distributed. Over six hundred questionnaires were distributed to the respondents via the NCV Mathematics lecturers in all levels.

A total of two hundred questionnaires were completed and returned to the researcher. As mentioned previously the reason for the low return of questionnaires was due to prior student protest and the consequent poor attendance of students. The aim of the questionnaire was to collect information from the students regarding the possible reasons for the high failure rate in NCV mathematics.

6.1 **Questionnaire design**

‘The basic objective of a questionnaire is to obtain facts and opinions about a phenomenon from people who are informed on the particular issue’. (De Vos, Strydom, Fouche, & Delport, 2010:166).

In constructing the questionnaire, there are certain basic principles for formulating the questions. According to Delport, C in De Vos, Strydom, Fouche, & Delport, (2010:171), they include the following:

- Sentences should be brief and clear.
- Questions and response alternatives should be clear and not reflect the bias of the researcher.
- Every question should contain only one thought.
- Every question should be relevant to the purpose of the questionnaire.
- Abstract questions not applicable to the milieu of the respondents should be avoided.

This study made use of closed ended questions. According to Delport, C in De Vos, Strydom, Fouche, & Delport, (2010:174) closed questions have the following advantages:
- These questions offer the respondents the opportunity of selecting one or more response choices from a number provided.
- Relevant responses to a question can be determined in advance and the number of possible responses is limited.
- The degree, frequency and comprehensiveness of a phenomenon can be ascertained quite meaningfully.
- The result of the investigation can become available fairly quickly.

In this study, closed ended questions (see Appendix B) were asked to try and identify the possible reasons for failure in the NCV Mathematics course. The Likert-type scale responses included; strongly agree, agree, disagree, strongly disagree.

The construction of the questions was based on the possible reasons as provided in the literature review. Each question was formulated using the subcategories for each category. Each subcategory was then divided into two to three questions that deal with that specific subcategory. In the final result a total of fifty two questions were compiled with a Likert- type scale response.

Letters requesting permission to conduct the research on campus was submitted to the CEO of PE College as well as the Campus Manager of Iqhayiya Campus. The letters explained the data collection procedure and the aim and objectives of the research.

All questionnaires were personally delivered to all NCV Mathematics lecturers on campus. The students’ questionnaires were administered by all lecturers on the same day. It took students about 45 to 50 min to complete the questionnaires.

The students were individually seated and the lecturer first fully explained the objective and instructions of the questionnaire. Students were also fully informed about the highly confidentiality of the completion of the questionnaires. The questionnaires were then distributed to all students present.

On completion of the questionnaires, lecturers collected it and returned them to the researcher. The researcher thanked the lecturers and students for their participation and assured them that all findings would be made available to any student on request.
6.2 Focus group interview design

Data collecting in the qualitative phase of the design was administered through focus group interviews. Three students from each level of the NCV Mathematics were selected to compile the focus group. The participants from the level 2 group were chosen from a class list containing names of level 2 students who were doing NCV Mathematics. The level 3 and level 4 participants were chosen from a list of students who had previously failed NCV Mathematics at levels 2 or 3, but were doing NCV Mathematics at level 3 and 4. A total of nine students were selected for the focus group interviews.

‘Focus group methodology is useful in exploring and examining what people think, how they think, and why they think the way they do about the issues of importance to them without pressuring them into making decisions or reaching a consensus’ (Liamputtong, 2011:5). Through focus group interviews the researcher can try to explore the divide between the written word and the spoken word.

According to Liamputtong (2011:4), a focus group interview has several important features:

- It enables in-depth discussion and involves a relatively small number of people.
- It is focused on a specific area of interest that allows participants to discuss the topic in greater detail.
- Interaction is a unique feature of the focus group interview.
- The researcher is a moderator who introduces the topic, assists the participants to discuss and guides the conversation. This ensures that good and accurate information is obtained.
- The participants usually have shared social and cultural experiences or shared particular areas of concern.

All the participants were personally invited by the researcher and interview sessions were conducted in a classroom setting. The researcher first created a free and warm environment by introducing himself and making the participants feel at ease.

After the researcher explained the objectives of the interview and ensuring the participants of the privacy and confidentiality of the process, the interviews were
conducted by posing certain questions (see Appendix C) to all groups. Interviews were conducted in three sessions, starting with level 2, then level 3 and finally the level 4 students. These sessions lasted between 25 to 30 minutes each.

All conversations were recorded and saved on hard drive. The researcher thanked each group for sharing their thoughts and time and assured them that the results of the research will be available to any of them on request.

7. PILOT TESTING

A pilot test for the questionnaires was done at the end of 2012. This was done to detect any possible ambiguity to the questions. According to Delport et al (2010), the pilot study can be viewed as the ‘dress rehearsal of the main investigation’.

A preliminary questionnaire was issued to three classes of the NCV Mathematics students to complete and a rough analysis was done. In consultation with the research supervisor, questions were then modified and compiled to be distributed at the beginning of 2013.

8. ETHICAL CONSIDERATIONS

On administering the questionnaires, the researcher considered ethical issues by firstly informing the participants about the objectives of the study and the potential impact it will have on the improvement of NCV mathematics as a subject.

Participants were also made aware of the voluntary nature of the study as to avoid any intimidation of participants. Participants were also assured of the strict confidentiality and anonymity of all participants and information.

During the focus group interviews, participants were also assured of the strict confidentiality that will be adhered to in order to conceal the true identity of all participants. The researcher also asked participants of the focus groups to respect the confidences of all group members and not to repeat what is said outside the group.
According to Delport et al. (2010:67) the guidelines for social work as suggested by The Code of Ethics of the National Association of Social Workers in the United States states:

- The possible consequences for research participants should be carefully considered.
- It should be ascertained that the consent of participants is voluntary and informed.
- Participants should be protected from unwarranted physical or mental discomfort, distress, harm or danger.
- All information obtained about participants should be treated confidentially.

No specific ethical code, as far as social work is concerned, exists in South Africa, but the general Ethical Code of the South African Council for Social Service Professions can be seen as binding.

9. DATA ANALYSIS

In this study the researcher used the explanatory mixed methods design, which makes use of both quantitative and qualitative methods of data analysis. In the analysis of the quantitative data the researcher used a computer (excel) to analyse data descriptively which resulted in the drawing of tables.

These tables helped the researcher to analyses data quantitatively using mean scores. The questionnaire items formed the basis of the discussion for the results. The tables were used to describe the scores derived from the questions on the questionnaires.

The design of the qualitative instrument was based on the quantitative results. The qualitative data was collected and transcribed for data analysis. Thematic analysis was used to analysis the data. This involves finding repeated patterns of meaning.

The results of the quantitative and qualitative data are then used in the discussion to answer the research question. The next chapter will deal with the data analysis and presentation of results in more detail.
10. Chapter Summary
This chapter dealt with the research methodology used in this study. It also outlined the collection and analysis of data. Furthermore it discusses the choice of data gathering instruments and outlines the procedures followed in administering these instruments.
CHAPTER FOUR

RESULTS AND FINDINGS

1. INTRODUCTION

This chapter reports on the results and findings generated through the analysis of the data gathered in this study. The study generated both qualitative and quantitative data from students doing the NCV course at levels two, three and four. Firstly, quantitative data were collected from questionnaires and secondly, qualitative data were collected from Focus group Interviews. The quantitative data was analyzed using the frequency of responses obtained on the Likert scale to the questions posed. The qualitative data was collected and analyzed from the transcriptions recorded during the focus group interviews.

2. QUANTITATIVE RESULTS

A total of 190 questionnaires were returned and analyzed using basic excel software. The raw data (see Appendix D) from each question of each candidate’s questionnaire was arranged in the appropriate category and sub category.

An average was then calculated from the frequencies tallied for each category and sub category. These averages were then recorded and the analysis is shown in Table 1. The interpretation of the average scores was based on the following guide:

- A score of 4.0 or more suggests that participants strongly agree.
- A score 3.5 or bigger but smaller than 4.0 suggests that participants agree/positive.
- A score of 2.7 to 3.4 suggests that participants are neutral.
- A score less than 2.7 but more than 1.8 suggests that participants disagree/negative.
Table 1: Average scores of Students response to questionnaire

Table 1 represents the data of the average scores obtained from the questionnaires submitted to the sample of students.

