Tracking learners' performances in high-stakes Grade 10 mathematics examinations

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Tracking achievement tests

Improvement over time

Socio-economic status

Differential achievement

ABSTRACT

One of the educational ideas used in mathematics education to improve mathematics achievement in schools is examination-driven teaching. Its effects have sparked intense debates in different didactic circles regarding its usefulness as a teaching technique. More specifically, researchers have consistently debated whether examination-driven teaching is a good or a bad approach that can be used beneficially for learners' achievement. In South Africa, the urgent need to uplift the low performances of high school learners in Mathematics has led to a development of a project which is a partnership with the Western Cape Education Department (WCED) and the University of the Western Cape (UWC). This project used examination-driven teaching in the context of a continuous professional development to improve learners' mathematics scores. Five secondary schools that were opportunistically sampled in the province of the Western Cape were exposed to examination-driven teaching. For evaluation, the project yearly developed and implemented high-stakes Grade 10 end-of-year mathematics examinations, and the data subjected to analysis were learners' mathematics scores for 2012, 2013 and 2014. A quantitative approach employing Rasch procedures and some statistical procedures were used to analyse the data. The study intended to answer the following questions: 1) Do learners' achievement scores in a high-stakes Grade 10 mathematics examinations improve over time when an examination-driven teaching approach is being used as intervention? 2) Does socio-economic status of schools influence mathematics performances in the case of using examination-driven teaching ? 3) Are there differences over time in the achievement of learners in the two different papers comprising the examination?

In order to address these research questions, evidence from high-stakes examination scores was used to calibrate trends of 2012, 2013 and 2014. Over this period, study findings reveal that mathematics mean score improved substantially from 22.32% to 35.42%. This is apparently in response to examination-driven teaching strategies. In detail, mathematics mean score declined marginally from 2012 to 2013 and rose dramatically between 2013 and 2014. The decline could be explained by the teachers' non-mastery of the strategies and new curriculum named Curriculum and Assessment Policy Statement (CAPS) introduced in 2012. However, the improvement could be explained by teachers' mastery of both strategies and new curriculum. The same pattern is noticeable along with the overall performance of learners from different socio-economic backgrounds as well as the overall performance for

Paper 1 and Paper 2. In particular, the gap between learners' performances from different socio-economic backgrounds has decreased toward reversing inequalities. For illustration, the middle social class of learners who had the lowest performance in 2012 obtained the highest performance in 2014. Likewise, in the decline from 2012 to 2013 learners performed slightly better in Paper 1 than in Paper 2, but in the improvement from 2013 to 2014 learners performed better in Paper 2 than in Paper 1.

Hence, this thesis evidences that examination-driven teaching improves mathematics achievement scores, decreases differential achievement along socio-economic dimensions and may reverse gaps between topics in school mathematics. It is just a point of departure from which further detailed studies may be conducted in order to improve learners' scores in school mathematics.

DECLARATION

I declare that *tracking learners' performances in high-stakes Grade 10 mathematics examinations* is my work, that it has not been submitted for any degree or examination in any other university and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Okitowamba Onyumbe   November 2015

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There are many devices in a man's heart; nevertheless the counsel of the Lord, that shall stand (Pro19:21.)

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DEDICATION

So let's dedicate our lives, our church, out tasks, our service, and everything we have to the kingdom of God

(Rev. William Marrion Branham, 1963).

LIST OF ACRONYMS

ADI	Assessment-Driven Instruction
AFT	American Federation of Teachers
ALG	Algebra
AN G	Analytical Geometry
ANAs	Annual National Assessments
CAPS	Curriculum and Assessment Policy Statement
COSATU	Congress of South African Trade Union
DCSF	Department for Children, Schools and Families
DDDM	Data-Driven Decision Making.
DDI	Data-Driven Instruction
DIF	Differential Item Functional
EDI	Examination-Driven Instruction
ES	Effect Size
EU G	Euclidean Geometry
FIN	Finance and Growth
FPLT	Fee Paying Less Than Thousand
FPMET	Fee Paying More or Equal to Thousand
FUN	Functions and Graphs

HSRC	Human Sciences Research Council
IRT	Item Response Theory
LEDIMTALI	Local Evidence-Driven Improvement of Mathematics Teaching And Learning Initiative
MDI	Measurement-Driven Instruction
MDT	Measurement-Driven Teaching
MEA	Measurement
MNSQ	Mean Squares
NCS	National Curriculum Statement
NEA	National Education Association
NFP	Non-Fee Paying
NSC	National Senior Certificate
OECD	Organisation for Economic Co-operation and Development
P1	Paper 1
P2	Paper 2
PAT	Patterns and Sequences
PCM	Partial Credit Model
PISA	Programme for International Student Assessment
PRO	Probability
RMT	Rasch Measurement Theory
RSM	Rating Scale Model

SACMEQ	Southern and Eastern Africa Consortium for Monitoring Educational Quality
SADTU	South African Democratic Teachers Union
SEI	Socioeconomic Index
SES	Socio-Economic Status
STA	Statistics
TIMSS	Trends in International Mathematics and Sciences Study
TRI	Trigonometry
USA	United States of America
UWC	University of the Western Cape
WCED	Western Cape Education Department
ZSTD	Z-Stamdardised

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CHAPTER ONE

THE RESEARCH PROBLEM AND ITS CONTEXT

1.1 Introduction

Mathematics can be viewed as the cornerstone of science and technology (Susac & Braeutigam, 2014) both of which impact on the economic performance of societies. As economic growth has become a national and international concern particularly in the last two decades, Drake, Noyes and Wake (2012) insist that the learning of Mathematics is central to the agenda of each organisation which wants to promote economic growth. For instance, the Organisation for Economic Co-operation and Development (OECD) has prioritised increasing the number of people in its workforce who are mathematically highly-qualified (Hanushek & Woessmann, 2010). This indicates that mathematics skills are very important for the economic growth of a country because many professions – such as engineering, accounting, architecture, forensic science, medical science and so forth – are based on some knowledge of Mathematics. Although she does not sideline the importance of other areas of study in the school program, Reddy (2011) believes that Mathematics is a proxy for analytical thought. According to her, mathematical skills are very important for the development of high-skills capacity in a country. However, there is a growing crisis in mathematics education in the world (Stanic, 1986), and South Africa is no exception.

In South Africa there is a persistent concern about the low national average scores in Mathematics in various kinds of tests and assessments. The South African government together with national and international organisations are trying to address this challenge of improving performance in Mathematics. One of the organizations involved in this initiative is the project, Local Evidence-Driven Improvement of mathematics Teaching And Learning Initiative (LEDIMTALI), started at the University of the Western Cape. This project aims to develop and maintain good teaching in school mathematics. It is comprised of collective and collaborative work between mathematics teachers, mathematics educators, mathematicians and mathematics curriculum advisors. The sharing of experience amongst the members of the project occurs in the context of continuing professional development with a special focus on examinations-driven teaching.

Although many different strategies are employed, this research is not concerned with the identification of how much each input or a combination of inputs influences achievement; rather, it is concerned with tracking mathematics achievement scores of Grade 10 learners from 2012 to 2014. The impact of measurement-driven teaching is assessed by the outcome trends of five schools sampled. With the afore-mentioned focus firstly this chapter provides the study background, motivation, and statement of the problem. Secondly, it presents the research aims and research questions. Finally, it concludes with a discussion of the significance of the study.

1.2 Background, motivation and problem statement

1.2.1 Background

In 2012 the South African government changed the National Curriculum Statement (NCS) to a new curriculum called Curriculum and Assessment Policy Statement (CAPS) with the objective of responding to the politics of South African education. It was considered that examination-driven teaching is one approach that could ostensibly contribute towards improvement of achievement scores.

This study forms part of an engagement with a vast and growing body of research on whether examination-driven teaching is a good or a bad teaching strategy, that is, whether it may enhance the quality of mathematics achievement in schools (Bracey, 1987; Julie, 2013a; Mahadevan, 2011; McCarthy, 2006; Popham & Rankin, 1980; Randall, 2001). Certain trends emerge from the discussion generated by the above scholars. One trend supports the position that examination-driven teaching is a potent force for educational improvement when it is examination-driven teaching properly conceived and implemented. Furthermore, some of these scholars argue that examination-driven teaching decreases social inequalities in learning Mathematics. Yet another trend becomes noticeable in the argument of other scholars who view examination-driven teaching as a curse where, in a less flattering light, they proffer that this approach to learning Mathematics increases social inequalities. The research interest is in investigating this controversial educational issue. However most of the research reports pertain to initiatives and projects in developed countries such as Australia, China, USA and England; very little research exists for similar initiatives in developing countries such as South Africa. Literature relating to the South African educational system concerns itself with persistent low performance in school mathematics (Department of Basic Education, 2009; Reddy, 2011). This is evidenced in the national assessments such as the National Senior

Certificate (NSC), the Annual National Assessments (ANAs) and in international comparative studies on student achievement in Mathematics, such as the Trends in International Mathematics and Science Study (TIMSS). In addition, the poor performance in school mathematics is differentially distributed amongst schools along socio-economic lines (Bloch, 2009; Fleisch, 2008; Reddy, 2005) and in Paper 1 and Paper 2 of the NSC mathematics examination (Sasman, 2011).

1.2.2 Motivation

Mathematics education in South Africa is in a state of crisis in terms of quality and equity in achievement scores (Mbekwa, 2002). Referring to learners' poor performance in Mathematics in the context of South Africa, Reddy (2011) highlights two relevant characteristics in the South African education system. The first is that the national average mathematics achievement score for different grade levels across the schooling system is similar and stable: around 30% to 40% at different grades. The second is that there is a high differentiation of the educational performance of students from various socio-economic backgrounds. It is striking that there are two 'streams of education' considering the fact that 30% of schools are performing reasonably satisfactorily whilst 70% of schools are underperforming. Furthermore, in each Trends International Mathematics Sciences and Study (TIMSS) in which South Africa participated, the performance of its learners was poor. An analysis of the National Senior Certificate (NSC) results of 2011 showed that a pass rate of 46.3% was attained for Mathematics. This pass rate is a decline from the 2010 pass rate of 47.4% (Spaull, 2013b). Thus learners' performance in Mathematics has become an educational and social concern that requires rigorous investigation. This research therefore proposes to provide an understanding of the trend of learners' performances over time when an examination-driven teaching approach is used as a strategy for intervention. The study is premised on the fact that over time the use of examination-driven teaching strategies can improve learners' performances in summative mathematics examinations. As one of the goals of South Africa's democracy is to attain significant increases in mathematics achievement among all socio-economic categories it is relevant to consider an aspect of Socio-Economic Status (SES) in this study. In addition, it has to be stated that learners' abilities in Mathematics differ, and that their performance is also dependent on the difficulties of the topics tested or items included in tests. With this in mind the study investigated the gap in performance between Paper 1 and Paper 2.

1.2.3 Statement of the problem

The main issue underlying this study concerns the extremely polarised contentions around whether examination-driven teaching is a good or a bad approach to teaching. In other words, many scholars believe that examination-driven teaching improves achievement scores while others dispute this claiming that examination-driven teaching reduces achievement scores. Illustrative of the former view Popham (1987: 680 cited in Ashley & Hand, 2007) contends that examination-driven teaching has improved public education in the U.S. He argues that the U.S is the most powerful, wealthiest country today because examination-driven teaching has played an important role in increasing proficiency through skills acquisition, thereby reducing socio-economic inequalities.

However, some critics of examination-driven teaching are of the view that standardized testing causes greater socio-economic inequality, and that indirectly it promotes polarization in society (Christie & Gilmour, 2012; Yu & Suen, 2005). In contrast to Popham (1987) and other proponents, opposing statements about examination-driven teaching are articulated by Bracey (1987), Davis and Martin (2008), McCarthy (2006), Shepard (1988) and Zhao (2010) amongst others. These scholars equate examination-driven teaching with academic violence or punishment with numerous negative effects. For them, examination-driven teaching fragments instruction, turns the curriculum away from its goals and focuses on the performance of disconnected skills. As Popham (1987) contends that most arguments against examination-driven teaching lack analytic rigour and empirical support – an ongoing contestation that is growing – it is the purpose of this study to investigate within the specific context of South Africa, whether or not examination-driven teaching improves mathematics achievement and whether or not examination-driven teaching increases social inequality.

1.3 Research aims and research questions

1.3.1 Research aims

The objective of this investigation was to track Grade 10 learners' performances in Mathematics between 2012 and 2014. It aimed at ascertaining whether the performance of learners in Mathematics was improving over time as evidenced by high-stakes examinations results. The study also hoped to determine whether the declared improvement applied in similar or different terms in relation to learners' socio-economic status. Finally, as the high-stakes examinations are divided into two parts – Paper 1 and Paper 2 – it was hoped that the trend of learners' achievement scores would signal in which paper learners performed better over time.

1.3.2 Research questions

Main question

Do learners' achievement scores in high-stakes Grade 10 mathematics examinations improve over time when an examination-driven teaching approach is being used as an intervention?

Subsidiary questions

Are there differences in achievement over time between learners from different socio-economic backgrounds when an examination-driven teaching approach to teaching is being used?

Are there differences in achievement over time between Paper 1 and Paper 2 when an examination-driven teaching approach to teaching is being used?

Justification of research questions

There is an expectation of positive change in outcomes when strategies in education are implemented. Therefore, to measure that change it is essential for evaluation. Consequently, determining the expected change that a particular teaching approach to Mathematics yields on learners' performance, measured as improvement in achievement, becomes imperative. In Mathematics Education two important interactions can be observed between teaching and learning. On one hand, Mathematics influences the learner by conveying competences and skills (Council Resolution, 2007). On the other hand, the person learning Mathematics is from a socio-economic environment which constitutes an important factor impinging on the process within the learning opportunity (Carnoy, Chisholm, Addy, Arends, Baloyi, Irving and Sorto, 2011). This means that influences on learning achievement gain may be ascertained when Mathematics is viewed both as a subject and as a learning context or opportunity. Thus, it is relevant when studying improvement to evaluate conditions governing this purported improvement. It is important to take into account equivalence indicators between learners and across all topics.

1.4 Significance of the study

This study is significant for several reasons. Firstly, the study has value on the level of educational measurement as this is the concern of educators, researchers and policy-makers who are in search of intervention strategies to address the vexing problem of unsatisfactory achievement in school mathematics. Secondly, the study is expected to generate tentative hypotheses about the effects of examination-driven teaching over time in the quest for the enhancement of mathematics achievement in the school context of the Western Cape. Thirdly, this research may contribute to the government's vision for the improvement of mathematics achievement in schools especially in the previously disadvantaged schools. Therefore, it will augment the South African literature regarding teaching strategies and it will add to the body of knowledge some insights that can support the implementation of the Integrated Strategic Planning Framework for Teacher Education in South Africa set up for the period 2011 to 2025. Fourthly, the study hopes to contribute both empirically and methodologically to the field of mathematics education, particularly in relation to continuous professional development focussed on examination-driven teaching. Fifthly, this study is expected to add to the debate about examination-driven teaching and whether it is a good or bad approach to teaching.

1.5 Limitations of the study

Three limitations were encountered in conducting this study.

Firstly, the study was limited to the marks from only an opportunistic sample of learners who belonged to the ten schools selected by negotiations between the Western Cape Education Department and UWC. However, the research sample was reduced because some schools did not write all the common examinations. A summary of the number of schools who did participate in common examinations is presented in Table 6.1.

Table 1.1: *Participation of schools in common examinations*

Year	2012	2013	2014
Number of schools Participating	9	5	6

The reasons why some schools did not write the common examinations include the following: (1) the timing and availability of the common question papers were not aligned to the year plan of schools in terms of the moderation of questions papers. Therefore teachers set their own papers. (2) The standard of question papers was high in terms of their cognitive demand so teachers set their own papers corresponding to the level of their learners. (3) The Grade 10 learners of one school were not available in 2013 and 2014 because they had gone to another school following a prior arrangement. Due to such instability of the data, for consistency, I decided to work with the five schools which wrote in each year of the enquiry period of investigation. This was what was possible, given the constraints. As a result these findings are not representative of all schools of LEDIMTALI project.

The sample was not representative in the Western Cape Province or South Africa. Therefore to generalise about the outcomes for the entire Province or for the country, requires careful consideration if they are to be more broadly applied. Also, the study was carried out for 2012, 2013 and 2014 regarding the time frame of the project.

Secondly, it is important to consider that test scores were based on three years of high-stakes examinations results. The researcher ignored whatever outcomes can result after five or ten years of high-stakes examinations.

Thirdly, many interventions are addressing the low performance of school mathematics in such a way that in this investigation the researcher was not able to separate in the findings the action of examination-driven teaching from other interventions.

1.6 Thesis outline

Chapter One provides the background, the motivation and problem statement of the study. In the section covering the background I refer to the change of curriculum in South Africa with examination-driven teaching as a strategy for improving mathematics achievement scores in LEDIMTALI schools. Already a feature in the literature, the question as to whether this examination-driven teaching constitutes a good or bad approach forms the key problem in this research. Regarding the crisis in mathematics education in the world and especially in the context of South Africa, I was motivated to investigate whether examination-driven teaching may address this challenge. The chapter ends with a discussion about research aims, research questions and the importance of the study.

Chapter Two presents the conceptual framework and the literature review of the study. Six concepts were used to develop the conceptual framework in order to explore the effects of examination-driven teaching by tracking performance for improving achievement scores. These concepts include examination-driven teaching, high-stakes examinations, tracking performance, differential achievement, socio-economic status, and topics (Paper 1 and Paper 2). In the process of outlining the conceptual framework, key concepts are described and discussed in relation to a review of the literature, and in the light of the research questions. The chapter ends in a diagrammatic representation of the conceptual framework which forms the basis of the whole investigation.

Chapter Three presents the research design and methodology that were employed. A quantitative research design was adopted and two procedures are described: Rasch procedures and statistical procedures. Concerning Rasch procedures, only the concepts that are used in this work are reviewed such as partial credit model, fit and unidimensionality, and differential item functioning. Regarding statistical procedures, only the notions of t-test, effect size and missing data are discussed. Also, validity and reliability are discussed as provided by the Rasch model. The chapter ends with a discussion of the ethics statement.

Chapter Four presents the analysis of data using Rasch procedures to ensure exactitude in measuring by eliminating all items that do not fit Rasch principles. On one hand, only the items in which Rasch measures fall into the acceptable range are kept for the analysis related to the main research question. On the other hand, only the items in which differential item functioning contrasts are acceptable and also kept for the analysis, relate to the subsidiary research questions. This selection is done for all items of the three high-stakes mathematics examinations.

Chapter Five analyses the rest of the data using statistical procedures. Trends are examined in such a way as to provide answers to the research questions. The findings of the study are presented.

Chapter Six summarises the findings of the study. The major conclusions of the study are highlighted as responses to the research questions. A discussion of the findings emphasises their integral part in the literature. Recommendations for further research and implications about examination-driven teaching are highlighted for the enhancement of the quality and equity in mathematics education.

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

In this chapter the conceptual framework for examination-driven teaching is described, with performance tracking as core among six constructs that underpin the study. The conceptual framework of the chapter is developed as each construct is explained and contextualized in a literature review. A diagram linking two key constructs is presented to generate an understanding of examination-driven teaching in two ways.

2.1 Constructs underpinning the study

There is evidence to suggest that educational achievement is a complex concept influenced by many factors such as teaching, school environment, school administration, socio-economic status, and learning opportunity (Carnoy et al, 2011; Mahimuang, 2005). However, it is neither possible nor necessary to investigate all the possible factors that impact on educational achievement in a single study. This study therefore focuses on one of these factors namely, the impact of teaching on educational achievement. In particular, it tracks mathematics performance of learners in high-stakes examinations over three years in the context of examination-driven teaching. The main conceptual constructs that underpin the study are the following: (1) examination-driven teaching, (2) high-stakes examination, (3) tracking performance, (4) differential achievement, (5) socio-economic status and (6) mathematical topics.

2.2 Examination-driven teaching

This section describes the concept of examination-driven teaching. It also discusses the following: a brief history of examination-driven teaching; other terms for examination-driven teaching; various approaches in examination-driven teaching; principles for the design of examination-driven teaching; conditions for the effectiveness of examination-driven teaching; key controversies; the inevitability of examination-driven teaching; and highlights of some achievements of examination-driven teaching .

2.2.1 Description of examination-driven teaching

At the centre of the study is examination-driven teaching as the first construct. It is the main strategy that underpins a continuous professional development initiative in which this study is embedded. Examination-driven teaching is described by Popham (1987) as "teaching to the test". According to Julie (2013b:1), examination-driven teaching is normally viewed as "teaching the content of previous examinations and anticipated questions that might crop up in an upcoming examination of the subject". Regarding its effects, this approach to teaching is also viewed as an opportunity and catalyst for the improvement of mathematics achievement (Burkhart, 2006). However, some educational associations such as the American Federation of Teachers (AFT) and the National Education Association (NEA) (AFT & NEA, 2012) comment on the negativity of standardized tests. They argue that examination-driven teaching sometimes results in pressure and anxiety for teachers and for the designers of tests (Randall, 2001). Nevertheless, they cannot attack the criteria laid out by Popham for successful examination-driven teaching (Ashley & Hand, 2007). Shepard and Dougherty (1991:1) argue that "tests measure important skills and serve as instructional magnets to improve dramatically the efficiency and the effectiveness of instruction". High-stakes examinations motivate teachers and administrators to work continually to boost achievement (Johnson & Johnson, 2009). Examination-driven teaching provides new teaching strategies that adjust to results forthcoming from assessments. Examination-driven teaching further enhances the quality of education when high-stakes tests are properly conceived of and implemented (Popham, 1987).

2.2.2 Brief history of examination-driven teaching

Historically testing has been something that teachers have always implemented after instruction has been completed (Popham, 1987). The influence of tests and their results on an educational instruction program, which today is called examination-driven teaching, started toward the end of the 19^{th} Century (McArthur, 1983). In 1929, the University of Iowa initiated the first state-wide testing program thus opening the way for diagnosis and remediation (McArthur, 1983). In 1930 tests were set to measure basic skills comprising reasoning and the application of knowledge, thus directly influencing the curriculum and its instruction (Haertel, 2005). From the 1950s to the 1970s, the main focus in the theory and application of educational testing was to expound on teaching that focussed on what could be tested.

The crisis of the Second World War encouraged the measurement of intelligence and educational achievement to such an extent that during the 20th century Classical Test Theory, Item Response Theory and Rasch Measurement Theory were born (Andrich, 1978). The analyses emanating from the application of these three theories and their related techniques provide a description of the relationships between the abilities of learners and levels of difficulty in the concepts that were tested. They provide teachers with information with which to plan for better teaching and intervention.

Consequently, examination-driven teaching has been identified as a tool for providing new strategies for teaching that are adjusted on the basis of results emanating from tests. Examination-driven teaching is perceived as enhancing the quality of education when tests are properly conceived of and implemented (Popham, 1987). Yet it is this very perception that is contested by opponents of examination-driven teaching, as will be demonstrated later.

2.2.3 Other terms for examination-driven teaching

In the literature different terms are used for examination-driven teaching. These include: measurement-driven teaching (MDT), examination-driven instruction (EDI), measurement-driven instruction (MDI), assessment-driven instruction (ADI), data-driven instruction (DDI) and data-driven decision making (DDDM).

2.2.4 Various approaches to examination-driven teaching

Over the years, available literature has revealed several approaches to examination-driven teaching with variations depending on the kinds of assessment, analysis of data, and planning of the teaching. For example, whereas Mandinach and Jackson's (2012) approach is driven teaching by progressive classroom assessments and Julie's (2013b) is driven by teaching towards yearly summative examinations, Popham and Rankin's, (1980) approach is driven by teaching for systemic examinations. This study explores the examination-driven teaching approach that involves teaching towards summative examinations.

2.2.5 Principles in the design of an effective examination-driven teaching

As a doctor diagnoses sickness by interpreting test results from a laboratory in order to prescribe appropriate treatment, so the teacher has to discover the difficulties of learners as follows:

> The diagnosis of learning difficulties is a most important skill for all teachers. If children did not have learning difficulties, teaching would be much simpler and less demanding; however there seems to be little likelihood that in the near future any teachers will become bored because of the simplicity of their jobs. If teachers are to remedy accumulated defects shown by children, they need to have some basis on which to analyse what the defects are. It is difficult to get the answer when the question is unknown (Wilson, 1971: 3).

High-stakes examination and data scores analysis reveal the weakness or sub-skills of learners which can be remedied by what is considered an appropriate approach to instruction that is, examination-driven teaching. Popham and Rankin (1980) demonstrate how this principle enables teachers to teach fundamental skills because they understand the learning task better and can focus on needed sub-skills.

2.2.6 Conditions for the effectiveness of examination-driven teaching

According to Popham (1987: 680), "examination-driven teaching can be a potent force for educational improvement if properly conceived and implemented". In the light of this, Ashley and Hand (2007) identified in Popham and Rankin (1980) that an examination-driven teaching program has to meet five criteria to generate the optimal effect:

> 1) Criterion referenced tests instead of norm referenced tests should be used; 2) tests must assess defensible content and proficiencies; 3) tests must have a manageable number of assessment targets (around five to ten); 4) tests should function as vehicles to improve teaching; 5) educators must receive adequate teaching support (Ashley and Hand, 2007: 1).

Firstly, according to Popham (1987), the criterion-referenced tests are the chief virtue of examination-driven teaching for describing clearly to teachers what is being tested. Although norm-referenced tests are useful for other educational purposes, they fail to clearly describe the instructional targets that are necessary to design instruction. Secondly, if examination-driven teaching is used to enhance the quality of schooling, its tests have to measure the genuine content of the curriculum. A well-assessed defensible content reflects legitimate skills and knowledge. Thirdly, too many instructional targets turn out to be fraught with confusion; therefore the number of instructional targets should be in the threshold of five or ten. This is important to focus testing on a manageable number of relevant skills and knowledge instead of assessing a multitude of objectives. Fourthly, the developed tests to be used for examination-driven teaching should clearly describe skills or knowledge in such a way so as to help teachers design appropriate and effective instructional sequences. In fact, tests should serve as a tool for enabling teachers to design their instructional sessions. Fifthly, teachers should have support in how to use tests for designing their teaching, instead of the old approach in which the teacher thinks about tests only after teaching. Also, teachers should use test results to determine the extent to which learners have learned, and should use this information to assign grades.

Likewise, Julie (2013b) captures some elements of meaningful teaching to incorporate into examination-driven teaching to enhance its effectiveness. For instance, examination-driven teaching must contain the legitimate knowledge stipulated by the curriculum. Thus many of the criticisms levelled against examination-driven teaching can be avoided by improving, rather than eliminating examination-driven teaching.

2.2.7 Main controversy regarding examination-driven teaching

Currently there are contending views concerning the use of examination-driven teaching in mathematics education. One school of thought claims that examination-driven teaching restricts instruction and thus it is not an appropriate strategy for improving the quality of education. Another school of thought defends the position that if the knowledge tested is legitimate in such a way that it reflects the content of curriculum, then tests would reflect the principles of an education system and they might improve mathematics achievement. Regarding these two trends, the question that arises is the following: Does examination-driven teaching improve mathematics achievement or not? Such a question really needs enough evidence for an informed assessment of the matter.

To begin with, while the arguments of proponents of examination-driven teaching are based on some evidence, all criticisms of opponents to examination-driven teaching are without evidence. Popham (1987) for instance argues that any tool can always be misused. Therefore, examination-driven teaching is a potent force for educational improvement when it is properly conceived and implemented. On his part, Julie (2013b) demonstrates how teaching can proceed by incorporating aspects of meaningful teaching into examination-driven teaching. In addition, Popham (1987) believes that the use of examination-driven teaching reduces differential achievement along socio-economic lines contrary to the belief of Christie and Gilmour (2012) besides Yu and Suen (2005) who argue that educational assessments increase social inequalities regarding achievement. It is the latter view which raises the question: Does examination-driven teaching indeed increase or decrease social inequalities in terms of achievement?

This study thus investigates and sheds some light on the question of whether examination-driven teaching increases or decreases social inequalities in terms of achievement. Although the controversy is ongoing, examination-driven teaching continues to be used to improve mathematics education. Proponents contend that in learning contexts, tests serve to motivate learners to work hard to pass examinations. Julie’s (2013b) interest in the alignment between meaningful teaching and examination-driven teaching therefore contributes to the discussion in this thesis.

Although, many disadvantages of examination-driven teaching are pointed out by the opponents, proponents strongly believe that examination-driven teaching is an opportunity and a catalyst for reforming the teaching of school mathematics. Proponents base their argument on the notion that no matter what the disadvantages of examination-driven teaching are, teaching will always be driven by what is examined. In the light of this position, the proponents of examination-driven teaching conclude that not only does examination-driven teaching improve student learning but also that such learning is inevitable.

2.2.8 Inevitability of examination-driven teaching

Examination-driven teaching is an approach to teaching that occupies a significant place in mathematics education. In light of this statement, Julie (2013b: 1) believes that “regardless of what reforms in teaching are desired and agitated for, it will always be examination-driven as long as summative examinations are used for the awarding of certificates with which learners can trade upon graduating from schools”. Best qualified workers are required in each company to maximise production. And one way to identify the best is through testing. Diamonds can appear to look the same but may have important differences in value and that only a laboratory test can detect (Gunning, 2008). All human beings have the potential and the ability to learn Mathematics but the capacity with which we understand what has been taught may differ. One way to identify these differences is by testing.

The outcome of testing after learning is the certificate. As learning has to be evaluated by assessment for the awarding of a certificate or promotion to the next grade level, examinations have to be performed. Once examinations have been written, results reveal learners' difficulties – information which in turn, helps the teacher to adjust his or her teaching plan. This is already an approach to examination-driven teaching. Owen (1998: 5) believes that:

> Test results are almost indispensable for identifying those students in a class who may require special attention because of learning difficulties. If these difficulties can be timeously identified, the problems can often be solved by appropriate remedial teaching. This aim cannot be accomplished without the use of diagnostic tests.

In effect, the teacher is teaching with an eye on what was tested, and on what could be tested in the next examination. Therefore, an examination-driven teaching approach is implicitly used. In light of this Julie (2013b) argues that examination-driven teaching is indispensable in the context of summative examinations. The indispensability of testing automatically implies the indispensability of examination-driven teaching. Haertel (2005) contends that students' needs have to be addressed through teaching and learning opportunities. Therefore, any reasonable theory of education that uses assessment will emphasize the importance of classroom assessment for the improvement of teaching and learning. Without classroom assessment, the teacher cannot be well-informed about the needs of the learners, and his or her teaching is dispersed and without any focus. Along the same lines of thought, Haertel (2005: 9) cites Bloom (1968) who argues that the "central role of ongoing assessment in mastery learning, ... (and) feedback on student learning (is) seen as essential in today's classroom teaching and learning". There is no doubt that classroom assessment is a part of teaching and learning in modern pedagogy.

2.2.9 Some achievements in examination-driven teaching

Popham (1987), cited in Ashley and Hand (2007), argues that the USA is the most powerful, wealthiest country today because examination-driven teaching promotes educational skills, increases job proficiency and reduces differential achievement along socio-economic lines.

> The USA is currently the most powerful and wealthiest nation in the world. It is encouraging to see Popham note that examination-driven teaching seems to

> be accomplishing some good (i.e., increased proficiency in basic skills and a narrowing of the black-white achievement gap) (Ashley & Hand, 2007: 2).

In England and Wales, Torrance (1993) has recently found that assessment stands out as a key mechanism for monitoring and intervening in the educational process. Torrance constructs new forms of assessment that are able to drive teaching and learning positively, in lieu of the old forms of assessment which were considered more narrowly as testing programs.

The section that follows discusses the second construct of the conceptual framework for this study.

2.3 High-stakes examination

This section provides the definition and the origin of the term 'high-stakes examination'. It also outlines the major points in the debate about the use of high-stakes examination and the reason why the Grade 10 end-of-year examination in South Africa may be viewed as such.

2.3.1 Definition of high-stakes examinations

High-stakes examination is defined as:

> Any test used to make important decisions about students, educators, schools, or districts, most commonly for the purpose of accountability i.e., the attempt by government agencies and school administrators to ensure that students are enrolled in effective schools and are being taught by effective teachers. In general, high-stakes means that test scores are used to determine punishments (such as sanctions, penalties, funding reductions, negative publicity), accolades (awards, public celebration, positive publicity), advancement (grade promotion or graduation for students), or compensation (salary increases or bonuses for administrators and teachers) (Abbott, Guisbond, Levy & Sommerfeld, 2013: 1).

2.3.2 Origin of the term high-stakes examination

According to Pearlman (2001), the term high-stakes is derived from gambling. A stake is the quantity of money or goods that is risked on the outcome of some specific event. The high-stakes game is one in which, in the player's personal opinion, a large quantity of money is being risked. In financial theory, a stake is referred to as the price of risk (Grewal, Gotlieb & Marmorstein 1994).

In education, the stakes are the important decisions and sanctions that are related to the outcomes of the examinations. Most of these decisions are life-altering. Johnson and Johnson (2009) present some of the decisions that are taken in the case of unsatisfactory performance in relation to conditions or criteria: "as denial of a high school diploma, repetition of a grade, closing of a school, withholding funding, publication in newspapers, classifying students, staff and parents (...by inducing) pride ...(or) shame". These decisions make high-stakes examinations very important and vital precisely because the stakes are high. Historically, high-stakes examinations emerged from the history of educational testing.

2.3.3 A brief history of high-stakes examinations

In China, civil examinations have featured over several millennia (McArthur, 1983), with informal tests dating from 2200 B.C. and formal tests dating from 1115 B.C. In England, educational assessment started several centuries ago in the form of traditional oral examinations until the 1660's, the time of Isaac Newton, when educational measurement developed with the first lectures in Statistics. Following this, but hundreds of years later, both Oxford and Cambridge decided to improve their curriculum by instituting yearly written examinations (McArthur, 1983).

During the 19th century the Chinese test system became the model for civil service positions in Europe and in the USA. By the 1870s the testing of spelling and arithmetic was in place in the USA. Educational measurement in terms of standards for testing schools' efficiency was introduced in 1913 when the application of Mathematics in education marked one of the most significant movements at the beginning of World War 1. Fisher and Price (1924) initiated the first formal scientific measurement of educational products or learners' written tests, as cited in Haertel (2005). In the 1930s, power tests referred to as high-stakes began to measure the basic skills – including reasoning and application of knowledge – that influenced curriculum and instruction (Haertel, 2005). Although, the program of evaluation started in the 1960s in the USA, project funders' lack of information and trust, meant that high-stakes testing was only officially recognized as such in the 1980s with the publication of Nation at Risk (Gardner, 1983) issued by President Reagan's administration.

In South Africa, Chisholm and Wildeman (2013) citing Steiner-Khamsi and Quist (2000) argue that standardised testing has a long history but that it has taken forms similar to those of other countries at the beginning of the 20th century. In 1918, the standard test at the end of high-school named the 'matriculation examination' was introduced as a high-stakes examination. Today, this standard test is called the National Senior Certificate (NSC). Another standard test called Junior Certificate existed before 1994 at Grade 10 level.

The following section outlines major points that form part of the high-stakes examinations debate.

2.3.4 Debate about high-stakes examinations

High-stakes examinations are a controversial topic in education especially in the USA where it has become popular in recent years. Gunning (2008) believes that high-stakes examinations are just and sensible because they enable poor students to emerge and because they hold schools accountable to all children. However, Johnson and Johnson (2009) argue that high-stakes examinations punish poor students who must compete with middle-class and wealthy students in the same test. Gunning (2008) further argues that testing motivates students, teachers and administrators to work ever harder to boost achievement accordingly. It provides the same (high) expectations and the same basis of evaluation for all learners. High-stakes examinations also provide the conduit for monitoring efforts by educational institutions. These examinations help to identify learner strengths and weaknesses and assist in the development of targeted instruction.

However, for Berliner and Nichols (2007), high-stakes testing serves as an incentive for corruption by creating a cheating system with the potential falsification of test data by teachers and administrators. Such malpractice in testing has many effects as it makes one unable to defend his/her certificate, it discredits academic institutions and academia, it cheapens scholarship and degrades intellectual integrity. It affects national growth and productivity, encourages mediocrity and incompetence amongst a corrupt workforce and reduces the value of certificates.

Yet proponents contend that testing has to be administered under the right conditions to avoid all malpractices. High-stakes examinations allow teachers to discuss the low performance of students with a diagnostic tool; they generate remedial instruction for improvement. In addition, testing ensures that high school graduates will have the academic skills requisite for success in the workplace.

However, Hamilton, Stecher and Yuan (2008) argue that high-stakes examinations deskill teachers by trivializing education. Viadero (2007) raises concern for people with low performance rates who are neglected in society and who may be discouraged or frustrated by such examinations and who are likely to commit suicide for feeling useless in society. He also argues that a test does not correctly measure the individual's knowledge or skills.

Other opponents claim that a test may not measure what the critic wants measured. For proponents, the effectiveness of high-stakes examinations is a function of the stakes. They point out that if high-stakes examinations are to be 'effective,' the sanctions for low achievement have to be as severe as having to repeat a grade, being denied a high school diploma or facing the closure of a school.

However, as high-stakes examinations concern only Mathematics and reading in the U. S, Dillon (2006) raises concerns about the neglect of other subjects such as art, music, history, science to mention a few. Furthermore, schools eliminate certain subjects to make time for Mathematics and reading. Dillon (2006) claims that there is no innovation, creativity and critical thinking, discussion and debate in schools because all such activity is replaced by test preparations. Testing also causes too much stress, a phenomenon that results in what is called test anxiety. Finally, he asserts that tests are given as a single long examination instead of being administered as a series of continuous assessments. The single test score may not reflect true changes in learner achievement.

Yet in the learning process tests motivate learners to work hard in order to pass examinations. They give the student a model for collaboration, communication and innovation (Rubin, 2009). Along the same lines of thought, Reay and William (1999) claim that testing supports collaborative learning and increases competition in learning.

Indeed, Dreyer (2008) had cited the Commission of the States (2007), asserting that without assessments there is no other process by which to identify and gather information about the learners' achievement. High-stakes examinations provide information that can inform policy makers on the quality of education. They allow for the recognition of institutions; they assist teachers to identify learners who perform well or otherwise, thus generating the possibility of significantly improving their performance.