From the table it appears that categories 5, 6 and 7 can be strong reasons for the high failure rate while categories 2 and 8 can also be relevant. Categories 1 and 3 seem to be, according to the average scores, weak reasons for failure.

2.1 Discussion of Quantitative results

The averages (see Appendix E) of each subcategory are indicated. This is followed by a brief discussion on the meaning of the acquired averages with regard to each subcategory.

<table>
<thead>
<tr>
<th>Category</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Student motivation and attitude</td>
<td>4.0</td>
</tr>
<tr>
<td>2. Student’s belief about the usefulness of mathematics</td>
<td>3.5</td>
</tr>
<tr>
<td>3. Quality of teaching &amp; learning</td>
<td>4.0</td>
</tr>
<tr>
<td>4. Quality of physical resources</td>
<td>3.4</td>
</tr>
<tr>
<td>5. Language</td>
<td>3.1</td>
</tr>
<tr>
<td>6. Curriculum implementation</td>
<td>3.3</td>
</tr>
<tr>
<td>7. Admission requirements</td>
<td>3.3</td>
</tr>
<tr>
<td>8. Nature of final exams and internal continuous assessments</td>
<td>3.5</td>
</tr>
</tbody>
</table>
2.1.1 Category 1 – Student motivation & attitudes

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Attendance</td>
<td>4.3</td>
</tr>
<tr>
<td>Student emotions</td>
<td>3.9</td>
</tr>
<tr>
<td>Length of contact time</td>
<td>3.7</td>
</tr>
<tr>
<td>Average Total</td>
<td>4.0</td>
</tr>
</tbody>
</table>

*Table 2: Indicating average scores for sub category 1*

The category average of 4.0 suggests that students perceive themselves to be fairly confident and motivated. Most students seem to agree that attendance is an important aspect in their development which is justified with an average of 4.0 for this sub category.

The emotional aspect which is probed through questions on the feelings towards the enjoyment of NCV mathematics produced a score of 3.9, which suggests a midway between ambivalence and a positive feel towards the subject.

In terms of the sub category which deals with the length of the periods, students seem to take a stand of ambivalence which is suggested by the score of 3.7 for this sub category.

2.1.2 Category 2 – Student belief about the usefulness of Mathematics

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
</table>
Table 3: Indicating average scores for sub category 2

This category shows an average score of 3.5, which suggests that student are ambivalent in their beliefs about the usefulness of the NCV mathematics.

In terms of subcategories, most students agree that the NCV mathematics is relevant in their field of study indicated by a score of 4.3.

In terms of school mathematics versus NCV mathematics the score of 2.7 suggests that the majority have a neutral view.

Many students agree that the NCV mathematics is practical and can be used in life and work which is substantiated by a score of 3.5.

2.1.3 Category 3 – Quality of teaching and learning

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer preparation</td>
<td>4.4</td>
</tr>
<tr>
<td>Lecturer explanations</td>
<td>4.1</td>
</tr>
<tr>
<td>Lecturer interaction</td>
<td>3.4</td>
</tr>
<tr>
<td>Average Total</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Table 4: Indicating average scores for sub category 3
The average score of 4.0 for this category suggests that students strongly agree that lecturers who are presenting the course are maintaining a high quality of teaching.

In the subcategories of lecturer presentation and lecturer explanations a score of 4.4 and 4.1 respectively suggests that students fully agree that such lecturers are fully prepared and that the explanations are of good quality.

The subcategory of lecturer interaction suggests a neutral stand with a score of 3.4. Based on the personal experiences of the researcher, many lecturers do not have the time to give personal attention to individual students, hence the less positive score of the latter subcategory.

### 2.1.4 Category 4 – Quality of physical resources

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility of resources</td>
<td>3.2</td>
</tr>
<tr>
<td>Quality of resources</td>
<td>3.5</td>
</tr>
<tr>
<td>Effective use of resources</td>
<td>4.0</td>
</tr>
<tr>
<td>Effective use of teaching aids</td>
<td>2.9</td>
</tr>
<tr>
<td>Average Total</td>
<td>3.4</td>
</tr>
</tbody>
</table>

*Table 5: Indicating average scores for sub category 4*

This category with an average score of 3.4 again suggests that of neutral/ambivalence from students.

This means that students are, once again not fully informed or lack understanding in terms of quality of learning.

A sub category score of 3.2 and 3.5 suggests that students are neutral with regards to accessibility and quality of resources.
This may be contributed to a lack of knowledge on resources and the availability thereof. Perhaps an inadequate resource centre can be a contributing factor.

A score of 4.0 suggests a strong agreement to the effective use of textbooks by lecturers, but the other sub categories with a score of 2.9 suggests the text book is probably the only source that lecturers are using. Lecturers are textbook bound.

Lecturers also seem to not make use of any other education aids to support their teaching of NCV mathematics.

2.1.5 Category 5 – Language

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home language</td>
<td>2.5</td>
</tr>
<tr>
<td>Mathematical terminology</td>
<td>2.9</td>
</tr>
<tr>
<td>Peer assistance</td>
<td>3.7</td>
</tr>
<tr>
<td>Average Total</td>
<td>3.1</td>
</tr>
</tbody>
</table>

*Table 7: Indicating average scores for sub category 5*

The average score of 3.1 for this category suggests a neutral view with regard to the influence of language on the understanding of English.

The first subcategory, that of home language, with a score of 2.5 suggests that most students strongly disagree to the receiving of instruction in home language.

The next subcategory that deals with the mathematical terminologies produced a score of 2.9, which would suggest that students agree that some mathematical terminologies can be difficult. Most students, however, strongly agree to the advantage of peer assistance which is indicated by a score of 3.7.

Currently such peer intervention programmes lack at college.
2.1.6 Category 6 – Curriculum implementation

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time frames</td>
<td>3.4</td>
</tr>
<tr>
<td>Level of difficulty</td>
<td>3.2</td>
</tr>
<tr>
<td>Content</td>
<td>3.5</td>
</tr>
<tr>
<td>Average Total</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 8: Indicating average scores for sub category 6

Once again an average score of 3.3 for this category indicates ambivalence with regard to curriculum implementation.

Subcategory scores of 3.4, 3.2 and 3.5 respectively for issues such as time frame, level of difficulty and content of curriculum suggests that students are not fully aware or informed about such issues.

This should be dealt with during the registration process or even prior. Students should be made explicitly aware of curriculum content.

The subcategory of content which scored 3.5, suggests that many students would accept what is taught to them without questioning the level of difficulty.

Students tend to agree towards the content having too many topics and sections.
2.1.7 Category 7 – Admission requirements

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency test</td>
<td>3.4</td>
</tr>
<tr>
<td>Prior mathematical knowledge</td>
<td>3.6</td>
</tr>
<tr>
<td>Bridging course</td>
<td>3.3</td>
</tr>
<tr>
<td>Sufficiency of Grade 9</td>
<td>2.9</td>
</tr>
<tr>
<td>Average Total</td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 9: Indicating average scores for sub category 7

A score of 3.3 for this category suggests once again a neutral stand towards the influence of admission requirements.

The first sub category, that of competency testing scored a 3.4 which suggests that students are not certain about testing, and have taken a neutral stand.

Once again the lack of information could be the reasons for such a stand.

However students also feel confident that their prior mathematical knowledge, which differs from student to student, is sufficient to cope with the NCV mathematics curriculum which is suggested by a score of 3.6.

With regard to a bridging course for the NCV mathematics, which shows a score of 3.3, students are once again ambivalent.

This can be because of the lack of information concerning the content and more importantly, the objective of such a course.

The last sub category, which is the sufficiency of grade 9 learner’s admission to the NCV course and which is a requirement from the Department of Education, shows a score of 2.9.
This would suggest that students do not fully agree with the requirement from the Department of Education.

2.1.8 Category 8 – Nature of Final Examinations and Continuous Assessment

<table>
<thead>
<tr>
<th>Sub Category</th>
<th>Average Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of ICASS Assessments</td>
<td>4.2</td>
</tr>
<tr>
<td>Relation between ICASS and Final Examinations</td>
<td>3.5</td>
</tr>
<tr>
<td>Length of Final examinations</td>
<td>2.9</td>
</tr>
<tr>
<td>Average Total</td>
<td>3.5</td>
</tr>
</tbody>
</table>

*Table 10: Indicating average scores for sub category 8*

This category has an average score of 3.5 which suggests a move towards agreement to the influence of this category for students.