In effect, testing serves as a conduit for distinguishing between who is eligible for a certificate, and for establishing who is qualified for a certain profession, which indicates that testing is essential to obtaining a qualification. Put another way, a law without punishment is not a law (Branham, 1963). Any test without reward, decisions and sanctions is not a test. If the results of tests go without consequence people can refuse to be tested. Therefore, it is relevant to consider all pertinent critics of high-stakes examinations; it is important to check such examinations empirically to improve their effectiveness. Potier's view is that (1994) a lack of empirical evidence about this issue remains relevant today. Likewise, it is relevant to mention how the outcomes of high-stakes examinations determine the role of standards-based reform which was influenced by the examination-driven teaching put forward by Popham (1987) according to Hamilton et al. (2008). For this reason Popham (1987) championed the experimentation of high-stakes examinations that would be sensitive to high-quality, cognitively challenging instruction. This position informs the study in respect of the characteristics of high-stakes examinations which were used as the instrument of choice on three occasions – in 2012, 2013 and 2014.

2.3.5 South African Grade 10 end-of-year mathematics examinations viewed as a high-stakes examination

The Department of Basic Education stipulates that:

> Learners in Grade 10 will be promoted from Grade 10 to Grade 11 if they have offered and completed the School-Based Assessment, Practical Assessment Tasks, where applicable, and end-of-year examination requirements in not fewer than seven subjects as contemplated in the policy document, National Protocol for Assessment Grade R-12 and the curriculum and Assessment Policy Statements of the various subjects. Achieved 40% in three subjects, one of which is an official language at Home Language level, and 30% in three subjects, provided the School-Based Assessment component is submitted in the subject failed (Department of Basic Education, 2011b: 36).

For the purposes of the scope of this work, the Grade 10 end-of-year examination is a common examination that has consequences of passing or failing. In the case of failing, the learner has a higher chance of falling out of the yearly total mark in Mathematics since the examination mark is 75% of the total mark (Department of Basic Education, 2011b). A Grade 10 learner who fails to attain the set minimum mark in Mathematics and in another subject must repeat the grade. This is the reason why the Grade 10 school-based examination is generally viewed as a high-stakes examination.

As the period of inquiry was three years, three high-stakes examinations provided scores for the study. In this investigation, appropriate question papers for high-stakes Grade 10 mathematics examinations were set to evaluate learners' performances during 2012, 2013 and 2014. The outcome scores of these high-stakes examinations constitutes the research data that was analysed for interpretation and the results fed back to teachers. The feedback of the results to teachers was for use in their planning. This aspect is crucial for implementing examination-driven teaching. It is the reason for an interest in examining the general direction in which achievement scores from those high-stakes examinations were developed or changed over time. Such concerns require performance tracking.

2.4 Tracking performance

Tracking performance is a presentation of students' results trend in a way that helps to show their success and/or failure as well as the performances of different schools, so as to provide evidence of the likely improvement over time (Hanushek, 2006). In order to track whether learners' performance has improved or not over time, the study proposes to map Grade 10 learners' mathematical performance over a period of three years. In mathematics education, there is improvement over time if mathematics achievement scores of a certain time are better than mathematics achievement scores of the previous time.

Literature in education provides two relevant meanings of tracking. On the one hand, according to Riegle-Crumb (2006), the concept of tracking examines the path or trend over time of academic performance in general at the intersection of socio-economic status of learners in particular. Reddy (2005) believes that in mathematics education, tracking describes mathematics achievement trends over time to demonstrate decline or improvement. On the other hand, Hallinam (1994) views educational tracking as the practice of assigning students to instructional groups on the basic of academic ability. Referring to the research questions which concern the detection of improvement or non-improvement of mathematics achievement scores, the first meaning is employed in this study. As 'trend' is the key word in the definition of tracking related to the first meaning, it is relevant to know what a trend in education is.

The Oxford Dictionary (Waite, 2012) defines (educational) trend as a pattern of gradual change in a condition, output, or processes, or an average or general tendency of a series of data points to move in a certain direction over time, represented by a line or curve on a graph. Dauber, Alexandre and Entwisle (1996) assert that such a representation of a trajectory over time is key to the understanding of educational outcomes and as such, makes it a dominant theme in school attainments research. Many scholars (Afrassa & Keeves, 1999; Department of Basic Education, 2009; Di Martino & Zan, 2015; Leder & Lubienski, 2015; Lee & Orfield, 2006; Reddy, 2005; Seymour, 2002) who undertook research by using national or international assessments outcomes (from NSC, TIMSS, Programme for International Student Assessment (PISA)) employed this representation of educational outcomes in the form of a line to identify whether or not there was improvement over time of learners' mathematics performance. Thus the study intends to represent in the form of line graphs, the general tendency of mathematics average scores of five schools for describing patterns and gradual change over a period of three years of learners' mathematics performance. Such description determines improvement or decline in a part of the trajectory or in the overall trajectory, by triangulation of results from 2012 to 2014. In particular, the study examines patterns of mathematics achievement of learners from different socio-economic backgrounds and the tendency of overall mathematics achievement of different mathematics topics. In each case, the study follows the pathways or trajectories of mathematics performance of learners over the three years to describe change or features in a changing landscape to identify progress or the lack thereof in mathematics performance from one year to the next.

Regarding concerns about social equity in mathematics achievement in South Africa and equity in performance determined by the difficulties of the topic, the concept of differential achievement is used, which is discussed in the next section.

2.5 Differential achievement

Differential achievement is a concept that describes wide variations of educational achievement amongst different groups (race, gender, ethnic, socio-economic status and so forth) within society (DeAngelis & Talbert, 1995). Theoretically, differential achievement is underpinned by insights from the sociology of mathematics education. In the literature, researchers have established the effects of SES on educational achievement and they have found social class-aligned differences in mathematics achievement in school mathematics (Fleisch, Shindler & Perry, 2012; Reddy, 2005; Rollock, 2012; Van der Merwe TM, Van der Merwe AJ & Venter, 2010).

2.5.1 Differential educational achievement and socio-economic status

Amongst differential educational achievement determinants, SES stands-out as the most influential (Bond, 1981). Over the years, research has shown that for learners of low SES, their academic performance tends to be poor irrespective of the test type of any subject (Bond, 1981). Traditionally, student academic achievements have been assessed using test scores. Besides test scores, grades may serve a useful purpose in informing parents and teachers about students' performance, weaknesses and strengths. Whereas similar trends are observed for grades, like test scores, these variations may be explained by "parental background and student characteristics and behaviour" (Kao & Thompson, 2003: 22). Besides test scores and grades, students' educational aspirations have been used as a proxy for measuring educational achievement even though not rigorously (Kao & Thompson, 2003). As the name suggests, this indicator foreshadows students' future educational attainment and occupational status. While it is an established fact that SES and educational achievement are correlated, clarity on the true reason(s) remains a highly contested issue (Rossi, 1961 cited in Bond, 1981). In a review of literature along this trajectory, Bond (1981: 239) categorizes these reasons under four main headings: "(1) a genetic argument, (2) a cultural argument, (3) an argument positing unequal educational treatment, and (4) an explanation of educational differences as part of class analysis" (Bond, 1981: 239). The first three points are elaborated further.

Per the genetic argument, it is argued that the low SES of certain groups can be attributable to what is called "genetic inferiority" (Bond, 1981: 239). That is, given the fact that society has been designed in a way that it is supportive of the well-to-do and not of those from poor backgrounds, persons coming from these affluent homes are perceived to be more successful even at school level when compared to those coming from low social class positions as the former is perceived to benefit from "genetically inherited abilities" (Bond, 1981: 240). By implication, belonging to a high social class is 'naturally accompanied by a superior intelligence', and it is perceived that children from such families tend to perform better academically than their peers from the middle and low classes (Jensen, 1969 cited in Bond, 1981). This view has however been disputed by Bowles and Gintis (1972 cited in Bond, 1981) on the basis that evidence available to justify such claims is scanty.

Also, the cultural set-up from which a person comes somehow explains the relations between SES and academic success (Bond, 1981). It is believed that to an extent the socialization experiences children are exposed to in the home environment exert a bearing on their academic success. As Bond (1981) puts it, students coming from low SES most often do lack the "motivation" to perform better, unlike their counterparts from rich homes. To illustrate this, Bernstein (1977 cited in Bond, 1981: 241) observes that unlike children from low SES, children from high social class are exposed to what he calls "elaborative codes" or speech, and that because the school curricula has been standardized according to these same codes, the student coming from a lower class, who is by default exposed to a more "restrictive code" system, may find it difficult to catch-on in learning, resulting in unequal educational academic performance. It has also been argued that stereotypes such as those that restrain children of low social class from communicating with their parents or elders, to some extent limit their academic success. At other times, a general lack of parental interest in their child's educational affairs could also be a reason for low performance in school tests (Westergaard & Resler, 1976 cited in Bond, 1981). Granted, Drucker (1971 cited in Bond, 1981) note that the fact that people of the low- and middle-class are exposed to a more restrictive language does not necessarily imply that such language patterns are deficient in themselves.

A third wave of reasons why SES is linked to academic success lies in the discriminatory nature of the school system itself (Bond, 1981). This is later discussed in detail.

2.5.2 Differential educational achievement in South Africa

Poor school performance amongst South African learners, particularly in Mathematics, is a well-documented phenomenon (Bayat, Louw & Rena, 2014; Bohlmann & Pretorius, 2008; Graven, 2013; Spaull, 2011a; Van Der Berg, 2008). However it is important to note that achievement in school mathematics is differentiated and follows the same pattern of the socio-economic make-up of the country.

Making no pretence about the fact that the Government, over the last 20 years of democratic rule, has introduced a considerable number of interventions and has initiated reforms to reverse the phenomenon, these commitments are yet to translate into significant gains in bridging the academic performance equity gap (Graven, 2013). Commenting on the seemingly undesirable state of affairs with the educational system, Zwelinzima Vavi, the former General Secretary of the Congress of South African Trade Union (COSATU) in an address to the South African Democratic Teachers Union (SADTU) on 28 September 2011 in East London noted that:

> Apartheid fault-lines remain stubbornly in place in our education system. Children born to poor parents remain trapped in an inferior education with wholly inadequate infrastructure; 70% of our schools do not have libraries and 60% do not have laboratories; 60% of children are pushed out of the schooling system before they reach Grade 12… It is estimated that only 3% of the children who enter the schooling system eventually complete with higher-grade mathematics. Nevertheless, white learners perform in line with the international average in both Science and Mathematics, which is twice the score of African learners…The National Planning Commission in its diagnostic report states that in 2008, teachers scored less than minimum scores expected from the average learner in the subjects they teach. This underlines the need to contentiously upgrade and retrain educators – something that is largely neglected in our country (Vavi, 2011:1).

At this point schools that were patronized by whites during apartheid are more efficient and successful than those patronized by blacks (Spaull, 2013b).

Reports by TIMSS and the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) hinted that South Africa performed poorly in Mathematics and Science Education compared to the rest of the world with the exception of Yemen. This creates grave concern for the quality of the educational system in general as mathematics and science education form an important part of quality education. At the primary school level datasets from multi-country tests such as the Southern and Eastern African Consortium for Monitoring Educational Quality, Trends in International Mathematics and Science and Progress in International Reading and Literacy Study have been used to investigate factors that influence differences in academic achievement (Spaull, 2013b). For studies that have relied on these datasets, a common trend has been established: low performance by learners on the whole. In the 2003 TIMSS study conducted by South African Human Sciences

Research Council (HSRC) for 8th graders across 6 African countries, South Africa obtained the lowest score in Mathematics and Science (Siyepu, 2013).

Recent reports (for example Development Bank of South Africa, 2009; OECD, 2012; Vavi, 2011) point to "a range of factors affecting learner performance including: socio-economic status and social disadvantage; teacher knowledge, teaching time and teacher absenteeism; as well as linguistic factors, poorly managed schools and the effects of poverty, including malnutrition and HIV/AIDS" (Graven, 2013: 1042).

In his work Van der Berg (2008) notes that factors such as teachers' ability to meet curriculum targets, and the number of times students are given exercises, parents' role and the level of difficulty of topics being treated, impede students' performance. According to Van der Berg, "the difficulty level of what is covered in class (some of which is rooted in weak teacher subject knowledge) is simply too low, the pace too slow, there are too many interruptions — and most principals are not really interested enough about how much teaching and learning is really happening in classrooms".

The nature of the school curriculum has significant implications for poor academic performance (Reddy, 2006 cited in Graven, 2013) even though Graven (2013) remains quite sceptical that a mere change in curriculum could help undo the academic performance chasm. Drawing on the 2007 SACMEQ, Spaull (2011a) reveals how a school's SES significantly predicts learner performance rather than "than teacher subject knowledge". What this study reveals is that whereas a learner's SES does affect performance, the SES of the school which the student attends affects academic performance equally. From the same dataset Spaull (2011a) found that a disaggregation of students' performance in Mathematics revealed that those in the bottom of SES underperformed.

Moreover, other strands of the school enterprise such as poor curriculum development and low-qualified teachers do drive differential educational achievement in South Africa. According to the Department of Basic Education (2009 cited in Siyepu, 2013), poor mathematics performance amongst South African learners can be attributed to the fact that the vast majority of mathematics teachers lack the requisite pedagogical skills and competencies to teach the subject. Also, studies by Moloi (cited in Siyepu, 2013) for example have revealed gaps in the content of mathematical textbooks, thereby impeding effective teaching and learning. For Bohlmann and Pretorius (2008), the language in which

Mathematics is taught and the qualification of teachers has a strong bearing on learners' performance. In their study, Bohlmann and Pretorius (2008) found literacy to be an important predictor of mathematics performance.

Spaull (2011a: 60) found that absenteeism amongst mathematics teachers was high, "more than twice as much as mathematics teachers in the other three countries." It was however observed that for top performing provinces in South Africa (Western Cape and Gauteng) teacher absenteeism was less when compared to the least performing provinces – Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga and North West (Spaull, 2011b). From this, it becomes apparent that teacher absenteeism could be a possible factor in accounting for differences in mathematics performance.

Using the SACMEQ III dataset for South Africa which targeted Grade 6 students and teachers from a total of 392 schools, Spaull (2013c: 443) confirms the last point as he found the following factors to be associated with mathematics performance in high SES schools:

> teacher education, the average proportion of students in the school where at least one parent has a degree, one parent has matric; home resources ('more than ten books at home'), school resources ('school building index'); speaking English at home 'always', and additional preschool education.

Within the country, disparities exist between Mathematics and Science performance at the provincial level (Reddy, 2006 cited in Siyepu, 2013). Of the nine provinces, the Western Cape, Northern Cape and Gauteng rank as top performers whilst KwaZulu Natal, the Eastern Cape and Limpopo comprise low performing provinces (Reddy, 2006 cited in Siyepu, 2013).

While literature on factors responsible for students' low performance remains limited to the Western Cape Province, available studies point to a variety of factors as triggers in differential educational achievement. In their paper, Bayat, Louw and Rena (2014: 195) found that "lack of parental involvement and interest in their children – both in their general wellbeing and particularly in their school work" affect children's performance. It is also an established fact that neighbourhoods in which learners reside do affect their achievement. Lee and Madyun (2009) cited in Bayat, Louw and Rena (2014) found out that learners from crime

– and poverty – induced neighbourhoods perform poorly in mathematics tests when compared to their counterparts from high class neighbourhoods.

Evidently the performance inequality challenge is locatable at an intersection of factors – apartheid, race, SES of learners and schools, teacher competencies and commitment. Given the fact that poor learner performance continues to persist as recent Annual National Assessments and TIMSS have shown, Graven (2013) posits that devising interventions that could generate a long-lasting impact on mathematics learning is worth the investment, instead of the mere rush for interventions that seek to improve performance at the expense of quality education. Low incentives and inadequate support for teachers especially in Mathematics and Science Education have compounded the problem (Graven, 2013). Also, Graven (2013) calls for a renewed research agenda that is not preoccupied with testing SES and learner performance hypothesis to paint a rather negative picture of the South African educational system, but one that seeks to explore innovative spaces in which to improve the mathematics performance of learners from low SES backgrounds and schools.

2.6 Socio-economic status

According to the Oxford English dictionary (Waite, 2012) socio-economic status comprises characteristics of a group of people relating to, or involving a combination of social and economic factors.

2.6.1 Conceptualizing socio-economic status

Socio-economic status (SES) has been the focus of extensive scholarship within the social and behavioural sciences. Over the last four decades or so, SES has been studied to embrace such issues as poverty and inequity, social exclusion, psychological health, and educational achievement, thus forming the basis for an understanding of the broader spectrum of society (American Psychological Association, Task Force on Socioeconomic Status, 2007). Given its eclectic nature, what SES means and its conceptual composition remain contentious (Sirin, 2005), giving rise to a multiplicity of definitions.

Traditionally, indicators such as family income, educational attainment of parents and employment of the household head have been used to measure SES (American Psychological Association, Task Force on Socioeconomic Status, 2007; Clements & Samara, 2008 cited in Jordan & Levine, 2009; White, 1982 cited in Reyes & Stanic, 1988). Within the sociology of education, SES is measured by three key indicators: parental income, parental education, and parental occupation. Diemer (2013) provides an elaborate review of the varying perspectives on measuring SES. They categorize the indicators cited into two main fields: prestige and resources. The former, according to Diemer (2013), measures SES based on one's social standing, which involves the use of occupational indicators such as Duncan's Socioeconomic Index (SEI). The latter comprises income, assets and educational attainment variables, what is referred to as the "materialist perspective" (American Psychological Association, Task Force on Socioeconomic Status, 2007: 5). Thus decisions about which specific SES indicator or combination of indicators is appropriate should be dependent on the research objectives (Diemer, 2013). Of the indicators outlined, sociologists tend to favour educational attainment, income and wealth indicators (Duncan & Magnuson, 2003 cited in Diemer, 2013).

The educational attainment indicator measures the level of education or years of schooling attained by an individual, in this case parents. It is the commonest SES indicator that serves as a gauge for occupational flexibility and welfare and thus remains an important SES indicator at the level of the individual or household (American Psychological Association, Task Force on Socioeconomic Status, 2007). Unlike income and wealth, educational attainment can be obtained from two sources: from parents directly or from their children (Diemer, 2013). Family income remains the preferred SES indicator even though computing it can be time-consuming, particularly as family incomes may come from multiple sources (Diemer, 2013).

Over the past decades, the SES concept has broadened to incorporate other measures such as wealth (Orr, 2003). That is, besides income, household or family wealth, appropriated as assets owned by a family, has been used extensively as a proxy indicator for measuring SES. According to Diemer and Ali (2009) cited in Diemer (2013), the wealth indicator gives a vivid representation of a family's socioeconomic status since it captures all household economic resources. While ownership of assets such as television, mobile phones, and radios are used in core welfare studies, assets like "books, computers, and a study room" are used as proxies for SES-schooling studies (Sirin, 2005: 419).

Consequently, study insights from Hardaway and McLoyd (2009) also Shanks and Destin (2009) have shown links between family wealth and educational outcomes (Diemer, 2013). In a comparative analysis of income and wealth measures, Orr (2003) argues that the latter is more effective at predicting educational outcomes, especially academic achievement. Orr further argues that even though two families may earn the same income, their wealth can be dependent on family consumption, and so the wealth levels may vary. Nevertheless, Diemer (2013: 93) argues that unlike income, family wealth as a SES indicator may be “more invasive”, since it involves asking participants about the specific details of household assets they possess or own.

While the use of composite scores is gaining traction, “it is generally more informative to assess the different dimensions of SES ...(to) understand how each contributes to an outcome under study rather than merge the measures” (American Psychological Association, Task Force on Socioeconomic Status, 2007: 11). From the study context however, SES is operationalized at a scale other than actual family incomes of learners, bringing to the fore another SES classification.

For studies that have examined the relationship between SES and academic achievement, two main units of analysis are distinguished – aggregate SES and a learner’s SES (Sirin, 2005). For aggregate SES, the SES of students is determined at the level of the school or neighbourhood, using specific modalities (American Psychological Association, Task Force on Socioeconomic Status, 2007). For example, whether or not schools are beneficiaries of a feeding programme may be used to distinguish between which schools fall within low-income and high-income thresholds, while income quintiles are used at the neighbourhood level (Sirin, 2005). This is to suggest that aggregate SES is more suitable in situations where a community or neighbourhood is considered poor or deprived, a phenomenon that makes its residents vulnerable.

Sirin (2005) however opines that opting for the aggregate SES brings with it methodological limitations, what he refers to as “ecological fallacy”. This is to suggest that, using the aggregate SES assumes the same SES for all learners in the particular school or neighbourhood, which in real terms, is not so. In spite of this, the aggregate SES measure remains an important alternative when data on the income of the parents of learners is difficult to obtain.

2.6.2 SES indicator used in the study

The socio-economic status of learners is characterised in this study by the criterion of whether or not schools are classified as fee-paying. Hence this study investigates differential achievement in terms of fee-paying and non-fee-paying schools – two constructs that express wealth and poverty respectively.

The distribution of achievement in schooling is related to the social class membership of the student. So historically, the post-apartheid South African education system inherited highly unequal schooling. As a result, the post-apartheid government, as part of its efforts to redress these schooling inequities, has designed a mixed-bag of policies (Jansen & Taylor, 2003; Kanjee & Chudgar, 2009). In 2007 the Government declared some schools located in poverty-stricken neighbourhoods as no-fee schools (Burger, 2011). These schools do not charge any fees, and in return they receive larger state allocations per student than other schools. This makes school fees a reliable indicator of the socio-economic status of learners and it signals parents who are able or unable to pay for the education of their children.

Within the educational research trajectory, some studies have used the payment or non-payment of school fees as proxy for social class (Luckay, 2010; Reeves, 2005). Specific to this study however, the aggregate SES is used at the level of the school. The criterion used for distinguishing between learners from low SES and those from high SES is whether schools are fee-paying or not. That is, learners in non-fee paying schools are referred to as low SES students and those patronizing fee-paying schools are referred to as high SES students. Likewise, one of the beliefs of scholars is that social class is distinguished in a simple three-class model which is: the "rich", the "middle class" and the "poor" (Porpora, 1989). Therefore the study considers three classes of schools related to fees payment: non-fee-paying schools as lower class, fee-paying schools where the fee is less than R 1000 as middle class and fee-paying schools where the fee is more than R 1000 as upper class.

In the subsequent section, an empirical review of how SES impacts on mathematics achievement is discussed.

2.6.3 An empirical review of the relationship between SES and mathematics achievement

In general, building competencies in Mathematics has strong leverage on social advancement, serving as an important conduit for people to respond innovatively to real world challenges for the common good of society. Graham and Provost (2012) for instance, opine that competence in Mathematics helps people to make informed decisions. Implicit in this statement is the view that being competent in Mathematics, as demonstrated in test achievement, has the potential to guarantee societal development. The reverse is equally true – that a learner's ability to study and to excel in Mathematics is somewhat dependent on his or her socioeconomic background or social condition, measured as SES. At the foundational level, a multiplicity of factors constrains children's ability in mathematics learning. These, according to Jordan and Levine (2009: 63) include the child's SES, "early home and preschool experiences" and "cognitive capacity". This deems SES and mathematics achievement important research action within the sociology of education.

Over the last decades, a plethora of literature has examined the purported linkage between SES and mathematics achievement (Graham & Provost, 2012; Jordan & Levine, 2009; Reyes & Stanic, 1988). Jordan and Levine (2009) posit that low SES or incomes have been identified as one of the key determinants of poor mathematics achievement amongst learners all over the world. In their study, they found that this relationship is observable for almost every learning cohort. For example, Klibanoff, Levine, Huttenlocher, Vasilyeva and Hedges (2006) also Sarama and Clements (2009) observe an association between SES and mathematics competence even at the pre-school level (Jordan & Levine, 2009). In a study that sought to test the mathematics readiness of preschoolers in the US, it was found that those from low-income families performed poorly compared to their counterparts from rich families (Klibanoff et al., 2006 cited in Jordan & Levine, 2009).

Likewise, Graham and Provost (2012) found family SES to be a major predictor of mathematics achievement amongst learners in rural, peri-urban and urban areas in the USA. In addition, they found that unlike poor children, the rate of improvement in mathematics achievement over time was high for children from rich families. This also meant that as children move from lower to higher grades, disparities in mathematics achievement is still evident. Such academic inequalities between rural and urban schools according to Waters (2005 cited in Graham & Provost, 2012: 1), are sometimes the result of rural schools' inability to secure adequate financial resources so they are able to "attract highly qualified teachers". These financial constraints can be attributed to rural poverty, which then presupposes that low fees paid by parents or fee subsidization policies and grants by government generally undermine the quality of teaching and learning outcomes. What this reveals is that indirectly SES can generate adverse effects on teaching processes. This presupposes that addressing achievement inequalities, particularly in Mathematics, would require a multifaceted approach, thereby providing ample justification for teacher development interventions.

Also, using the US National Education Longitudinal Study of 1988, DeAngelis and Talbert (1995), found SES to be a significant predictor of mathematics test scores amongst 8^{th} - 10^{th} graders. In a meta-analysis of 143 studies, White (1982 cited in Reyes & Stanic, 1988) found an average positive correlation of 0.25 between SES and standardized mathematics tests. White further found that the strength of association was higher for an aggregate unit of analysis such as a school than when the SES of the learner was used. Similarly, Sirin (2005) in a more recent meta-analysis found a strong correlation between SES and mathematics achievement. In New Zealand, Caygill and Kirkham (2008) draw on three cycles of the Trends in International Mathematics and Science Study for Year 5 students, to assess how SES indicators such as the number of books in students' homes, educational items in the home, and household size are related to TIMSS achievement. Results from the computation revealed that for each of the indicators used as a proxy for determining students' family SES, a significant relationship existed between them and students' achievement.

Similarly, Orr (2003) found wealth to be a vital factor in understanding racial educational achievement inequalities. Using the standardized scores on the mathematics subscale of the 1996 Peabody Individual Achievement Test, Orr found that family wealth significantly impacted on the mathematics achievement amongst older children.

In a study that assessed the relationship between the SES of learners in South Africa on achievement for the Trends in International Maths and Science Survey (TIMSS), Taylor and Yu (2009 cited in Shalem & Hoadley, 2009) found a relationship between learners' TIMSS score and their SES. Taylor and Yu (2009: 121) therefore observed that "social composition of the schools" played an equally important role in explaining educational outcomes. Furthermore, Davis and Martin (2008) proffer that mathematics education be tailored to the socio-cultural conditions of learners of Black American origin as opposed to the use of narrow instructional methodologies.

As pointed out, another factor that influences the differential in educational achievement is the difference between the topics of Mathematics. For this reason the next section examines literature concerning Paper 1 and Paper 2.

2.7 Topics (Paper 1 and Paper 2)

In South Africa, the National Curriculum Statement (NCS) introduced by the Department of Education into Grade 10 in 2006, into Grade 11 in 2007 and into Grade 12 in 2008 was amended in 2012 to give birth to the new curriculum known as the Curriculum and Assessment Policy Statement (CAPS). According to this current official curriculum, Mathematics in high schools has different topics that are grouped into two categories: Paper 1 and Paper 2 (Department of Basic Education, 2011a; Sasman, 2011). Paper 1 comprises the following topics: Functions, Numbers Patterns, Sequences and Series, Finance, Growth and Decay, Algebra, Differential Calculus, and Probability. Paper 2 consists of the following topics: Euclidean Geometry and Measurement, Trigonometry, Analytical Geometry and Statistics. It is important to note that in Grade 10 there is no Differential Calculus, and in Grade 12 Probability and Handling Data are separately covered in Paper 3.

There is a scarcity of literature on the comparison between learners' performance in Paper 1 and Paper 2. Yet, such a comparison is very important because the mathematics curriculum contains specific subject-matter and interventions with instructional design principles that should target specific needs. Furthermore, such a comparison can also cast light on what curriculum should be implemented. Sasman (2011) has undertaken such a comparison by investigating the responses and performance of students from the Western Cape in the 2009-2010 National Senior Certificate mathematics papers.

Her analysis identified obstacles to improving mathematics performance in schools. Using the average as an indicator, the overall performance in mathematics Paper 1 revealed an improvement from 29.4 % in 2009 to 34.34% in 2010. However, there was no noticeable improvement in performance in mathematics Paper 2 because the average of 34.1 was the same in 2009 and in 2010. These results suggest that learners' improvement rates were better over time in Paper 1 compared to Paper 2. Furthermore, having included the concomitant topic per question Sasman reported that although learners' performance had improved in certain topics (Algebra, Functions, Patterns Sequences and Series), their performance had declined in others (Finance, Calculus, Linear Program) – all of which needed attention. This indicates the relevance of such a comparative study as it has provided insight into learners' performance. To activate the enhancement of the quality of mathematics education, policy recommendations can be made in a specific way per topic to learners, teachers and everyone involved.

Reddy (2006) conducted a similar national analysis of TIMSS 2003 in Mathematics. This analysis tracked the performance of learners by content area such as numbers, algebra, measurement, geometry and data. She found that South African learners performed relatively well in the domains of measurement and data and scored lowest in the domain of geometry. Reddy (2006) further tracked performance by question-type and found that for most items, fewer than 30 percent of learners answered them correctly. She obtained the profile of learners' response rates for the content domains (numbers, algebra, measurement and data). In the area of geometry, notably, there were fewer learners who answered correctly.

Such tracking allows for comparisons in learners' performance between content domains, thereby providing a picture in 2003 of what South African learners knew, and could do in Grade 9 mathematics.

It is against this backdrop that the Department of Basic Education is undertaking annual diagnostic analysis per paper and per question in the mathematics component of the National Senior Certificate results. The Department is not interested in comparing learners' performance between papers for an academic year and over time. However, its diagnostic analysis per question has helped the researcher to do such comparisons at least for NSC results of 2012 and 2013. In the national diagnostic of NSC, the Department of Basic Education (2012) issued separate reports for performance in Paper 1 and Paper 2. Researchers' calculation of the average in 2012 of mathematics Paper 1 (from diagnostic analysis per question) is 46.5%. Whilst the department have mistakenly presented the table of diagnostic analysis for Paper 1 instead of Paper 2, the calculation considering the overall mathematics performance gives the average of 24.9% for Paper 2. In 2013 similar calculations gave 46.6% as the average for Paper 1 and 37.7% for Paper 2 – Department of Basic Education (2013). Obviously learners performed better in mathematics Paper 1 than in Paper 2 in both NSC 2012 and NSC 2013.

Although there was an improvement over time (2012-2013) in learners' performances in both Paper 1 and Paper 2, it was found that the improvement over time in Paper 2 (with 12, 8 %) was more significant than the improvement in Paper 1 (with 0.1 %). It is important to mention that similar diagnosis could be done by using the Rasch procedure and this could render more information about how learners perform per question than a simple descriptive statistics analysis. When such a diagnostic analysis of low performance is done according to the topics, all sectors of mathematics education may implement interventions with precision where low performances are noticed.

In no way this literature review is exhaustive. In order to be much more informed about the topic, it is expected of readers to consult more references concerning the constructs proposed in the conceptual framework.

2.8 Conceptual framework diagram

Drawing on the above review and within the context of the study, the scheme which follows (see Figure 2.1) serves as a conceptual framework that underpins examination-driven teaching and academic performance. Essentially, the scheme argues that findings obtained from performance tracking will eventually provide a basis for planning new strategies of teaching. This viewpoint is advanced by Mandinach and Jackson (2012) when they present a cyclical process by which to increase students' achievement gains; including instruction, assessment, and data inquiry. Therefore two cycles, which are similar to the Mandinach and Jackson cycle, are diagrammatised as follows: In the first instance, when an examination-driven teaching strategy is used by teachers, high-stakes examinations are to be given. The resulting outcome scores from the high-stakes examinations are then tracked. The outcome (positive or negative) obtained from performance tracking then serves as a feedback-mechanism for improving teaching, thus, informing the examination-driven teaching strategy. In the case of the second cycle however, the feedback-mechanism goes beyond the performance tracking level. That is, results obtained from high-stakes examinations under an examination-driven teaching approach are tracked according to differential educational achievement along two lines: SES and topics. Through the feedback-mechanism, the findings from tracking performance along SES and topics guide teachers to design teaching strategies for individual instruction or instruction per group – informing examination-driven teaching in the process. Figure 2.1 illustrates these relationships:

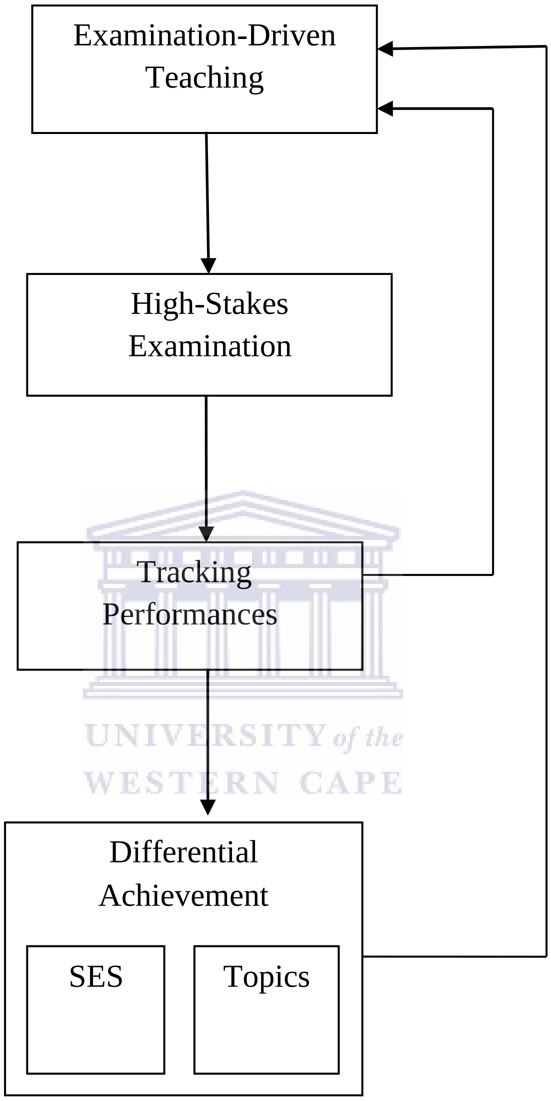

Figure 2.1: *Conceptual framework diagram*

The diagram in Figure 2.1 guided the study and contributed towards a deeper understanding of its direction by providing a structure for designing the research and for analysing and interpreting data. It served as a reliable basis for examining concepts and drawing conclusions.

2.9 Concluding Remarks

Chapter Two has presented and explained the different components that are essential in the study. It has also provided a literature review for all concepts used in the conceptual framework by discussing issues related to tracking learners' performances in high-stakes Grade 10 mathematics examinations. First, the examination-driven teaching concept and its advantages and disadvantages as well as preconditions for success were discussed, highlighting it as an indispensable strategy for improving mathematics education. Parallel to this, perspectives in support of and against examination-driven teaching were presented. Inferences from this review informed the two research questions of the study: first, whether or not examination-driven teaching improves learners' performances in mathematics over time; and second, whether the use of examination-driven teaching increases or decreases social inequalities in mathematics education. In connection with the examination-driven teaching concept, a high-stakes examination was identified as the main tool used for implementing examination-driven teaching because its results inform the design of strategies for teaching Mathematics. Also, the Chapter has discussed high-stakes examinations literature by explaining the reasons why Grade 10 school-based mathematics examinations can be viewed as a high-stakes examination.

Besides the examination-driven teaching concept, tracking performance as a concept was defined. Similarly, the relationship between differential educational achievement and SES was explored within the South African context. In the case of SES, historical trends were examined, succinctly highlighting how its measurement has evolved over the decades. Also, the need to use school fee-paying status as an indicator of SES for this study's context was elaborated. To conclude the chapter, a comparative review of Grade 10 mathematics Paper 1 and Paper 2 was undertaken.

The chapter concluded by connecting both components: high-stakes examination, tracking performance, differential achievement, socio-economic status and mathematical topics to manufacture examination-driven teaching in two ways that were represented by a diagram with tracking performance as central.

In order to answer the research questions, the next chapter focuses on, and explains the research design and the methodology that is appropriate for reflecting the objectives and framework of the study. It gives the reasons why a quantitative approach was adopted and why the Rasch model was used as the preferred main tool for analysis. It also describes the sample and procedures for data analysis.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The previous chapter provided a schema of research ideas and a review of the literature. In this chapter I describe the design as well as the methodology I have used to conduct this study. Next I explain the sampling procedure and present the sample. I then describe how the data was collected, collated and analysed. The strategies taken to ensure that the collected data was valid and reliable are also discussed. The chapter closes by explaining how the research ethics and principles were complied with during the course of the study. The following first section is a discussion of the research approach as it was designed.

3.2 Research design

A quantitative design was adopted in this study because learners' scores are used to describe the investigated phenomena. McMillan and Schumacher (2010) classify quantitative designs as experimental and non-experimental. Experimental design includes an intervention for participants while non-experimental design has no active or direct intervention. This investigation examines the effects of an intervention by measuring an educational outcome, making it an experimental design. The three most common experimental designs, according to McMillan and Schumacher (2010), are a true experimental, a quasi-experimental and a single-subject. True experimental design includes random assignment of participants, thus every individual in the sample population used in the study has an equal chance of being included in the sample. In quasi-experimental design there is no random assignment of subjects, while in single-subject design the researcher is obliged to work with 1 or 2 subjects because the situation is not suited to a group investigation.

Consequently this research adopted a quasi-experimental design because it involves several classes or schools that are organised for instructional purposes that are not assigned randomly.

3.3 Research methods

In order to address the research questions (see Subsection 1.3.2) this study seeks to determine the trend of overall mathematics scores between 2012 and 2014. It attempts to examine the trend over time of learners' performance along the SES of schools on the one hand, and performance in Papers 1 and 2 on the other. To explore such diverse issues that threaten the tracking of performance, I used two methods: Rasch modelling, which serves as the analytical machinery, and a statistical method. These methods are described in the section on analysis procedures.

The following section describes the sample and the sampling procedure of the study.

3.4 Sample and sampling procedure

In quantitative studies, McMillan and Schummacher (2010) define a sample as a group of individuals from whom data is collected. A sample may be selected from a population, or it may refer only to the group of subjects from which data is collected (even in cases where the subjects are not selected from a population). In this investigation, the sample is formed from learners of the LEDIMTALI schools who participated in the high-stakes Grade 10 mathematics examinations. As sampling is the term used for drawing a sample, McMillan and Schummacher (2010) distinguish between two major categories of sampling techniques: probability and non-probability.

In probability sampling, subjects are drawn from a larger population in such a way that the probability of selecting each member of the population is known. However, in non-probability sampling, there is non-random selection of subjects from a population. This is the form of sampling that is most commonly used in educational research, as McMillan and Schummacher (2010) emphasise. Based on this the investigation uses non-probability sampling, as subjects were selected non-randomly.