In the sub category of value of ICASS assessments, the score of 4.1 suggest that most students strongly agree to the ICASS assessments forming an essential part of the final mark for NCV mathematics.

A score of 3.5 in the sub category relation between ICASS and final examinations suggests that students also agree, be it less, to the fact that the ICASS is easier than the final examinations. Opinions become neutral with a score of 2.9 in the last subcategory for the duration of the final examination. Once again students might not be fully informed as to the time allocation and time management for final examinations.
3. QUALITATIVE RESULTS

Responses from nine students during the focus group interviews were recorded. Here follows the key points and selected responses extracted from the transcriptions (see Appendix F) of these responses, followed by a summary of each main question response.

3.1 Discussion of Qualitative Results

*Question 1*: Many students say NCV maths is easier than School maths? What do you think?

Seven of the nine students indicated that NCV maths was not easy or reasonably difficult suggesting that they did not believe that NCV math was easier than school maths. The majority of students stated that they had only passed maths in Grade 9 or 10 or had at best done Maths literacy indicating that they had a very low level maths pass when entering college. One student stated, “I didn’t do grade 10, 11 and 12, so obviously the maths is not going to be that easy” whilst another stated that, “I’ve done maths literacy, so it’s going to be difficult”.

One in particular stated “I always had difficulty with mathematics” which suggests that his/her experience of struggling with school maths carried over to NCV maths.

Thus participants fully agree to the fact that NCV mathematics is not easier than school mathematics. Those who do not have the necessary core maths background find it difficult to pass the NCV mathematics. A student stated, “I think it a bit difficult ..cause there was a time I wanted to leave college and I wanted to go to another school ..cause they say our maths here is more difficult, it’s like varsity”.

*Question 2*: How beneficial do you think the NCV mathematics is to the course /field that you are studying for? Do you think it is very relevant to what you are doing?

Once again seven students agreed that the NCV mathematics is relevant to their field of study. Many of them referred to the use of especially calculations of measurement in their vocational fields as being the main skill required. One student stated, “We have to calculate how much centimeters to cut” while another said, “I have to calculate the material.”
Students have also indicated that they do not see the use of algebra or calculus as relevant to their vocational fields. One student mentioned, “And by us we also have calculations and stuff”.

Question 3: How much individual attention do lecturers give you in the mathematics class?
Question 3.1: Do you think we can improve on this?

All of the level 2 participants were complaining that they receive very little individual attention from maths lecturers by stating, “There is no individual attention.” Level 3 and 4 participants did indicate that they do receive some individual attention from maths lecturers. Some of the level 3 and 4 participants also referred to their previous level 2 experiences where no individual attention was given by maths lecturers.

One student stated, “For me, sir, from level 2 there wasn’t much individual attention I only got it now at level 4 and also at level 3 I did not get”.

Question 4: Have you ever used the resource centre for mathematics?
Question 4.1: Give reasons for your answers.

All participants replied that they have never used the Library Resource Centre (LRC). Most participants complained about having to make an appointment before they could make use of the LRC. Some even mentioned the unfriendly and uncooperative reception of the person in charge of the LRC. Most students stated, “We used to go there then she would look at us nasty and say you must book first before you can come in.”

One participant remarked, “Yes, I would have used other text books or I think there is internet programme or something for maths if it was available at college I would have probably used it”. Another student stated, “I did not know that you can go there for maths I thought you only go for computers. I did not know you can go there for maths”.
Question 5: Based on students response it seems as if maths lecturers are not making use of other sources besides the textbook. Is this your experience as well?

Question 5.1: Do other lecturers, besides maths lecturers, use other sources and does it help?

Level 2 and 3 participants agree that their maths lecturers are not making use of other resources besides the text book. Level 4 participants are saying that their maths lecturers are using other resources. One student stated, “Only the computers”.

All participants agree that the use of other resources in class does help. Some participants suggested the use of data projectors for maths lessons helped. One student stated, “Yes it would be nicer if we could have practical experience maybe with the monitors show us something.”

Question 6: According to many students the maths periods must be in the morning rather than in the afternoon. Do you agree?

Question 6.1: Give reasons why.

Question 6.2: Do you think the current periods for maths are long enough?

All participants agree that mathematics periods should be in the morning session due to the fact that you are full of energy in the morning and become tired after break times. One student stated, “Yes because we are too tired in the afternoon and maths needs your full brain”. Most participants are in favour of the current length of mathematics periods.

When student were asked about the preference of mathematics periods being in the morning session, one student answered, “Yes most definitely sir”.

Question 7: Many students have said that they find it helpful if their own friends explain the maths to them. Do you agree?

Question 7.1: How do you communicate with your friend? What language do you use?

Many agreed that they find it helpful to have their friends explain some of the maths if they do not understand. One participant mentioned that sometimes she prefers to communicate the maths in Xhosa as this is easier to understand stating, “Yes sir,
and with us Africans you find it like sometimes it is a language barrier in class when the lecturer is explaining. Now for us when someone is explaining in your language the language that you understand it is much more effective."

Question 8: The research has shown that most of the students find the NCV maths curriculum difficult. Is this your opinion as well?

Question 8.1: In terms of the topics, which would you want to change, take away or remove?

The majority of participants agreed that the NCV curriculum is difficult, that it is a “pile up”; there are too many topics to cover. One participant stated, “if a lecturer could drill us on a certain topic until the whole class knows and then move to the other topic, because there are cases where we have topic 5 than he sets up a big test that is going to cover the whole book than we have already forgotten topic 1”.

Trigonometry and Geometry as well as formulas for volumes and areas were named by participants as being irrelevant topics. One stated, “I think the trigonometry should be cut out”, while another indicated “for me sir it would be geometry and trigonometry.”

Question 9: What is your view about a grade 9 student doing this course? Would he be able to cope with the course?

Question 9.1: When you enter this course you need to write an admission test. How do you feel about that? Are you in favour of an admission test?

Question 9.2 Do you think a grade 9 learner must do a bridging course before he does level 2 mathematics?

In terms of the admission of grade 9 students, the level 2 participant is of the opinion that a grade 9 learner will be able to cope with this course, while the level 3 and 4 participant is of the opinion that such a learner would not be able to cope.

A level 2 student stated “It won’t be difficult as long as he practiced before the time”, while a level 4 student said “we had a student like that in level 2 and he didn’t cope very well, so I wouldn’t advise a grade nine student to come here.”
With regard to admission test and bridging course for grade 9 learners, all participants agreed that this would be to the benefit of such a learner. One student stated, “For me for the maths I think there should be admissions test for the maths”.

**Question 10:** If you were to write the final examination now without any internal assessments that is no tests, no assignments nor any formal tasks, do you think that would influence your final mark? How?

**Question 10.1:** Do you think the internal assessments (ICASS) that we are doing are to your advantage or disadvantage?

**Question 10.2:** Is there anything about the ICASS that is bothering you?

Most participants agree to the importance of the internal assessment marks and how it could be to their advantage. Some mentioned that these marks can be an indication of what you know and how much you need to study for the final examinations. One student stated, “It’s to our advantage because when you get your marks back than you see where you need to be studying”.

Participants did question the use of these marks in determining their final mark. One student was saying, “I just don’t know how it benefits us because I did my level 2 and I passed right through the year but the final I failed with 28% and I didn’t see how I failed”.

**Question 11:** If you were given the chance to start all over again with this course, knowing what you know now about the admission, the exams. Do you think you would do better if you started again?

**Question 11.1:** Can you tell me why you would do better?

All participants agreed that they would do much better if they were given a second chance to start the course again. Many indicated that they would be better informed about the course. One student stated, “Yes, I will do better because I am advanced, I know already what is up”.

The responses from participants indicate that prior to them entering the course there was a lack of information and misconceptions regarding the NCV course and in particular the level of the mathematics required to pass this course.
4. **Summary of Chapter**

The chapter provides the Data from the Quantitative as well as the Qualitative Research. This chapter also provides a summary for each question result or response in both Research Methodologies. The next chapter will provide possible recommendations based on the results provided in this chapter.
CHAPTER FIVE

DISCUSSION OF RESULTS AND RECOMMENDATIONS

1. INTRODUCTION
A discussion of the research results is presented in this section. Firstly, a general overview of the research results is discussed and presented, thereafter; recommendations are made based on the results.

2. GENERAL OVERVIEW
Category 1 – Student motivation & attitudes
The overall quantitative results indicate that students are fairly confident and motivated in terms of attending the NCV mathematics classes.