Furthermore, in quantitative studies non-probability sampling has three approaches: convenience sampling, purposeful sampling and quota sampling. Whereas convenience sampling is also called available sampling, quota sampling or opportunist sampling involves a group of subjects selected on the basis of being accessible or expedient. In the case of purposeful sampling, the researcher selects particular elements from the population that are representative or informative of the topic of interest. It is essential to note that quota sampling is used when the researcher is unable to take a probability sample but is still able to select subjects on the basis of the characteristics of the population. Although the disadvantage of this kind of sampling suggests that findings cannot be generalized and that they are limited to the type of subjects in the sample, the main advantage of this sampling technique according to McMillan and Schummacher (2010) is that the researcher can accomplish it due to practical constraints, efficiency and accessibility. In addition, it is one of the popular sampling techniques used in education because it is easier to conduct – it does not require any process for the generalisation of results on any population. The sampling method that was used in this study is therefore an opportunistic sample of five schools in which learners are participants.

Specific parameters laid down by the project founders for sampling schools were incorporated in the sampling accordingly. Given the history of South Africa where the distribution of academic achievement in schooling is related to the social class membership of the student population of schools; given also the objective to develop a partnership with the University of the Western Cape (UWC) for developing and delivering teacher development training for senior/leader mathematics teachers at partner schools, the project founders selected ten secondary schools that were previously disadvantaged and that are in close proximity to UWC. These schools are symbolised by the letters: A, B, C, D, E, F, G, H, I and J. In order to explore the second issue related to SES, it is important to emphasize here that schools are differentiated according to whether or not they are classified as fee-paying. Three schools are non-fee-paying, three schools require fees of less than R 1000, and four schools require fees greater or equal to R 1000, as may be seen in Table 3.1

Table 3.1: *Classification of the ten schools according to fee structure*

Classification of schools according to fees levied		
No fees	**< R 1000**	**>= R 1000**
A	B	C
G	H	D
J	I	E
		F

While it had been stipulated by the project that all ten schools participate in the high-stakes examinations, schools F, G, H and I did not participate in the 2013 and 2014 examinations. Likewise, school J did not participate in both examinations. The reasons are presented in more detail in Section 6.3 covering the limitations of the study. The number of schools who participated in the examinations is as follows: nine in 2012; five in 2013 and five in 2014. Based on this, it becomes apparent that only five schools participated in all three examinations. In order to be consistent in this study, I considered only the schools which had participated in all examinations. Consequently social constraints reduced the sample from ten schools to five schools (A, B, C, D and E).

Regarding these five schools, one school is a non-fee-paying school, another requires fees of less than R 1000, and three schools require R 1000 or more as demonstrated in Table 3.2.

Table 3.2: *Classification of the five retained schools according to fee structure*

Classification of schools according to fees levied		
No fees	**< R 1000**	**>= R 1000**
A	B	C
		D
		E

It should be noted that these five schools are the same throughout the three year period; however there are new Grade 10 learners every year. The study was therefore conducted on three different cohorts (independent samples) of learners who were examined to generate data.

3.5 Data and data collection

In order to describe the nature of the data requirements for the study and the data collection procedure, I first discuss the instrumentation that targeted the population in order to obtain data.

3.5.1 Instrumentation and participants

Three high-stakes Grade 10 mathematics examinations were used as instruments for the study. These three instruments are the yearly final examinations in which items were parallel questions. The question papers (see Appendix A) were set by the members of the LEDIMTALI project, namely mathematics educators, mathematicians, mathematics teachers and mathematics curriculum advisors. Participants were Grade 10 learners of schools in partnership with the project during the years 2012, 2013 and 2014.

Construction of the tests

Each summative examination was divided in two tests. One, called Paper 1, consisted of the topics on Algebraic Expressions, Exponents, Patterns, Finance, Functions and Probability. The other, called Paper 2, consisted of topics on Statistics, Analytical Geometry, Euclidian Geometry, Trigonometry and Measurement. Items are set by examiners in such a way as to keep testing the same principles, abilities and constructs in Grade 10 mathematics. For instance, in Paper 1 of 2012, the item 1.4.1 is: factorise $x^2 - 5x + 6$ and in 2013 the parallel item 1.4.1 is: factorise $x^2 - x - 2$. These two items test the same principle of factorising a trinomial. Hence the three summative examinations are set on the same constructs. It is similar to the case in which the same number of items, having the same level and range of difficulty are selected from an items bank. The results from such items are comparable even though students have taken different tests. Wright and Bell (1984:333) argue that:

> It is not necessary for every student to take the same test in order to be able to compare results. Students can take the selections of bank items most appropriate to their levels of development. The number of items, their level and range of difficulty, and their type and content can be determined for each student individually without losing comparability provided by standardised tests. Comparability is maintained because any test formed from bank items, on which a student manifests a valid pattern of performance, is automatically equated, through the calibration of its items onto the bank, to every other test that has been or might be so formed.

This is to suggest that teachers can construct many items in which they consider the level of persons who have to be measured as well as the educational objectives, in order to keep comparability. Therefore, although teachers and circumstances are different during the students' learning process, as long as items are calibrated onto one scale from an items' bank, teachers can compare their tests results, even when their tests contain no common items (Wright & Bell, 1984). Such a quantitative comparison of results enables teachers to examine how the same topic is learned by different learners; and hence to evaluate alternative teaching strategies. In this regard, the three summative examinations are set on the same constructs in a near-similar way as end-of-year examinations. These examinations describe what learners have learnt according to the structure and content of the intended curriculum in Grade 10 mathematics. Thus the study proposes to make general comparisons which are required between yearly results.

Regarding the results, the student answer to the item should express the difference between the student's ability and the item's difficulty. All parameters (causes of students' errors) for any process other than the one intended are excluded in the interaction between student and item through the logistic model (Rasch, 1960; Wright, 1997).

Administration of the tests

The three high-stakes Grade 10 mathematics examinations were administrated as the final end-of-year school-based examinations. These examinations were therefore run according to the procedure of school-based examinations as described by the national protocol for assessment of Grade R-12 (Department of Basic Education, 2012). All examinations were written in November for 2012, 2013 and 2014.

Regarding the organisation of the examination, each school formed an examination committee consisting of some teachers. The examination committee provided the time-table, the rules concerning the question papers, moderation of question papers, and moderation of scripts. It also set the rules of the examinations for learners and educators. The same committee was also responsible for the supervision of compliance to the rules, the preparation of the classrooms, and examination packages.

Once the question papers were completed they were moderated and handed in to the office for printing. Before completing a full print-run the educator had to have the first paper moderated by the moderator who checked for corrections. It should be noted that the moderation was done in the context of LEDIMTALI. After moderation examiners received feedback from the moderator in a discussion of the paper. Then question papers were handed to the secretary to be printed two days before the subject was written. One copy was sent to the deputy principal; another to the principal. After receiving all the question papers from the secretary, examiners packed them.

Before the test, in accordance with what Kubiszyn and Borich (1990) suggest, teachers maintained a positive test-taking attitude by telling the learners to do likewise. It was known by the learners that a test is not a punishment but an evaluation of achievement. They were encouraged in such a way so as to maximise motivation. In an effort to avoid surprise they had been given sufficient advance notice as well as clarification of the rules of the test.

On the day of the examination learners entered the classroom when a bell rang to indicate the start of the examination session. The time allotted per paper was two hours. All bags and books were placed in front of the classroom before the examination commenced. Mathematics teachers were not allowed in the venue where mathematics tests are taking place. The teacher invigilator placed learners in rows of different grades and compiled the register. Learners who were not there were marked “A” for being absent. In the case of sickness or for any valid reason, a doctor’s certificate or acceptable proof had to be provided by the learner. Five minutes before the examination, questions papers and response sheets were distributed. Once each learner was in possession of the question paper, the invigilator asked learners to turn it over. He/she then went through each page of the test with the learners. He/she read the first and last line on each page to ensure that each learner had every page before the test started. During this time, only the necessary equipment for the test was permitted on the desk, and learners were also reminded of the examination rules. Thereafter the learners were allowed to read through the question paper but not permitted to write before the commencement time. The invigilator had to be vigilant concerning the following: no cell phones, no MP3 devices and no communication were allowed during the examination. Learners were not allowed to copy from classmates, notes, textbooks, etc. No electronic device was allowed. If such device was found on a learner, he was guilty of copying and given a clean sheet with no extra time to complete the examination. Learners were not to speak to or borrow stationery from other learners during the examination. They were to address the invigilator only while in the examination room. During the course of the examination, no learner was allowed to leave the examination room without permission and no visitor was allowed to enter. This was in an attempt to minimize distractions. When a learner asked permission to use the wash room, the invigilator collected his or her script until his or her return. The invigilator also compiled the names of learners who used the washroom and made it available to the examination committee.

It was forbidden for learners to be disruptive, rude or aggressive towards any person in the examination room. Learners who came late or misbehaved wrote late in the defaulters’ room. For any defaulters (latecomers and those who misbehaved), a report was written according to a form prepared by the examination committee. This committee had sole decision-making power over any irregularities. For instance, if a learner was suspected of cheating, the invigilator had to confiscate the answer sheet and write the time on the page. A new sheet was then issued to the cheater to continue writing the test. After the examination, the learner-cheater was brought together with his or her sheet to the examination committee to decide on a further course of action.

A warning fifteen minutes prior to the end of the examination was given so that the learners were not taken unawares when the allocated time for the examination was over. At the end of examination, invigilators collected the scripts while the candidates signed the register. All learners kept quiet until all scripts had been collected. The invigilator had to check that he had taken all the scripts. Then learners were dismissed when the final bell was rung. Teachers had to collect their scripts for marking from their pigeon-hole in the staff room. They scored items in such a way so as to identify marks per question with the total mark at the end. In the process of marking, teachers marked the scripts of their learners with respect to the examination rules.

3.5.2 Description of data

Durrheim (2006: 88) asserts that "data are the raw materials of research". In quantitative research, data consists of lists of numbers that represent scores on variables. The data for this study are learners' scores obtained from their scripts of high-stakes examinations for 2012, 2013 and 2014. These marks were captured electronically for analytic computation. The process was as follows: at the beginning data was gathered in the form of learners' examinations scripts. I collected learners' scripts of high-stakes examinations in three phases. The phases were based on academic year. The scripts for 2012 examination session were collected from 10 December 2012 to 14 December 2012; the scripts for 2013 examination session were collected from 17 June 2014 to 21 June 2014; and the scripts for 2014 examination session were collected from 18 February 2015 to 10 March 2015. Table 3.3 presents the numbers of scripts collected per school and the total of scripts per year. Scripts represented participants by year, for Paper 1 and for Paper 2.

Table 3.3: *Participants of ten per year and per school*

Schools	2012		2013		2014	
	P1	P2	P1	P2	P1	P2
A	64	64	124	124	91	91
B	94	93	63	63	90	90
C	68	68	36	35	22	22
D	78	78	42	39	109	108
E	101	100	116	113	95	95
F	128	128				
G	102	100				
H	48	47				
I	5	5				
J						
Total	688	683	381	374	407	406

As the schools F, G, H, I and J did not participate in all examinations (see Table 3.3), the data considered in this work of five schools who participated in all examinations is presented in the Table 3.4 that follows.

Table 3.4: *Participants of the five retained schools per year and per paper*

Schools	2012		2013		2014	
	P1	P2	P1	P2	P1	P2
A	64	64	124	124	91	91
B	94	93	63	63	90	90
C	68	68	36	35	22	22
D	78	78	42	39	109	108
E	101	100	116	113	95	95
Total	405	403	381	374	407	406

It can be observed from Table 3.4 that some learners participated in one paper and did not participate in another. In this study, the scores for learners who missed a paper were assimilated into the missing data. In this regard, the number of participants reduced from 688 for the ten schools to 405 for the retained five schools in 2012. However, the number of participants is 381 in 2013 and 407 in 2014.

Therefore, Table 3.2 and Table 3.4 generate the following – Table 3.5 – which is a classification of participants of the five retained schools per year in terms of fee levies.

Table 3.5: *Classification of participants of the five retained schools according to fees levied*

Fees	2012	2013	2014
No fee	64	124	91
< R 1000	94	63	90
>= R 1000	247	194	226

Regarding the strategy for capturing data, I captured scores from scripts per item for each participant. Therefore, the only data I had were the scores as reflected on the scripts of the learners. Each year, after collecting common examination scripts, data was prepared in such a way that the validity and reliability of collected data was guaranteed. This involved three steps: coding, entering and cleaning.

Coding data

The first step in coding data was to give codes to the five schools that belong to the sample. I assigned alphabetical codes to the schools from A to E as indicated in Table 3.4. These codes represent schools from one to five respectively. The coding was done for "identification and classification" purposes of persons and items (see Burton & Bartlett, 2009, p. 101). The second step was to count and to number scripts in pencil on the scripts. This was done in order to identify each script with a number that would signal its code. In other words that number became the code of the participant. The last step consisted in the identification of each item by its number given on the question paper. This coding allows the researcher to go back to the original script at any stage if necessary.

Entering data

The scores were entered onto the computer for three subsequent years in two separate Excel files: one for Paper 1 and another for Paper 2. The entering of 2012 data was conducted between 12 December 2012 and 06 February 2013. The data for 2013 was captured between 18 June 2014 and 10 August 2014. Finally, the data for 2014 was captured between 19 February 2015 and 25 March 2015. Therefore, at the end the three years, 2012, 2013 and 2014 I had three excel data files. In entering data, the numerical codes representing learners were entered into the first column in ascending order. In the first row, the numbers of items following the order of the questions in the test paper were entered. Then the scores of each learner were entered in a row per item column. The empty cell was filled with the asterisk symbol (*) that is recognised by WINSTEPS software process. Finally, learners' scores corresponding to the learners' rows and respective items columns were entered. As coding and entering data are labour-intensive and boring tasks, errors can easily occur. Therefore, the researcher had to think about cleaning the data.

Cleaning data

Durrheim (2006) believes that data cleaning is the final stage in the process of collecting the data. In accordance with this the researcher had to take valid measures to eliminate errors at this stage. Thus, data cleaning involved checking the data set and detecting errors and then correcting these errors. In this study, after entering all participants' scores by items, the excel file was submitted to the Rasch software WINSTEPS to transform it to a WINSTEPS file. WINSTEPS has the capacity to detect all errors committed during the entering. It is relevant to note that WINSTEPS is also an integrated computer programme for data verification. WINSTEPS includes series of checks and verification procedures that help ensure the quality of the data (Linacre, 2011). To illustrate this, the researcher would automatically notice errors in the WINSTEPS file produced by an excel file that was submitted to WINSTEPS procedures, where it was written in section codes. Only the marks representing partial credits of items could be observed in that section. Any mark without these partial credits was detected as an error which the researcher could go straight to the excel file to locate. This was followed by identifying the learner which meant that the researcher could go straight to the script to take the real mark.

This is one of the ways the researcher used to correct errors. All the data went through the WINSTEPS quality control check for verification. During the data-capturing process, some data was recaptured for verification purposes. Table 3.6 gives the exact numbers of the data recaptured by file for verification.

Table 3.6: *Number of detected and corrected errors*

File	Number of data corrected	Out of	% Corrected errors
2012	16	405	4%
2013	10	381	3%
2014	3	407	0.7%
Total	29	1193	2%

According to WINSTEPS procedures of verification, all errors that were detected were corrected. Therefore the data underwent a rigorous cleaning process using WINSTEPS software. After eliminating all errors detected by WINSTEPS procedures the data was ready in WINSTEPS files which I symbolised by preceding all the excel files with 'win'. I created three WINSTEPS files entitled: win2012p1p2, win2013p1p2, win2014p1p2.

As the data follows a partial credit model, it is relevant to build different keys according to the keys scoring which represents response categories for each item before the use of WINSTEPS files, and then to run data for the relevance of findings according to Linacre (2008). Therefore in the win2012p1p2 file, the keys scoring are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 because the highest category in the model is 12. The highest maximum mark for items is 12. Similarly, in win2013p1p2 the keys scoring are 0, 1, 2, 3, 4, 5 and 6. In win2014p1p2, the keys scoring are 0, 1, 2, 3, 4, 5, 6, 7 and 8. According to Linacre (2008), such keys scoring are developed on the Table 4; Table 5 and Table 6 (see Appendix B).

Once all keys scoring for the three high-stakes examinations had been completed, analysis procedures could be performed. The next section details these.

3.6 Analysis procedures

In order to respond to the research questions, two kinds of procedures were employed to analyse the data. These procedures were relevant to this study in order to critically analyse the phenomena in the results, to recognise and to avoid bias through abstracting the insights which emerged (Cohen, 1988). One of the procedures used was Rasch procedures, which involved my analytical machinery and some statistical procedures.

3.6.1 Rasch procedures

Rasch measurement theory is an approach of Item Response Theory (IRT) that provides information on all items collectively. It is independent of both the sample of learners tested and the samples of items employed. This theory attempts to model student ability by using question level performance instead of aggregate test level performance. In the scope of this study, instead of assuming that all test questions contribute equally to our understanding of a student's abilities, the use of IRT was meant to provide a more nuanced view on the information that each question gives about a student (Alejandro, 2012). The Rasch model measures students' ability by linearising scores. It therefore gives students' ability on a calibrated scale. This is comparable to the field of physics, where in comparing two different liquids that have their mass and their volumes; it is required to bring them in the same scale or density to make them comparable (Bond & Fox, 2010).

The literature indicates that Rasch measurement was used to compare different cohorts of students in Australia and to detect improvement in students' mathematics achievement in lower secondary schools over time (Afrassa & Keeves, 1999). This method fits the purpose of the investigation as it can help to detect the improvement (or non-improvement) over time of different cohorts of learners' performance in Mathematics, which is indeed the main research question. There is a vast body of literature in which Rasch measurement theory is broadly explained, from its origin to its applications (Andrich, 1988; Bond & Fox, 2010; Dunne, Long, Craig & Venter, 2012; Griffin, 2007; Long, 2011; Rasch, 1960/1980; Wilson, 2005; Wright & Stone, 1979).

The mathematical form of the Rasch model is described in what follows.

Dunne et al (2012: 7) present the Rasch model for dichotomous items as:

> the probability of a person *n* with ability β_n responding successfully on a dichotomous item *i*, with two ordered categories, lower and upper designated as 0 and 1, in the equation:

$$P\{X_{ni} = x\} = \frac{\exp x(\beta_n - \delta_i)}{1 + \exp(\beta_n - \delta_i)}$$

Where P is the probability, X_{ni} is the item score variable allocated to a response of person n on dichotomous item *I*, x is an observed score value (either 0 or 1), β_n is the ability of person n and δ_i is the difficulty or the location of item *i*.

Regarding polytomous items, these probabilities of dichotomous-scored data are extended to multi-ordered scores categories higher than one for partially or completely correct responses. Each item response is recorded as an ordinal category like 0, 1, …m, where m>1. Therefore the Rasch model for polytomously-scored responses is presented as follows:

$$\pi_{xni} = \frac{\exp[K_x + \phi_x(\beta_n - \delta_i)]}{\sum_{k=1}^{m} \exp[K_k + \phi_k(\beta_n - \delta_i)]} \qquad x = 0, 1, \ldots m$$

Where π_{xni} is the probability of person *n* responding in the x^{th} category to item *i*, K_x is a parameter associated with response with response category *x* as a nonparametric "scoring coefficient" (Masters, 1982).

Partial credit model

Algebraically, the "distinction between the different polytomous Rasch models can be described in terms of different expressions that can be used to represent the location parameter (δ) of the category boundaries" (Masters & Wright, 1984 cited in Ostini & Nering 2011: 26). Masters (1982) developed a model that incorporates the possibility of having differing numbers of response opportunities for different items on the same test. Such a model describes a unidimensional latent trait model for items scored in two or more ordered categories. This model with more than two ordered categories in scoring is named Partial Credit Model (PCM). This is the model used in this study because there are items in high-stakes examinations that are scored with more than two ordered categories.

According to Andrich (1978), the PCM is a model that can be viewed as an extension of the Rating Scale Model (RSM), and RSM is an extension of the simple dichotomous model that involves data with two values, 0 and 1. The RSM involves data with more than two values and every item in a test has the same number of response categories (Bond & Fox, 2010).

Furthermore, Masters (1982) extends Andrich's model to situations in which ordered response alternatives are free to vary in number and structure from item to item of a test. Such a model in which they can incorporate in the same test the possibility of having different numbers of response opportunities for different items is named Partial Credit Model'. Masters (1982) believes that the PCM makes objective comparisons of persons and items from graded responses. He obtained the mathematics form of PCM by the general expression for the probability of person n scoring x on item i:

$$\pi_{xni} = \frac{\exp \sum_{j=0}^{x} (\beta_n - \delta_{ij})}{\sum_{k=0}^{m_i} \exp \sum_{j=0}^{k} (\beta_n - \delta_{ij})} \qquad x = 0,1,..., m_i$$

where for notational convenience, $\sum_{j=0}^{o} (\beta_n - \delta_{ij}) \equiv 0$ (Masters, 1982: 158). It gives the probability of person n scoring x on the m_i-step item i as a function of the person's position β_n on the variable and the difficulties of the m_i steps in item i. This study is not interested in the mathematical development of this formula but in its use by WINSTEPS software for analysing data. The data of this study has the features of PCM as it incorporates in high-stakes examinations the possibility of having differing numbers of response opportunities for different items on the same examination. In addition, it is considered the possibility of examinations which one or more intermediate levels of success might exist between complete failure and complete success (i.e. partially correct answers). In this case, part marks are awarded for partial success as elaborated by Bond and Fox (2010). It is in the light of this that PCM played an important role in this investigation because of part marks awarded in high-stakes examinations. In what follows the fitting of data to the model is presented.

Model fit and unidimensionality

It is essential to know at the beginning of the analysis how closely the data fits Rash procedures. Rasch theory challenges the notion that the statistical model chosen has to fit the data. It presents something of a paradigm shift where the data are required to fit the model. Julie and Holtman (2008: 382) state that in Rasch modelling, a model is not sought to fit the obtained data, rather, it is the data that must fit the model. The concept of fit "describes how well data conform to the Rasch model" (Boon, Staver & Yale, 2014: 161). As the focus of the Rasch model is reflected by the concept of unidimensionality on the process of fundamental measurement, it is “essential that the data fit the model in order to achieve invariant measurement within the model’s unidimensional framework” (Bond & Fox, 2010: 235). Bond and Fox (2010) believe that the concept fit is associated with the concept of unidimensionality. Likewise, the concept of unidimensionality reflects the Rasch model’s focus on the process of fundamental measurement. Many scholars argue that unidimensionality holds from a theoretical standpoint and fit statistics determines whether the assumption indeed holds empirically (Bond & Fox, 2010). Therefore, fit statistics establishes cut-off indication of respect of the principle of Rasch theory that states the following: for any item, persons of higher ability should be more likely to answer correctly than persons of lower ability.

Likewise, for any learner, easier items should be easier to answer correctly than difficult items. Where serious anomalies occur, that is where either items or persons function unexpectedly, these items and persons need to be investigated. Thus, only when data fits the model can all benefits and properties of RMT exist. Thus unidimensionality of the data has to be tested. For this reason Rasch suggested the use of chi-square fit statistics to determine how well any set of empirical data meets the requirements of his model. In order to compare the data and the model Rasch calculated the difference between the observed score in any cell and the expected response value for that cell as response residual. If the residual is low the actual response is close to the model’s expectation. Likewise, if the residual is large the actual performance is far from the Rasch-modelled expectation. These standardized residuals serve to calculate the two chi-square ratios: infit and outfit mean square statistics. The latter are explained in the citation which follows.

> Outfit is based on the conventional sum of square standardized residuals, so for each person, each standardized residual cell is squared and the string of those squared residuals, one for each and every item encountered by a person, is summed and its average found by dividing by the number of items to which a person responded, hence mean squares. To calculate infit, each squared standardized residual value in the response string, say, the residual for each of the items encountered by a person, is weighted by its variance and then summed. Then the total is divided by the sum of the variances which leaves the differential effects of the weightings in place (Bond & Fox, 2010: 238).

Rasch procedures by WINSTEPS programme computer software provides a table in which there are values characterising the hierarchical property of a scale: the Rasch measure of an item, the mean square (infit and outfit) MNSQ and the ZSTD (z-standardized) that gives a t-test statistic measuring the probability of the MNSQ calculation occurring by chance. Boone, Staver and Yale (2014) assert that in general, a range between 0.5 and 1.5 suggests a reasonable fit of the data to the model. If items are in an acceptable range of MNSQ then the researcher has to ignore the ZSTD, suggesting that there is evidence that none of the items are significantly problematic. Otherwise, there is no need to remove from the analysis the misfit items as argued by Afrassa and Keeves (1999). In this case the researcher has to check the ZSTD instead of removing the item concerned. The reasonable predictability of ZSTD is between -1.9 and 1.9. When the ZSTD is greater or equal to 2, data is unpredictable (Boone, Staver & Yale, 2014). Nevertheless, for larger sample sizes as is the case in this investigation, the substantive misfit can be neglected. Therefore, it can be accepted that data are predictable. This is to respect the Rasch principle that suggests that a capable person unexpectedly gets easier items wrong or a less able person unexpectedly gets harder items correct (Bond & Fox, 2010).

The concept of fit is of paramount importance in this study because the data that will be used has to fit all the requirements of Rasch analysis to assure the validity of the conclusions. Likewise, running the data through WINSTEPS software provides items measures and a person-items map where items appear in a hierarchical order of difficulty that helps when comparing persons and items in the same logit scale.

It is relevant to note that the Rasch model is used to measure improvement in students' performance. Amongst various applications in diverse domains the Rasch model is applied as a fundamental measurement in the human sciences in general, and in the determination of the improvement over time of performance in particular (Afrassa & Keeves, 1999; Bond & Fox, 2010; Cunningham & Bradley, 2010; Watson, Kelly & Izard, 2006). These studies have examined changes in mathematics achievement over time through the Rasch model's capacity to ensure the quality and the validity of the instrument. Glynn (2012) has used the Rasch model in a study of TIMSS and states that item quality influences the validity of the scores used while it also ensures a rigorous measurement. The Rasch model is the best method by which to emphasise high quality items through evaluating items psychometrically. Therefore it helps to detect all persons or items that are 'misfits in' the analysis. Such items and persons were excluded from the analysis, according to Afrassa and Keeves (1999) who have used the Rasch model to bring data to a common scale that is independent of both the sample of participants and the sample of items. In order to compare different cohorts, they have also used some statistical procedures for comparing the means scores of different cohorts in mathematics achievement.

For instance, a t-statistic was calculated to determine the level of statistical significance between means scores, and a standardised effect size was also calculated to examine the level of practical significance of the differences between cohorts in mathematics achievement. Conclusions were drawn showing improvement or decline in mathematics achievement over time when a mean score was greater than another mean score or vice versa. Nevertheless, the improvement or decline over time reflected as mean difference was declared practically significant and/or statistically significant according to the value of effect size and/or t-value.

In the next subsection, I justify my choice of this method and present its advantages and limits.

Choice and advantages of the method

In this study, the researcher emphasizes the quality of the measurement to find out whether or not there is improvement when examination-driven teaching has been used over a three-year period. Bond and Fox (2010) are critical of quantitative researchers in the human sciences whom they see as focussing too narrowly on statistical analysis with insufficient concern for the quality of the measures on which they base these statistics. In light of this critique it seems important to focus not only on data analysis but also on the construction of quality scientific measures.

Along the same lines of thought, Bradley, Sampson and Royal (2006) insist on the accountability of the quality of the measurement tool in the analysis of the data when they state:

> Quality of the measurement tool – here the survey instrument should play a fundamental role in the analysis of the data it produces; however, this element is often overlooked. This study addresses that concern through the use of a Rasch rating scale model to operationalize quality mathematics instruction as

perceived by students. It thereby demonstrates a practical application of an emerging methodological tool (Bradley, Sampson & Royal, 2006: 11).

It was therefore decided that the best method to adopt for this kind of investigation was the Rasch model (Afrassa & Keeves, 1999). For instance, the understanding of the changes in students' mathematics achievements in Australia in secondary schools over time was possible because of the use of the Rasch model. Therefore, Afrassa and Keeves (1999) argue like Sontag (1984):

> The Rasch model has been shown to be the most robust of the item response models and was used in this study not 'primarily' to equate students 'performance in Mathematics in a common scale (Afrassa & Keeves, 1999: 3).

Likewise, in a longitudinal study, Watson, Kelly and Izard (2006) found that the use of the Rasch model allows comparisons of cohorts over a decade. In their own words,

> Rasch analysis could be performed and all the students were subsequently placed on the same logit scale for comparison. The purpose of the analysis is to consider average cohort change overtime trends in performance during the first 10 years after the curriculum was introduced in Tasmania (Watson, Kelly and Izard, 2006: 40).

This study needs a deep analysis of item response data prior to any comparison. Wu and Adams (2006) in their research about modelling mathematics problem solving, believe that IRT is a powerful tool:

> The framework was then used as the basis for the research and involved the analysis of item response data. It was demonstrated that multidimensional IRT models were powerful tools for extracting information from a limited number of item responses (Wu & Adams, 2006: 93).

While I was conducting this research, I was concerned about the validity and reliability related to the findings. But an analysis of items (developed in TIMSS) by a project named SSI in Ohio has led D'Ambrosio, Boone and Harkness (2004) to conclude that Rasch analysis is proposed for best item separation reliability and construction validity:

> Rasch analysis of the SSI student data suggested good item separation reliability (ranging from .80 to .95). Also content and construct validity were evaluated during the SSI project through the construction of Rasch person-item maps (D'Ambrosio, Boone & Harkness, 2004: 5).

Grimbeek and Nisbet (2006) have used several quantitative analytic methods including Rasch analysis. They believe that their research was improved by using Rasch analysis.

> The present paper improved on this outcome by utilising Rasch analysis to identify items with orderly sequences of scores across responses categories, and to subject these to fresh exploratory and confirmatory factor analysis. The resulting 3-factor scale proved acceptable in terms of exploratory and confirmatory factor analysis as well as in terms of Rasch items analysis (Grimbeek & Nisbet, 2006: 27).

This study also needed a comparison of items and learners on the same scale. Callinghan and Bond (2006) assert that Rasch analysis is used increasingly by researchers in mathematics education as follows:

> Rasch measurement is being used increasingly as a research tool by "main stream" researchers rather than merely by the sophisticated psychometricians involved in large scale achievement testing. Using the performance interactions between persons and items, it is possible to produce an ordered conjoint measurement scale of both people and items. This allows researchers to examine the behaviour of persons (e. g. students, markers, and teachers) in relation to a particular set of items (e. g. test questions, curriculum outcome indicators, problem solving methods, attitude surveys), (Callingham & Bond, 2006: 1).

The nature of comparison of high-stakes examinations performances that I use in this study requires a common scale for calculation as to subtract apples and pears. It is also demonstrated by Dunne, Long, Craig and Venter (2012) that traditional instruments assume the validity of some analysis which does not necessarily fit statistical theory. They posit that:

> The unique role of Rasch measurement models in confirming the admissibility of summing test item scores to obtain a test-performance indicator, in supporting interpretations of test results, will be outlined shortly. Comparison

> of assessment performances using numerical differences requires that there is some common scale against which the two sets of performances can be authentically captured as numbers of common kind. Then we may compare by subtraction. In effect, we mimic the way we compare 23 apples with 26 pears by obtaining a distinct currency value for each individual fruit of each set, and then use additions and a subtraction. We must assure ourselves that we can discern differences by use of a common inherent unit. Rasch approaches also allow evidence on change to emerge from the differences observed between two testing contexts where whole comparability has been carefully constructed (Dunne, Long, Craig &Venter, 2012: 5).

In the investigation of preferences for context real-life situations of South African and Albanian students in Mathematics, Kacerja, Julie and Hadjerrouit (2013) have chosen Rasch modelling to be used. Julie (2013c) confirmed that Rasch procedures were selected as the best instrument for the comparison of cohorts having the data of different time periods.

Thus with regard to literature about this kind of phenomenon, the Rasch model is chosen for this study. Nevertheless, the advantages and disadvantages of the Rasch analysis are presented as follows.

Advantages of the method

The major advantage of the Rasch analysis is that it measures the ability of a person by testing this against a set of items of calibrated difficulty so that the person's ability can be placed appropriately on the scale. Therefore, this allows a comparison between items and persons; and between two testing contexts. It also helps to improve learners' performance by targeting items that are difficult and thereby giving appropriate teaching. In addition, as all tests provide only estimates of performance and all are affected by the test and by student-related factors, Kubisyn and Borich (1990) assert that it is important in the interpretation of test results or the performance of a student to consider test-related and student-related factors that may affect the usefulness of high-stakes examinations (validity, reliability and accuracy). Rasch analysis of student data suggests good item separation reliability (ranging from .80 to .95). Also content and construct validity are evaluated through the construction of Rasch person-item maps (D'Ambrosio, Boone & Harkness, 2004).

Limitations of the method

One of the limitations of the Rasch analysis mentioned in the literature relates to the development of a scale; a person's ability and an item difficulty need to be unidimensional variables (Afrassa & Keeves, 1999; Hambleton & Cook, 1977; Stacey & Steinle, 2006). In order to employ the items in the mathematics tests for calibration, it was necessary to examine whether or not the items were unidimensional since the unidimensionality of items is one of the requirements for the use of the Rasch model. Stracey and Steinle (2006) argue that conceptual learning cannot be measured on a scale, and therefore the essential requirement for the applicability of the Rasch model is not met. Thus, the Rasch model is inapplicable in this case. If the items will be found to not satisfy the condition of unidimensionality it will not be possible to employ the Rasch procedures in the calibration of the tests (Afrassa & Keeves, 1999). For example Stacey and Steinle present a case of inapplicability of the Rasch model where the conceptual learning cannot be measured on a scale. In this case the Rasch model is therefore not applicable. Nevertheless, Afrassa and Keeves (1999) suggest that mathematics tests provide the best items fitting the model. As the items of high-stakes examinations developed in the project are unidimensional, the study met the essential feature of Rasch analysis. In this work Rasch analysis will not help me to generalize findings in the whole population. In addition, Rasch analysis cannot help me to extend findings or project findings for the future.

Differential Item Functioning (DIF)

In order to ensure that the three instruments were or were not of the same difficulty for both subgroups related to SES background of learners, I had recourse to the concept of DIF. DIF is a statistics procedure of the Rasch model which organises items in the same order of endorsement for different subgroups (Boone & Rogan, 2005). It determines whether or not there are significant differences for endorsement of the items by subgroups of the sample. This forms the answer to the question, 'Are there differences in the endorsement of items between learners relative to their SES background?' In particular, 'Has an item the same difficulty for both subgroups?' The relevance of this question is emphasized by Linacre (2011) who states that:

> Significance tests, such as DIF tests, are always of doubtful value in a Rasch context, because differences can be statistically significant, but far too small to

> have any impact on the meaning, or practical use, of the measures. So we need both statistical significance and substantive difference before we take action regarding bias, etc. (Linacre 2011: 415).

In the context of this work, the subgroups of the sample are formed with regard to SES and topics. The different subgroups in this context are schools that are differentiated according to a learner’s fee-paying status as in the above classification. Therefore, DIF is the difference in endorsement difficulty of the item between the measures of schools of non-fee-paying status, schools requiring fee-paying of less than R 1000, and schools levying fees of more than R 1000. This is to suggest that DIF reports on whether or not there are significant differences for the endorsement of the items by the three subgroups. The calculation of the DIF is done by WINSTEPS software programme. Linacre (2008) states the condition for the DIF contrast should be noticeable. It is when it indicates at least 0.5 logit that the DIF for learners from different SES backgrounds is statistically significant for the item considered on the scale. This criterion determines if an item is easier to endorse for one particular class of schools rather than another. The absence of DIF shows that members of different groups with the same underlying ability or attributes have the same probability of responding correctly. Therefore there is no bias or disadvantage for one group over the other. The presence of DIF shows a clear dependency between group membership and performance on an item. The DIF gives different probability for different groups with the same underlying true ability to give a certain response of an item. The group with the higher probability of correctly responding to an item is the group advantaged by the test item. This is to suggest that the test is biased and it functions differently for groups, thereby exhibiting DIF. The difficulty of each mathematical item for the class of schools according to their fee-paying status is estimated while holding constant all the other item difficulty and person ability measures.

In order to determine whether there is improvement or decline of learners’ performance in mathematics examinations for 2012, 2013 and 2014, the comparisons of mathematics results of different cohorts are required. Therefore, statistical techniques to compare groups have to be employed.

3.6.2 Some statistical procedures

According to the European commission, "average achievement is the most common indicator when comparing the performance of education systems in international student assessment surveys" (Europe Commission, 2006). Therefore, the study uses the average scores of learners to compare learners' performance amongst different groups in the mathematics examinations on the three occasions. T-test and effect size were chosen to provide additional information that allows the differences between the achievement level of the different groups to be interpreted in statistical significance and practical significance terms.

T-test

Pallant (2011) asserts that some statistics techniques to compare groups are parametric and others are non-parametric. If the population in which the sample has been drawn has normally distributed scores, statistics techniques used are parametric; otherwise they are non-parametric. The study employed parametric techniques because data dealt with larger sample sizes and was therefore supposed to be normally distributed according to the theorem central limit (Kolokoltsov & Lapinski, 2015). In addition, as research questions require comparisons of groups, the T-test is a parametric technique appropriated to this kind of analysis as it compares the means scores of cohorts. Therefore, a t-statistic is calculated to determine the level of statistical significance of the difference between the mean scores on 2012, 2013 and 2014 in mathematics performance. Regarding the interpretation, a t-value (at the significance level smaller than 0.05) means that the difference is statistically significant. By contrast, values larger than 0.05 mean that the difference is not statistically significant. The software SPSS (Pallant, 2011) computer program was used to calculate the case estimate mean scores, standard deviation, t-statistic with appropriate weighting of data considered after exclusion of some items results that do not fit the Rasch principle in terms of Rasch measures and DIF measures for more accuracy. It is worth noting that maximum marks for examinations change when some items results are excluded. Therefore all total marks were transformed into percentages for pertinent comparisons. The Micro Software Excel Computer Program was used to draw tracks by using the obtained mean scores. However, results can indicate a difference that is statistically different but the probability value does not describe the degree to which the two variables are associated with one another. For instance, Pallant (2011) argues that if samples are large, even very small differences between groups can become statistically significant and it does not mean that the difference has any practical significance.