Subcategory 1 – Attendance
The quantitative analysis shows that students do attach a high level of importance to attending the NCV mathematics classes. The qualitative results which probed the best time for attending classes revealed that students prefer the morning session for mathematics. The reasons for this preference were due to the fact that they become tired especially after the break sessions.

Subcategory 2 – Emotions
Quantitatively students are neutral to slightly positive in terms of how they feel in a NCV mathematics classroom. There was no further probing during the qualitative phase.

Subcategory 3 – Length of periods
The quantitative analysis shows ambivalence which can be interpreted as acceptance of the status quo. This is also substantiated by the qualitative results which indicated that students are in favor of the current length of periods. Reconstruction of time table to accommodate the teaching of mathematics during morning sessions should be considered.

Category 2 – Student beliefs on the usefulness of mathematics

The quantitative data revealed that students do have a positive perception about the NCV mathematics. In the researcher’s view, many students agreed to the latter because of their practical vocational subjects such as electrical, civil and mechanical, but the NCV curriculum as such does not lend itself to much practical implementations.

Sub category 1 – Relevance of Mathematics

Quantitative data reveals that students agree that the NCV mathematics is relevant to the field they are studying. This is further enhanced by the qualitative data analysis with student’s predominant positive response to the question. Participants are thus of the view that only certain aspects of the NCV mathematics can be used in their respective vocational fields.

Subcategory 2 – School Maths vs NCV Mathematics

Quantitative results indicated a neutral view on this, but with further probing by means of qualitative means, the results indicates a move towards NCV mathematics being more difficult than school mathematics.

The responses from students also revealed, and in fact justify the claims, that students with grade 9 mathematics or students with mathematical literacy find the NCV mathematics course more difficult.

Subcategory 3 – Practical Mathematics

Quantitative results show students agree to the practicality of the NCV Mathematics, but with further probing it is clear that not all parts of the curriculum used in practice.
Category 2 – Quality of teaching and learning

It appears from the quantitative data that students are very positive about the extent to which lecturers prepares and the explanations they offer when teaching but it seems they are less positive about the manner in which the lecturers interact with them. This lack of interaction between lecturers and students are further enhanced through the qualitative data. Reasons for this can perhaps be subscribed to the high volume of curriculum content, administrative work which is time consuming or poor time management from lecturers.

Subcategory 1 – Lecturer preparation

This subcategory scored the highest quantitative score which indicates the NCV mathematics lecturers are well prepared.

Subcategory 2 – Lecturer explanation

Here students also agreed that the explanation of the work from the NCV mathematics lecturers is of a good quality.

Sub category 3 – Lecturer interaction

The quantitative results indicated a neutral stand by students on the level of interaction and individual attention that lecturers are giving. The qualitative results indicate that lecturers in level 2 are not giving any individual attention and that this only improves at level 3 and 4. All participants agreed that more individual attention was needed and more so at level 2. According to the response from students, lecturers at level 2 should provide more individual attention to students.

Category 3 – Quality of physical resources

Students overall have a neutral stance on the quality of learning NCV Mathematics.

Subcategory 1- Resources accessibility

The quantitative analysis reveals that students are once again ambivalent with regards to the accessibility of resources. The qualitative results further indicate that students are not using the existing library resource centre. Further probing into the matter revealed that students are unhappy with the current administrator of the
centre or person in charge. The fact of having to make a scheduled appointment in order to use the facility is a concern to most students.

Subcategory 2 – Quality of resources

Quantitative analysis reveals ambivalence with regard to the quality of resources at the resources centre. This can be linked to the previous qualitative finding which revealed a total lack in use of the resource centre. Students who do not have access to resources would not have any idea of the quality of such resources.

Subcategory 3- Effective use of resources

This refers to the use of resources by lecturers. The quantitative analysis reveals that lecturers are using textbooks effectively and this is substantiated by the qualitative results.

Subcategory 4 – Effective use of other educational aids.

Once again this refers to the use of other sources for teaching and learning by lecturers. The quantitative analysis reveals that lecturers are not making use of such sources, but are textbook bound. The qualitative results indicates that this is only prevalent in level 2 lecturers, while level 3 and 4 lecturers does make use of other sources in their teaching and learning. The quantitative results also reveals that other lecturers beside mathematics lecturers are making use of other sources.

Based on the response of participants, the training of lecturers in the use of more modern teaching resources should be considered.

Category 5 – Language

The quantitative analysis indicates an uncertainty on the influence that language have on the understanding of mathematics. The qualitative results indicate a change in the perception of language as a means to understand mathematics better.

Subcategory 1 – Home language

The quantitative analysis shows a strong rejection in the use of home language for teaching NCV mathematics. This subcategory as well as subcategory three, was probed during the qualitative phase.
Subcategory 2 – Mathematical terminologies

The quantitative analysis indicates that students do find some mathematical terminologies difficult. During the qualitative phase it also emerged that some students do find certain mathematical terminologies difficult to understand.

Subcategory 3 – Peer assistance

The quantitative analysis indicated that students are in favour of peer assistance. The qualitative results confirm this and also reveal that the preferred language of communication between peers would be in their home language. The Xhosa language was predominantly the language of communication amongst peers of African students.

Category 6 – Curriculum implementation

Quantitative analysis suggests that students are not fully aware of curriculum issues. The qualitative results indicate that when students are informed about curriculum issues, they could make a positive contribution.

Subcategory 1 – Time frames

The quantitative analysis indicates a neutral score with regard to the time frames for the NCV mathematics curriculum. Further probing during the qualitative phase also revealed that students would prefer that more time was spend on certain topics than others. Student responses indicate that a restructuring of the NCV mathematics course in terms of time frames and topics should be considered.

Subcategory 2 – Level of difficulty

The quantitative analysis indicated that students are ambivalent to the level of difficulty. The qualitative results reveals that the curriculum becomes more difficult as students’ progress from level 2 to level 4.

Subcategory 3 – Content

The quantitative analysis indicates that students agreed to the fact that there are too many topics and sections in the current NCV mathematics curriculum. The qualitative results substantiate this and also reveal those topics that students are not
comfortable with. These include volumes and areas, geometry and trigonometry. The results can also be linked to category one, subcategory three, which enhances the fact that only certain part of the mathematics content is used in the practical aspect of the course.

Category 7 – Admission requirements

This category in my view and from personal experience is a category that could have Student responses indicate that a restructuring of the NCV mathematics course in terms of time frames and topics should be considered.

The quantitative analysis shows that the students are once again ambivalent with regard to this category. The qualitative results indicate that the level 3 and 4 student, who have more experience of the course, take a more positive stand towards the course.

This difference of opinion could be attributed to the fact that the current level 2 participant has not experienced the level 3 and 4 scenarios and would therefore not know the challenges that lie ahead.

Subcategory – 1 Competency test

The quantitative analysis indicates a neutral stand on the competency testing of students. The qualitative results show that students accept a test but that it should mostly concentrate on the mathematical ability of those who register.

Subcategory 2 – Prior Mathematical Knowledge

The quantitative analysis indicates that students are confident that the prior mathematical knowledge they have is sufficient to cope with the NCV mathematics course. The qualitative results indicate that the level 3 and 4 students are of the view that the level of prior mathematical knowledge will influence the degree of success of a student.

Responses from level 2 students during qualitative analysis indicate the misconception that can exist with regards to student’s prior mathematical knowledge and proficiency when entering the NCV course.
Subcategory 3 – Bridging course

The quantitative analysis reveals a neutral stand by students on this category. The qualitative results provide a clear acceptance for such a course by all participants.

Subcategory 4 – Sufficiency of grade 9

The quantitative analysis shows the disagreement of students to the ability of a grade 9 student to cope with the NCV mathematics course. The qualitative results indicate a split in the perception of level 2 and levels 3 and 4 students. The former agrees that a grade 9 student can cope while the latter is of the opinion that a grade 9 student would not be able to cope. The results also show that level 3 and 4 students being able to support their claim with relevant examples from their peers.

Category 9 – Nature of final examinations and continuous assessments (ICASS)

The quantitative analysis shows that most students are aware of the effect this category will have on their final result. The qualitative results indicate further that many students are not fully informed about the manner in which the ICASS will influence their final result.