One way to assess practical significance for the relevance of the finding is to calculate the effect size.

Effect size (ES)

The concept of effect size is used to compare the effectiveness of different interventions or to evaluate the growth over time (Coe, 2002). For Thalheimer and Cook (2002), the effect size is the size of the experimental effect. In essence, an effect size is the difference between the means of the two groups divided by the mean of the standard deviation of the two groups. One group is before the intervention and another is after the intervention. They also call them control group and treatment group. A simple comparison will propose to calculate the difference between the means of the two groups. Negative values will indicate a decrease of mathematics performance whereas positive values will indicate an increase or improvement of mathematics performance. Such a conclusion may be mistaken if the relative magnitude of the differences between means is not considered. In other words, the difference between groups in terms of standard deviation units has to be taken into account for comparing in a relevant way the mean values of different cohorts. The division by the standard deviation enables us to compare effect size across experiments. In this study, the formula below is used to calculate an ES value (Afrassa and Keeves, 1999: 4)

$$\frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{{s_1}^2 + {s_2}^2}{2}}}$$

Where $\overline{x_1}$ = estimated mean for group one;

$\overline{x_2}$ = estimated mean for group two;

s_1 = standard deviation of the mean of group one; and

s_2 = standard deviation of the mean of group two.

There are many indicated limits for the interpretation of the ES, but in this investigation (see Appendix F1), if ES value is less than 0.20, the size of effect is a trivial case. If ES value is between 0.20 (inclusive) and 0.50 (exclusive), the size of effect is considered as small. In addition, if ES value is between 0.50 (inclusive) and 0.80 (exclusive), the size of effect is taken as medium and if ES value is greater than or equal to 0.80, it is treated as large. These values indicate the level of practical significance of mean difference.

Missing data

The issue about the treatment of omissions and non-responses to the items of high-stakes examinations in the three years were considered in data analysis procedure. Firstly, results in schools have scored a missing data as zero when teachers were adding marks of items to obtain total marks for a learner. Secondly, Afrassa and Keeves (1999: 5) assert that:

> The results of the Rasch analysis did not show marked differences between ignoring the missing data or treating the missing data as wrong during the calibration and scoring. Therefore, for both calibration and scoring purposes it was decided to treat the missing data as wrong.

Thus, this study chose the procedure that treats omissions and non-responses as wrong.

3.7 Validity and reliability

McMillan and Schumacher (2010:10) define validity as "a judgement of the appropriateness of a measure for specific inferences or decisions that result from the scores generated. It depends on the purpose, population and context". Similarly, Alagumalai and Curtis (2005) view validity as a complex set of criteria used to judge the extent to which inferences based on scores derived from the application of an instrument are warranted. The data of this study were learners' scores. These scores are deemed valid and reliable because they are actual scores obtained from authentic test administration. In addition, an instrument is seen as being reliable when it can be used by a number of different researchers under stable conditions, with constant and consistent results (Neuman, 2003). Regarding the analysis of data, the Rasch model provides a wide range of techniques to evaluate the functioning of an instrument by carefully investigating items as well as scores endorsed by test takers (Long, 2009).

3.7.1 Reliability

Concretely, concerning the reliability, Rasch measurement provides person reliability index and item reliability index. According to Wright and Masters (1982), person reliability index indicates how a parallel set of items measuring the same construct could be given the same sample and produce the same ability ordering. For instance, if person A is more able than person B in a set of item X, person A will still be more able than person B in a parallel set of item Y. In addition, the item reliability index indicates how the same items, if given to another sample of the same size that behaved the same way, should be ordered in difficulty in the same order. For example, if the item I1 was more difficult than the item I2 in using a sample S1, then item I1 will still be more difficult than the item I2 in another sample S2 which has the same size and behaviour as the sample S1. Note that the bigger the sample the bigger the item reliability index (Bond & Fox, 2010). WINSTEPS calculates these indices of reliability for persons and items. In this study, this index helps me to determine whether there are enough items spread along the continuum, as opposed to clumps of items, and enough spread of ability among persons.

3.7.2 Validity

Bond and Fox (2010) assert that a good measurement process in education will not combine two or more human characteristics into one item. As a human being has many different attributes, good measurement supposes the use of many items in which each item contributes in a meaningful way to the construct or concept being investigated. Rasch modelling provides a determination of construct validity through the concept of fit that can assert that the data matrix related to items and persons is coherent and is more likely to represent the construct under investigation. Fit statistics provided by Rasch analysis is a quality control mechanism for the researcher to determine whether data holds the assumption of unidimensionality (each item contributes to measure only one construct that represents one attribute or ability at a time). It helps to know whether item measures hold the meaningful quantitative summaries of the observations. It therefore indicates how much closer the empirical model approach may be to the theoretical Rasch model, as is expected.

3.8 Ethics statement

3.8.1 Ethical considerations

Educational research is located in a knowledge-producing community (Adler & Lerman, 2003) and the researcher needs to be ethically mindful (Coles & Barwell, 2007) and understand the legal responsibilities of conducting research (McMillan & Schumacher, 2010). This research is part of a larger project, the LEDIMTALI project. The project was approved by the WCED and the ethics committee of the University of the Western Cape (Registration no: 11/9/33). Schools agreed to participate in the project and the letters of agreement were signed by principals and heads of mathematics departments. These letters of agreement have been secured in the project's administrative offices.

However, according to the operational modalities of the project, the schools had to agree to the use of materials under their custodianship. The marked examination scripts are materials which schools must hold for safe-keeping for five years. To make sure that the rights of schools are maintained, consent and permission from participating schools was sought for access to the Grade 10 end-of-year examinations scripts. Learners' scores were recorded as data from these scripts. In conducting the research, the ethical considerations included the rights of the individual participants in terms of three practices ensuring the privacy of the research: anonymity, confidentiality and appropriate data storage (McMillan & Schumacher, 2010).

3.8.2 Anonymity

The data was anonymous in that learners and schools cannot be identified (McMillan & Schumacher, 2010). More specifically, the names of learners and their schools were not used; instead and where needed only pseudonyms were used. Furthermore, education research should "take sufficient care of those being researched" (Adler & Lerman, 2003: 29). In conducting this investigation, the researcher did not meet the participants but had access to the examination scripts only to record scores.

3.8.3 Confidentiality

The right to confidentiality means that no one has access to the individual data or name of participants except the researcher (McMillan & Schumacher, 2010:122). In the scope of this study, learners' scores remained confidential. Furthermore, no information about the nature of the actual marking of the scripts was divulged or used in presentations and conversations about this research.

3.8.4 Storage of data and security

The examination scripts were collected from the schools and later returned to the schools not more than three working days after the data had been recorded. When in the possession of the project the scripts were securely stored by the LEDIMTALI project and the researcher had access to these scripts only under the supervision of the project director. Data scores were electronically stored and kept secure by saving them in a format with a protected password. No unauthorised access to these records was allowed.

3.9 Concluding remarks

This chapter has dealt with the presentation of the research design and methodology. It has described the rationale of research questions and the quantitative approach used as research design.

As to the method, I have presented the research participants who are Grade 10 learners of schools in partnership with the LEDIMTALI project during 2012, 2013 and 2014. I have discussed all relevant procedures of quasi-experimental design like the description of the "experiment" through sample and sampling, the nature of data as scores from year-end examinations and how data collection was carried out. I have described how the size of a sample was reduced from ten schools to five schools. I also have described the methods used to analyse quantitative data. Also, I have presented the essential concepts of Rasch procedures and statistical procedures employed in the study. Regarding Rasch procedures, the focus was on a partial credit model, model fit and unidimensionality, and differential items functioning. The argument that Rasch analysis is used as a preferred tool was discussed. I presented through some studies the use of the Rasch model in measuring the improvement over time of learner performance in Mathematics. Concerning statistical procedures, I discussed the notions of effect size and t-test for relevant comparisons of different cohorts. The missing data as non-responses was addressed. This chapter was concluded by a presentation of the issues of reliability and validity as ensured by Rasch techniques. Finally, I outlined how the investigation was conducted in accordance with ethical considerations.

In order to examine and guarantee the quality of instruments, the next chapter is the analysis of data using Rasch procedures.

CHAPTER FOUR

FINDINGS RELATED TO RASCH ANALYSIS OF ITEMS

In Chapter Three procedures for analysing data were described. In this chapter an analysis of item measures, levels of item difficulty and differential item functioning by applying the Rasch model is discussed to ensure accuracy in measuring. As would be expected, some items may ascertain measure of performance while others may not. In the study, only the items which ascertained performance were kept for tracking. Technically items that ascertain performance meet Rasch criteria (see Subsection 3.6.1). Therefore items that were found to not satisfy the Rasch criteria were discarded and excluded from the analysis. To guarantee rigorous statistical results this strict process was carried out for all items of the three instruments. This chapter thus presents a process describing the selection of items.

4.1 Items measures analysis

This analysis consists of checking misfit diagnosis by observing infit and outfit mean square in the output tables of items statistics given with Rasch measure order. These tables are generated by running data (through files win2012p1p2, win2013p1p2 and win2014p1p2) in WINSTEPS version 3.65.0 computer programme. Columns in the items statistics table provide for each item the value of the Rasch measure, the mean square (MNSQ) (infit and outfit) and the ZSTD (z-standardized). According to Linacre (2012) it is important to examine the MNSQ for evaluating the fit. In this study, fit statistics were used to detect discrepancies between Rasch model principles and the collected data. Findings resulting from such theoretical and empirical analysis were the items which ascertain the measure of performance. Therefore I decided to remove from the analysis items whose mean square (infit or outfit) is outside of the acceptable range and which also have a ZSTD that does not meet Rasch requirements. This process is done for more accuracy although the sample size used is very large.

4.1.1 Item measures analysis of 2012 high-stakes examinations

In this subsection, I analyse the item measures of the high-stakes Grade 10 mathematics examinations which were written in 2012. I pointedly examine the mean square (infit in the

4th column and outfit in the 6th column) in Table C1.1 (see Appendix C1). The purpose of this check is to see which mean square is between 0.5 and 1.5 (see Subsection 3.6.1).

It can be observed that almost all mean squares of all items fall under the Rasch model's mean square acceptable range, except for four items that are problematic in the 2012 examinations. These items are: item 1.1.2(STA) with infit mean square of 1.57 and outfit mean square of 1.55, item1.1.4 (ALG) with infit mean square of 1.52 and outfit mean square of 1.54, item 1.1.3(STA) with infit mean square of 1.97 and outfit mean square of 1.75 and item 1.4.1(ALG) with infit mean square of 1.70 and outfit mean square 1.36. This indicates that these items do not meet the Rasch criterion. Hence they were excluded from the analysis for a more accurately rendered analysis.

After excluding these four items it is observable in Table C1.2 (see Appendix C1) that all mean squares of all items (infit in the 6th column and outfit in the 8th column) fall under the Rasch model's mean square acceptable range. Thus the items excluded from this analysis of Rasch measures for the 2012 examinations are 1.1.2(STA), 1.1.4 (ALG), 1.1.3(STA), and 1.4.1(ALG). The rest of the items ascertain learners' mathematics performance.

4.1.2 Item measures analysis of 2013 high-stakes examination

Regarding the items of 2013 high-stakes mathematics examinations, it is observable in Table C2 (see Appendix C2) in the 4th and 6th columns, that all mean square infit and outfit fall within the acceptable range. Therefore there are no problematic items. Thus, the examination ascertains the measure of learners' performance in Grade 10 mathematics. All items of 2013 high-stakes mathematics examinations are retained for additional analysis.

4.1.3 Item measures analysis of 2014 high-stakes examinations

Like the item measures analysis of 2013, an inspection of the 4th and 6th column of Table C3 (see Appendix C3) shows that all item measures fall under the acceptable range of Rasch prescription. Therefore, it may be suggested that all items in the 2014 high-stakes examinations constitute a good measure for learners' performance in Mathematics. Finally, I retain all items of the 2014 high-stakes mathematics examinations for further analysis. In the section that follows I provide an analysis of the difficulty level of items for each summative examination to establish – for every year – the transfer of items from the zone of high difficulty to the zone of less difficulty when examination-driven teaching was being used.

4.2 Item difficulty analysis

In order to determine whether the high-stakes examinations functioned well it is relevant to display both items and learners on the same scale to find out whether or not they are spread along the whole scale. Such a map, combining person and item, also gives information about the number of learners at all levels on the map. Likewise, an analysis of relative location of learner proficiency and item difficulty of high-stakes examinations may give an idea of whether (and if so where among the topics) the strategy of examination-driven teaching was developed as an appropriate intervention. It could be assumed that these strategies should have been targeted at the constructs relative to the most difficult items for better teaching methods. Consequently, it is relevant to note from 2012 to 2013 and from 2013 to 2014 the change of the level of difficulty relative to the most difficult topic targeted for observing the effectiveness of the strategies underpinned by examination-driven teaching. Such an idea requires that for each year items are classified according to their level of difficulty, and that these classifications be compared. Julie (2012) presents an organisational scheme to cluster items into four zones of difficulty that can be developed from a person-item around the mean Rasch measure and the standard deviation. Before classifying, it is important to point out that Rasch modelling by WINSTEPS version 3.65.0 provides such a person-map. The logit scale is an interval scale in which all logit units are of the same size. Jacobs, Mhakure, Fray, Holtman and Julie (2014:4) state that:

> The person-item map represents the Rasch measures in order of difficulty. The right-hand side is a hierarchical ordering of the difficulty of the items with the most difficult item at the top and the easiest item at the bottom. The number of examinees who had success at a particular level of difficulty is on the left. In essence the right-hand side gives an indication of the number of examinees who had at least 50 % chance of succeeding on items of similar difficulty.

Each item and person item is "located along the logit scale according to its estimated value: more positive (higher) persons are more able, and more positive (higher) items are more difficult" (Bond & Fox, 2010: 43). The highest values are located at the top of the map, and the lowest values are located at the bottom. The spread of items and learners on the whole scale shows that the high-stakes examinations have functioned well. This analysis is done only for the items that were retained for the analysis and which fit the criterion of unidimensionality.

4.2.1 Person-item map of 2012 high-stakes examinations

A scrutiny of the map person-item presented in Figure 4.1 shows that items 7(EU G), 5.1(FIN), 7.5(FUN), 8.2(PRO), 2.7(AN G), 7.2(FUN), 7.4 (FUN) and 8.3.1(PRO) were the most difficult in the 2012 high-stakes examinations. In the clustering of items, they belong to the high zone of difficulty as shown in Table 4.1. The examination-driven teaching approach is supposed to develop and use special strategies for teaching topics related to those items. The efficiency or effectiveness of those strategies can be noticed by the change of these topics or related items from the high zone of difficulty to another zone of less difficulty for 2013.

	High Ability			Difficult Item			
1							
0.968							
0.936							
…	…	.	.				
0.328	.			7(EU G)			
0.296	.						
0.264	.						
0.232	.						
0.200	.#	T	T				
0.168	.###			5.1(FIN)	7.5(FUN)	8.2(PRO)	
0.136	.########	S		2.7(AN G)	7.2(FUN)	7.4(FUN)	8.3.1(PRO)
0.104	.#########		S	2.5(AN G)	3.2.2(TRI)	6.2.1(FUN)	6.2.3(FUN)
				7.1.2(FUN)	7.3(FUN)	8.1.3(PRO)	
0.072	.############	M		1.1.1(STA)	1.1.4(STA)	2.1.(ALG)	2.2(AN G)
				3.1.1(TRI)	4.2(TRI)	5.1.2(TRI)	5.2(TRI)
				6.2.2(FUN)	7.1.1(FUN)	8.3.2(PRO)	8.3.3(PRO)
0.04	.###########			3.2.1(TRI)	3.3.2(TRI)	3.3.3(TRI)	3.4(ALG)
				5.1.1(TRI)	6.1(EU G)	6.2(EU G)	8(EU G)
0.000	.#####	S	M	1.2.3(STA)	2.2.1(ALG)	2.3(ALG)	2.6(AN G)
				3.3.1(TRI)	5.2(FIN)	6.1.2(FUN)	8.1.1(PRO)
				8.1.2(PRO)			
-0.040	.###			2.2.2(ALG)	2.4(AN G)	3.1(ALG)	3.2.2(ALG)
				3.3(ALG)	4.1(TRI)	5.3(FIN)	
-0.072	.	T		1.2.1(STA)	1.2.2(STA)	2.3(AN G)	3.1.2(TRI)
				3.1.3(TRI)	4.2(PAT)	6.1.1(FUN)	
-0.104	.		S	1.4.2(ALG)	2.1(AN G)	3.2.1(ALG)	4.3.2(PAT)
				4.3.4(PAT)			
-0.136	.			1.1.2(ALG)	4.1.1(PAT)	4.1.2(PAT)	4.3.3(PAT)
				1.1.3(ALG)	1.2.1(ALG)	1.2.2(ALG)	4.3.1(PAT)
-0.168				1.1.1(ALG)	1.3.2(ALG)		
-0.200			T	1.3.1(ALG)			
…	…	.	.				
-0.936							
-0.968							
-1							
	Low Ability			Easy Item			

Each ‘#’ is 7. Each ‘.’ is at most 6.

Figure 4.1: *Person-item map of 2012 high-stakes examinations*

According to the person-item map of Figure 4.1, the Julie clustering is presented as follows:

Clustering of 2012 items

Table 4.1: *Clustering of 2012 items*

Zone of difficulty	Definition	Items
High	More than one standard deviation above the mean	7(EU G), 5.1(FIN), 7.5(FUN), 8.2(PRO), 2.7(AN G), 7.2(FUN), 7.4(FUN), 8.3.1(PRO)
Moderately high	Mean to one standard deviation above the mean	2.5(AN G), 3.2.2(TRI), 6.2.1(FUN), 6.2.3(FUN), 7.1.2(FUN), 7.3(FUN), 8.1.3(PRO), 1.1.1(STA), 1.1.4(STA) 2.1.(ALG), 2.2(AN G), 3.1.1(TRI), 4.2(TRI), 5.1.2(TRI), 5.2(TRI), 6.2.2(FUN), 7.1.1(FUN),8.3.2(PRO), 8.3.3(PRO),3.2.1(TRI), 3.3.2(TRI),3.3.3(TRI), 3.4(ALG), 5.1.1(TRI), 6.1(EU G), 6.2(EU G), 8(EU G), 1.2.3(STA), 2.2.1(ALG), 2.3(ALG) 2.6(AN G)
Moderately low	Below mean to one standard deviation below the mean	3.3.1(TRI), 5.2(FIN), 6.1.2(FUN), 8.1.1(PRO), 8.1.2(PRO), 2.2.2(ALG), 2.4(AN G), 3.1(ALG), 3.2.2(ALG), 3.3(ALG), 4.1(TRI), 5.3(FIN), 1.2.1(STA), 1.2.2(STA), 2.3(AN G), 3.1.2(TRI), 3.1.3(TRI), 4.2(PAT), 6.1.1(FUN), 1.4.2(ALG), 2.1(AN G), 3.2.1(ALG), 4.3.2(PAT)
Low	More than one standard deviation below the mean	4.3.4(PAT), 1.1.2(ALG), 4.1.1(PAT), 4.1.2(PAT), 4.3.3(PAT), 1.1.3(ALG), 1.2.1(ALG), 1.2.2(ALG), 4.3.1(PAT), 1.1.1(ALG), 1.3.2(ALG), 1.3.1(ALG)

The next person-item map for 2013 high-stakes examinations is presented below. It is important to note not only the items that were difficult in 2013 but also to locate items in 2013 that were parallel to the items most difficult in 2012 where the same principle was tested. This reveals the dynamism of items from the zone of more difficult level to the zone of less difficult level in the transition from 2012 to 2013.

4.2.2 Person-item map of 2013 high-stakes examinations

High Ability				Difficult Item			
1							
0.933							
0.866							
…	…	.	.				
0.665	.						
0.598							
0.531	.						
0.464	.						
0.397	.##	T					
0.330	.####						
0.263	.#######	S	T	5.1.4(FUN)			
0.196	#########			5.1.5(FUN)	6.1.3(FUN)	6.1.5(FUN)	6.1.6(FUN)
				8.3(MEA)			
0.129	.##########	M	S	2.8(STA)	3.4(ALG)	5.1(TRI)	5.1.3(FUN)
				6.1.2(FUN)	6.1.4(FUN)	6.2.i(EU G)	6.2.ii(EUG)
				7.1.3(FIN)	8.2(MEA)	8.2.3(PRO)	
0.062	.###########			2,10(STA)	2,11(STA)	2.7(STA)	3.1(AN G)
				3.3(AN G)	4.4.1(TRI)	4.4.2(TRI)	5.1.1(FUN)
				5.1.2(FUN)	6.1(EU G)	6.1.1(FUN)	7.1(EU G)
				7.1.1(FIN)	7.1.2(FIN)	7.2(EU G)	7.2(FIN)
				7.3(EU G)	8.1(MEA)	8.2.1(PRO)	8.2.2(PRO)
0.000	.####	S	M	1.1(STA)	1.1.3(STA)	2.1(STA)	2.9(STA)
				3.2(AN G)	3.2.2(ALG)	3.3(ALG)	4.13(TRI)
				4.3(TRI)	4.3.3(PAT)	4.3.4(PAT)	5.2(TRI)
				8.1.1(PRO)	8.1.3(PRO)		
-0.062	.##			1.1.1(STA)	1.1.2(STA)	1.1.4(ALG)	1.4.2(ALG)
				2.2(STA)	2.2.1(ALG)	2.2.2(ALG)	2.3(ALG)
				2.5(STA)	2.6(STA)	3.1(ALG)	4.1.2(TRI)
				4.2(PAT)	4.3.2(PAT)	8.1.2(PRO)	
-0.129	.	T	S	1.1.2(ALG)	1.1.3(ALG)	1.4.1(ALG)	3.2.1(ALG)
				4.1.1(PAT)	4.1.1(TRI)	4.3.1(PAT)	
-0.196	.			1.1.1(ALG)	2.4(STA)	4.1.2(PAT)	
-0.263	.		T	1.2.1(ALG)	1.3.2(ALG)	2.1(ALG)	2.3(STA)
-0.330	.			1.2.2(ALG)	1.3.1(ALG)		
…	…	.	.				
-0.866							
-0.933							
-1							
Low Ability				Easy Item			

Each ‘#’ is 7. Each ‘.’ is at most 6.

Figure 4.2: *Person-item map of 2013 high-stakes examinations*

Clustering of 2013 items

Table 4.2: *Clustering of 2013 items*

Zone of difficulty	Definition	Items
High	More than one standard deviation above the mean	5.1.4(FUN) 5.1.5(FUN) 6.1.6(FUN) 8.3(MEA) 6.1.3(FUN) 6.1.5(FUN)
Moderately high	Mean to one standard deviation above the mean	2.8(STA) 3.4(ALG) 5.1(TRI) 5.1.3(FUN) 6.1.2(FUN) 6.1.4(FUN) 6.2.i(EU G) 6.2.ii(EU G) 7.1.3(FIN) 8.2(MEA) 8.2.3(PRO) 2,10(STA) 2,11(STA) 2.7(STA) 3.1(AN G) 3.3(AN G) 4.4.1(TRI) 4.4.2(TRI) 5.1.1(FUN) 5.1.2(FUN) 6.1(EU G) 6.1.1(FUN) 7.1(EU G) .1.1(FIN) 7.1.2(FIN) 7.2(EU G) 7.2(FIN) 7.3(EU G) 8.1(MEA) 8.2.1(PRO) 8.2.2(PRO) 1.1(STA) 1.1.3(STA) 2.1(STA) 2.9(STA)
Moderately low	Below mean to one standard deviation above the mean	3.2(AN G) 3.2.2(ALG) 3.3(ALG) 4.13(TRI) 4.3(TRI) 4.3.3(PAT) 4.3.4(PAT) 5.2(TRI) 8.1.1(PRO) 8.1.3(PRO) 1.1.1(STA) 1.1.2(STA) 1.1.4(ALG) 1.4.2(ALG) 2.2(STA) 2.2.1(ALG) 2.2.2(ALG) 2.3(ALG) 2.5(STA) 2.6(STA) 3.1(ALG) 4.1.2(TRI) 4.2(PAT) 4.3.2(PAT) 8.1.2(PRO) 3.2.1(ALG) 1.1.3(ALG) 1.1.2(ALG) 1.4.1(ALG)
Low	More than one standard deviation below the mean	4.1.1(PAT) 4.1.1(TRI) 4.3.1(PAT) 1.1.1(ALG) 2.4(STA) 4.1.2(PAT) 1.2.1(ALG) 1.3.2(ALG) 2.1(ALG) 2.3(STA) 1.2.2(ALG) 1.3.1(ALG)

It can be observed in Table 4.1 and Table 4.2 that topics related to the items 7(EU G), 5.1(FIN), 8.2(PRO), 2.7(AN G), and 8.3.1(PRO) in 2012 concerning Euclidian Geometry, Finance, Probability and Analytic Geometry have left the zone of high difficulty for the zone of less difficulty in 2013. In light of this observation, it could be inferred that examination-driven teaching has yielded dividends from 2012 to 2013 in the teaching of Euclidian Geometry, Finance, Probability and Analytic Geometry. Nevertheless, the items 7.2(FUN), 7.4(FUN) and 7.5(FUN) concerning the topic Functions subsist in the zone of high difficulty from 2012 to 2013 in the form of respective parallel items 6.1.3(FUN), 6.1.5(FUN) and 6.1.6(FUN) . Concretely, given the function $f(x) = -x^2 + 9$ in 2012, it was posed to the learners in 2012 to draw a sketch of $f(x)$, writing down the range of $f(x)$, and to determine the values of x for which $f(x)$ increases as x increases. In 2013, the same questions were posed but for the function $f(x) = x^2 - 4$. As those similar items in 2013 are in a high difficult zone, it could be said that examination-driven teaching did not change the level of difficulty of items concerning concepts of functions from 2012 to 2013.

4.2.3 Person-item map of 2014 high-stakes examinations

	High Ability			Difficult Item			
1							
0.968							
0.936							
…	…	.	.				
0.360	.						
0.328	#	T					
0.296	.#						
0.264	.#		T	4.2(AN G)			
0.232	.###			2.4(STA)	4.3(AN G)		
0.200	.##			3.3(AN G)			
0.168	.#####	S		7(TRI)	8.4(MEA)		
0.136	#######		S	1.1(ALG)	1.1(STA)	1.2(STA)	2.3(STA)
				2.5(STA)	6.2(FUN)	6.2.1(TRI)	9.1.2(EU G)
				9.2(EU G)			
0.104	.#########			2.2(STA)	3.1(AN G)	5.2.3(PRO)	6.4(FUN)
				7.5(FUN)			
0.072	#########			4.4(AN G)	6.2.2(TRI)	6.3(FUN)	9.1.1(EU G)
0.040	.###########	M		1.3(ALG)	3.1.2(PAT)	3.2(AN G)	4.2.2(FIN)
				5(AN G)	6.1(FUN)	6.1.1(TRI)	7.4(FUN)
				8.2(MEA)	8.3(MEA)		
0.000	#############		M	2.1.2(ALG)	4.1(AN G)	5.2.1(PRO)	6.1.2(TRI)
				6.3(TRI)	8.1(MEA)		
-0.040	.##########			2.2(ALG)	7.3(FUN)		
-0.072	.############			2.1.4(ALG)	4.1(FIN)	7.2(FUN)	
-0.104	####	S		1.2(ALG)	3.1.1(PAT)	3.2(PAT)	
-0.136	.#		S	3.1.3(PAT)	4.3(FIN)		
-0.168	.#			4.2.3(FIN)	5.1(PRO)	5.2.2(PRO)	7.1(FUN)
-0.200	.#			1.4.1(ALG)			
-0.232	.			1.5.1(ALG)	1.5.2(ALG)	4.2.1(FIN)	
-0.264	#	T	T	1.4.2(ALG)	2.1.1(ALG)	2.1.3(ALG)	
-0.296	.			2.1(STA)			
-0.328							
…	…	.	.				
-0.936							
-0.968							
-1							
	Low Ability			Easy Item			

Each ‘#’ is 4. Each ‘.’ is at most 3.

Figure 4.3: *Person-item map of 2014 high-stakes examinations*

Clustering of 2014 items

Table 4.3: *Clustering of 2014 items*

Zone of difficulty	Definition	Items
High	More than one standard deviation above the mean	4.2(AN G), 2.4(STA) 4.3(AN G), 3.3(AN G), 7(TRI), 8.4(MEA)
Moderately high	Mean to one standard deviation above the mean	1.1(ALG), 1.1(STA) 1.2(STA), 2.3(STA) 2.5(STA), 6.2(FUN) 6.2.1(TRI), 9.1.2(EU G) 9.2(EU G), 2.2(STA) 3.1(AN G), 5.2.3(PRO) 6.4(FUN), 7.5(FUN) 4.4(AN G), 6.2.2(TRI) 6.3(FUN), 9.1.1(EU G) 1.3(ALG), 3.1.2(PAT) 3.2(AN G), 4.2.2(FIN) 5(AN G), 6.1(FUN) 6.1.1(TRI), 7.4(FUN) 8.2(MEA), 8.3(MEA) 2.1.2(ALG), 4.1(AN G) 5.2.1(PRO), 6.1.2(TRI)
Moderately low	Below mean to one standard deviation below the mean	6.3(TRI), 8.1(MEA), 2.2(ALG), 7.3(FUN), 2.1.4(ALG, 4.1(FIN) 7.2(FUN), 1.2(ALG), 3.1.1(PAT), 3.2(PAT), 3.1.3(PAT), 4.3(FIN),
Low	More than one standard deviation below the mean	4.2.3(FIN), 5.1(PRO), 5.2.2(PRO), 7.1(FUN), 1.4.1(ALG), 1.5.1(ALG), 1.5.2(ALG), 4.2.1(FIN), 2.1(STA), 1.4.2(ALG), 2.1.1(ALG), 2.1.3(ALG)

It is noticeable that all items in 2013 (5.1.4(FUN), 5.1.5(FUN), 6.1.6(FUN), 8.3(MEA), 6.1.3(FUN), 6.1.5(FUN)) which were in the zone of high difficulty, moved to the zone of less difficulty in 2014 except the item 8.3(MEA). The move of all items concerning the topic function from a high-difficulty zone to a less difficult zone could be attributed the success of examination-driven teaching. However, the persistence of one item concerning measurement may be considered as a failure of measurement-driven teaching.

In order to determine whether or not the items were endorsed differently by different subgroups of the population, relative to their socio-economic status, I undertook an analysis of the differential item functioning of examinations as presented in the section that follows.

4.3 Differential item analysis

This analysis investigates whether or not some items of high-stakes examinations discriminate between different subgroups of the population. Before making a comparison between these different subgroups it is important to ensure that items are in the same level of difficulty for all subgroups. Then all items which are found to be more difficult for one subgroup than for another, have to be excluded from the comparison of subgroups. This is because the item that is easier for one subgroup than for another is endorsed better by one group than by the other group. Such an item is not ascertained to equally measure the performance of both subgroups and it has to be excluded from the comparative analysis of subgroups (Shifula, 2012). Technically such a discriminative item has a DIF contrast that does not respect the criterion of the Rasch model.

This analysis is only for the high-stakes mathematics examinations combining paper 1 and paper 2 for the three years where the DIF of subgroups arranged according the socio-economic background is displayed.

4.3.1 Socio-Economic Status Differential item functioning (DIF) in 2012 examinations

Considering only the data presented in Table C1.2 (see Appendix C1) after the exclusion of the four items that fall out of the acceptable range of the Rasch principle, it is observed in the seventh column of Table D1 (see Appendix D1) below that all DIF contrast satisfied the differential functioning criterion. Therefore there is no problematic item in terms of DIF effect among learners who are not paying fees, learners who are paying fees less than R 1000 and learners who are paying fees more than or equal to R 1000. Thus there is no item that is discriminative. By extension, no item was found to be easier for one subgroup than for another.

It is observable from Table D1 (see Appendix D1) that because the report of items probabilities are all less than 0.5, DIF for learners who are not paying fees, those who are paying fees less than R 1000 and those who are paying fees more than or equal to R 1000, was satisfied in terms of differential functioning criterion for all items of the 2012 high-stakes examinations. In keeping with the Rasch model's expectations, learners' scores did not differ. It can also be visualised in the excel plot if learners who are not paying fees are represented by the curve (1), learners who are paying less than R 1000 are represented by the curve (2) and the learners who are paying more than or equal to R 1000 are represented by the curve (3). Curves 1, 2 and 3 are closer, and for every item they follow the same kind of pattern.

Figure 4.4 displays an excel plot that shows how the DIF contrast for the items satisfied the differential item functioning criterion for learners from different socio-economic backgrounds.

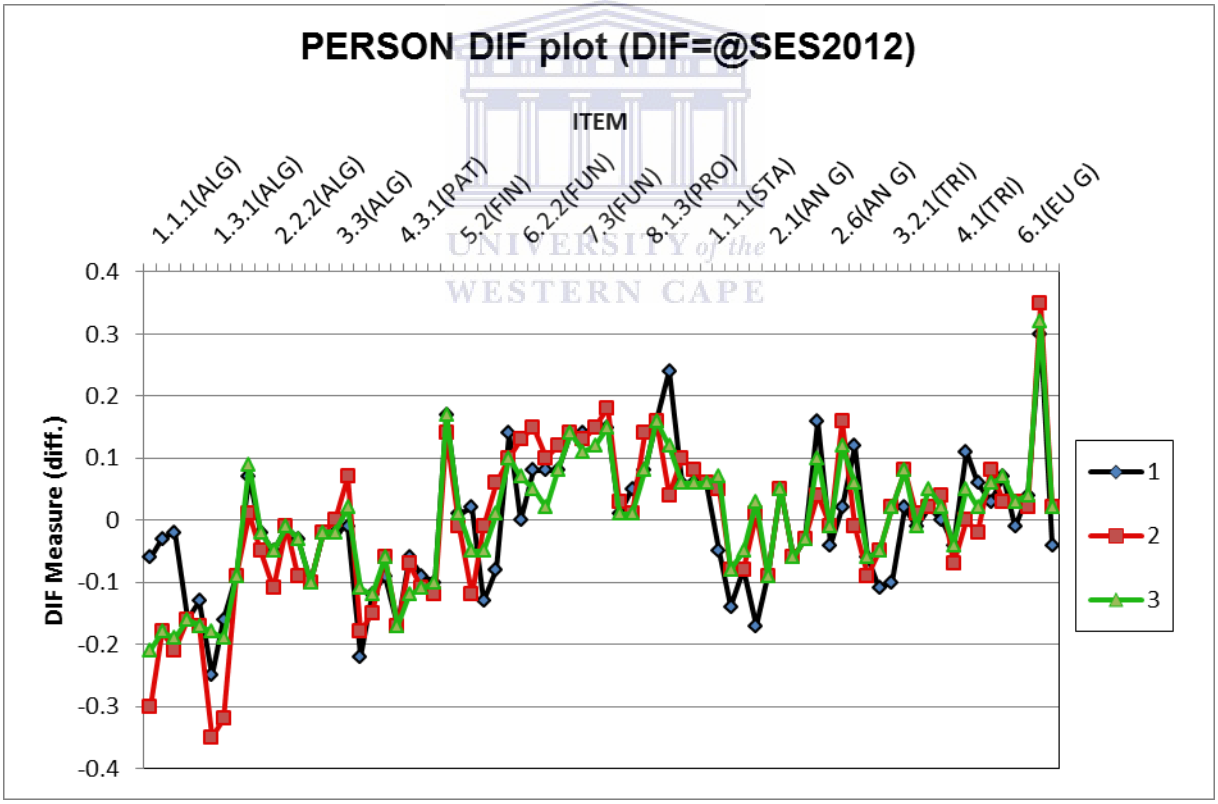

Figure 4.4: *Person DIF Excel plot for the three classes of SES in 2012*

In light of the preceding figure, it can be assumed that there is an overall noticeable differential item functioning for the three classes of SES. Hence, the answer to the question as to whether there are differences in the endorsement of items between the different classes of SES in 2012 high-stakes examinations is no. This outcome shows that all items of the year-end examination of 2012 were at the same level of difficulty for both the three subgroups of SES (Cornelissen, 2006).

4.3.2 SES Differential item functioning (DIF) in 2013 examinations

The observation of DIF contrast for items of 2013 high-stakes examinations in the Table D2.1 (see Appendix D2), and it indicates that the only item that is problematic is 2.6(STA) with DIF contrast 0.50 for the subgroup (1) and also 0.50 for the subgroup (2).

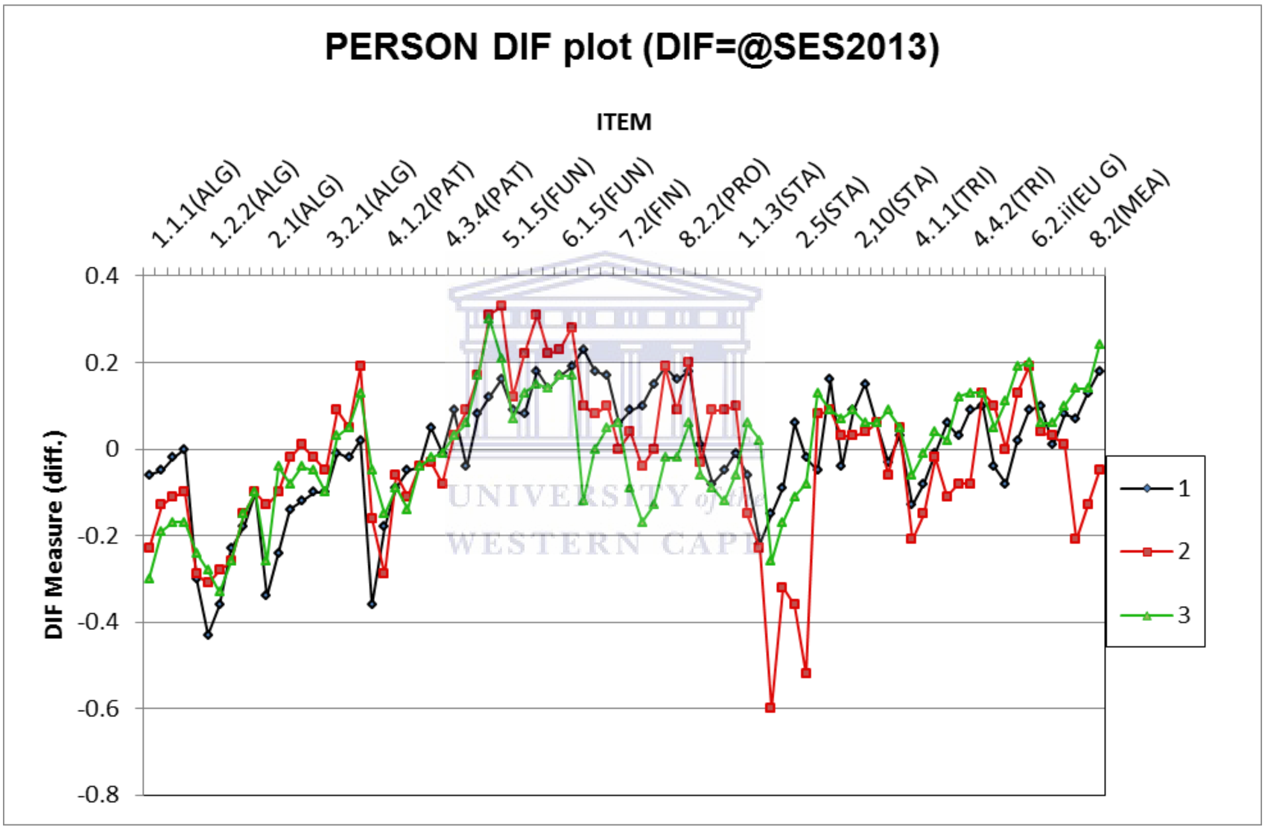

Figure 4.5: *Person DIF Excel plot for the three classes of SES in 2013 examination*

It can be observed from the preceding figure that these three curves follow the same shape except in the item 2.6(STA), where the item distinguishes learners paying less than R 1000 from those who are not paying fees. This means that item 2.6(STA) is more easily endorsed for learners who are paying less than R 1000 than for learners who are not paying fees in terms of DIF measure. Therefore item 2.6(STA) has to be excluded from the comparison of subgroups because its level of difficulty is different for the two subgroups.

After the exclusion of item 2.6(STA), the following results reported in Table D2.2 (see Appendix D2) were obtained.

From Figure 4.6, it becomes evident that the three curves follow the same shape or pattern. They increase together and decrease together to show that all items considered after the exclusion of item 2.6(STA) satisfy the differential item functioning criterion for the three groups of learners, including those who are not paying fees, those who are paying less than R 1000 and those who are paying more than or equal to R 1000. Thus those items have the same level of difficulty for the three groups and the comparison between groups is equitable.

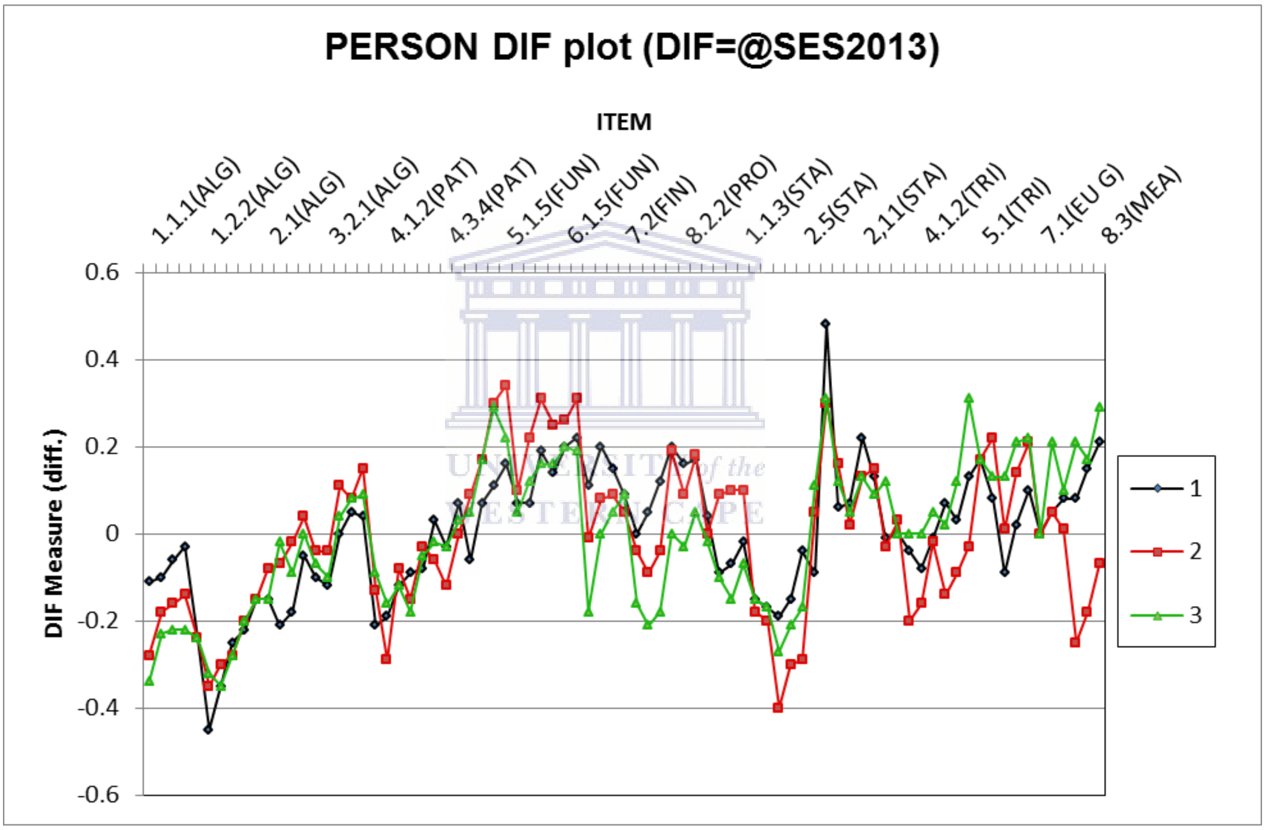

Figure 4.6: *Person DIF Excel plot for the three classes of SES in 2013 after excluding 2.6(STA)*

4.3.3 SES Differential item functioning (DIF) in 2014 examinations

Table D3.1 (see Appendix D3) displays the SES item functioning in 2014 examinations. It can be observed in the 7th column of this table that three items are problematic in terms of acceptable DIF contrast (0.50). These items are: 6.2(FUN) with a DIF contrast of -0.61 for the subgroup (1); 0.61 for the subgroup (2) and -0.59 for the subgroup (3). Also, 2.5(STA) with a DIF contrast of 0.69 for the subgroup (1), -0.69 for the subgroup (2) and -0.52 for the subgroup (3). In addition, 9.1.2(EU G) having a DIF contrast of -0.50 for the subgroup (1) and 0.50 for the subgroup (2).

It can be visualised in Figure 4.5 of the excel plot that the shape curves representing the three socio-economic classes of learners diverge at the items 6.2(FUN), 2.5(STA) and 9.1.2(EU G).

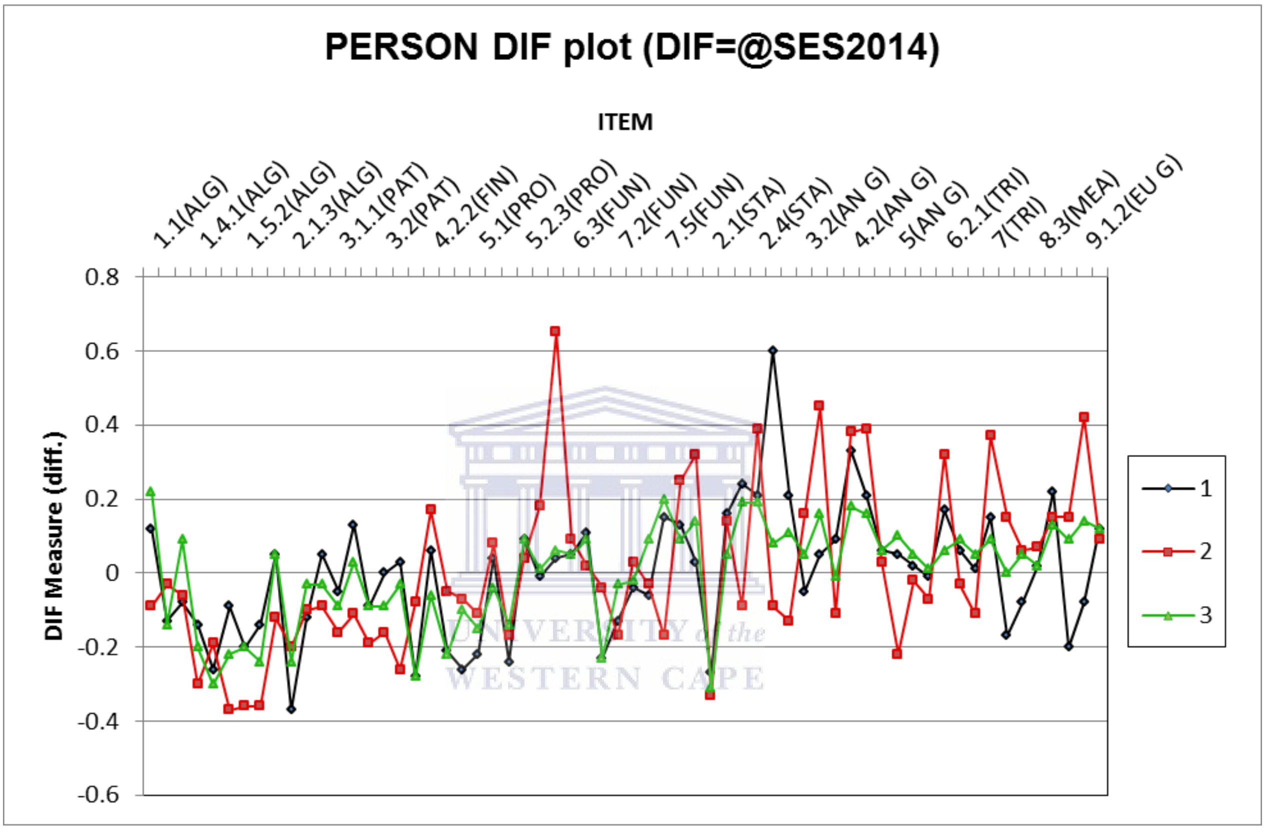

Figure 4.7: *Person DIF Excel plot for the three classes of SES in 2014 examinations*

In terms of DIF measure, item 6.2(FUN) was easier to endorse for learners who were not paying fees and learners who were paying more than or equal to R 1000 than for learners who were paying less than R 1000. Similarly, item 2.5(STA) was easier to endorse for learners who were paying fees than for learners who were not paying fees. Finally, item 9.1.2(EU G) was easier to endorse for learners who were not paying fees and learners who were paying fees more than or equal to R 1000. Given the purpose of the study which is to compare subgroups, items should not function differentially for subgroups. Therefore, for more accuracy, these four items having a DIF that is out of the acceptable Rasch prescription are excluded from the analysis concerning the comparison of SES results. After excluding these items, and as Table D3.2 (see Appendix D3) indicates, the rest of the items have an acceptable DIF contrast and can be retained for a comparative analysis of subgroups.

Figure 4.7 below clearly sketches how the rest of the items are not differentiated in terms of criterion of DIF contrast as the three curves have almost the same shape or behaviour. This ensures that the retained items are almost in the same level of difficulty and a comparison of subgroups results is pertinent.

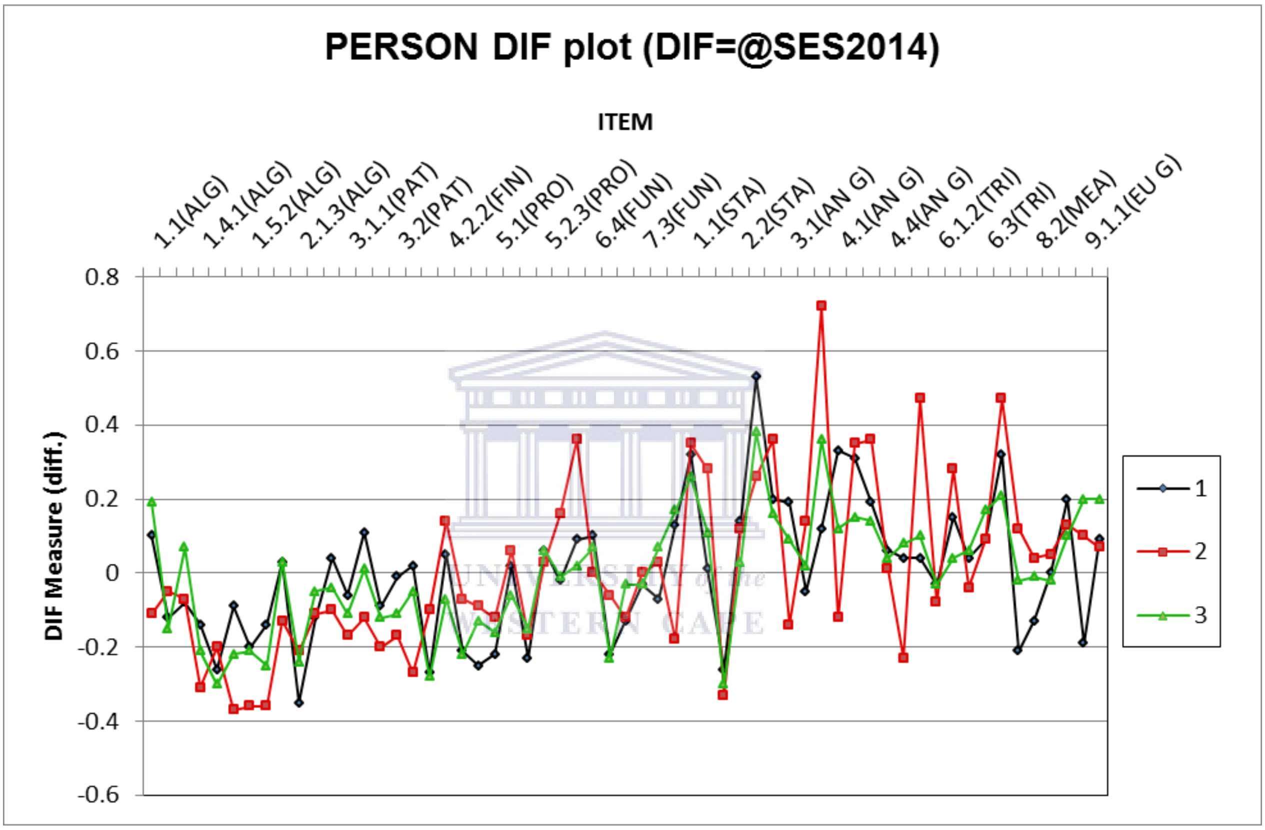

Figure 4.8: *Person DIF Excel plot for the three classes of SES after excluding 6.2(FUN), 2.5(STA) and 9.1.2(EU G)*

The following is a brief summary of the major findings emanating from this analysis.

4. 4 Concluding remarks

Firstly, in this chapter the study determined and selected the items that fit the prescription of the Rasch model with the mean square infit and outfit that fall in the acceptable range. All items of 2013 and 2014 high-stakes examinations are kept for analysis because there was no problematic item among them. However, from the analysis of 2012 high-stakes examinations, items 1.1.4(ALG), 1.4.1(ALG), 1.1.2(STA) and 1.1.3(STA) were excluded because they are problematic in terms of Rasch measure and are out of the acceptable range.

Secondly, an analysis of items difficulty through item-maps assisted not only with visualising the overall rank ordering of the items but also with examining how the examination-driven teaching was working in terms of moving a topic from the most difficult cluster in 2012 to a less difficult cluster in 2013 and so too from the year 2013 to 2014. For instance, from 2012 to 2013 items 7(EU G), 5.1(FIN), 8.2(PRO), 2.7(AN G) and 8.3.1(PRO) moved from the zone of high difficulty to the zone of low difficulty regarding their items' parallelism. However, the items 7.2(FUN), 7.4(FUN) and 7.5(FUN) remained in the zone of high difficulty. In addition, from 2013 to 2014 almost all items left the zone of high difficulty and moved to the zone of low difficulty in 2014, namely 5.1.4(FUN), 5.1.5(FUN), 6.1.3(FUN), 6.1.5(FUN) and 6.1.6(FUN). The only item that remained in the zone of difficulty in the form of 8.4(MEA) is 8.3(MEA).

Finally, through an analysis of DIF contrast of items a description was obtained of how well the three year-end examinations functioned for the subgroups of different socio-economic backgrounds. In fact, the items remaining after the exclusion of the four problematic items from the 2012 high-stakes examinations analysis functioned well in terms of DIF measure. However in 2013, item 2.6(STA) was problematic in terms of DIF measure and was excluded from SES analysis as well as items 6.2(FUN), 2.5(STA) and 9.1.2(EU G) in 2014. Therefore, the analysis also helped in the selection of only the items which were not problematic in terms of DIF criterion of the Rasch model, which consequently allowed for comparison of subgroups.

The next chapter presents the different trends of learners' performance in Mathematics over the three years: 2012, 2013 and 2014.

CHAPTER FIVE

FINDINGS RELATED TO LEARNERS' MATHEMATICS ACHIEVEMENT OVER TIME

In this chapter learners' mathematics performance is measured in terms of Rasch measures and DIF measures as revealed in Chapter Four. Using only the selected items, the chapter summarises learners' mathematics attainment in the three high-stakes Grade 10 mathematics examinations. Achievement scores from 2012 to 2014 are tracked and discussed in the following domains: firstly, the overall achievement scores for the five schools, secondly the achievement scores of learners from different socio-economic backgrounds and finally the achievement scores for Paper1 and Paper 2.

5.1 Trend of overall mathematics achievement scores

In order to track results, a comparison of learners' performance in mathematics tests for the three occasions was undertaken in cohorts two by two: (1) cohort 2012 and cohort 2013; and (2) cohort 2013 and cohort 2014. For each case, the average mathematics scores are calculated in percentages regarding the maximum scores after the use of Rasch fitted items (see Appendix B for calculations of average). As cohorts are independent, the independent-sample t-test was undertaken to establish whether or not the mean difference was statistically significant between cohorts (Afrassa & Keeves, 1999). In order to provide such an interpretation, I considered the two primary outputs of the t-test by SPSS (2011 version) software namely: the t-test's statistical significance and the t-test's effect size.

The statistical significance indicates whether the difference between the sample averages is likely to represent an actual difference between populations. The effect size indicates whether the difference is large enough to be practically (i.e. "really") meaningful. In addition, regarding the interpretation of effect size provided by Cohen (1988) for t-test (see Subsection 3.6.2), Afrassa and Keeves (1999) assert that there is a slight significance for trivial effect size, a marginal significance for small effect size, a substantial significance for medium effect size, and a dramatic significance for large effect size. Moreover, a negative effect size indicates a decline, while a positive effect size indicates an improvement.

5.1.1 Comparison of mathematics achievements between 2012 and 2013

It is noticeable from Table 5.1 that the estimated mean scores (26.14%) in 2012 are higher than the mean scores (22.32%) of learners in 2013, translating into a mean difference of -3.82%. In Table 5.1, the t-value is 4 with a significance level of 0.000; suggesting that the difference is statistically significant. However, the effect size of - 0.29, after calculations as indicated in appendix F2, was small. The estimated mean difference in scores indicates that learners' mathematics achievement declined between 2012 and 2013. The effect size shows that the difference is practically meaningful. Therefore it can be concluded that the decline is marginally significant in mathematics achievement from 2012 to 2013.

Table 5.1: *Average of five schools for cohorts 2012 and 2013*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Total from p1p2	Y2012	405	26.14	13.483	.670
	Y2013	381	22.32	13.276	.680

Table 5.2: *T-test for mean difference*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total from p1p2	Equal variances assumed	.519	.472	4.000	784	.000	3.821	.955	1.946	5.696
	Equal variances not assumed			4.002	782.364	.000	3.821	.955	1.947	5.695

Effect size (see calculations in Appendix F2) =-0.29

5.1.2 Comparison of mathematics achievements between 2013 and 2014

The data displayed in Table 5.3 shows that the mean score (22.32%) of the cohort 2013 is lower than the mean score (35.42%) of the 2014 cohort. The mean scores difference between the two cohorts is 13.10%. The estimated mean difference indicates that learners' mathematics performance increased from 2013 to 2014. The effect size is large (0.88) and the t-value is 12.243. These values of effect size and t-value suggest that the difference is both statistically and practically meaningful at a 0.000 level. Hence it may be concluded that there was a dramatic improvement in mathematics achievement.

Table 5.3: *Average of five schools for cohorts 2013 and 2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Total from p1p2	Y2013	381	22.32	13.276	.680
	Y2014	407	35.42	16.478	.817

Table 5.4: *T-test for mean difference*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total from p1p2	Equal variances assumed	13.485	.000	-12.243	786	.000	-13.105	1.070	-15.206	-11.004
	Equal variances not assumed			-12.329	769.137	.000	-13.105	1.063	-15.192	-11.018

Effect size=0.88

5.1.3 Trend of mathematics achievement over time

Figure 9 shows that learners' performance in Mathematics declined slightly between 2012 and 2013 but it improved markedly between 2013 and 2014.

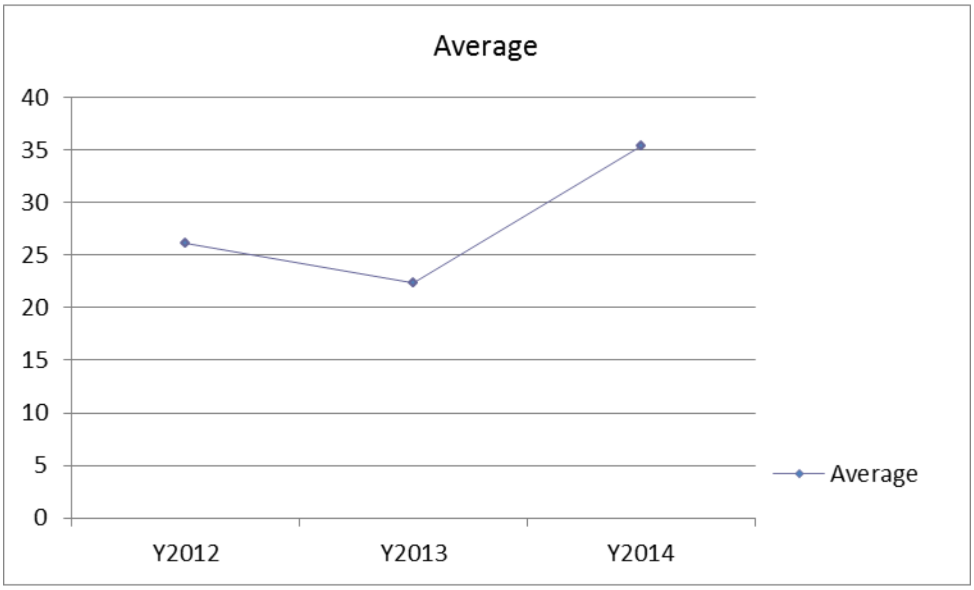

Figure 5.1: *Trend over time of learners' mathematics performance*

Regarding the main objective of the study and the necessity to take account of evidence by triangulating outcomes (DCSF, 2008), it is important to check whether improvement could definitively be said to have occurred at the end of the three years. In this regard, I considered the comparison between 2012 average scores and 2014 average scores as provided by Table 5.5 and Table 5.6. It is noticeable from the data in these two tables that the statistical significance is 8.784 and the effect size is medium (0.62). Therefore, the difference is statistically and practically meaningful at a 0.000 significance level, suggesting that mathematics scores improved substantially from 2012 to 2014.

Table 5.5: *Average of five schools for cohorts 2012 and 2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Total from p1p2	Y2012	405	26.14	13.483	.670
	Y2014	407	35.42	16.478	.817

Table 5.6: *T-test for mean difference between 2012 and 2014*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total from p1p2	Equal variances assumed	9.905	.002	-8.784	810	.000	-9.284	1.057	-11.359	-7.210
	Equal variances not assumed			-8.788	780.865	.000	-9.284	1.056	-11.358	-7.211

Effect size=0.62

In order to understand the developmental aspect of the overall trend over time of learners' mathematics achievement, the following provides insight into the trend among learners from different socio-economic backgrounds.

5.2 Performance over time by socio-economic status

This section presents an analysis of socio-economic status of the trend of learners' mathematics performances over the three years 2012, 2013 and 2014. It therefore describes the mathematics performance trend over time for the three subgroups of learners: non-fee paying (NFP), fee-paying less than R 1000 (FPLT), and fee-paying more or equal to R 1000 (FPMET). This section presents a comparison between the trends of the three subgroups, to identify which one performed better over time in such a way that the trend of the gap between subgroups is identifiable.

5.2.1 Performance by SES between 2012 and 2013

Comparisons are undertaken firstly for learners belonging to the same class NFP, secondly for learners belonging to the class FPLT and finally for learners belonging to the class FPMET.

Comparisons of mathematics achievements between NFP learners in 2012 and in 2013

The data displayed in Table 5.7 shows that the estimated mean scores in mathematics tests of learners belonging to class NFP in 2012 is 26.97% while those for 2013 cohort is 20.34%; with the mean difference of -6.630. The statistics indicate that mathematics performance decreased from 2012 to 2013. The t-value is 3.522 as shown in Table 5.8 and the effect size is medium effect (-0.50). These values of effect size and t-value indicate that the difference between the means is practically and statistically significant at a 0.001 level. In light of this data it is possible to conclude that the decline in mathematics achievement scores is substantially significant.

Table 5.7: *Mathematics achievement of NFP, FPLT, FPMET from 2012 to 2013*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
NFP	Y2012	64	26.97	15.931	1.991
	Y2013	124	20.34	9.811	.881
FPLT	Y2012	94	16.54	6.893	.711
	Y2013	63	15.24	7.224	.910
FPMET	Y2012	247	29.57	12.948	.824
	Y2013	194	26.36	15.490	1.112

Table 5.8: *T-test for mean difference for NFP, FPLT and FPMET*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
NFP	Equal variances assumed	19.726	.000	3.522	186	.001	6.630	1.883	2.916	10.344
	Equal variances not assumed			3.045	88.344	.003	6.630	2.178	2.303	10.957
FPLT	Equal variances assumed	.898	.345	1.140	155	.256	1.304	1.144	-.956	3.565
	Equal variances not assumed			1.129	128.790	.261	1.304	1.155	-.981	3.590
FPMET	Equal variances assumed	7.492	.006	2.370	439	.018	3.211	1.355	.548	5.874
	Equal variances not assumed			2.320	374.489	.021	3.211	1.384	.490	5.933

Effect size for NFP = -0.50

Effect size for FPLT = -0.18

Effect size for FPMET= -0.22

Comparisons of mathematics achievements between FPLT learners in 2012 and in 2013

The data presented in Table 5.7 shows that the mean score for FPLT learners was 16.54% and 15.24% in 2012 and 2013 respectively. Furthermore, the estimated mean difference is -1.304. This is to suggest that there was a decrease of mathematics scores from 2012 to 2013. Both effect size (-0.18) and t-value (1.140) were very small at a 0.256 significance level. These values showed that the mean difference between FPLT learners in 2012 and FPMET learners in 2013 is not statistically and practically significant. Therefore this slight decline cannot be considered as meaningful.

Comparisons of mathematics achievements between FPMET learners in 2012 and in 2013

Examining Table 5.7, the average mean of FPMET learners was 29.57% in 2012 and 26.36% in 2013. Therefore, the estimated mean difference was -3.211. This indicates a decrease of mathematics achievement. Since the effect size is small (-0.22) and the t-value is 2.370, it appears that the mean difference in mathematics achievement for FPMET learners between 2012 and 2013 is statistically and practically significant at a 0.018 level. Therefore, it may be concluded that the decline is marginally significant in mathematics achievement.

The following section compares mathematics achievements by SES between 2013 and 2014.

5.2.2 Performance by SES between 2013 and 2014

In this subsection, I compare mathematics achievements of learners belonging to each class of SES.

Comparisons of mathematics achievements between NFP learners in 2013 and in 2014

The data in Table 5.9 shows that the estimated mean of mathematics achievement for NFP learners in 2013 and 2014 is 20.34% and 33.05% respectively, and the mean scores difference is 12.716. This indicates a dramatic increase of NFP learner's performance from 2013 to 2014. The effect size (0.94) and the t-value (-7.090) are large. Therefore, the difference is both statistically and practically significant at a 0.000 level. It can therefore be concluded that the mathematics achievement of NFP learners improved dramatically from 2013 to 2014.

Table 5.9: *Mathematics achievement of NFP, FPLT and FPMET from 2013 to 2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
NFP	Y2013	124	20.34	9.811	.881
	Y2014	91	33.05	16.372	1.716
FPLT	Y2013	63	15.24	7.224	.910
	Y2014	91	37.65	11.401	1.195
FPMET	Y2013	194	26.36	15.490	1.112
	Y2014	225	35.05	17.904	1.194

Table 5.10: *T-test for mean difference for NFP, FPLT and FPMET*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
NFP	Equal variances assumed	29.016	.000	-7.090	213	.000	-12.716	1.794	-16.252	-9.181
	Equal variances not assumed			-6.591	136.738	.000	-12.716	1.929	-16.531	-8.901
FPLT	Equal variances assumed	10.305	.002	-13.795	152	.000	-22.410	1.625	-25.620	-19.201
	Equal variances not assumed			-14.918	150.957	.000	-22.410	1.502	-25.378	-19.442
FPMET	Equal variances assumed	2.410	.121	-5.275	417	.000	-8.698	1.649	-11.939	-5.457
	Equal variances not assumed			-5.331	416.994	.000	-8.698	1.631	-11.904	-5.491

Effect size for NFP = 0.94

Effect size for FPLT= 2.3

Effect size for FPMET= 0.52

Comparisons of mathematics achievements between FPLT learners in 2013 and in 2014

The estimated mean scores of FPLT learners in the mathematics tests is 15.24% in 2013 and 37.65% in 2014 (see Table 5.9). The mean score difference between the two cohorts is 22.410. This indicates that FPLT learners increased their performance markedly from 2013 to 2014. Both effect size (2.3) and t-value (13.795) are large (see Table 5.10). These values show that the difference between average scores is statistically and practically significant at a 0.000 level. In light of these statistics it can be concluded that FPLT learners dramatically improved their performance in Mathematics from 2013 to 2014.

Comparisons of mathematics achievements between FPMET learners in 2013 and in 2014

Table 5.8 illustrates that the estimated mean scores of FPMET learners is 26.36% in 2013 and 35.05% for the cohort 2014. It also indicates that the mean difference is 8.698. This suggests an increase of mean scores of FPMET learners from 2012 to 2014. The effect size is medium (0.52) while the t-value is 5.275. These values indicate that the difference is both practically and statistically significant at a 0.000 level. Therefore, it can be concluded that there is a substantial improvement in mathematics achievement of FPMET learners between 2013 and 2014.

5.2.3 Trends of mathematics achievement over time for NFP, FPLT and FPMET learners

Figure 5.2 shows that the trends of NFP, FPLT and FPMET learners follow a similar pattern because their mathematics achievements decreased between 2012 and 2013, and increased between 2013 and 2014.

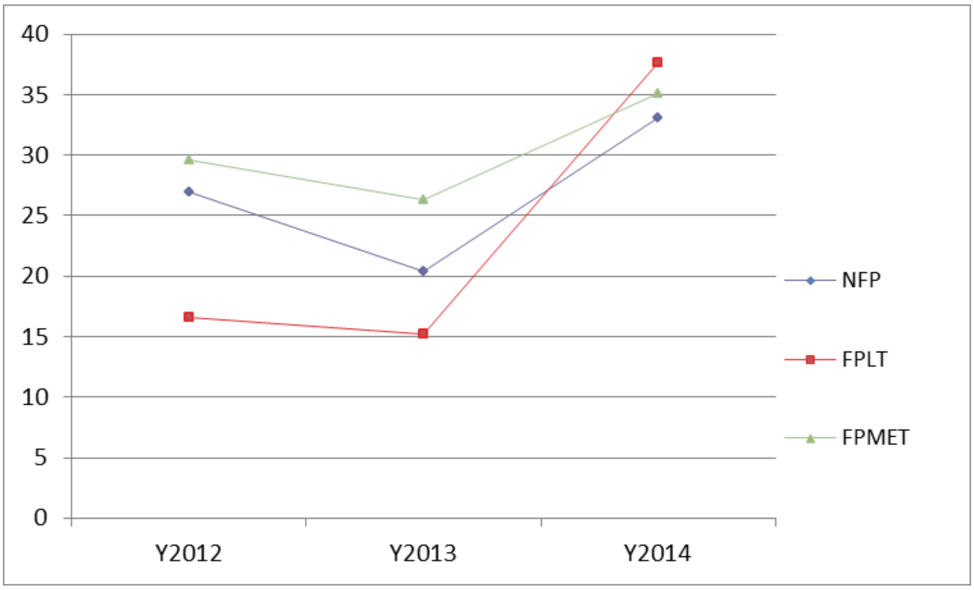

Figure 5.2: *Trends over time of NFP, FPLT, FPMET learners' mathematics performance*

Furthermore, many scholars believe that the disparity in academic performance between SES groups of learners characterises an achievement gap (Johnston & Viadero, 2000; Ladson-Billings, 2006; Valencia, 2015). It should be noted that achievement gap is currently one of the most talked-about issues in U.S. education according to Ladson-Billings (2006). It is therefore relevant to look at the trends over time of achievement gaps between the three groups of learners to verify inequalities shapes.

5.2.4 Trends over time of gaps between learners from different classes of SES

Regarding the achievement gap between the three groups of learners, the amplitudes of means difference between groups are summarised in Table 5.11:

Table 5.11: *Gaps between different classes of SES learners' mathematics achievement per year*

Gap between classes	2012	2013	2014
NFP-FPLT	10.43	5.1	4.6
NFP-FPMET	2.6	6.02	2
FPLT-FPMET	13.03	11.12	2.6

Data presented in Table 5.11 shows that in 2012, the highest gap (13.03) is between learners FPLT and learners FPMET, followed by the gap of 10.43 between learners NFP and learners FPLT; and the lowest gap of 2.6 between learners NFP and learners FPMET.

In 2013 the highest gap (11.12) is between learners FPLT and learners FPMET, followed by the gap (6.02) between learners NFP and learners FPMET and the last is the gap (5.1) between learners NFP and learners FPLT. Finally, in 2014 the highest gap (4.6) is between learners NFP and learners FPLT, followed by the gap (2.6) between learners FPLT and learners FPMET, while the lowest gap is (2) between learners NFP and learners FPMET.

The trends over time of gaps between learners from different SES classes are sketched graphically in Figure 5.3.

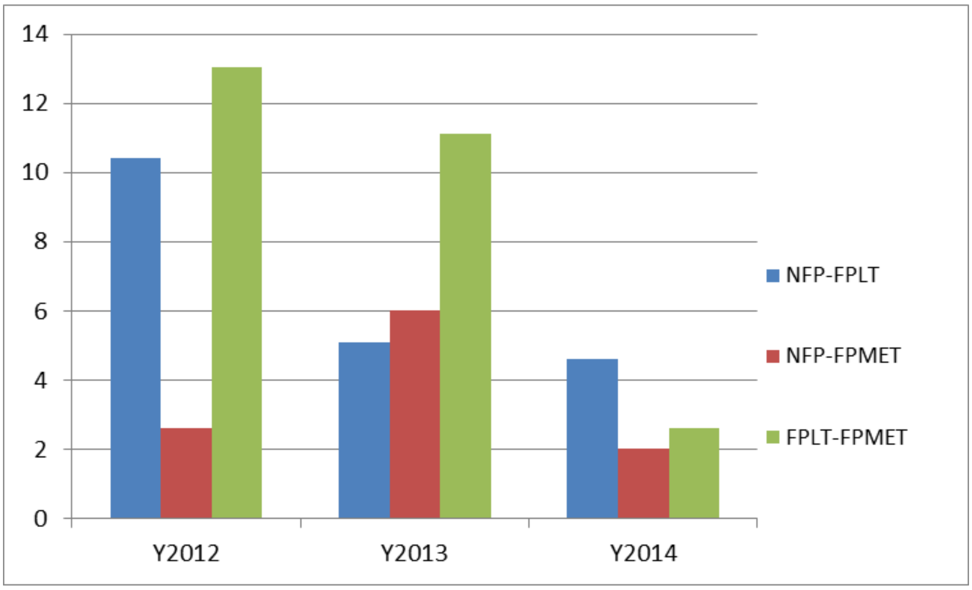

Figure 5.3: *Trends over time of different gaps*

It is observable in Figure 5.3 that between 2012 and 2013, the two gaps NFP-FPLT and FPLT-FPMET decreased, although FPLT-FPMET decreased steadily while the gap NFP-FPMET increased. Between 2013 and 2014 all the three gaps decreased. They are ordered according to their gradients as follows: firstly FPLT-FPMET, then NFP-FPMET, and lastly NFP-FPLT. From 2012 to 2014, both gaps definitely decreased converging on zero because NFP-FPLT dropped from 10.43 to 4.6, NFP-FPMET dropped from 2.6 to 2 and FPLT-FPMET dropped from 13.03 to a low 2.6. Of course, there is no gap that reached zero although this is the purpose for social equalities in schooling mathematics. However, Figure 5.4 presents a combination of all gaps that shows a continuous perceptible decrease of overall trend over time.

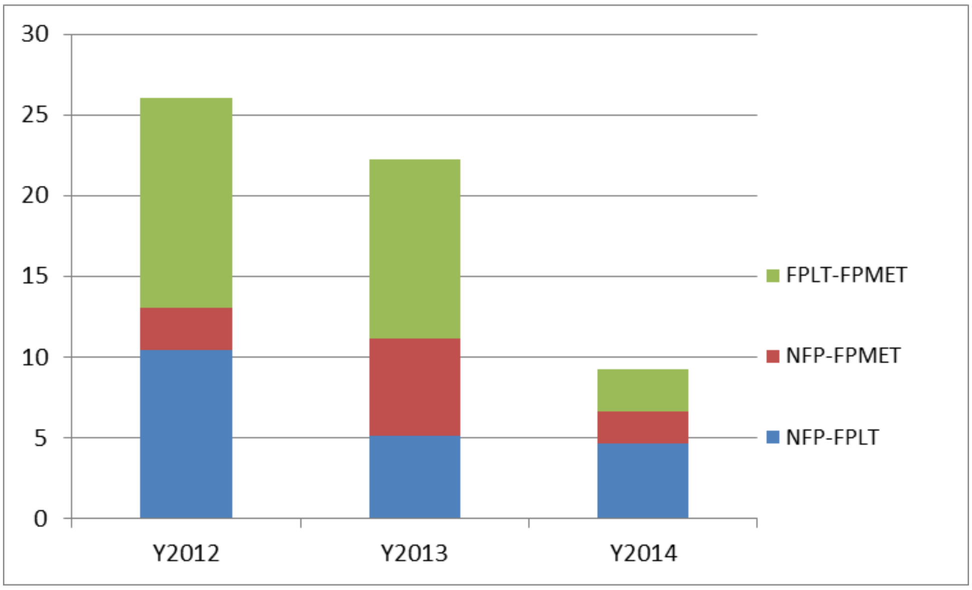

Figure 5.4: *Overall trend over time of different gaps*

It can be expected that over many more years, the overall trend of gaps may converge on zero when the same educational strategy is continually used in the same context.