Subcategory 1 – Value of ICASS

The quantitative results reveal that students are fully aware of the influence and value of the ICASS. The qualitative results substantiate this view, but some of the participants indicated that they do not understand how the ICASS is used in determining the final mark.

Response from participants indicates the lack of information that students have with regard to the internal assessment marks.

Subcategory 2 – Relation between ICASS and final examination

The quantitative finding reveals a neutral stand on the relation between ICASS and the final examination. According to the qualitative results this is being questioned and some students have had personal experiences with ICASS marks showing a pass but yet the student failed the examination.
Subcategory 3 – Duration of final examinations

Both quantitative and qualitative results indicate that students agree to the current duration of the NCV mathematics examination papers.

Other

When students were asked about a second chance in repeating the course, the response was that they would do much better if given a second chance. According to these students it would be because of the fact that they would know what is expected of them. Sufficient information on the course and the curriculum could go far in ensuring that students make a success of their studies.

3. META-ANALYSIS

The analysis of the quantitative data suggests that six of the eight categories indicated, namely student’s belief about the usefulness of mathematics, quality of physical resources, language, curriculum implementation, admission requirements and the nature of final examinations and continuous assessment are all strong possible reasons for failure while the remaining two categories, student motivation and attitude as well as quality of teaching seem to be weaker reasons for failure. It must be recognized that these reasons emerge from the student body and so for a more comprehensive overview other stakeholders must be consulted. This trend was further explored through the qualitative analysis which further enhances the findings of the quantitative analysis.

Based on the above, it seems that the stronger reasons for failure can be linked to the lack of availability and where possibly available, the lack of effective use of physical resources for both students and lecturers to enhance teaching and learning as well as the nature of curriculum implementation and admission requirements which are functions of national and local management - with policies and practises seeming to restrain rather than enhancing student progress.

Put another way it seems that staff and students engaged in the mathematics courses might perform better if the policy and management environment was more responsive and supportive. Herein lies a tentative answer to the central question of this research. In essence it seems that it is within the capability of both the
Department of Education and management of PE College to apply their minds and take the necessary action to change or improve in order to improve the pass rate for NCV mathematics.

4. RECOMMENDATIONS

3.1. Student motivation and attitudes

Results show that, in general, students have positive motivation and positive attitudes towards the NCV Mathematics. Despite this overall positive motivation and attitude, the scenario changes when we consider the attendance of students which indicates a less than positive attitude. A disjuncture between attendance and motivation does exist. Many other factors as indicated by the literature have a direct effect on student motivation and attitudes towards the subject, but what is essential is the fact that if students are positively motivated, they will develop a positive attitude towards their progress in Mathematics. It is recommended that lecturers and management should thus engage in trying to create a culture that emulates a positive motivation and a positive attitude towards the subject mathematics across the campus. Perhaps, as a starting point, through the constant recognition and rewarding of those students who do achieve in Mathematics, could serve as a positive motivation to those who are not achieving in mathematics.

3.2. Student’s beliefs about the usefulness of mathematics

It is clear from the findings that students at IQH have a misconception about the use of the NCV mathematics in their respective vocational studies. It is also clear from the literature that these misconceptions directly affect student’s motivation and attitude towards the subject which in turn leads to low achievement in mathematics. The recommendation is that students at IQH need to be orientated towards the import and essential role mathematics plays in their future work environment. Much can be done in the form of workshops, seminars and providing general information to educate student in this regard. Orientation of this nature should be permanently incorporated into the registration process of especially first year students.
3.3. **Quality of teaching and learning**

Although scores and students remarks favors lecturers at IQH to be well prepared and very articulate in presenting contend knowledge, it is the human interaction between student and lecturer that is of concern. Many students could be afraid or too embarrassed to talk to lecturers. Again this has a negative impact on student motivation and self-esteem, which according to the literature causes low achievement. It is thus recommended that lecturers be trained in improving the skills and methodology required to improve interaction with students. Workshops on effective classroom management can assist lecturers in creating more time for much needed individual attention.

The findings have also indicated the lack of modern IT assisted teaching methodology. It is thus also recommended that the upgrading of classrooms with the necessary IT resources and the training of lecturers in the effective use of IT technology for teaching and learning should become priority for management.

3.4 **Quality of Physical Resources.**

The findings indicate a definite lack in sufficient physical resources required by students to facilitate in teaching and learning. This specifically refers to the outdated and under-utilized resource centre at IQH campus. It is therefore recommended that management need to invest into upgrading this facility to a modern state of the art and student friendly resource centre to which students can have unlimited access.

3.5 **Language**

There is not much that can be done to change English as the language of learning and teaching (LoLT), however it is strongly recommended that lecturers must be aware of the issue of language and how it can effect student performance. Collaboration between lecturers teaching English as a second language and those teaching mathematics can assist in trying to alleviate the problem of understanding the language of mathematics. The research findings also indicate that students often seek the assistance of their peers to sometimes clarify certain mathematical concepts. This would suggest that the need for a support system for students by students does exist. It is thus recommended that the prior Student Intervention
System (SI) that existed at IQH campus should be re-established in order to provide students with such support.

### 3.6 Curriculum implementation

The NCV mathematics curriculum does not coincide with its admission policy. The course content does not accommodate for those students coming from grade nine or for those students who did not pass matric with mathematics nor does it accommodate for the ‘gap in knowledge’ that students come with. It is therefore recommended that a serious rework of the NCV mathematics curriculum is needed to accommodate such students. The research also indicates the incoherence of the NCV mathematics curriculum and other vocational curriculum. It is thus recommended that lecturers and in particular senior head of departments, from all subjects of the NCV courses should collaborate to establish coherence in order to realign mathematics with all other NCV subjects.

### 3.7 Admission policy.

As mentioned previously, the contend of the NCV mathematics curriculum does not accommodate the admission policy in the fact that the policy allows for a grade nine student to enroll, while the content of the NCV mathematics curriculum is pitched at grade eleven and twelve. The gap in knowledge that is created cannot be filled by lecturers during the first year of the NCV mathematics course. It is thus recommended that a student who comes from grade nine and also those students who do not have prior mathematics knowledge, be directed into a bridging course that could assist in filling the gap in their existing mathematical knowledge.

### 3.8 Continuous Assessment

The research has found that many students have misconceptions about the value of the internal assessments. Continues assessments must be seen as a means to encourage and motivate students to study and as a tool to identify difficulties and provide feedback to students. It is thus recommended that students be well informed about the value of the ICASS assessments during the registration process. It is also recommended that the national exams should form the basis for the DHET’s quality assurance system and that less emphasis should be placed on the administrative
burden of learner portfolios of evidence. This will reduce the burden on the educator so that valuable time is not wasted on administration but rather used for teaching and learning.

3.9 General

It is recommended that all students, enrolling at college for the first time, should be properly assessed in terms of their mathematical ability and advised to enrol in the correct field of study.

Colleges should introduce students’ induction/orientation teams and ensure that all the new students should be thoroughly orientated about importance of mathematics in engineering studies.

It is highly recommended that colleges prepare academic staff in encouraging students to be committed to their studies, motivate students to be responsible and provide such students with different study skills.

The researcher is aware that both students and educators are no longer motivated due to various reasons; therefore the colleges should provide incentives for both students and lecturers who do excel which can serve as motivation to those who do not perform.

This study has highlighted the possible reasons for the high failure rate at Iqhayiya Campus, PE College only. The potential exists to further deepen this debate by more research into the reasons for failure in Mathematics at possibly more FET Colleges.
BIBLIOGRAPHY


Dibetle, M. (2010, January 29). FET sector is the class dunce. Mail & Guardian. 7


## Catogory

### Sub-Catogory

### Questions

1. **Students Perceptions of mathematics**

   1. **Relevance of Mathematics**
      
      - **a**: NCV Mathematics is relevant to my field of study
      
      - **b**: I need NCV Mathematics to qualify for my chosen career

   2. **School Maths versus NCV Mathematics**
      
      - **a**: NCV Mathematics is more difficult than school mathematics.
      
      - **b**: I struggle more with NCV Mathematics than my school mathematics

3. **Practical Mathematics**

   - **a**: NCV Mathematics is very practical.
   
   - **b**: NCV Mathematics can be used in life and work

2. **Quality of teaching/instruction**

   1. **Lecturer preparation**
      
      - **a**: My NCV Mathematics Lecturers is always well prepared
      
      - **b**: My NCV lecturer is organized and ready for each lesson

   2. **Lecturer explanation**
      
      - **a**: My NCV lecturer presents mathematics very clearly
      
      - **b**: My NCV lecturer makes use of various examples in his explanations.