Likewise, it is relevant to statistically test the difference between the means of cohorts 2012 and 2014 to establish whether these mean differences are meaningful. In this regard, the t-test was used and from 2012 to 2014 the results are presented in Table 5.12 and Table 5.13. As to the respective t-value -2.304 for NFP, 15.292 for FPLT and -3.839 for FPMET, with their respective effects sizes of 0.38 (small), 2.24 (larger) and 0.35 (small), both differences are statistically and practically significant respectively at the level 0.23, 0.000, and 0.000. Therefore, it can be concluded that there was an improvement for both SES classes of learners in mathematics achievement from 2012 to 2014. In particular, the improvement observed was marginally significant for both NFP and FPMET learners; and dramatically significant for FPLT learners.

Table 5.12: *Mathematics achievement of NFP, FPLT, FPMET from 2012 to 2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
NFP	Y2012	64	26.97	15.931	1.991
	Y2014	91	33.05	16.372	1.716
FPLT	Y2012	94	16.54	6.893	.711
	Y2014	91	37.65	11.401	1.195
FPMET	Y2012	247	29.57	12.948	.824
	Y2014	225	35.05	17.904	1.194

Table 5.13: *T-test of mean difference for NFP, FPLT and FPMET*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower	Upper
NFP	Equal variances assumed	.172	.679	-2.304	153	.023	-6.086	2.642	-11.305	-.868
	Equal variances not assumed			-2.315	138.037	.022	-6.086	2.629	-11.284	-.888
FPLT	Equal variances assumed	19.766	.000	-15.292	183	.000	-21.106	1.380	-23.829	-18.383
	Equal variances not assumed			-15.177	147.141	.000	-21.106	1.391	-23.854	-18.358
FPMET	Equal variances assumed	18.206	.000	-3.839	470	.000	-5.487	1.429	-8.295	-2.678
	Equal variances not assumed			-3.783	404.660	.000	-5.487	1.450	-8.338	-2.635

Effect size for NFP = 0.38

Effect size for FPLT = 2.24

Effect size for FPMET = 0.35

The next section calibrates and examines trends of mathematics performance over Paper 1 and Paper 2.

5.3 Performance for Paper 1 and Paper 2

This section focuses on the comparison of the trends of learners' mathematics performance over time in Paper 1 and Paper 2. The purpose is to determine in which paper the learners performed better over time. In order to reach that goal, I compare first the results of each paper between 2012 and 2013, and then between 2013 and 2014.

5.3.1 Comparisons of mathematics achievements of Paper 1 between 2012 and 2013

Table 5.14 indicates that mathematics achievement of Paper 1 was 26.06% in 2012 and 22.73% in 2013. The mean scores difference in Table 5.10 was 3.327. This result indicates a decrease from 2012 to 2013. The effect size is trivial (-0.19) and t-test value is 2.709 (Table 5.14). The value of effect size and t-value indicates that there is not a practical and statistical decline at a 0.007 significance level. Therefore it is possible to conclude that there is slight, significant decline in mathematics achievement of Paper 1 from 2012 to 2013.

5.3.2 Comparisons of mathematics achievements of Paper 2 between 2012 and 2013

Similar to the above, the data in Table 5.14 shows that mathematics achievement for Paper 2 is 26.09% in 2012 and 21.94% in 2013. Therefore, the mean difference is 4.152 (Table 5.14). The effect size is small (-0.26) and the t-value is 3.598. This means that the mean scores difference is practically and statistically significant at a 0.000 level. Hence, it is possible to conclude that mathematics achievement of Paper 2 declined significantly from 2012 to 2013.

Table 5.14: *Mathematics achievement in Paper 1 and Paper 2 from 2012 to 2013*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Paper 1	Y2012	405	26.06	16.709	.830
	Y2013	381	22.73	17.723	.908
Paper 2	Y2012	405	26.09	16.006	.795
	Y2013	381	21.94	16.337	.837

Table 5.15: *T-test for mean difference of Paper 1 between 2012 and 2013*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Paper 1	Equal variances assumed	2.196	.139	2.709	784	.007	3.327	1.228	.916	5.738
	Equal variances not assumed			2.704	772.898	.007	3.327	1.230	.912	5.742
Paper 2	Equal variances assumed	.008	.930	3.598	784	.000	4.152	1.154	1.887	6.417
	Equal variances not assumed			3.596	778.813	.000	4.152	1.155	1.885	6.418

Effect size for paper 1 =-0.19

Effect size for paper 2 = -0.26

5.3.3 Comparisons of mathematics achievements of Paper 1 between 2013 and 2014

In light of the data presented in Table 5.16 it could be observed that the mean scores difference between mathematics achievement (22.73%) for Paper 1 in 2013 and mathematics achievement (28.53%) for Paper 2 in 2014 is -5.599 (Table 5.13). This indicates an increase of mathematics achievement for Paper 1 from 2013 to 2014. The effect size is small (0.38) and the t-value is -4.800. This shows that there is practically and statistically a significant improvement. It could further be concluded that learners improved their performance marginally in Mathematics in Paper 1 between 2013 and 2014.

5.3.4 Comparisons of mathematics achievements of Paper 2 between 2013 and 2014

The data displayed in Table 5.16 shows that the estimated average of mathematics achievement of Paper 2 is 21.94% for 2013 and 42.44% for 2014. This indicates a dramatic increase of mathematics achievement of Paper 2 between 2013 and 2014. Both effect size (1.10) and t-value (15.429) are large. Therefore, the estimated mean difference shows that mathematics achievement in Paper 2 significantly improved both practically and statistically at the 0.000 level. Therefore it can be concluded that there was a dramatic improvement of mathematics performance in Paper 2 from 2013 to 2014.

Table 5.16: *Mathematics achievement in Paper 1 and Paper 2 in 2013 and 2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Paper 1	Y2013	381	22.73	17.723	.908
	Y2014	407	28.53	16.184	.802
Paper 2	Y2013	381	21.94	16.337	.837
	Y2014	407	42.44	20.558	1.019

Table 5.17: *T-test for mean difference between Paper 1 and Paper 2*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Paper 1	Equal variances assumed	5.599	.018	-4.800	786	.000	-5.799	1.208	-8.170	-3.427
	Equal variances not assumed			-4.786	767.236	.000	-5.799	1.212	-8.177	-3.420
Paper 2	Equal variances assumed	27.504	.000	-15.429	786	.000	-20.498	1.329	-23.105	-17.890
	Equal variances not assumed			-15.544	766.062	.000	-20.498	1.319	-23.086	-17.909

Effect size for paper 1 = 0.34

Effect size for paper 2 = 1.10

5.3.5 Trends over time of mathematics achievement for Paper 1 and Paper 2

Figure 5.4 shows that both trends of Mathematics over time for Paper 1 and Paper 2 follow a similar pattern because they decreased between 2012 and 2013, and increased between 2013 and 2014. Nevertheless, the gap between the two papers is small. Yet achievement in Paper 1 was much larger than achievement in Paper 2. However, the gap between the two papers becomes larger from 2013 to 2014. Achievement in Paper 2 improved more dramatically than Paper 1 achievement. A calibration of trends over time for Paper 1 and Paper 2 achievements is sketched graphically in Figure 5.4 below.

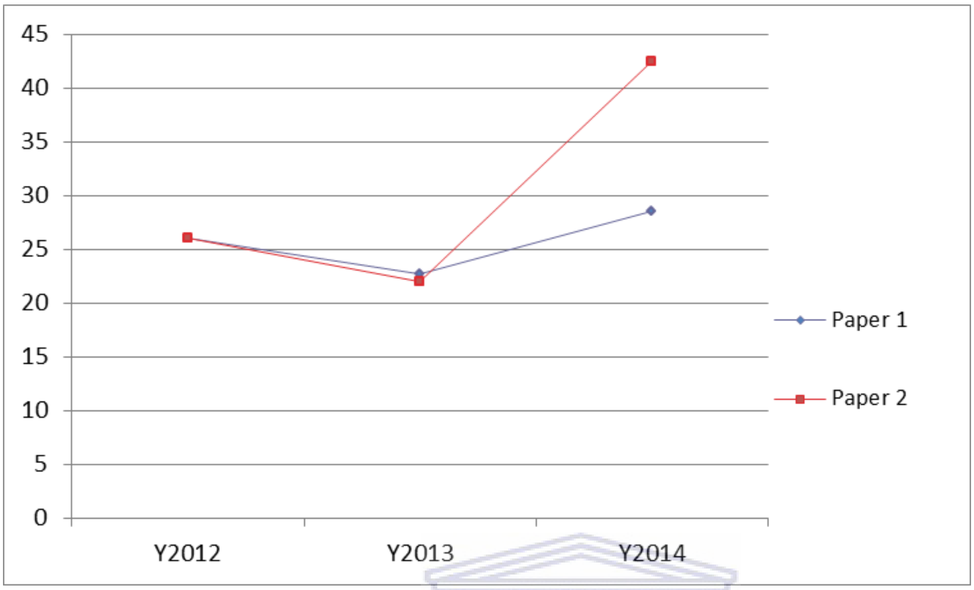

Figure 5.5: *Trends over time of Paper 1 and Paper 2 mathematics achievements*

Additionally, a t-test statistics was computed to determine trends from 2012 to 2014 and also to find out whether the mean difference between Paper 1 and Paper 2 is statistically and practically meaningful. A look at Table 5.18 and Table 5.19 shows that the mean difference for Paper 1 and Paper 2 is -2.471 and 16.346 respectively. The t-value is -2.141 while the effect size is very small (0.15) for Paper 1. Therefore the difference is not statistically and practically significant. However, the mean difference for Paper 2 is statistically and practically significant because the t-value is 12.638 and the effect size is large (0.89). It could thus be concluded that there is definitely a dramatic improvement of scores in Paper 2 but not in Paper 1 from 2012 to 2014.

Table 5.18: *Average of Paper 1 and Paper 2 from 2012 to2014*

Group Statistics

	Year	N	Mean	Std. Deviation	Std. Error Mean
Paper 1	Y2012	405	26.06	16.709	.830
	Y2014	407	28.53	16.184	.802
Paper 2	Y2012	405	26.09	16.006	.795
	Y2014	407	42.44	20.558	1.019

Table 5.19: *T-test of mean difference*

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Paper 1	Equal variances assumed	.818	.366	-2.141	810	.033	-2.471	1.154	-4.737	-.205
	Equal variances not assumed			-2.141	808.899	.033	-2.471	1.155	-4.738	-.205
Paper 2	Equal variances assumed	30.514	.000	-12.638	810	.000	-16.346	1.293	-18.885	-13.807
	Equal variances not assumed			-12.645	765.744	.000	-16.346	1.293	-18.884	-13.808

Effect size for Paper 1 = 0.15

Effect size for Paper 2 = 0.89

The next subsection is a summary of the main results of this chapter.

5.4 Concluding remarks

Over the three years under review, the overall mathematics performance of learners was low for the five sampled schools because the average score varied between 22.32 % and 35.42 % (Table 5.1 & Table 5.3). The trend declined from 2012 to 2013 but it improved dramatically from 2013 to 2014. Nevertheless, it is noticeable that there was a substantially significant improvement from 2012 to 2014. A similar pattern is observed for the trends of mathematics achievement of SES subgroups and topics. All gaps between the mathematics achievements of learners from different socio-economic backgrounds decreased over time except the gap (between learners who are not paying fees and learners who are paying more than or equal to R 1000); the latter increased from 2012 to 2013.

In brief, the overall trend over time of different gaps decreased expectedly from 2012 to 2014. It is possible to expect a closing of gaps should the same educational process be repeated for many more years. Concerning the trends in topics, learners performed better in Paper 1 than in Paper 2 from 2012 to 2013 but this pattern was markedly reversed from 2013 to 2014 when learners performed better in Paper 2 than in Paper 1. Taking into account the comparisons considered in the period 2012 to 2014, learners definitely performed better in Paper 2 than in Paper 1.

In summary, the study objectives were investigated and the necessary feedback I wanted was extracted from the data, using descriptive statistics and exploring relevant statistical tests. The last chapter recapitulates the main outcomes. In the discussion conclusions are drawn from the study, followed by an outline of the implications, with consequent recommendations.

CHAPTER SIX

CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

6.1 Introduction

The previous chapter focussed on the presentation of the data analysis and the outcomes of the study. This chapter draws conclusions by answering the research questions. It then describes the limitations of the study, discusses findings related to the literature review; and finally presents some recommendations for further research.

6.2 Conclusions

Regarding conclusions, I relate the main research question and the subsidiary research questions to the outcomes discussed in the previous chapter. This procedure generates and summarises the findings of this thesis.

6.2.1 Do learners' achievement scores in high-stakes Grade 10 mathematics examinations improve over time when an examination-driven teaching approach is being used as intervention?

In the light of the study outcomes of Chapter Five, I can answer that mathematics achievement scores appear to be substantially improved over time when an examination-driven teaching approach is used. However, this improvement in mathematics achievement is not necessarily immediate.

In this study it is important to state that the marginal decline in the first year of the inquiry period may be justified by teachers' non-mastery of the new curriculum (CAPS) and of examination-driven teaching. Consequently, the study has also revealed the speed with which the teachers then mastered both examination-driven teaching and CAPS. Therefore, I suggest that for early efficiency and effectiveness of an examination-driven teaching programme an advanced in-service training programme regarding examination-driven teaching should be given to mathematics teachers. More generally too, a great focus on examination-driven teaching should be developed in pre-service teachers in higher-education institutions. Nevertheless, from what the overall findings have shown in the improvement over time of mathematics achievement, I recommend that mathematics teachers, educators and policy-makers seriously consider the strategy of examination-driven teaching in terms of the methodology for teaching Mathematics.

6.2.2 Are there differences in achievement over time between learners from different socio-economic backgrounds when an examination-driven teaching approach to teaching is being used?

As to the outcomes presented in Chapter Five, there are few differences in achievement over time between learners from different socio-economic backgrounds simply because the socio-economic achievement gaps become narrower while overall achievement improves at the same time. In light of this finding, I am inclined to suggest that socio-economic inequalities in mathematics achievement decrease over time when an examination-driven teaching approach is being used although this is not immediate.

6.2.3 Are there differences in achievement over time in Paper 1 and Paper 2 when an examination-driven teaching approach to teaching is being used?

Regarding the outcomes of mathematics achievement trends between different topics, over time learners appear to improve substantially in Paper 2 rather than in Paper 1, contrary to the trend at the beginning of the enquiry period. Therefore I suggest that the gap of performance in Mathematics between topics could be reduced; and even reversed when an examination-driven teaching approach is being used.

6.3 Discussion of findings and integration into the literature

In the literature of Mathematics Education, the study could have implications for the debate about examination-driven teaching – as to whether it is a good or bad approach to teaching. At first the details of findings revealed a decline in mathematics performance but improved dramatically in the later cohort when examination-driven teaching was being used. Therefore the immediate results after one year align with the argument of the opponents who argue that examination-driven teaching decreases achievement scores (Bracey, 1987). However, the later cohort results complement the argument of the proponents who believe that examination-driven teaching dramatically increases the achievement score (Popham, 1987). It is relevant to mention that the decline of achievement scores in the first year may be explained by teachers' non-mastering of examination-driven teaching and the new curriculum

(CAPS) which was introduced in 2012. Nevertheless, the definitive trend of this work confirmed the position of the proponents.

Hence I suggest that examination-driven teaching could be a catalyst for the improvement of mathematics achievement in schools. Such a statement is an attempt to generate tentative theory about the effect over time of examination-driven teaching in the quest for enhancement of mathematics achievement gains. Taking into account the literature reviewed in this study, I also suggest that the conditions stipulated by Popham (1987) have been reinforced with other conditions that can be conceptualised regarding the pertinent criticisms of Bracey (1987) and his group for the efficiency of examination-driven teaching.

In addition, the study showed a decrease over time of mathematics achievement gaps between groups of learners from different SES. Consequently, socio-economic inequalities in terms of mathematics scores are narrowed when an examination-driven teaching is used. This leans towards the position of the proponents of examination-driven teaching and contradicts the position of their opponents.

Sasman (2011) had shown that learners in NSC perform better in Paper 1 than in Paper 2. This is the opinion of many mathematics teachers and also my own experience in mathematics teaching. However, the findings of this study have shown the opposite when an examination-driven teaching was being used.

Likewise, the conceptual framework of the study leans on the cyclical process of Mandinach and Jackson (2012) in terms of ways in which to increase students' achievement gains: instruction, assessment, and data inquiry. The study extended this cyclical process by conceptualising two similar cyclical processes: The first is that an examination-driven teaching strategy may be used by the teacher and thereafter the teacher sets a high-stakes examination. Then, the outcome scores from the high-stakes examination are used to diagnose the weaknesses of learners by tracking performances. The learners' weaknesses inspire the teacher to develop an examination-driven teaching. The second is that a high-stakes examination is set after the use of an examination-driven teaching strategy. The outcome scores from high-stakes examinations are tracked according to differential educational achievement against the socio-economic background of learners or on topics. Such a diagnosis may inspire the teacher to design teaching strategies for individual instruction or instruction per group in order to remedy learners' weaknesses, so as to conceive of examination-driven teaching. It is envisaged that the study findings will help to inform the implementation of examination-driven teaching in the sampled schools for the subsequent years, which will consequently result in the improvement of learners' achievement scores. Then, cyclically, a continuous process over time (cohort after cohort) should maximise the expected improvement of achievement scores. Thus, this conceptual framework can maximise learners' performance over time with cyclical repetitions of examination-driven teaching on successive cohorts.

Regarding the methodology, the study may be considered as research conducted to detect the decline or improvement over time of performance when an examination-driven teaching is being used. It has implications for an application of the rigour of Rasch measurement in particular and item responses theory in general. Therefore, educational measurement that is a concern for educators, researchers and policy-makers in the search of strategies to enhance achievement in school mathematics finds value in the form of empirical procedures.

6.4 Recommendations for further research

Recommendations are based on the conclusions and discussion of the study. One clear direction for future research would be to ameliorate the main limitations of the study by extending the sample context and the experimental time. Therefore, this kind of research could be undertaken in the context of the whole province or the whole country in order to obtain a much more representative picture of the research concept. In addition, as the Department of Basic Education is still seeking strategies for enhancing the quality of education in general and of mathematics in particular, education research could be conducted to determine the impact of examination-driven teaching as a strategy in the longer term i.e. (five years or more).

Furthermore, scholars can also undertake research to improve the conditions for an examination-driven teaching approach that can improve achievement scores as early as possible (for example, after one year). I also recommend that other scholars conduct research in order to determine whether the socio-economic background of learners is differentiated according to mathematics topics when an examination-driven teaching strategy is being employed. Researchers may consult the methodology of this study for implementation in mathematics education or others fields of study. Concerning Rasch measurement, the item difficulty analysis that was done has given examiners as well as policy makers an idea as to how to set mathematics assessment which can ascertain the measure of learners' performance in Grade 10. The items that were found to be good may be included in the item bank of Grade 10 mathematics examinations. However, researchers could examine why the items that were excluded from analysis do not fit the Rasch model criteria in terms of Rasch measures or differential item functional contrasts.

6.5 Concluding remarks

We currently live in an economic crisis in the world that may be partly underpinned by the actual mathematics education crisis. Therefore the upliftment of performance in school mathematics remains a concern. The current movement of democracy in many nations constitutes attempts at reducing socio-economic inequalities even in mathematics schooling. This thesis suggests that examination-driven teaching is a strategy which can aptly address these persistent challenges and can reduce or even close the performance gap between different mathematics topics. In light of the findings generated by this study, I strongly believe that such an approach can promote quality and equity in mathematics education.

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APPENDICES

Appendix A

Questions paper of high-stakes Grade 10 mathematics examinations

Appendix A1: 2012 questions paper
MATHEMATICS PAPER 1

TIME: 2 HOURS

MARKS: 100

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

This question paper consists of 8 questions.
Answer ALL the questions.
Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
Answers only will not necessarily be awarded full marks.
You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
If necessary, round answers off to TWO decimal places, unless stated otherwise.
Diagrams are NOT necessarily drawn to scale.
Number the answers correctly according to the numbering system used in this question paper.
Write legibly and present your work neatly.

QUESTION 1

1.1 Consider the expression $\sqrt{\frac{12}{x+1}}$

1.1.1 Write down one value of x that will make the expression a rational number (1)

1.1.2 Write down one value of x that will make the expression an irrational rational number (1)

	1.1.3	Write down one value of x that will make the expression a non- real number rational number	(1)
	1.1.4	Write down one value of x that will make the expression undefined.	(1)
1.2		Simplify the following	
	1.2.1	–3 + 5	(1)
	1.2.1	$\frac{1}{2}+\frac{4}{8}$	(1)
1.3		Determine the following products	
	1.3.1	$(x+5)^2$	(1)
	1.3.2	$(2-a)(2+a)$	(1)
1.4		Factorise the following expressions	
	1.4.1	x^2-5x+6	(1)
	1.4.2	m^2-r^2	(1)
			[10]

QUESTION 2

2.1	Determine the following product: $(3x-5y)^2+(2-x)(3+y)$	(3)
2.2	Factorise the following expressions fully	
2.2.1	x^3-x^2-5x+5	(3)
2.2.2	$x^3-y^3-3x+3y$	(4)
2.3	Show that $\frac{x}{x+y}-\frac{x^2+y^2}{y^2-x^2}=\frac{2x+y}{x+y}$	(5)
		[15]

QUESTION 3

3.1 Simplify: $\dfrac{27x^2y^2 \times 36x^5y^7}{12x^4y^9}$ (4)

3.2 Solve the following equations

3.2.1 $3x^2 + 5x = 12$ (4)

3.2.2 $4^{x-3} = 8^{x+2}$ (4)

3.3 Solve the following system of equations

$x + 2y = 5$ (4)

$2x - 5y = -8$

3.4 Solve for x: $3(x + 4) < 5x - 1$ (3)

[19]

Question 4

4.1 Are the following number patterns linear or not. Give a reason for your answer

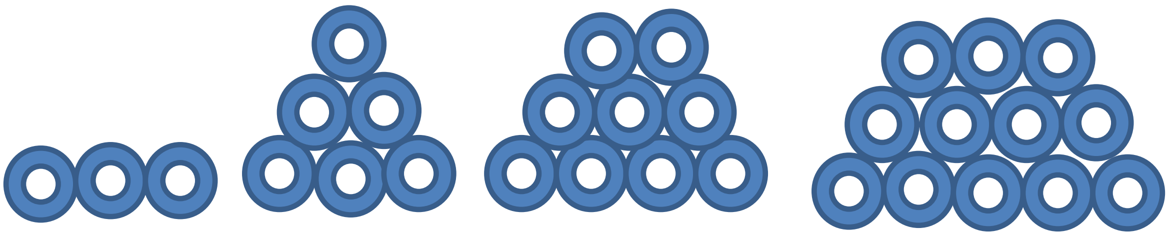
4.1.1 $-7;\ -3;\ 1;\ 5;\ldots$ (2)

4.1.2 2; 4; 8; 16; ... (2)

4.2 Determine the general term of the number pattern: (2)

$-8;\ -3;\ 2;\ 7;\ldots$

4.3 Tyres in a factory were set according to the following pattern to help the quality control staff to count them.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

4.3.1 How many tyres will be in the sixth pattern if the pattern continues in the same way as above? (1)

4.3.2 Determine the number of tyres in the nth pattern. (1)

4.3.3 Calculate the number of tyres in the 20th pattern. (1)

4.3.4 In which pattern will there be 45 tyres? (1)

[10]

QUESTION 5

5.1 Determine by doing the relevant calculations which is the better investment option:

Option A: R8 000 invested at 7,5 % per annum compound interest for 5 years

Option B: R8 000 invested at 8,5% per annum simple interest for 5 years (5)

5.2 Calculate how much a scooter costing R 11 995,00 in 2011 will cost in 5 years' time if the rate of inflation over that period in 6,3% per annum (2)

5.3 Sharon buys a fridge costing R 8995,00 on hire purchase. He pays a deposit of 15%. The balance is paid off over 24 months. The shop charges 23% per annum, simple interest. Calculate her monthly repayments. (3)

[10]

QUESTION 6

6.1 Consider the functions $g(x) = \frac{6}{x}$ $and\ f(x) = 3^x$

Determine the following values

6.1.1 $f(-1)$ (1)

6.1.2 $x \text{ if } g(x) = 2$ (2)

6.2 6.2.2 Set up table of values for each function in 6.1.
choose values for *x* from -3 to 3 (2)

6.2.2 Use the table of values to draw a sketch graph of each function where $x \in \mathbb{R}$ (4)

6.3.3 How does the graph of $h(x) = \frac{6}{x} + 6$ differ from the graph of $g(x) = \frac{6}{x}$ (2)

[11]

QUESTION 7

7.1 Consider the function $f(x) = -x^2 + 9$

7.1.1 Calculate the *x*-intercepts of *f* (2)

7.1.2 Write down the coordinates of the turning points of *f* (2)

7.2 Draw a sketch graph of $f(x) = -x^2 + 9$. Show all the intercepts with the axes (3)

7.3 For which values of x will $f(x) \geq 0$ (2)

7.4 For which values of x will $f(x)$ be increasing as *x* increases (2)

7.4 Write down the range of *f* (2)

[13]

QUESTION 8

8.1 A fair die is thrown once

8.1.1 Write down the sample space (1)

8.1.2 Let A be the event: a number greater than 2 is obtained. List all the outcomes for event A (1)

8.1.3 Determine P(A) (1)

8.2 Let X and Y be mutually exclusive events.
Determine P(X) if P(Y) =0,34 and P(X or Y)= 0.67 (2)

8.3		There are 88 boys in a Grade 10 at Promotion High School. The following data emerged from a survey on participation in sport. 12 boys did not play any sport 65 boys plays soccer 48 boys plays rugby Let the boys who plays both rugby and soccer be *x*	
	8.3.1	Represent the data in a Venn diagram	(4)
	8.3.2	Hence calculate the value of *x*	(2)
	8.3.3	Now determine the probability that a randomly chosen boy plays soccer only	(1)
			[12]

MATHEMATICS PAPER 2

TIME: 2 HOURS

MARKS: 100

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 8 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round answers off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this
9. question paper.
10. Write legibly and present your work neatly.

QUESTION 1

1.1 The following data represents the number of runs scored by a batsman named John during the past T20 season

12; 10; 22; 40; 39; 30 46; 32; 54; 50; 70; 44, 60

1.1.1 Which one of the following two box-and whisker plots represents John's data: (Give a reason for your answer) (4)

Diagram 1

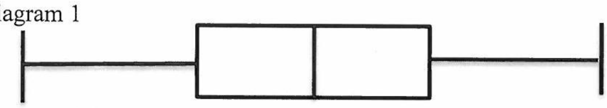
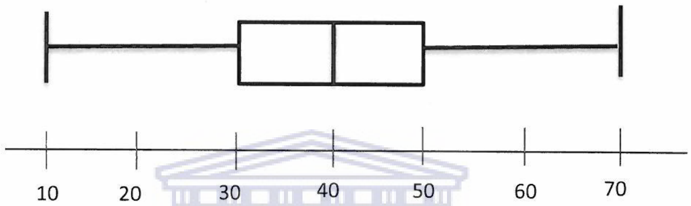


Diagram 2



1.1.2 Write down the inter-quartile range for John's scores (2)

1.1.3 What percentage of John's runs is represented by the inter-quartile range. (1)

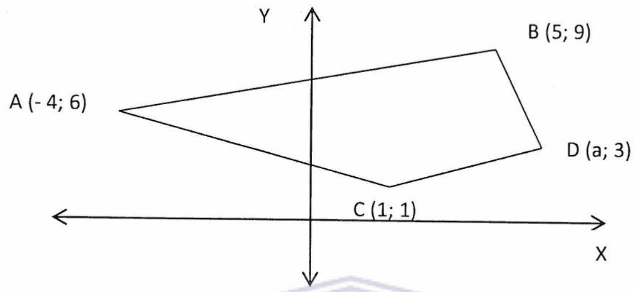
1.1.4 In another player in the team, named Lance, scored runs represented by the remaining box-and whisker plot, explain who the better player is. Give a reason for your answer. (2)

1.2 A survey of 35 Grade 10 leaners was done to determine the time they spent in playing computer games. The frequency table below is a record of their responses

Minutes	Frequency
$5 \leq x < 10$	5
$10 \leq x < 15$	6
$15 \leq x < 20$	14
$20 \leq x < 25$	8
$25 \leq x < 30$	2

1.2.1	Calculate the estimated mean time	(3)
1.2.2	In which interval will the mean lie?	(2)
1.2.3	Write down the model interval	(1)
		[17]
		[15]

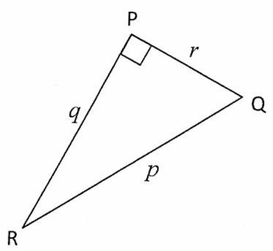
QUESTION 2



2.1	Calculate the gradient of AB.	(2)
2.2	Given that $AB \perp BD$, Determine the value of a.	(4)
1.3	Assuming that $a = 7$, determine the gradient of line DC.	(2)
2.4	Explain why AB // DC.	(1)
2.5	E(x; y) is the midpoint of line AB, determine the values for x and y.	(3)
2.6	Calculate the length of BD.	(3)
2.7	Show that the area of $\Delta BCD = 20\,sq.units$ if $BC = 8{,}94cm$.	(3)
		[18]

QUESTION 3

3.1 Refer to the diagram shown below and answer the questions that follow in terms of p, q and r.



3.1.1 $\sin \hat{R}$ (2)

3.1.2 $\cos \hat{Q}$ (2)

3.1.3 $\tan(90^o - \hat{R})$ (2)

3.2 If $17\cos\theta = 8$, and$\theta < 90^o$, evaluate the following with the aid of a sketch.

3.2.1 $\sin\theta$ (3)

3.2.2 $34.\sec\theta.\ \tan\theta$ (3)

3.3 Solve for θ, correct to 2 decimal places, if $0° \leq \theta \leq 90°$.

3.3.1) $\sin\theta = 0{,}8$ (2)

3.3.2) $3\sin\theta = 1{,}2$ (3)

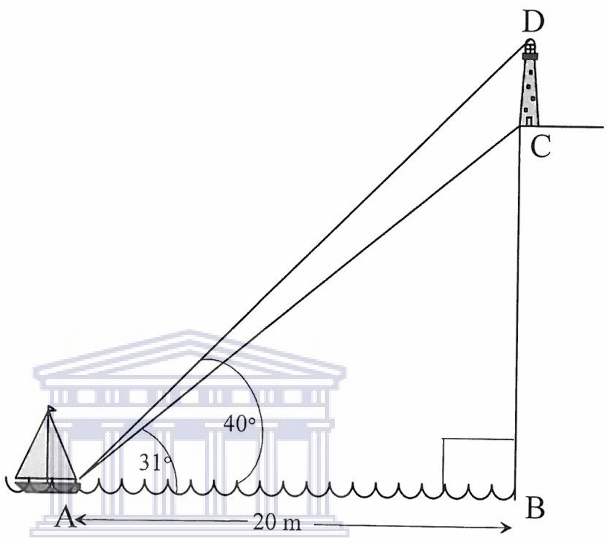
3.3.3 $\frac{1}{2}\cos 2\theta = 0{,}3$ (3)

[20]

Question 4

A person sits on a boat 20 m out to sea from the base of a cliff (B).

He measures the angle of elevation of the top of the cliff (C) to be 31°, and to the top of the lighthouse (D) on top of the cliff to be 40°.



4.1 Calculate the height of the cliff (BC). (3)

4.2 Calculate the height o the lighthouse (CD). (4)

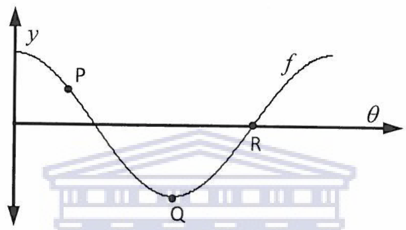
[7]

Question 5

5.1.1 On the **Answer Sheet** provided, sketch the graph of $y = -\sin 3x$ where $x \in [0°;180°]$, showing the co-ordinates of all turning points and intercepts with the axes. (4)

5.1.2 How will the graph of $y = sin3x$ differ from the graph of $y = 3\ sin\,x$ (4)

5.2) The diagram below show a sketch graph of the curve defined by $y = 2\cos\theta$ for $0^o \leq \theta \leq 360^o$.



Give the values of the letters *a, b, c, d, e* , the missing co-ordinates of the following points, labelled on the curve above.

P (60^o ; a)

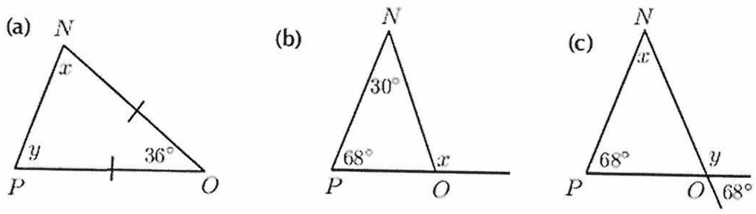
Q (b ; c) (Q is a turning point of f)

R (d ; e) (R is an intercept with the horizontal axis) (5)

[9]

QUESTION 6

6.1. Write down the values of x and y in each of the following figures.

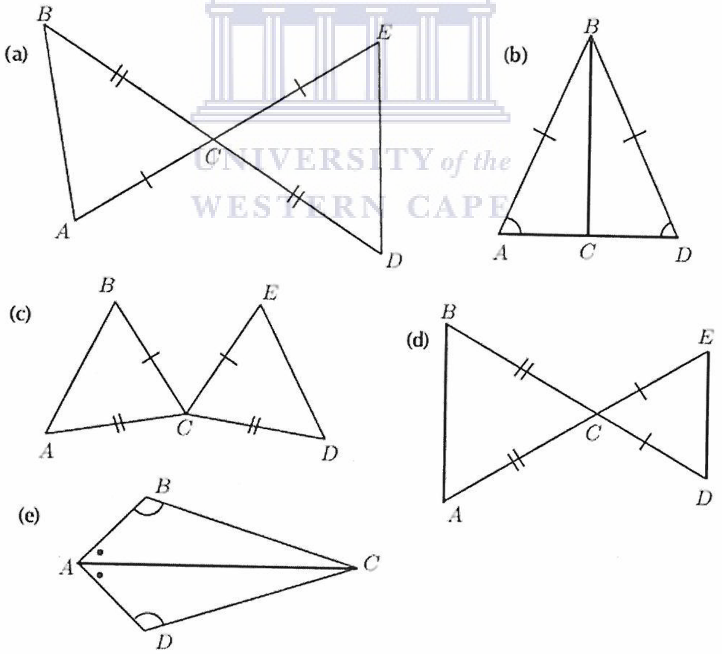


(5)

6.2

O

State whether the pair of triangles in each diagram are congruent or not. If they are congruent state the case of congruency. If not, give a reason why you say so.



(10)

7

[15]

Question 7

Complete the following table on your answer sheet by writing yes or no in the blank cell

Quadrilateral	Diagonals bisect	Diagonals perpendicular	Diagonals the same length	A pair of opposite sides parallel
Kite				
Rhombus				
Square				

[12]

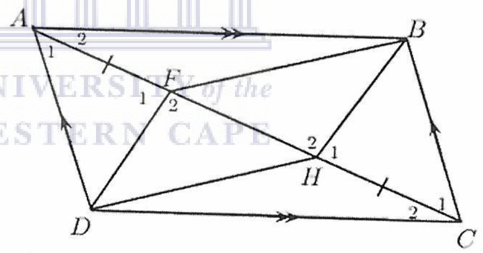
Question 8

$ABCD$ is a parallelogram with diagonal AC.
Given that $AF = HC$, show that:

(a) $\triangle AFD \equiv \triangle CHB$

(b) $DF \parallel HB$

(c) $DFBH$ is a parallelogram



[10]

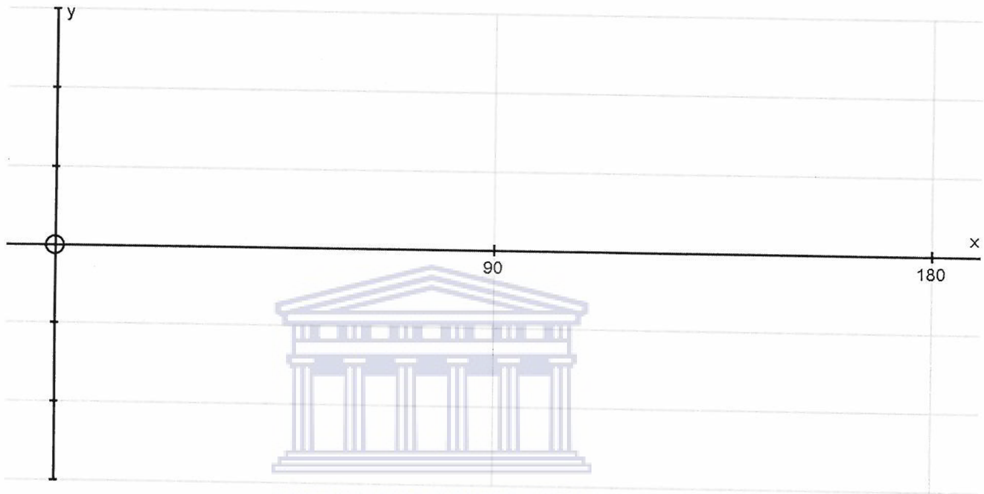
Diagram sheet

Write your Name and Class Here

Name:

Class

Question 5.1



Question 7

Complete the following table on your answer sheet by writing yes or no in the blank cell

Quadrilateral	Diagonals bisect	Diagonals perpendicular	Diagonals the same length	A pair of opposite sides parallel
Kite				
Rhombus				
Square				

Appendix A2: 2013 questions paper

LEDIMTALI Grade 10 common Mathematics P1 examination (2013)

MATHEMATICS PAPER I

TIME: 2 HOURS

MARKS: 100

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

1. This question paper consists of 8 questions.
2. Answer ALL the questions
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round answers off to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write legibly and present your work neatly.

QUESTION 1

1.1 Consider the expression: $\sqrt{\frac{8}{5-x}}$, for $x\ an\ integer$

1.1.1 Write down one value of x that will make the expression a rational number. (1)

1.1.2 Write down one value of x that will make the expression an irrational number. (1)

1.1.3 Write down one value of x that will make the expression undefined. (1)

1.1.4 Write down one value of x that will make the expression a non-real number. (1)

1.2 Simplify the following:

1.2.1 $-4-6$ (1)

1.2.2 $5\frac{1}{2}-\frac{3}{6}$ (1)

1.3 Determine the following products:

1.3.1 $(y-2)^2$ (1)

1.3.2 $(x^2-3)(x^2+3)$ (1)

1.4 Factorise the following expressions:

1.4.1 x^2-x-2 (1)

1.4.2 $25x^2-9y^2$ (1)

[10]

QUESTION 2

2.1 Determine the following product:

$(x+3y)^2-(x+2)(y+3)$ (3)

2.2 Factorise the following expressions fully:

2.2.1 $3y^3-6y^2+4y-8$ (3)

2.2.2 a^3+b^3-a-b (4)

2.3 Simplify the following expression fully:

$\frac{5(x-1)}{6}+\frac{x-3}{3}-\frac{x-1}{2}$ (5)

[15]

QUESTION 3

3.1 Simplify: $\frac{5p^4q^6}{p^{-8}q^{-1}}\div\frac{2p^2q^4}{p^{-4}q}$ (4)

3.2 Solve the following equations:

3.2.1 $9x^2=6-3x$ (4)

3.2.2 $3^{x-2}=\frac{1}{9^x}$ (4)

3.3 Solve the following system of equations:

$x + 5y = 11 \quad and \quad 2x - 2y = 10$ (4)

3.4 Solve for x: $2(x - 5) > -3x + 5$ (3)

[19]

QUESTION 4

4.1 Are the following number patterns linear or not. Give a reason for your answer:

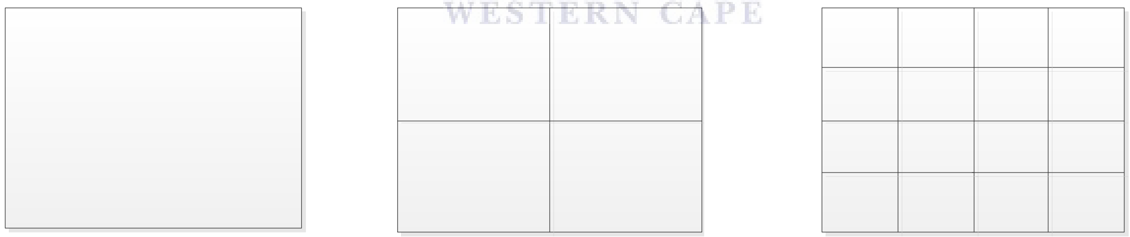
4.1.1 $15; 2; -1; -4; -7; \ldots$ (2)

4.1.2 $3; 6; 12; 24; \ldots$ (2)

4.2 Determine the general term of the number pattern:

$8; 4; 0; -4$ (2)

4.3



4.3.1 How many tiles will be in the sixth pattern if the pattern continues in the same way as above. (1)

4.3.2 Determine the number of tiles in the *n-th* pattern. (1)

4.3.3 After which pattern number will the number of tiles exceed 5000? (1)

4.3.4 In which pattern will there be 256 tiles? (1)

[10]

QUESTION 5

5.1 Consider the functions $g(x) = \frac{8}{x}$ and $f(x) = 2^x$

Determine the following values:

5.1.1 $f(-1)$ (1)

5.1.2 $x\ if\ g(x) = 4$ (2)

5.1.3 Set up a table of values for each function in 5.1. choose values from -4 to 4. (2)

5.1.4 Use the table of values to draw a sketch graph of each function where $x \in \mathbb{R}$. (4)

5.1.5 How does the graph of $h(x) = \frac{8}{x} - 4$ differ from the graph of $g(x)$ (2)

[11]

QUESTION 6

6.1 Consider the function $f(x) = x^2 - 4$

6.1.1 Calculate the $x - intercepts\ of\ f$ (2)

6.1.2 Write down the coordinates of the turning points of f. (2)

6.1.3 Draw a sketch graph of $f(x) = x^2 - 4$. Show all the intercepts with the axes. (3)

6.1.4 For which values of $x\ will\ f(x) \geq 0$. (2)

6.1.5 For which values of $x\ will\ f(x)$ be increasing as x increases? (2)

6.1.6 Write down the range of f. (2)

[13]

QUESTION 7

7.1 Mrs Japtha bought a flat in 2001 for R86 000. The city council valued her flat in 2009 for rates purposes and gave her a valuation of R292 000.

7.1.1 By how much has her flat increased in value? (1)

7.1.2 Express this as a simple growth percentage per annum. (2)

7.1.3 From 2009 to 2012, the value of Mrs Japhta's house increased at a simple growth rate of 6% per annum. Calculate the value of the house when she sold it in 2012. (3)

7.2 John invests an amount of R10 000 for four years in an account that pays 8% interest per annum. How much money will he have at the end of the investment period?

(4)

[10]

QUESTION 8

8.1 In a class of 30 learners, 15 are tall, 12 are of medium height and 3 are short. Calculate the probability that a learner chosen at random will be:

8.1.1 Tall (1)

8.1.2 Not short (1)

8.1.3 Not tall (1)

8.2 A poll was conducted in 68 households in a suburb. Every house had a burglar alarm or an armed response company or both. 60 houses have burglar alarms and 40 houses have an armed response company.

8.2.1 Draw a Venn diagram to illustrate the given data. (4)

8.2.2 How many households have both alarm and an armed response company? (2)

8.2.3 Use your Venn diagram to calculate the probability that a household chosen at random will have the following:

(a) An alarm but not an armed response company. (1)
(b) An alarm and an armed response company. (1)
(c) Neither an alarm nor an armed response company. (1)

[12]

LEDIMTALI Grade 10 common Mathematics P2 examination (2013)

MATHEMATICS PAPER 2 (2013)

TIME: 2 HOURS

MARKS: 100

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions:

10. This question paper consists of 8 questions.
11. Answer ALL the questions
12. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
13. Answers only will not necessarily be awarded full marks.
14. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
15. If necessary, round answers off to TWO decimal places, unless stated otherwise.
16. Diagrams are NOT necessarily drawn to scale.
17. Number the answers correctly according to the numbering system used in this question paper.
18. Write legibly and present your work neatly.

QUESTION 1

Two hundred teenagers had to answer the following question in a survey:

What type of music do you like?

The teenagers responses were as follows:

160 said they liked hip-hop (H).

140 said they liked kwaito. (K)

108 said they liked hip-hop and kwaito (H) and (K).

1.1 Draw a Venn diagram which illustrates the above information. Use the Venn diagram to calculate the probability (in simplest form) that a teenager, randomly chosen, would like the following type of music. (4)

1.1.1 Kwaito only (2)

1.1.2 Kwaito or hip-hop (3)

` 1.1.3 None of the two (2)

[11]

QUESTION 2

The marks of 24 learners in a Grade 10 class at a particular school are given:

10 48 74 82 33 54 18 46 66 74 21 42 74 57 64 42 52 82 24 58 74 76 80 94

Determine the following:

2.1 the minimum value (1)

2.2 the maximum value (1)

2.3 the median (1)

2.4 the lower quartile (1)

2.4 the upper quartile (1)

2.5 the mode (1)

2.6 the interquartile range (1)

2.7 Draw a box and whisker diagram using the information above (3)

2.8 Use the given data to complete the frequency table given below: (6)

Marks Obtained(m)	Frequency *(f)*
$0 \leq m \leq 20$	
$21 \leq m \leq 40$	
$41 \leq m \leq 40$	
$41 \leq m \leq 60$	
$61 \leq m \leq 80$	
$81 \leq m \leq 100$	

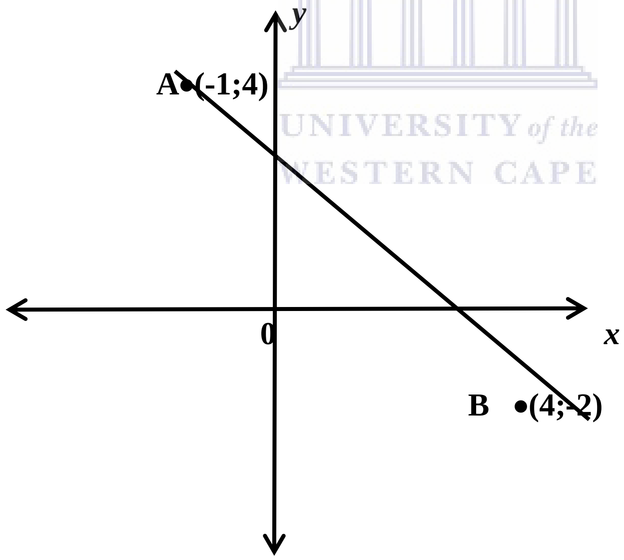
2.8.1 Write down the modal interval (1)

2.8.2 Calculate the estimated mean mark. (3)

[20]

QUESTION 3

3.1

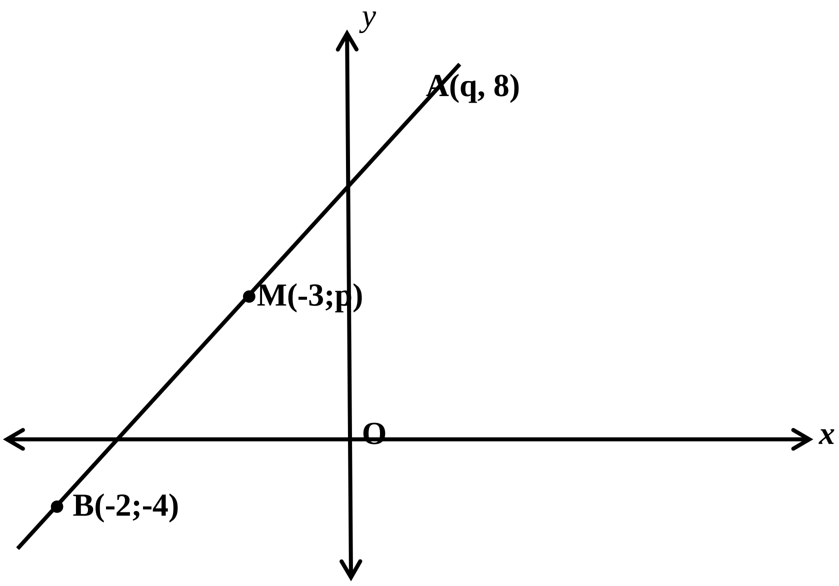


The sketch above shows the graph of a line passing through the points A(-1;4) and B(4;2).

Calculate the distance of the line segment AB to 2 decimal digits. (4)

3.2 Find the midpoint of the line segment; (2)

3.3

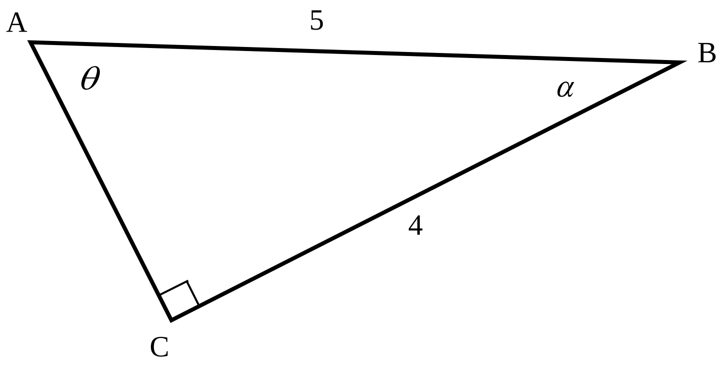


In the figure above, M(-3;*p*) is the midpoint of the line passing through A(*q*;8) and B(-2;-4). Determine the values of *p* and *q*. (6)

[12]

QUESTION 4

4.1 Given triangle ABC with angle $\hat{C} = 90°$, $C\hat{A}B = \theta$, $A\hat{B}C = \alpha$



a

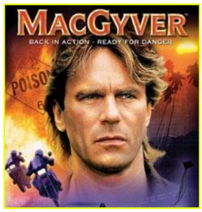
Determine the value of the following.
Show ALL the calculations:

4.1.1 $\cos\theta$ (3)

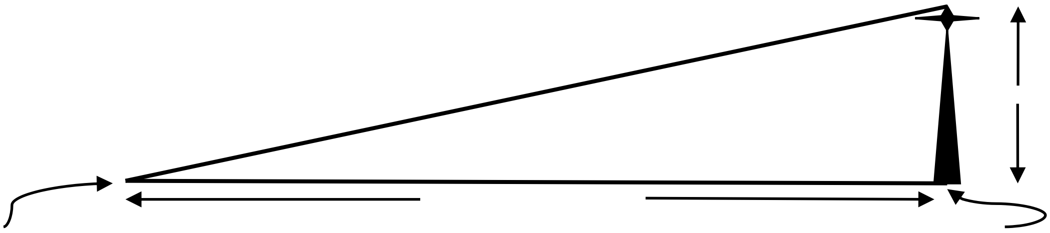
4.1.2 $1 + \tan^2\theta$ (3)

4.1.3 $\dfrac{\cos\alpha}{\sin\alpha}$ (3)

4.3 MacGyver is stranded at sea. He notices a lighthouse on the distant shoreline. MacGyver estimates that the top of the lighthouse is at an angle of $36°$ from his current position. If the lighthouse is 80 m high, how far must MacGyver swim till he reaches the lighthouse?

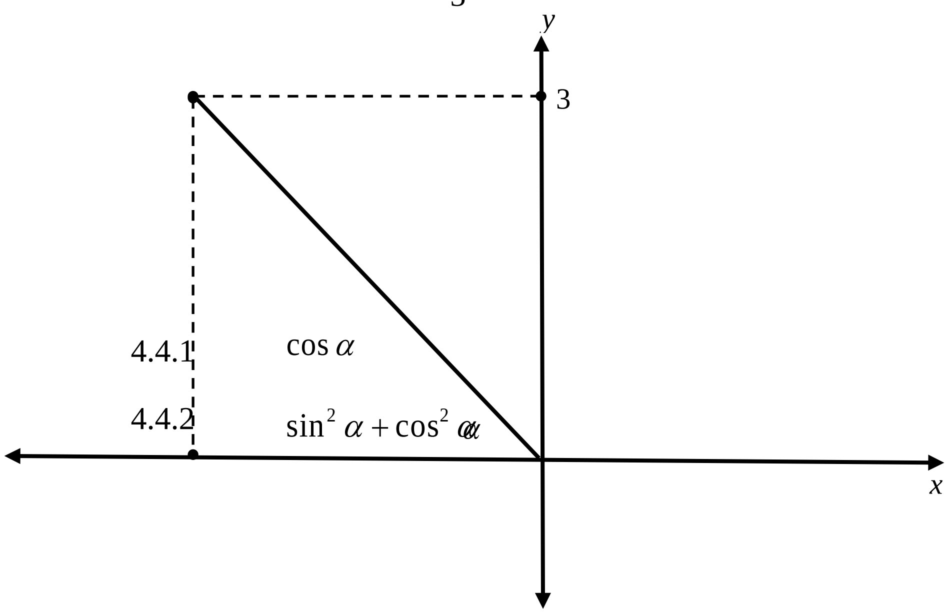


Use the diagram above to calculate your answer (3)



(3)

4.4 Determine the following if $\sin\alpha = \dfrac{3}{5}$ and $90° \leq \alpha \leq 180°$



4.4.1 $\cos\alpha$

4.4.2 $\sin^2\alpha + \cos^2\alpha$

QUESTION 5

5.1 Use the function $f(x) = \sin x + 1$ to calculate the values represented by letters:
a, b, c and d in the following table.
(4)

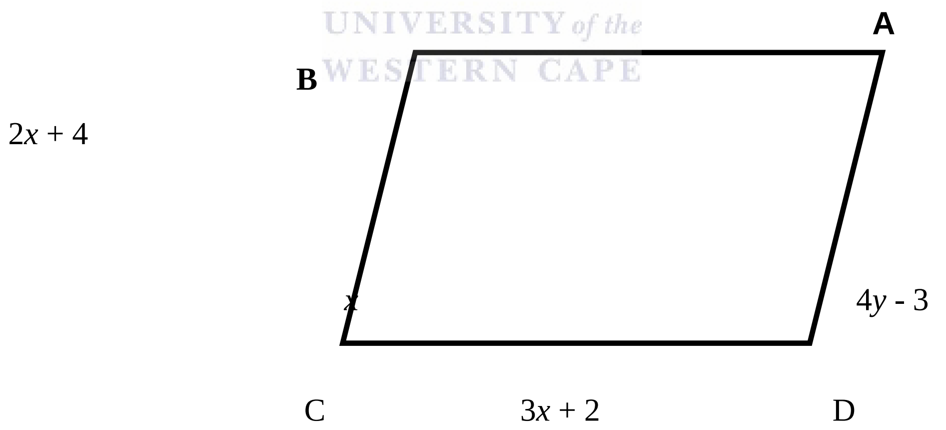
x^0	0^0	45^0	90^0	135^0	180^0	225^0	270^0	315^0	360^0
$y = f(x)$	**a**	1.71	**B**	1.71	**c**	0.29	**d**	0.29	1

5.2 Use the ANNEXURE to sketch the graph of $f(x) = \sin\theta + 1$ for $\theta \in [0°;360°]$

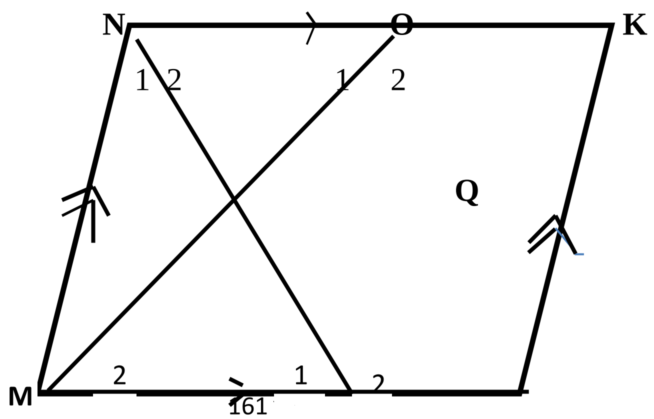
QUESTION 6

6.1 Refer to the following quadrilateral ABCD and find the values of x and y if ABCD is a parallelogram.

(4)



6.2



P **L**

The above figure shows a paralleogram KLMN with $\angle M$ and $\angle N$ bisected by MO and NP. respectively. MO and NP meet at Q.

Prove that (i) MN $\perp$ NP

(4)

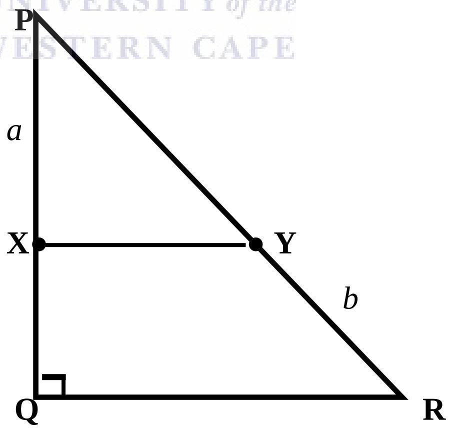
(ii) MNOP is a rhombus.

(6)

[14]

<u>**QUESTION 7**</u>

In ΔPQR below, $\angle Q = 90^0$, X and Y are the midpoints of sides PQ and PR respectively. QR = 24cm and XQ = 5cm.



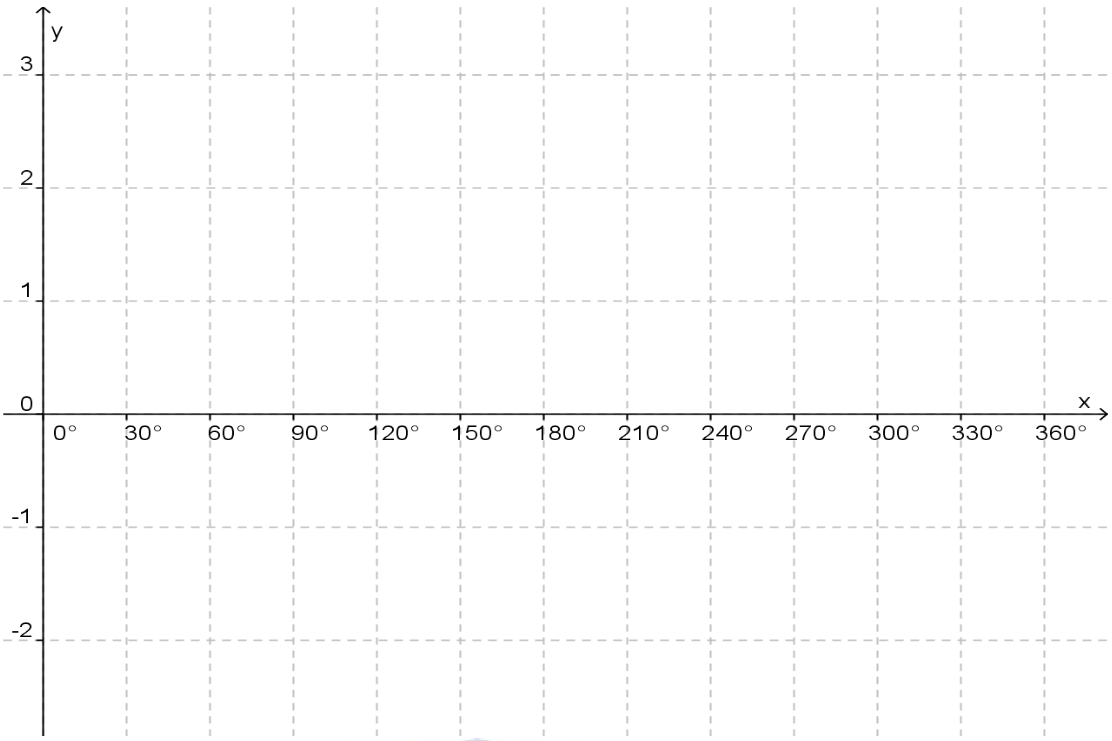
Calculate the values of:

7.1 *a* (1)

7.2 b (4)

7.3 XY **(2)**

[7]



Appendix A3: 2014 questions paper

Question Paper 1 (2014)

DRAFT GRADE 10 PAPER ONE: Draft 3

INSTRUCTIONS

Read the following instructions carefully before answering the questions.

1. This question paper consists of 7 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal numbers, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in the question paper.
9. Write neatly and legibly.

QUESTION 1

1.1 Determine, **without the use of a calculator,** between which two consecutive integers $\sqrt{37}$ lies. (2)

1.2 Express $0,\dot{4}\dot{5}$ in the form $\frac{a}{b}$ with *a* and *b* both Natural numbers. (3)

1.3 Simplify the following expression fully:

$(3y+5)^2-(3y+5)y+2y^2$ (5)

1.4 Given the expression $\dfrac{6m^2-m-2}{2m-1}$:

1.4.1 For which value of m is the expression undefined? (1)

1.4.2 Simplify the expression. (3)

1.5 Factorise the following expressions fully:

1.5.1 $10a^2-7ab-12b^2$ (2)

1.5.2 $2c^2-cd-2c+d$ (3)

[19]

QUESTION 2

2.1 Determine, **without the use of a calculator,** the value of *x* in each of the following:

2.1.1 $x^2-2(2x+6)=0$ (3)

2.1.2 $2-3x\leq-7$ (3)

2.1.3 $160=5x^{\frac{5}{3}}$ (3)

2.1.4 $x=\dfrac{-b+\sqrt{b^2-4ac}}{2a}$ for $a=1, b=1$ and $c=-6$. (3)

2.2 Solve for *a* and *b* simultaneously if:

$3b+a=4$

$3b-2a=13$ (6)

[18]

QUESTION 3

3.1 $4; 9; 14; ....$ are the first three terms of a linear number expression.

3.1.1 If the linear number expression continues in this way, write down the values of the next three terms. (3)

3.1.2 Determine the formula for T_p, the general term of the sequence. (2)

3.1.3 Determine which term of the sequence has a value of 119. (3)

3.2 Determine the value of the 10th term for the number pattern of the form:

$2; 6; 18; 54; ......$ (3)

[11]

QUESTION 4

4.1 Petrus has saved the amount of R6 500. The bank pays a compound interest rate of 6% p.a. Calculate the amount Petrus will receive if he withdraws the money after 36 months. (4)

4.2 A family decides to buy a bicycle to cut down on travelling costs. The following advertisement appeared in a local newspaper:

Purchase Price	*R8 000*
Required deposit	*10% of Purchase Price*
Loan term	*Only 24 months, at 9% p.a. simple interest*

4.2.1 Calculate the required deposit to be paid. (1)

4.2.2 Calculate the monthly amount that a person has to budget for in order to pay for the bicycle. (6)

4.2.3 How much interest will be paid for the full term of the loan period? (1)

4.3 Use the following given information to answer the question that follows:

1 ounce = 28,35 g

$1 = R10,62

Calculate the rand value of a 1kg gold bar, if 1 once of gold is worth $1 025,10. (4)

[16]

QUESTION 5

5.1 State which of the following set(s) of events is mutually exclusive:

A Event 1: The learners in Grade 8 in the chess team

Event 2: The learners in Grade 8 in the soccer team

B Event 1: The learners who take mathematics in Grade 10

Event 2: The learners who take mathematical literacy in Grade 10

C Event 1: The learners who take mathematics in Grade 11

Event 2: The learners who Life Sciences in Grade 11

(1)

5.2 Out of a Grade 8 group of 100 learners in total, 70 learners play sport and 60 belong to a society. Forty five of the learners play a sport and belong to a society.

5.2.1 Draw a Venn diagram to represent the above information. (4)

5.2.2 Determine the numbers of learners that:

5.2.2.1 Play sport, but do not belong to a society. (1)

5.2.2.2 Belongs to no society nor plays a sport? (2)

[8]

QUESTION 6

Given: $f(x)=\dfrac{4}{x}+2$ and $g(x)=-x-3$

6.1 Sketch the graphs of *f* and *g* on the same set of axes. (4)

6.2 Write down the equations of the asymptotes of *f*. (2)

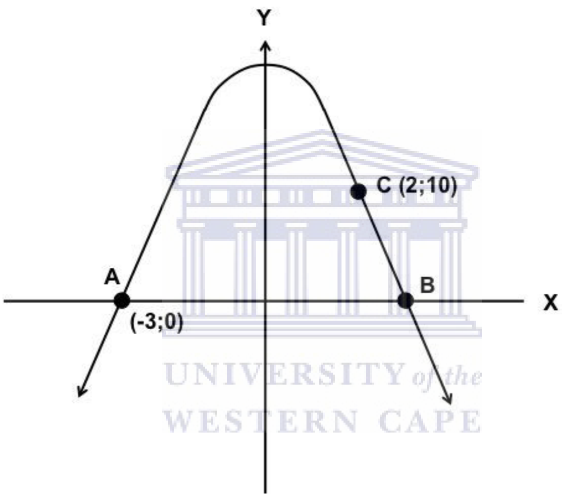
6.3 Solve for x if $f(x) = g(x)$. (6)

6.4 Determine the x-intercept of *m* if $m(x) = -3g(x)$. (3)

[15]

QUESTION 7

The graph of $f(x) = ax^2 + q$ is sketched below. Points $A(-3;0)$ and $C(2;10)$ lie on the graph of *f*. Points A and B are x-intercepts of *f*.



7.1 Write down the coordinates of B. (1)

7.2 Show that the equation of *f* is given by $f(x) = -2x^2 + 18$ (4)

7.3 Write down the range of *f*. (2)

7.4 Determine the coordinates of the turning of the equation of $p(x) = -f(x) + 18$. (3)

7.5 Determine the equation of an exponential function, $g(x) = a^x - 8$, which passes through point B. (3)

[13]

LEDIMTALI

GRADE 10

MATHEMATICS
PAPER 2

NOVEMBER 2014

MARKS: 100

TIME: 2 hours

**This paper consists of 9 pages
and a
Diagram sheet**

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions. Place your name on the diagram sheet and hand it in.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
5. Answers only will not necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Write neatly and legibly.

QUESTION 1

The Grade 10 average for all the subjects including the optional ones are listed below:

SUBJECT	ENG	AFR	ISIXHOSA	MATH	MATH LIT	PHYS SCI	LIFE SCI	GEOGS	ACC	BUS STUDIES	ECONOMICS	HISTORY	LIFE ORIEN
AVE %	70	62	66	52	78	56	64	67	72	54	58	76	60

1.1 Draw a box and whisker diagram for the above data using the DIAGRAM SHEET. (6)

1.2 Calculate the range and inter-quartile range. (2)

[8]

QUESTION 2

The progress in Mondre's Mathematics class has been improving since June. His latest mark is 89, here are the rest of the class' test marks :

10 48 74 82 33 54 18 46 66 74 74 94
21 42 74 57 64 42 52 82 24 58 64 80

2.1. How many learners are there in the class? (1)

2.2. Calculate the mean of the marks obtained. (2)

2.3. Complete the following table using the data above on the DIAGRAM SHEET:

Marks obtained (m)	Frequency
$0 \leq m < 20$	2
$20 \leq m < 40$	2
$40 \leq m < 60$	8
$60 \leq m < 80$	8
$80 \leq m \leq 100$	3

(5)

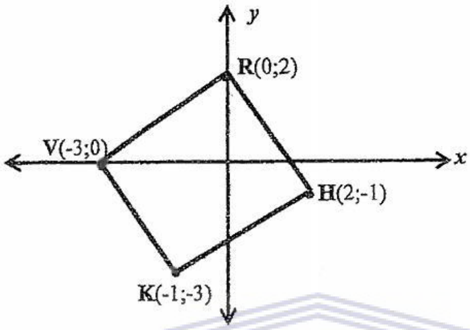
2.4 Represent this data in a histogram on the diagram sheet. (5)

2.5. Draw a frequency polygon on top of the histogram. (4)

[12]

QUESTION 3

VRHK is a quadrilateral with vertices V(-3;0); R(0;2); H(2;-1) and K(-1;-3).



3.1 Determine the coordinates of D, the midpoint of VH. (2)

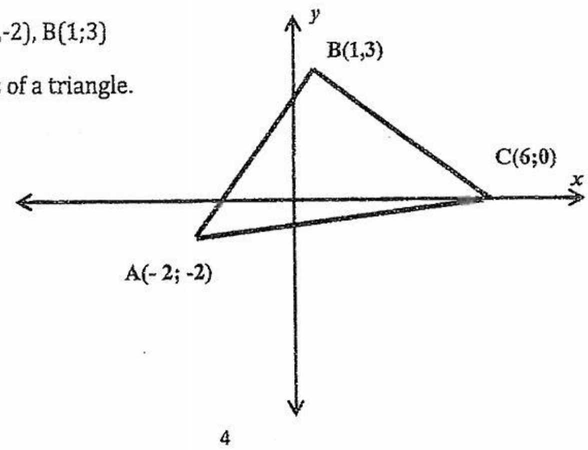
3.2 Show that VH and RK bisect each other. (3)

3.3 Prove that $V\hat{R}H = 90°$ (4)

[9]

QUESTION 4

In the diagram below, A (-2,-2), B(1;3) and C(6;0) are the vertices of a triangle.



4.1 Determine the length of AB and BC (4)

4.2 Determine the type of figure you have by determining the length of AC (5)

4.3 Find the gradients of BC and AB. Now determine the type of figure you have. (5)

4.4 Determine the equation of AC. (3)

[17]

QUESTION 5

The points A(-3;1), B(2;-5) and C(1, p) are collinear. Determine the value of p.

[4]

QUESTION 6

6.1 *If* $5\tan\theta = 12$ *and* $0° \leq \theta \leq 90°$ *use a sketch to find the values of* :

6.1.1. $\sin\theta$ (4)

6.1.2. $\dfrac{\cos\theta.\tan\theta}{\sin^2\theta}$ (3)

6.2 With the aid of a calculator

6.2.1. *if* $\alpha = 24°$ *and* $\beta = 57°$, *evaluate* $\sin 2\alpha - 2\sin\beta$. (2)

6.2.2. *determine the value of* θ *if* $\theta \in [0°;\ 90°]$ *of* $2\tan\theta = 3{,}28$ (3)

6.3 *From the top of a building, the angle of elevation to the top of a tower is 75° and the angle of depression to the foot of the tower is 42°. If the distance between the tower and the building is 50m, determine the height of the tower correct to the metre.* (8)

[20]

QUESTION 7

Draw the graphs of $f(x) = 2\sin x$ *and* $g(x) = \cos x + 1$ *on the same set of axe*

Indicate clearly all the intercepts on the axes and the points where the graphs intercept.

[6]

QUESTION 8

USEFUL FORMULAE

$$V = l \times b \times h$$

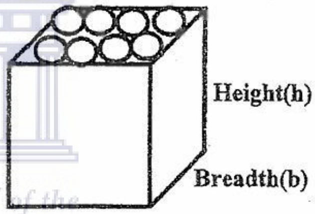
The picture shows an open box with length 196 cm, width 148 cm and height 200cm.

8.1 Calculate the Volume of one jar of jam with a height of 45cm and diameter of 30cm that can be packaged in this box.

8.2 Calculate the total surface area of the box.

8.3 Calculate the number of jars the box can hold.

8.4 What volume of the box do the cans occupy?



[10]

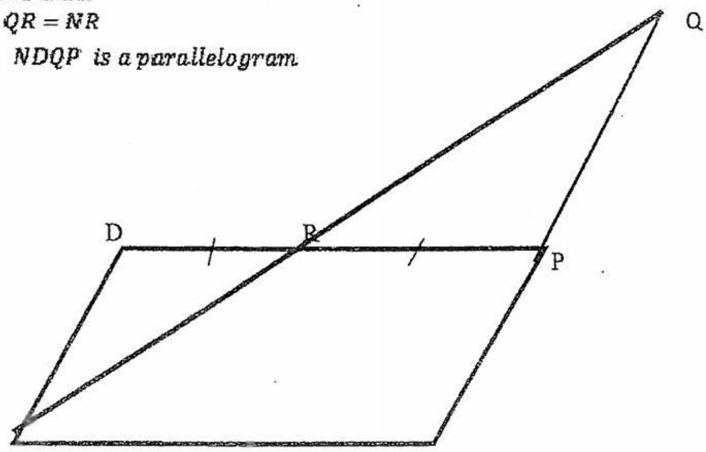
QUESTION 8

9.1 *POND is a parallelogram with $DR = RP$ and OQ is a straight line.*

Prove that:

9.1.1 $QR = NR$ (5)

9.1.2. *NDQP is a parallelogram* (2)

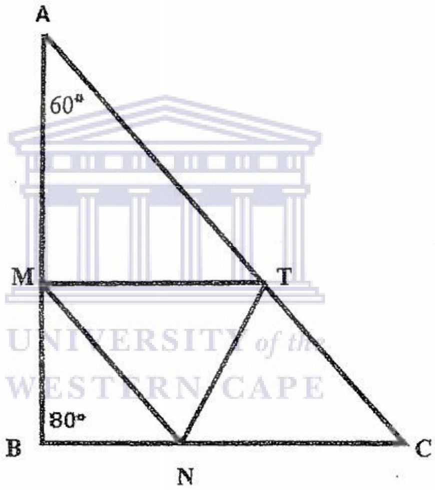


N O

9.2

M, N and T are the midpoints of AB, BC and AC respectively and MN is parallel with AC of $\Delta\, ABC$. $< A = 60°$ *and* $< B = 80°$. *Calculate the* $<'s$ *of* $\Delta\, MNT$.