   3. **Lecturer interaction**
      
      - **a**: My NCV Mathematics lecturer connects with me and understands my needs.
      
      - **b**: My NCV mathematics lecturer gives me individual attention.

3. **Quality of Learning/Resources**

   1. **Resources accessibility**
      
      - **a**: I have access additional learning materials.
      
      - **b**: I can get hold of extra textbooks or examples

   2. **Quality of Resources**
      
      - **a**: The NCV mathematics course materials help me learn

   3. **Effective use of resources/learning aids**
      
      - **a**: The lecturer uses the textbook effectively when teaching
      
      - **b**: The lecturer uses examples and exercises from the textbooks in an effective way

4. **Effective use of education aids**

   - **a**: The lecturer uses more than "chalk and talk" too teach
<table>
<thead>
<tr>
<th>4. Student Confidence and motivation</th>
<th>Effective use of educational aids</th>
<th>b</th>
<th>The lecturer makes use of helpful pictures, posters and other teaching aids when teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Attendance</td>
<td>a</td>
<td>I attend NCV mathematics classes regularly.</td>
<td></td>
</tr>
<tr>
<td>Attendance</td>
<td>b</td>
<td>I am in class for most of the NCV mathematics lessons</td>
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<tr>
<td>Attendance</td>
<td>c</td>
<td>Regular attendance will improve my understanding of NCV mathematics</td>
<td></td>
</tr>
<tr>
<td>2 Emotions</td>
<td>a</td>
<td>I feel quite relaxed in my NCV Mathematics classroom</td>
<td></td>
</tr>
<tr>
<td>Emotions</td>
<td>b</td>
<td>I enjoy attending NCV Mathematics classes.</td>
<td></td>
</tr>
<tr>
<td>3 Length of period</td>
<td>a</td>
<td>The NCV Mathematics periods should be only in the morning sessions.</td>
<td></td>
</tr>
<tr>
<td>Length of period</td>
<td>b</td>
<td>The NCV mathematics periods are often too short.</td>
<td></td>
</tr>
<tr>
<td>5. Language</td>
<td>1 Home language</td>
<td>a</td>
<td>I would prefer to learn and do NCV Mathematics in my home language.</td>
</tr>
<tr>
<td>Home language</td>
<td>b</td>
<td>I would understand the NCV Mathematics better in my home language.</td>
<td></td>
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<tr>
<td>2 Mathematical terminology</td>
<td>a</td>
<td>The NCV Mathematics terminologies are very difficult to understand.</td>
<td></td>
</tr>
<tr>
<td>Mathematical terminology</td>
<td>b</td>
<td>I find that I often struggle with remembering or understanding mathematical terminology</td>
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<tr>
<td>3 Peer assistance</td>
<td>a</td>
<td>I find it helpful when my classmates explain the work to me</td>
<td></td>
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<tr>
<td>Peer assistance</td>
<td>b</td>
<td>I learn better when I can discuss the work with others in the class</td>
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<tr>
<td>6. Curriculum implementation</td>
<td>1 Time frame</td>
<td>a</td>
<td>The NCV Mathematics curriculum can be completed in three years.</td>
</tr>
<tr>
<td>Time frame</td>
<td>b</td>
<td>There is too little teaching time to complete the NCV Mathematics curriculum.</td>
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</tr>
<tr>
<td>2 Level of difficulty</td>
<td>a</td>
<td>The NCV Mathematics curriculum is a very difficult curriculum.</td>
<td></td>
</tr>
<tr>
<td>Level of difficulty</td>
<td>b</td>
<td>The NCV Mathematics curriculum must be made easier</td>
<td></td>
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<tr>
<td>3 Content</td>
<td>a</td>
<td>The NCV Mathematics curriculum involves too many different topics.</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>b</td>
<td>The NCV Mathematics Curriculum has too many different sections</td>
<td></td>
</tr>
<tr>
<td>7. Admission requirements</td>
<td>1 Competency test</td>
<td>a</td>
<td>Students should only be allowed to register for NCV mathematics if they have passed a competency test</td>
</tr>
<tr>
<td>Competency test</td>
<td>b</td>
<td>A competency test is necessary for admission to NCV Mathematics courses.</td>
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<tr>
<td>Prior Mathematical Knowledge</td>
<td>a</td>
<td>My basic mathematical knowledge before starting at college was enough to master the NCV Mathematics.</td>
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<tr>
<td>Prior Mathematical Knowledge</td>
<td>b</td>
<td>I came to college with sufficient mathematical knowledge to be able to cope with NCV</td>
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<td>Mathematics</td>
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<tr>
<td>3</td>
<td>Bridging course</td>
<td></td>
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<tr>
<td></td>
<td>a There should be a bridging course for the NCV Mathematics who are underprepared for college</td>
<td></td>
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<tr>
<td></td>
<td>b A NCV Mathematics bridging course will assist underprepared students in passing NCV Mathematics</td>
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<tr>
<td>4</td>
<td>Sufficiency of Grade 9</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>a Any student who has passed Grade 9 should be able to pass NCV Mathematics</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>b A pass in Grade 9 mathematics should be good enough to succeed at NCV mathematics</td>
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</table>

8. Nature of Final Examinations and ICASS Assessments

<table>
<thead>
<tr>
<th></th>
<th>Value of ICASS Assessments</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>a The ICASS assessments should carry more weight than the final examination.</td>
</tr>
<tr>
<td></td>
<td>b The ICASS assessment marks must form an important part of the final marks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Relation between ICASS(Internal) and Final Examination(External)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>a The ICASS assessment content and tasks were simpler than the final examination content</td>
</tr>
<tr>
<td></td>
<td>b The ICASS assessment is much easier than the Final examinations.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Duration of Final Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>a The time allocated for completion of the final examination papers was not enough.</td>
</tr>
<tr>
<td></td>
<td>b The final examination was too long</td>
</tr>
</tbody>
</table>
QUESTIONNAIRE for NCV - Mathematics students LEVELS 2,3 and 4

Read the statements below and CROSS (X) the number that best describes your opinion

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tr>
<td>1</td>
<td>NCV Mathematics is relevant to my field of study.</td>
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<td>2</td>
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<td>2</td>
<td>My NCV lecturer is organized and ready for each lesson.</td>
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<td>2</td>
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<td>4</td>
<td>5</td>
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<td>3</td>
<td>I have access to additional learning materials.</td>
<td>1</td>
<td>2</td>
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<td>4</td>
<td>I am in class for most of the NCV mathematics lessons.</td>
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<td>5</td>
<td>I would prefer to learn and do NCV Mathematics in my home language.</td>
<td>1</td>
<td>2</td>
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<td>6</td>
<td>The NCV Mathematics curriculum can be completed in three years.</td>
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<td>7</td>
<td>Students should only be allowed to register for NCV mathematics if they have passed a competency test.</td>
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<td>8</td>
<td>The internal assessments should carry more weight than the final examination.</td>
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<td>9</td>
<td>I can get hold of extra textbooks or examples if I need them.</td>
<td>1</td>
<td>2</td>
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<td>10</td>
<td>NCV Mathematics is a very practical course.</td>
<td>1</td>
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<td>11</td>
<td>I would understand the NCV Mathematics better in my home language.</td>
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<td>5</td>
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<td>12</td>
<td>NCV Mathematics is more difficult than school mathematics.</td>
<td>1</td>
<td>2</td>
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<tr>
<td>13</td>
<td>There is too little teaching time to complete the NCV Mathematics curriculum.</td>
<td>1</td>
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<tr>
<td>14</td>
<td>A competency test is necessary for admission to NCV Mathematics courses.</td>
<td>1</td>
<td>2</td>
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<tr>
<td>15</td>
<td>The NCV Mathematics Curriculum has too many different sections.</td>
<td>1</td>
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<td>No.</td>
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<tr>
<td>16</td>
<td>The NCV Mathematics final examinations I have written was too long.</td>
<td>1 2 3 4 5</td>
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<tr>
<td>17</td>
<td>A NCV Mathematics bridging course will assist underprepared students in passing NCV Mathematics.</td>
<td>1 2 3 4 5</td>
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<tr>
<td>18</td>
<td>My NCV lecturer presents the NCV mathematics very clearly</td>
<td>1 2 3 4 5</td>
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<tr>
<td>19</td>
<td>I need NCV Mathematics to qualify for my chosen career.</td>
<td>1 2 3 4 5</td>
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<tr>
<td>20</td>
<td>The NCV Mathematics lecturer uses the textbook effectively when teaching</td>
<td>1 2 3 4 5</td>
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<tr>
<td>21</td>
<td>I feel quite relaxed in my NCV Mathematics classroom.</td>
<td>1 2 3 4 5</td>
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<tr>
<td>22</td>
<td>I came to college with sufficient mathematical knowledge to be able to cope with NCV mathematics.</td>
<td>1 2 3 4 5</td>
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Appendix C

Possible questions for Focus group interviews

1. When we talk about school mathematics versus NCV mathematics, many students say that NCV is easier than school. Would you agree and can you give some reasons as to why?

2. Are you fully aware of the benefits of NCV mathematics in your current field of study? Do you think it is beneficial?

3. Would you prefer more individual attention during your maths session with maths lecturer. If so why?

4. Are you aware of any additional resources available at the resource centre that can assist you in better understanding the mathematics. Would you want to use such resources?

5. Many students agreed with the fact that lecturers are not making use of other sources when teaching, would you agree with this? What other sources would you suggest lecturers use?

6. Many students agreed that the mathematics periods should be in the morning session only, Why do think this is? Give reasons

7. What, in your opinion, should be the length of a mathematics period (time)?

8. Do you think that the mathematical terminologies used are too difficult to understand? If so give some examples.

9. Do you think that you will understand better if a friend (peers) explained certain sections of the work?

10. Do you ever get a chance to discuss work with peers in class or any other time? And if so, do think that that would help you in your understanding?

11. Would you rate your current mathematics curriculum as difficult or easy and give possible reasons why?

12. Do you think that things might have been different if you were aware of all the different sections and topics of the NCV maths curriculum?

13. Are you aware of the fact that a competency test is a requirement for entry to NCV course? Do you agree with such a test?

14. What is your opinion wrt a bridging course for NCV.

15. Are you aware that the minimum requirement for entry to the NCV course is a Grade 9 pass. What is your view on this?

16. If you had to rewrite your previous NCV Mathematics examination, would you want more time to complete?

17. Are you happy with way examinations are written?
## Appendix D

### Quantitative Raw Data

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### Appendix E

## Data Mean and Standard Deviation for Sub Categories

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| Question | Catg.3 | Catg.2 | Catg.2 | Catg.4 | Catg.1 |
| MEAN:    | 4.1    | 3.2    | 4.1    | 4.4    |
| STDEV:   | 0.8    | 1.2    | 1.0    | 0.8    |
Appendix F

Transcript of Focus group interview 1

Interview 1
Lecturer = L ; Student No. = S1

1. L: we can start with the first question. The first question basically is. Many students say that the NCV mathematics is easier than the school mathematics. Can you tell me how you feel about that.

S1 : I din’t see the difference actually between it. Its more or less the same

S2: From my view sir. I have got a point to prove. Level 2 is the same as grade 9. I dint do grade 10, 11 and 12, so obviously the maths is not going to be that easy. Cos I have to do level 3.

S3: On high school I never done maths you see. I’ve done maths literacy, so it going to be difficult.

L: How do you think is the NCV course mathematics specifically that you are doing is it beneficial for the field you are studying for. Is it beneficial. Do you think it is very relevant to what you are doing?

S3: lightly

S2:It is relevant

L:Can you give any reason why you think is relevant. How do think mathematics NCV is link to you course.

S2: As a fitter I need basic knowledge of mathematics. Because I will use it in the workplace.

S1: we need it in automotive, some maths yes, but we don’t need all of it, there’s to much stuff that we doing here that we don’t actually need.

L: How much individual attention does the lecturer give you, and others in the class. Is their individual attention in your class.

S1: there is no individual attention. L: not even last year. S1: nothing

S2: no

S3: there is a little bit.

L: on the same question do you think we can improve on this? In other words do think we need more individual attention?
S1, S2 and S3: Yes.

L: Going to the resource centre. As you know we have one here at college. Have you ever used the resource centre for your mathematical problems.

S1, 2, 3: no

S1: it is irritating and bad to go to the resource centre because.

L: that is my next question is why not

S1: you have to do bookings that is already unnecessary because the only reason I go to the resource centre today is because I need to do the work today I have to do a booking for tomorrow while I have other work to do.

L: anything else that you want to add. So the resource centre is not running as it should be running.

S1, 2, 3: yes it is not running as it should be running

L: based on what students report they that lecturer do not make use of other resources accept the textbook? Is this your experience as well.

S1: yes it would be nicer if we could have practical experience maybe with the monitors show us something

S2: Yes it would be nicer

L: Did any of the other lecturers use any other resources.

S1: Yes

S2: Ja

S3: Yes

S1: but not maths other subjects.

L: So others are using other sources, is this helping?

S1: yes

S2: yes it helps

S3: yes

L: also according to many students the maths periods should be in the morning instead of the afternoon what is you think?

S1: Yes because we are to tired in the afternoon and maths need your full brain

S2: yes I would prefer it in the morning rather than the afternoon.
S3: yes in the morning
L: Would like the periods to be longer or shorter.
S1: its ok the way it is now except for Fridays.
S2: Fridays are actually too long you, because the lecturer become bored and you end up not listening.
L: many guys have said that they find it very helpful when their friends explain the maths to them.
S1, S2, S3: Yes
L: so you all agree with that, why?
S1: because you understand your friend better than you understand your lecturer.
S2: yes
S3: yes
L: when you do ask your friend what language does he use?
S3: Xhosa
S2: It is just the way he explains, not the language
S1: yes it also just the way he explains.
L: the research show that most of the guys find that the maths syllabus the curriculum is difficult. Can you tells us maybe why?
S1: All the stuff that we don’t need in our trade, like geometry and all of those stuff we don’t actually need in our trade.
S:3 I think from my point of view, in the time frame we per subject per topic I think it is a bit short. If we could work like this, if a lecturer could drill us on a certain topic until the whole class knows and then move to the other topic, because there are cases where we have topic 5 than he sets up a big test that is going to cover the whole book than we have already forgotten topic 1.
S2: too many topic
L: So you are saying cut down on the topics. S2: yes cut down on the topics.
L: according to you which topics should be cut down on.
S2: Geometry is not to relevant to my study
S:1: the angle stuff sin and cos that we are doing now.
S3: I think the trigonometry should be cut out

L: many of the guys where neutral about the grade 9 learner coming to cope with this course. What is your view seeing that you are guys from grade 9. When you come into this course do think it is difficult not difficult, what is your view.

S1: It won’t be difficult as long as he practiced before the time, if he have more time

S2: I did grade 12 but did maths literacy.

L: so you guys think it is not to difficult when you come from grade 9.

L: now if you were a lecturer and you had to teach a guy from grade 9. Try to put yourself in my shoes as a lecturer and you had to teach a guy coming from grade 9. How would you feel.

S1: I would be quite comfortable because the syllabus in grade and level 2 is more or less the same.

L: perhaps you will have different view who comes from a maths literacy class. How would you as a lecturer handle a guy coming with maths literacy.

S3: I would try to help him.

L: Do you think that a grade 9 guy should be allowed to do this course.

S1, 2, 3 : Yes

L: Do think that a grade 9 learner should do a bridging course when he comes here

S1: No I don’t think so, I think the test in the beginning is ok. L: you mean the admission test, S1, 2, 3 Yes the admission test is enough.

L; if you were to write the final examination without any ICASS. Do think it would influence your final result?

S1: Yes

L: Do think it would be to your advantage or disadvantage.

S1: disadvantage.

S2: disadvantage, because we don’t practice that much at home so doing the ICASS make you go through it again.

S3: the same

S1: I just don’t know how it benefits us because I did my level 2 and I passed right through the year but the final I failed with 28 and I didn’t see how I failed.

L: maybe it is in the way they use the ICASS mark.
S2: I think it maybe in the way they calculate the final mark is a problem.

L: if you were given a chance to start all over again knowing what you know now about the curriculum and icass, do you think you would do better.

S1: yes I will do better because I am advance I know already what is up

S3: yes I think I will do better because I will know what is in line for me

S2: I think I will do better.

L: what else do you think would make you do even better.

S1: Resource Centre only for maths and someone to assist you. L: would you want that person to a lecturer or a student?

S1,2,3 : A lecturer

INTERVIEW 2
L: many students say that the NCV mathematics is easier than the school mathematics. How do you feel?

S1: on my side sir. I passed grade 9 to grade 10. not easy for me.

S2: yes sir to me the college maths is not easy because I only passed grade 10 and then there by the school I was doing maths lit not maths.

S3: I think it a bit difficult cause there was a time I wanted to leave college and I wanted to go to a other school cause they say our maths here is more difficult its like varsity.

L: the next question is related to the field are studying now. How beneficial do you think this ncv maths is to that field you are studying. in other word do you think it will help you in any way the maths that you are doing here?

S3: Yes. L: if you say yes just give a possible reason or way how it is going to help you.

S3: Now in our class we are doing a section............. and we have to calculate how much centimeters to cut

S2: yes I think almost everyday you have to calculate before you cut something you have to have your measurements.

S1: Yes I have to calculate the material I have to use for building.

L: How much individual, this is now about the lecturer, attention does the lecturer give you if any. or others during the maths class?
S2: He can listen to you, he does not criticize, but sometimes you do a lot of work and then you feel like you don’t have to do anything.

S3: This year’s lecturer is good to me but there by level 2 there is a problem sir, now one minute she teaches you maths the next minute she is telling a story about his husband. L: So it not all lecturers that give full attention, do all agree with that?

S1, 2 and 3: Yes

L: So if you were asked how we can improve with his scenario with lecturers, what do think can be an improvement in terms of contact, Would you maybe say more contact, less personal contact. Anything that you might think, suggestion.

S3: maybe it will improve if the lecturer give us more attention during the work. L: you mean during the lecturer. S3: Yes

S2: I think the school (college) should get like people who know maths in class to help us, cause sometimes someone is afraid to approach the lecturer than you can ask that person to help.

L: on that point that you mention now do you think that person should be a fellow student.

S2: It can be anyone, who looks like a student or approachable. L: So it doesn’t matter as long as it is somebody that can give you more attention. S1: Yes.

L: Also based on students response, they say that we have a resource centre you know? S1, 2 & 3: Yes

L: My question is, have you ever used that centre for maths specifically. S1, 2 & 3: NO

L: Can you give me a reason why you go there for extra maths information.

S2: the problem with that is the aunty, the lady that

S3: I did not know that you can go there for maths I thought you only go for computers. I did not know you can go there for maths.

S2: We use to go there than she would look at us nasty and say you must book first before you can come in for tomorrow what what. S1: yes, come tomorrow

L: Based on what students report it seems that lecturers do not make use of other sources besides the textbook? Is this true, is this your experience?

S(all): Yes

L: Have you any experiences of lecturers that uses other sources, besides your maths?
S2: I was at Master maths and they were using the computers to teach you maths. L: Does that help

S2: It helps but in some section it did not help, our maths they did not have the programme.

L: In this college is there other lecturer’s that uses other sources?

S3: Only the computers

S1: in the core subject, in Materials.

L: Based on your answers would you want us as lecturers to use other sources? Do think it would help?

S1 &2: yes I think so

L: According to many students the maths period that we have should be during the morning and not in the afternoon.

S(all): Yes L: so you all agree with this.

S3: Look on Friday maths is the last period by 1 clock, then maybe we came here by 8 o’clock than we sit there by the cafeteria, because of the maths, the other periods we finished with them, then we can’t wait for the last period than we go that’s why we want the classes to be in the morning.

S2: and sometimes the maths classes are after break, and you eat a lot than you fall asleep in class because you are tired. L: do you agree with that

S: 1 Yes (laughing)

L: On that point also would like the periods to be longer or shorter

S3: Longer sir

S2: I think one period is enough

S1: I also think one period is enough

L: And the length of the period as we are running it now is it sufficient the length one period?

S2: Ja S3: Yes it is fine.

L: Many guys have said that they find it very helpful when their friends explain the maths to them

S2: Oh, yes

S1: Yes
L: Now if you say yes, how do you communicate with your friend in terms of language.

S2: its more informal, like the lecturer would say pi times r squared, we forget, we will just say this thing is times what.

L: terminologies

S1: yes terminologies. S2: yes we don’t know all terms

L: the other thing I want to ask in terms of language Xhosa, Afrikaans, English is that an issue when friends have to explain to you?

S2: I think it is a big issue. Some of, most of others in our class come from rural areas so they don’t know proper English.

L: Than in what language would they converse when they would want someone to explain to them.

S2: Xhosa S1: Xhosa

L: So you would say a Xhosa speaking person would prefer a Xhosa speaking fellow student to explain to him

S2 & 3: Yes

L: The research also shows that most of the guys find the maths curriculum the one that we doing, slightly difficult.

Do you agree with that or not? As from L2 L3 you are currently L3. Do you think the syllabus as it is now is difficult and if you say it is difficult why and maybe specifically which parts.

S2: I think it is easier at level 3 L: don’t be afraid tell me what in level 3 are you struggling with now for example.

S2: This (showing to the board with formulae on volume and area) L: this would be volumes and the areas

S2: Ja and the cos, sine and what. L: Trigonometry S2: ja

L: What specifically are you struggling with if you are struggling with anything

S1: This one sir. L: the volumes and how about the Algebra?

S3: not to difficult

L: How would you like to change the curriculum if you could change it? in terms of the topics maybe or anything, would like it be more less, give your honest opinion.
S2: I think this one, but if I say we should take it all out we would be pinching ourselves, we’d be kicking ourselves cause we, what we doing now, plumbing, whatever, is based on all this (volumes and areas)

L: How about Geometry, would you want to take that out maybe, angles

S1: No

L: If there is anything you could take out what would it be?

S2 and 3: Trigonometry

L: How about differentiating would you want to take that out

S2: no to difficult

S3: not bad

L: Many of the guys when it comes to admission to this place you know the minimum requirement is grade 9.

They say or they don’t want to say that a grade 9 can cope or cannot cope, they don’t want to say or no. What is your view? Do think a grade 9 student, that come from wherever, can cope with this course when he enters here.

S2: I think if I was to continue with grade 10 I was going to do Maths literacy and then when I came here didn’t know what, I was very poor at maths so for me it depends on the person who is doing grade 9 are you ok with maths.

L: What is your view (S1) S1: I don’t know sir L: Your view sir (S3) (no answer. L: Ok lets go to the next question

L: Are you ok with the admission test that you have to write when you come here. Are you ok with the writing of an admission test before you are given entry into the college?

S1: yes I think so sir L: Do you think it is something necessary? S1: Yes sir.

L: Now also based on that do think a bridging course is necessary when a person comes in before you enter level 2

to do maybe in mathematics specifically, a small course, just to get your maths maybe at a level it should be. Do think that is something you would agree with.

S1, 2 ,3 : yes

L: If you were to write final exams for NCV mathematics without any internal assessments like our ICASS and ISAT
Do you think this will influence your final result? You only write examination, do you think that will influence your final result?

S2: Ja I think it will

S1: yes

S3: yes

L: and If you say yes like you all have, would it be an advantage to you or a disadvantage to have the internal assessments?

S2: It will be an advantage to have the Icass because they help us in our marks

S1: yes

S3: yes

L: So for you this is a good thing. Is there anything about the internal assessments that you want to raise in terms of what you do the test and the assignments.

S2: I want ask , I can’t remember which lecturer told me this but he told us that if you pass to much maybe we do an open book test on maths and we get maybe 80% and then when you get to the final exam and you did not pass what they do when they mark on your result they reduce the percentage of the assignments and then you find out that you failed .

L: I know what you are talking about so can I say that the way they calculate your final mark., is that maybe a problem The way they use our icass mark to calculate your final mark. Do you agree that the way they the department calculate your final mark is a problem?

S1,2 : Yes

S2: or maybe we don’t know the full information I don’t know

L: You are not informed as to how they calculate the marks

S2: yes

L: If you were given the chance to start all over again with this course knowing what you know now about the curriculum, the icass , and the admission requirements, and the examination. Do you think, if you were given a chance to start all over again, you would do better.

S1: By level 2, Yes

S2: I was not fully informed about the course when I came here everything just came in between. And in High School they told us that if you pass your project and what
ever at the end of the year even if you fail you still pass. So I had that thing in my mind.

L: Would you then agree if I say that you need more information before you enter this course.

S1, 2, 3: Yes

End