(5)



[12]

TOTAL 100

TOTAL: 100

Appendix B

Formation of Rasch keys scoring for high-stakes examinations

Appendix B1: Keys scoring for 2012 high-stakes examinations

Table B1: *Keys scoring for2012 high-stakes examinations*

Paper 1												
Max	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**3**
ITEMS	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**	**1.2.1**	**1.2.2**	**1.3.1**	**1.3.2**	**1.4.1**	**1.4.2**	**2.1.**	**2.2.1**
Key1	^	^	^	^	^	^	^	^	^	^	^	^
Key2	^	^	^	^	^	^	^	^	^	^	^	^
Key3	^	^	^	^	^	^	^	^	^	^	^	^
Key4	^	^	^	^	^	^	^	^	^	^	^	^
Key5	^	^	^	^	^	^	^	^	^	^	^	^
Key6	^	^	^	^	^	^	^	^	^	^	^	^
Key7	^	^	^	^	^	^	^	^	^	^	^	^
Key8	^	^	^	^	^	^	^	^	^	^	^	^
Key9	^	^	^	^	^	^	^	^	^	^	^	^
Key10	^	^	^	^	^	^	^	^	^	^	3	3
Key11	^	^	^	^	^	^	^	^	^	^	2	2
Key12	1	1	1	1	1	1	1	1	1	1	1	1
Key13	0	0	0	0	0	0	0	0	0	0	0	0

Table B1: *(Continued)*

Paper 1

4	5	4	4	4	4	3	2	2	2	1	1	1
2.2.2	**2.3**	**3.1**	**3.2.1**	**3.2.2**	**3.3**	**3.4**	**4.1.1**	**4.1.2**	**4.2**	**4.3.1**	**4.3.2**	**4.3.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	5	^	^	^	^	^	^	^	^	^	^	^
4	4	4	4	4	4	^	^	^	^	^	^	^
3	3	3	3	3	3	3	^	^	^	^	^	^
2	2	2	2	2	2	2	2	2	2	^	^	^
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B1: *(Continued)*

Paper1

1	5	2	3	1	2	2	4	2	2	2	3	2
4.3.4	**5.1**	**5.2**	**5.3**	**6.1.1**	**6.1.2**	**6.2.1**	**6.2.2**	**6.2.3**	**7.1.1**	**7.1.2**	**7.2**	**7.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	5	^	^	^	^	^	^	^	^	^	^	^
^	4	^	^	^	^	^	4	^	^	^	^	^
^	3	^	3	^	^	^	3	^	^	^	3	^
^	2	2	2	^	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B1: *(continued)*

Paper1	Paper 2											
2	**2**	**1**	**1**	**1**	**2**	**4**	**2**	**1**	**4**	**2**	**1**	**2**
7.4	**7.5**	**8.1.1**	**8.1.2**	**8.1.3**	**8.2**	**8.3.1**	**8.3.2**	**8.3.3**	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	4	^	^	4	^	^	^
^	^	^	^	^	^	3	^	^	3	^	^	^
2	2	^	^	^	2	2	2	^	2	2	^	2
1	1	1	^	1	1	1	1	1	1	1	1	1
0	0	0	^	0	0	0	0	0	0	0	0	0

Table B1: *(Continued)*

Paper 2												
3	**2**	**1**	**2**	**4**	**2**	**1**	**3**	**3**	**3**	**2**	**2**	**2**
1.2.1	**1.2.2**	**1.2.3**	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**3.1.1**	**3.1.2**	**3.1.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	4	^	^	^	^	^	^	^	^
3	^	^	^	3	^	^	3	3	3	^	^	^
2	2	^	2	2	2	^	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B1: *(Continued)*

Paper 2

3	3	2	3	3	3	4	4	4	5	5	10	12
3.2.1	**3.2.2**	**3.3.1**	**3.3.2**	**3.3.3**	**4.1**	**4.2**	**5.1.1**	**5.1.2**	**5.2**	**6.1**	**6.2**	**7**
^	^	^	^	^	^	^	^	^	^	^	^	12
^	^	^	^	^	^	^	^	^	^	^	^	11
^	^	^	^	^	^	^	^	^	^	^	10	10
^	^	^	^	^	^	^	^	^	^	^	9	9
^	^	^	^	^	^	^	^	^	^	^	8	8
^	^	^	^	^	^	^	^	^	^	^	7	7
^	^	^	^	^	^	^	^	^	^	^	6	6
^	^	^	^	^	^	^	^	^	5	5	5	5
^	^	^	^	^	^	4	4	4	4	4	4	4
3	3	^	3	3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B1: *(Continued)*

Paper 2
10
8
^
^
10
9
8
7
6
5
4
3
2
1
0

Appendix B2: Keys scoring for 2013 high-stakes examinations

Table B2 *Keys scoring for2013 high-stakes examinations*

Paper 1

Max	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**3**
Items	**1.1.1**	**1.1.2**	**1.1.3**	**1.1.4**	**1.2.1**	**1.2.2**	**1.3.1**	**1.3.2**	**1.4.1**	**1.4.2**	**2.1**	**2.2.1**
Key1	^	^	^	^	^	^	^	^	^	^	^	^
Key2	^	^	^	^	^	^	^	^	^	^	^	^
Key3	^	^	^	^	^	^	^	^	^	^	^	^
Key4	^	^	^	^	^	^	^	^	^	^	3	3
Key5	^	^	^	^	^	^	^	^	^	^	2	2
Key6	1	1	1	1	1	1	1	1	1	1	1	1
Key7	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 1

4	**5**	**4**	**4**	**4**	**4**	**3**	**2**	**2**	**2**	**1**	**1**	**1**
2.2.2	**2.3**	**3.1**	**3.2.1**	**3.2.2**	**3.3**	**3.4**	**4.1.1**	**4.1.2**	**4.2**	**4.3.1**	**4.3.2**	**4.3.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	5	^	^	^	^	^	^	^	^	^	^	^
4	4	4	4	4	4	^	^	^	^	^	^	^
3	3	3	3	3	3	3	^	^	^	^	^	^
2	2	2	2	2	2	2	2	2	2	^	^	^
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 1

1	1	2	2	4	2	2	2	3	2	2	2	1
4.3.4	**5.1.1**	**5.1.2**	**5.1.3**	**5.1.4**	**5.1.5**	**6.1**	**6.2**	**6.3**	**6.4**	**6.5**	**6.6**	**7.1.1**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	4	^	^	^	^	^	^	^	^
^	^	^	^	3	^	^	^	3	^	^	^	^
^	^	2	2	2	2	2	2	2	2	2	2	^
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 1									Paper 2			
2	**3**	**4**	**1**	**1**	**1**	**4**	**2**	**3**	**4**	**2**	**3**	**2**
7.1.2	**7.1.3**	**7.2**	**8.1.1**	**8.1.2**	**8.1.3**	**8.2.1**	**8.2.2**	**8.3**	**1.1**	**1.1.1**	**1.1.2**	**1.1.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	4	^	^	^	4	^	^	4	^	^	^
^	3	3	^	^	^	3	^	3	3	^	3	^
2	2	2	^	^	^	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 2

1	1	1	1	1	1	1	3	6	1	3	4	6
2.1	**2.2**	**2.3**	**2.4**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**	**2,10**	**2,11**	**3.1**	**3.2**
^	^	^	^	^	^	^	^	6	^	^	^	6
^	^	^	^	^	^	^	^	5	^	^	^	5
^	^	^	^	^	^	^	^	4	^	^	4	4
^	^	^	^	^	^	^	3	3	^	3	3	3
^	^	^	^	^	^	^	2	2	^	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 2

2	**3**	**3**	**3**	**3**	**3**	**4**	**4**	**5**	**4**	**4**	**6**	**1**
3.3	**4.1.1**	**4.1.2**	**4.13**	**4.3**	**4.4.1**	**4.4.2**	**5.1**	**5.2**	**6.1**	**6.2.i**	**6.2.ii**	**7.1**
^	^	^	^	^	^	^	^	^	^	^	6	^
^	^	^	^	^	^	^	^	5	^	^	5	^
^	^	^	^	^	^	4	4	4	4	4	4	^
^	3	3	3	3	3	3	3	3	3	3	3	^
2	2	2	2	2	2	2	2	2	2	2	2	^
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B2: *(Continued)*

Paper 2

4	**2**	**4**	**2**	**4**
7.2	**7.3**	**8.1**	**8.2**	**8.3**
^	^	^	^	^
^	^	^	^	^
4	^	4	^	4
3	^	3	^	3
2	2	2	2	2
1	1	1	1	1
0	0	0	0	0

Appendix B3: Keys scoring for 2014 high-stakes examinations

Table B3: *Keys scoring for2014 high-stakes examinations*

Paper 1

Max	**2**	**3**	**5**	**1**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**6**
Items	**1.1**	**1.2**	**1.3**	**1.4.1**	**1.4.2**	**1.5.1**	**1.5.2**	**2.1.1**	**2.1.2**	**2.1.3**	**2.1.4**	**2.2**
Key1	^	^	^	^	^	^	^	^	^	^	^	^
Key2	^	^	^	^	^	^	^	^	^	^	^	^
Key3	^	^	^	^	^	^	^	^	^	^	^	6
Key4	^	^	5	^	^	^	^	^	^	^	^	5
Key5	^	^	4	^	^	^	^	^	^	^	^	4
Key6	^	3	3	^	3	^	3	3	3	3	3	3
Key7	2	2	2	^	2	2	2	2	2	2	2	2
Key8	1	1	1	1	1	1	1	1	1	1	1	1
Key9	0	0	0	0	0	0	0	0	0	0	0	0

Table B3: *(Continued)*

Paper 1

3	**2**	**3**	**3**	**4**	**1**	**6**	**1**	**4**	**1**	**4**	**1**	**2**
3.1.1	**3.1.2**	**3.1.3**	**3.2**	**4.1**	**4.2.1**	**4.2.2**	**4.2.3**	**4.3**	**5.1**	**5.2.1**	**5.2.2**	**5.2.3**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	6	^	^	^	^	^	^
^	^	^	^	^	^	5	^	^	^	^	^	^
^	^	^	^	4	^	4	^	4	^	4	^	^
3	^	3	3	3	^	3	^	3	^	3	^	^
2	2	2	2	2	^	2	^	2	^	2	^	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B3: *(Continued)*

Paper 1									Paper 2			
4	**2**	**6**	**3**	**1**	**4**	**2**	**3**	**3**	**4**	**1**	**1**	**1**
6.1	**6.2**	**6.3**	**6.4**	**7.1**	**7.2**	**7.3**	**7.4**	**7.5**	**1.1**	**1.2**	**1.3**	**1.4**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	6	^	^	^	^	^	^	^	^	^	^
^	^	5	^	^	^	^	^	^	^	^	^	^
4	^	4	^	^	4	^	^	^	4	^	^	^
3	^	3	3	^	3	^	3	3	3	^	^	^
2	2	2	2	^	2	2	2	2	2	^	^	^
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B3: *(Continued)*

Paper 2												
3	**2**	**4**	**1**	**1**	**1**	**3**	**2**	**4**	**4**	**2**	**2**	**2**
2.1	**2.2**	**3.1**	**3.2**	**3.3**	**3.4**	**4.1**	**4.2**	**4.3**	**4.4**	**4.5**	**5.1.1**	**5.1.2**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	4	^	^	^	^	^	4	4	^	^	^
3	^	3	^	^	^	3	^	3	3	^	^	^
2	2	2	^	^	^	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B3: *(Continued)*

Paper 2

4	4	2	3	1	1	3	4	1	2	2	3	4
5.2	**5.3**	**5.4.1**	**5.4.2**	**6.1a**	**6.1b**	**6.2**	**6.3**	**6.4**	**7.1.1**	**7.1.2**	**8.1.1**	**8.1.2**
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
^	^	^	^	^	^	^	^	^	^	^	^	^
4	4	^	^	^	^	^	4	^	^	^	^	4
3	3	^	3	^	^	3	3	^	^	^	3	3
2	2	2	2	^	^	2	2	^	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0	0	0

Table B3: *(Continued)*

Paper 2

1	1	1	6	2	2	2	2	2	2	8
9.1.1	**9.1.2**	**9.1.3**	**9.2**	**1011**	**1012**	**1013**	**1021**	**1022**	**1023**	**11**
^	^	^	^	^	^	^	^	^	^	8
^	^	^	^	^	^	^	^	^	^	7
^	^	^	6	^	^	^	^	^	^	6
^	^	^	5	^	^	^	^	^	^	5
^	^	^	4	^	^	^	^	^	^	4
^	^	^	3	^	^	^	^	^	^	3
^	^	^	2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	0	0

Appendix C

Item statistics measures

Appendix C1: Item statistics measures for 2012 high-stakes examinations

Table C1.1: *Items statistics-Measure order of 2012 high-stakes examinations*

TABLE 13.1 F2012P1p2forSES 5.xls ZOU361WS.TXT Mar 21 15:34 2015 INPUT: 405 PERSONS 78 ITEMS MEASURED: 405 PERSONS 78 ITEMS						
ITEM	TOTAL SCORES	MEASURE	INFIT MNSQ	EXACT ZSTD	OUTFIT MNSQ	EXACT ZSTD
7(EU G)	1771	0.22	0.51	-9.9	0.65	-6.1
8(EU G)	2081	0.19	0.65	-9.7	0.78	-4.2
7.5(FUN)	2088	0.19	1.01	0.3	1.03	0.6
7.4(FUN)	2522	0.16	1	0.1	0.98	-0.5
7.3(FUN)	2617	0.15	0.98	-0.5	0.95	-0.9
2.7(AN G)	2699	0.14	1.16	3.8	1.21	3.8
7.2(FUN)	2759	0.14	0.86	-3.6	0.86	-2.8
8.2(PRO)	2920	0.13	0.94	-1.6	0.94	-1
7.1.2(FUN)	2949	0.12	0.9	-2.5	0.87	-2.3
8.1.3(PRO)	2966	0.12	1.07	1.6	1.04	0.8
6.2.3(FUN)	2975	0.12	1	0.1	0.99	-0.2
3.2.2(TRI)	3087	0.11	1.14	3.1	1.12	2
8.3.3(PRO)	3282	0.1	1.15	3	1.14	2.1
8.3.2(PRO)	3303	0.09	1.04	0.9	1.01	0.2
6.2.1(FUN)	3361	0.09	1.1	2	1.16	2.2
7.1.1(FUN)	3383	0.09	0.97	-0.5	0.92	-1.1
5.1.2(TRI)	3394	0.09	1.2	3.7	1.32	4
6.2.2(FUN)	3431	0.08	0.9	-2	0.85	-2.1
5.2(TRI)	3464	0.08	1.06	1.1	1.06	0.8
8.3.1(PRO)	3526	0.07	0.9	-1.8	0.98	-0.2
5.1(FIN)	3545	0.07	1.05	0.9	1.22	2.6
6.1(EU G)	3621	0.06	1.04	0.7	1.15	1.7
3.4(ALG)	3670	0.06	0.98	-0.4	1.01	0.1
6.2(EU G)	3693	0.06	0.74	-4.7	0.84	-1.9
3.3.3(TRI)	3742	0.05	1.12	2	1.08	0.9
3.2.1(TRI)	3752	0.05	1.14	2.2	1.08	0.9
2.2(AN G)	3816	0.05	1.07	1.1	1.1	1
4.2(TRI)	3822	0.04	1.11	1.7	1.1	1
1.2.3(STA)	3837	0.04	1.23	3.3	1.28	2.7
8.1.1(PRO)	3839	0.04	1	0	0.93	-0.7
8.1.2(PRO)	3843	0.04	1.04	0.6	0.99	-0.1
6.1.2(FUN)	3846	0.04	0.91	-1.4	0.85	-1.5

2.5(AN G)	3870	0.04	0.9	-1.6	0.93	-0.7
5.1.1(TRI)	3905	0.04	1.08	1.1	1.12	1.2
3.3.2(TRI)	3984	0.03	1.05	0.7	0.94	-0.5
2.6(AN G)	4069	0.02	0.85	-2	0.93	-0.6
3.3.1(TRI)	4084	0.01	0.99	-0.1	0.84	-1.4
2.3(ALG)	4129	0.01	1.3	3.4	1.35	2.6
3.2.2(ALG)	4136	0.01	0.88	-1.4	0.85	-1.3
3.3(ALG)	4142	0.01	1.08	1	1.16	1.3
3.1(ALG)	4208	0	0.56	-5.9	0.59	-3.6
2.4(AN G)	4225	0	1.27	2.8	1.29	2.1
4.1(TRI)	4306	-0.02	1.15	1.5	1.11	0.8
5.3(FIN)	4329	-0.02	1.18	1.7	1.2	1.3
6.1.1(FUN)	4351	-0.02	1.09	0.9	0.95	-0.3
1.2.2(STA)	4378	-0.03	0.92	-0.8	0.82	-1.2
3.1.3(TRI)	4381	-0.03	1.28	2.5	1.34	2.1
4.2(PAT)	4403	-0.03	1.22	2	1.39	2.3
1.1.4(STA)	4430	-0.04	0.93	-0.6	0.86	-0.9
2.3(AN G)	4431	-0.04	0.71	-2.9	0.77	-1.5
2.2.2(ALG)	4438	-0.04	1.28	2.4	1.29	1.7
3.1.2(TRI)	4446	-0.04	0.9	-0.9	0.85	-1
1.1.1(STA)	4486	-0.05	0.38	-7.1	0.39	-4.8
1.2.1(STA)	4523	-0.05	0.97	-0.2	0.91	-0.5
5.2(FIN)	4544	-0.06	1.16	1.3	1.17	1
1.4.2(ALG)	4581	-0.07	1	0	0.88	-0.6
4.3.2(PAT)	4621	-0.07	1.31	2.1	1.3	1.5
2.1(AN G)	4624	-0.08	0.38	-5.9	0.29	-5.2
3.1.1(TRI)	4624	-0.08	0.98	-0.1	0.87	-0.7
4.3.4(PAT)	4633	-0.08	0.91	-0.6	0.95	-0.2
3.2.1(ALG)	4638	-0.08	1.22	1.5	1.36	1.8
2.1.(ALG)	4656	-0.08	0.58	-3.3	0.79	-1.1
2.2.1(ALG)	4665	-0.09	1.17	1.1	1.33	1.6
4.3.3(PAT)	4708	-0.1	0.8	-1.3	0.88	-0.5
4.1.2(PAT)	4731	-0.1	0.87	-0.8	0.77	-1.1
4.1.1(PAT)	4787	-0.12	0.6	-2.5	0.55	-2.2
1.1.2(STA)	4796	-0.13	**1.57**	2.7	1.55	2.1
1.1.4(ALG)	4803	-0.13	**1.52**	2.5	1.54	2.1
1.1.2(ALG)	4806	-0.13	1.17	0.9	0.82	-0.7
1.1.3(STA)	4816	-0.13	**1.97**	4	1.75	2.6
1.1.3(ALG)	4819	-0.13	1.49	2.2	1.36	1.4
4.3.1(PAT)	4868	-0.16	0.48	-2.9	0.34	-3.4
1.2.1(ALG)	4869	-0.16	0.37	-3.8	0.26	-4.1
1.2.2(ALG)	4890	-0.17	0.97	-0.1	0.94	-0.1

1.4.1(ALG)	4892	-0.17	**1.7**	2.6	1.36	1.3
1.1.1(ALG)	4902	-0.17	1.44	1.7	1.14	0.6
1.3.2(ALG)	4929	-0.19	1.12	0.5	0.91	-0.2
1.3.1(ALG)	4964	-0.22	1.05	0.3	0.97	0

Table C1.2: *Items statistics-Measure order of 2012 after exclusion of 1.1.2(STA), 1.1.4 (ALG) 1.1.3(STA) and 1.4.1(ALG)*

TABLE 13.1 F2012P1p2forSES 5 moins.xls ZOU133WS.TXT Mar 21 12:24 2015
INPUT: 405 PERSONS 74 ITEMS MEASURED: 405 PERSONS 74 ITEMS

ITEM	TOTAL SCORES	MEASURE	INFIT MNSQ	EXACT ZSTD	OUTFIT MNSQ	ZSTD
7(EU G)	483	0.32	1	0.1	1.49	2.3
5.1(FIN)	1813	0.17	1.29	6.1	1.41	6.3
8.2(PRO)	1941	0.16	1.04	0.9	1.03	0.5
7.5(FUN)	2088	0.15	1	0	1.02	0.4
7.2(FUN)	2269	0.14	0.93	-2	0.93	-1.4
8.3.1(PRO)	2441	0.12	1.08	2.3	1.11	2.3
7.4(FUN)	2522	0.12	1	0	0.98	-0.4
2.7(AN G)	2529	0.12	1.13	3.8	1.18	3.8
7.3(FUN)	2617	0.11	0.97	-0.9	0.95	-1.1
6.2.1(FUN)	2734	0.1	1.09	2.6	1.13	2.7
2.5(AN G)	2740	0.1	1.12	3.3	1.1	2
7.1.2(FUN)	2949	0.08	0.88	-3.6	0.86	-2.9
8.1.3(PRO)	2966	0.08	1.03	1	1.03	0.5
6.2.3(FUN)	2975	0.08	0.96	-1.1	0.96	-0.8
3.2.2(TRI)	2977	0.08	1.07	1.9	1.06	1
6.2.2(FUN)	3087	0.07	0.98	-0.6	0.95	-0.9
2.1.(ALG)	3092	0.07	1.27	6.5	1.32	5.1
5.2(TRI)	3162	0.07	1.03	0.8	1.02	0.4
1.1.1(STA)	3278	0.06	1.1	2.4	1.1	1.5
5.1.2(TRI)	3277	0.06	1.15	3.4	1.23	3.4
8.3.3(PRO)	3282	0.06	1.09	2.2	1.1	1.6
3.1.1(TRI)	3293	0.06	1.18	4.1	1.15	2.2
8.3.2(PRO)	3303	0.06	1	0	0.99	-0.2
2.2(AN G)	3366	0.05	1.1	2.2	1.08	1.2
1.1.4(STA)	3374	0.05	1.17	3.6	1.21	3
7.1.1(FUN)	3383	0.05	0.92	-1.7	0.88	-1.7
4.2(TRI)	3404	0.05	1.11	2.4	1.1	1.4
3.3.2(TRI)	3444	0.05	1.09	1.9	1.05	0.7
6.2(EU G)	3532	0.04	0.74	-5.7	0.82	-2.6
6.1(EU G)	3621	0.03	0.88	-2.4	0.93	-0.9
5.1.1(TRI)	3698	0.02	1.05	0.9	1.09	1.1
8(EU G)	3723	0.02	0.9	-1.7	1.01	0.2
3.3.3(TRI)	3742	0.02	1.04	0.8	1.02	0.3
3.4(ALG)	3751	0.02	0.86	-2.5	0.9	-1.2
3.2.1(TRI)	3752	0.02	1.07	1.2	1.04	0.5

5.2(FIN)	3829	0.01	1.19	2.9	1.25	2.6
1.2.3(STA)	3837	0.01	1.14	2.2	1.17	1.8
6.1.2(FUN)	3846	0.01	0.85	-2.5	0.85	-1.6
8.1.2(PRO)	3854	0.01	0.99	-0.2	0.92	-0.9
8.1.1(PRO)	3883	0.01	0.94	-1	0.88	-1.2
2.6(AN G)	4069	-0.01	0.77	-3.3	0.92	-0.7
2.3(ALG)	4084	-0.01	1.18	2.2	1.19	1.7
3.3.1(TRI)	4084	-0.01	0.91	-1.1	0.84	-1.5
2.2.1(ALG)	4087	-0.02	1.24	3	1.34	2.8
3.2.2(ALG)	4136	-0.02	0.8	-2.7	0.83	-1.5
3.3(ALG)	4142	-0.02	0.97	-0.4	1.07	0.6
3.1(ALG)	4208	-0.03	0.48	-7.6	0.51	-4.9
2.4(AN G)	4225	-0.03	1.15	1.7	1.19	1.5
4.1(TRI)	4306	-0.04	1.02	0.3	0.97	-0.2
5.3(FIN)	4329	-0.05	1.07	0.8	1.11	0.8
2.2.2(ALG)	4348	-0.05	1.19	1.8	1.16	1.1
6.1.1(FUN)	4351	-0.05	0.99	-0.1	0.91	-0.6
1.2.2(STA)	4378	-0.05	0.84	-1.7	0.78	-1.6
3.1.3(TRI)	4381	-0.05	1.16	1.6	1.23	1.5
4.2(PAT)	4403	-0.06	1.09	0.9	1.31	2
2.3(AN G)	4431	-0.06	0.64	-3.9	0.73	-1.9
3.1.2(TRI)	4446	-0.06	0.81	-1.9	0.8	-1.3
1.2.1(STA)	4523	-0.08	0.86	-1.1	0.8	-1.3
1.4.2(ALG)	4581	-0.09	0.89	-0.8	0.85	-0.9
2.1(AN G)	4624	-0.09	0.33	-6.8	0.26	-5.9
4.3.4(PAT)	4633	-0.1	0.79	-1.6	0.8	-1.1
3.2.1(ALG)	4638	-0.1	1.06	0.5	1.12	0.7
4.3.2(PAT)	4643	-0.1	1.16	1.2	1.22	1.2
4.3.3(PAT)	4708	-0.11	0.7	-2.2	0.78	-1.1
4.1.2(PAT)	4731	-0.12	0.74	-1.7	0.63	-2
4.1.1(PAT)	4787	-0.14	0.5	-3.5	0.42	-3.3
1.1.2(ALG)	4806	-0.14	1	0.1	0.76	-1.1
1.1.3(ALG)	4819	-0.15	1.26	1.4	1.21	0.9
1.2.1(ALG)	4869	-0.16	0.3	-4.7	0.2	-4.7
4.3.1(PAT)	4879	-0.17	0.35	-4.1	0.19	-4.8
1.2.2(ALG)	4890	-0.17	0.79	-0.9	0.79	-0.8
1.1.1(ALG)	4902	-0.18	1.18	0.8	0.95	-0.1
1.3.2(ALG)	4929	-0.19	0.9	-0.3	0.76	-0.8
1.3.1(ALG)	4964	-0.21	0.82	-0.6	0.75	-0.8

Appendix C2: Item statistics measures for 2013 high-stakes examinations

Table C2: *Items statistics-Measure order of 2013 high-stakes examinations*

TABLE 13.1 C:\Documents and Settings\User\Desktop ZOU572WS.TXT Apr 21 12:53 2015
INPUT: 381 PERSONS 82 ITEMS MEASURED: 381 PERSONS 82 ITEMS

ITEM	TOTAL SCORE	MEASURE	INFIT MNSQ	EXACT ZSTD	OUTFIT MNSQ	ZSTD
5.1.4(FUN)	1188	0.24	0.94	-1.6	0.91	-1.7
5.1.5(FUN)	1247	0.21	0.96	-1.2	0.95	-1
6.1.6(FUN)	1249	0.19	0.88	-3.1	0.86	-2.5
8.3(MEA)	1287	0.18	1.05	1.3	1.04	0.6
6.1.3(FUN)	1337	0.18	0.93	-1.7	0.92	-1.6
6.1.5(FUN)	1301	0.17	0.85	-4	0.82	-3.3
6.2.ii(EU G)	1365	0.16	1.06	1.7	1.09	1.6
5.1.3(FUN)	1509	0.14	0.93	-1.8	0.92	-1.5
6.1.4(FUN)	1429	0.14	0.88	-3.3	0.85	-2.6
6.2.i(EU G)	1500	0.13	1.04	1	1.06	1.1
5.1(TRI)	1406	0.13	1.05	1	1.07	1.3
6.1.2(FUN)	1567	0.13	0.94	-1.3	0.9	-1.7
8.2.3(PRO)	1598	0.12	0.96	-0.9	0.99	-0.2
2.8(STA)	1580	0.11	1.08	1.3	1.1	1.5
3.4(ALG)	1654	0.11	1.01	0.1	1	0
7.1.3(FIN)	1660	0.1	0.96	-0.8	0.95	-0.8
8.2(MEA)	1568	0.1	1.02	0.6	1.01	0.2
2,11(STA)	1655	0.09	1.1	2.1	1.16	2.3
6.1.1(FUN)	1721	0.09	0.93	-1.4	0.9	-1.5
8.2.1(PRO)	1643	0.09	1.01	0.2	1.02	0.3
4.4.2(TRI)	1554	0.09	1	0.1	0.98	-0.4
2,10(STA)	1686	0.09	1.08	1.8	1.14	1.9
7.3(EU G)	1684	0.08	1.05	1	1.01	0.2
7.1.2(FIN)	1683	0.08	0.98	-0.3	0.99	-0.1
2.7(STA)	1792	0.08	1.08	1.4	1.28	3.2
8.1(MEA)	1677	0.07	1	0.1	1	0.1
7.1(EU G)	1861	0.06	1.02	0.4	0.97	-0.3
4.4.1(TRI)	1743	0.06	1.03	0.7	1.01	0.2
7.2(FIN)	1669	0.06	0.96	-0.7	0.93	-1.1
7.1.1(FIN)	2014	0.06	1.02	0.2	0.98	-0.1
3.1(AN G)	1720	0.06	0.98	-0.3	1	0.1
8.2.2(PRO)	1762	0.06	0.98	-0.4	1.03	0.4
3.3(AN G)	1774	0.05	1.06	1.2	1.06	0.8

5.1.1(FUN)	1849	0.05	0.94	-1.1	0.89	-1.3
6.1(EU G)	1771	0.04	1.01	0.2	1.01	0.2
5.1.2(FUN)	1846	0.04	0.9	-1.7	0.87	-1.6
7.2(EU G)	1742	0.03	1.02	0.5	1	0
5.2(TRI)	1638	0.03	1.01	0.3	1.06	1.2
2.9(STA)	1685	0.03	1.14	2.9	1.25	3.9
3.2(AN G)	1784	0.03	1.03	0.6	1.05	0.7
3.3(ALG)	1693	0.03	1	0.1	1.01	0.2
3.2.2(ALG)	1814	0.03	1.02	0.4	1.02	0.3
4.3(TRI)	1863	0.02	1.07	1.3	1.16	1.8
4.13(TRI)	1872	0.01	1.02	0.4	1.03	0.4
2.1(STA)	2226	0.01	0.88	-0.5	0.62	-1.4
4.3.3(PAT)	1964	0	1	0.1	0.98	-0.1
8.1.3(PRO)	2020	0	1.01	0.2	0.95	-0.4
8.1.1(PRO)	2105	-0.01	0.94	-0.6	0.77	-1.7
4.3.4(PAT)	1985	-0.01	1	0	0.94	-0.6
1.1.3(STA)	1967	-0.01	1.04	0.6	1.17	1.7
1.1(STA)	1918	-0.03	1.02	0.3	1.04	0.5
4.3.2(PAT)	2039	-0.04	0.97	-0.5	0.93	-0.6
8.1.2(PRO)	2118	-0.04	0.97	-0.3	0.81	-1.5
2.3(ALG)	1922	-0.04	1.08	1.2	1.04	0.6
4.1.2(TRI)	2022	-0.05	0.96	-0.5	0.93	-0.7
2.2(STA)	2248	-0.05	0.88	-0.4	0.66	-1.2
1.1.1(STA)	2057	-0.05	1.04	0.6	1.18	1.6
3.1(ALG)	2077	-0.05	1.07	0.8	1.07	0.6
1.1.2(STA)	2078	-0.05	1.04	0.5	1.24	2
2.5(STA)	2210	-0.07	0.96	-0.2	1.16	0.9
2.6(STA)	2217	-0.08	0.9	-0.8	1.05	0.3
2.2.2(ALG)	2125	-0.08	1.13	1.6	1.2	1.6
4.2(PAT)	2173	-0.09	1.03	0.4	1.17	1.2
2.2.1(ALG)	2087	-0.1	1.08	1	1.05	0.5
1.4.2(ALG)	2227	-0.1	1.02	0.2	0.98	-0.1
1.1.4(ALG)	2217	-0.1	1.04	0.4	0.97	-0.1
3.2.1(ALG)	2131	-0.1	1.02	0.3	0.97	-0.2
4.1.1(TRI)	2134	-0.1	0.96	-0.4	0.9	-0.8
4.3.1(PAT)	2229	-0.11	0.99	-0.1	0.94	-0.3
1.1.3(ALG)	2235	-0.11	1.05	0.5	0.96	-0.2
4.1.1(PAT)	2191	-0.12	0.96	-0.2	0.8	-1.3
1.1.2(ALG)	2272	-0.13	1.02	0.2	0.98	0
1.4.1(ALG)	2300	-0.15	0.99	-0.1	0.93	-0.3
2.4(STA)	2307	-0.17	0.9	-0.6	0.82	-0.8

4.1.2(PAT)	2283	-0.18	0.99	0	1	0.1
1.1.1(ALG)	2346	-0.19	1.06	0.4	1.01	0.1
2.3(STA)	2370	-0.26	0.91	-0.4	0.66	-1.5
1.3.2(ALG)	2384	-0.26	0.98	0	1.09	0.4
1.2.1(ALG)	2340	-0.26	0.95	-0.1	0.74	-0.9
2.1(ALG)	2230	-0.26	1.03	0.3	0.95	-0.3
1.2.2(ALG)	2442	-0.31	0.94	-0.2	0.83	-0.6
1.3.1(ALG)	2436	-0.33	0.95	-0.1	0.87	-0.4

Appendix C3: Statistics item measures for 2014 high-stakes examinations

Table C3: *Items statistics-Measure order of 2014 high-stakes examinations*

TABLE 13.1 2014p1p2 R before DIF excluded 62fun 2 ZOU092WS.TXT Apr 21 13:28 2015
INPUT: 407 PERSONS 62 ITEMS MEASURED: 407 PERSONS 62 ITEMS

ITEM	TOTAL SCORES	MEASURE	INFIT MNSQ	EXACT ZSTD	OUTFIT MNSQ	ZSTD
4.2(AN G)	878	0.25	0.98	-0.4	1.06	0.9
2.4(STA)	926	0.23	0.87	-2.9	1.05	0.8
4.3(AN G)	980	0.21	0.89	-2.5	0.95	-0.8
3.3(AN G)	1081	0.18	0.87	-3.3	0.91	-1.6
7(TRI)	1179	0.15	0.72	-8.3	0.75	-5.2
8.4(MEA)	1183	0.15	1.16	4.1	1.18	3.4
6.2(FUN)	1213	0.14	1.11	2.9	1.06	1.2
1.2(STA)	1223	0.14	1.22	5.5	1.28	5.1
9.1.2(EU G)	1233	0.14	1.18	4.7	1.15	2.9
2.3(STA)	1234	0.14	0.86	-3.9	1.07	1.3
6.2.1(TRI)	1239	0.14	1.16	4.1	1.16	3.1
1.1(STA)	1250	0.13	0.63	-9.9	0.74	-5.8
2.5(STA)	1271	0.13	0.91	-2.5	1.1	1.9
1.1(ALG)	1294	0.12	1.28	7.2	1.35	6.3
9.2(EU G)	1299	0.12	1.05	1.4	1.06	1.3
7.5(FUN)	1341	0.11	1.04	1.2	1.05	0.9
2.2(STA)	1390	0.09	1.24	6.3	1.27	5
6.4(FUN)	1418	0.09	1.11	2.9	1.17	3.3
5.2.3(PRO)	1419	0.09	1.17	4.6	1.16	3
3.1(AN G)	1436	0.08	1.16	4.3	1.18	3.5
4.4(AN G)	1499	0.06	0.97	-0.7	0.98	-0.3
6.2.2(TRI)	1523	0.06	0.9	-2.8	0.89	-2.1
6.3(FUN)	1532	0.05	1.05	1.2	1.05	0.9
9.1.1(EU G)	1543	0.05	0.96	-0.9	0.94	-1.1
3.2(AN G)	1552	0.05	0.96	-1	0.99	-0.3
6.1(FUN)	1553	0.05	0.96	-1	0.93	-1.4
3.1.2(PAT)	1600	0.03	1.19	4.6	1.19	3.3
7.4(FUN)	1614	0.03	1.11	2.7	1.07	1.3
8.2(MEA)	1628	0.03	1.23	5.3	1.22	3.8
1.3(ALG)	1631	0.02	1.11	2.5	1.18	3.1
5(AN G)	1632	0.02	0.92	-2	1	0.1
4.2.2(FIN)	1633	0.02	0.91	-2.2	0.96	-0.7
6.1.1(TRI)	1643	0.02	0.84	-4.1	0.93	-1.3
8.3(MEA)	1652	0.02	1.17	3.9	1.13	2.3

2.1.2(ALG)	1663	0.01	1.14	3.2	1.16	2.6
6.3(TRI)	1692	0.01	0.93	-1.7	0.95	-0.9
5.2.1(PRO)	1695	0	0.82	-4.5	0.85	-2.7
8.1(MEA)	1699	0	1.16	3.4	1.13	2.2
4.1(AN G)	1734	-0.01	0.75	-6.1	0.83	-3
6.1.2(TRI)	1756	-0.01	1	0	1.02	0.3
7.3(FUN)	1767	-0.02	1.12	2.5	1.09	1.4
2.2(ALG)	1796	-0.03	0.91	-1.8	0.92	-1.2
2.1.4(ALG)	1913	-0.07	0.93	-1.3	0.95	-0.7
4.1(FIN)	1915	-0.07	0.72	-5.6	0.84	-2.3
7.2(FUN)	1956	-0.08	1.09	1.5	1.07	1
3.2(PAT)	1993	-0.09	0.82	-3.2	0.95	-0.5
3.1.1(PAT)	1994	-0.09	0.23	-9.9	0.29	-9.9
1.2(ALG)	2037	-0.11	0.79	-3.6	0.76	-3
3.1.3(PAT)	2046	-0.11	0.81	-3	0.86	-1.6
4.3(FIN)	2060	-0.12	1.08	1.2	1.06	0.7
5.1(PRO)	2144	-0.15	1.15	1.9	1.21	2.1
4.2.3(FIN)	2174	-0.17	1.14	1.8	1.07	0.8
5.2.2(PRO)	2175	-0.17	1.19	2.3	1.2	1.9
7.1(FUN)	2187	-0.17	0.89	-1.4	0.92	-0.7
1.4.1(ALG)	2256	-0.2	1.36	3.6	1.33	2.7
4.2.1(FIN)	2280	-0.22	0.75	-3	0.6	-3.9
1.5.1(ALG)	2286	-0.22	1.44	4.2	1.4	3.1
1.5.2(ALG)	2316	-0.24	1.23	2.3	1.27	2.1
2.1.3(ALG)	2327	-0.24	1.13	1.3	0.97	-0.2
2.1.1(ALG)	2330	-0.24	0.87	-1.3	0.89	-0.8
1.4.2(ALG)	2357	-0.26	1.22	2	1.06	0.5
2.1(STA)	2426	-0.31	0.66	-3.2	0.71	-2.2

Appendix D

DIF measures

Appendix D1: DIF measures for 2012 high-stakes examinations

Table D1: *SES Differential Item Functioning in 2012 examinations*

TABLE 30.1 F2012P1p2forSES 5 moins.xls ZOU133WS.TXT Mar 21 12:24 2015
INPUT: 405 PERSONS 74 ITEMS MEASURED: 405 PERSONS 74 ITEMS
DIF class specification is: DIF=@SES2012

PERSON CLASS	DIF MEASURE	DIF S.E	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	ITEM
1	-0.06	0.03	2	-0.3	0.08	0.24	1.1.1(ALG)
1	-0.06	0.03	3	-0.21	0.03	0.15	1.1.1(ALG)
2	-0.3	0.08	1	-0.06	0.03	-0.24	1.1.1(ALG)
2	-0.3	0.08	3	-0.21	0.03	-0.09	1.1.1(ALG)
3	-0.21	0.03	1	-0.06	0.03	-0.15	1.1.1(ALG)
3	-0.21	0.03	2	-0.3	0.08	0.09	1.1.1(ALG)
1	-0.03	0.03	2	-0.18	0.05	0.15	1.1.2(ALG)
1	-0.03	0.03	3	-0.18	0.03	0.16	1.1.2(ALG)
2	-0.18	0.05	1	-0.03	0.03	-0.15	1.1.2(ALG)
2	-0.18	0.05	3	-0.18	0.03	0	1.1.2(ALG)
3	-0.18	0.03	1	-0.03	0.03	-0.16	1.1.2(ALG)
3	-0.18	0.03	2	-0.18	0.05	0	1.1.2(ALG)
1	-0.02	0.03	2	-0.21	0.05	0.19	1.1.3(ALG)
1	-0.02	0.03	3	-0.19	0.03	0.17	1.1.3(ALG)
2	-0.21	0.05	1	-0.02	0.03	-0.19	1.1.3(ALG)
2	-0.21	0.05	3	-0.19	0.03	-0.02	1.1.3(ALG)
3	-0.19	0.03	1	-0.02	0.03	-0.17	1.1.3(ALG)
3	-0.19	0.03	2	-0.21	0.05	0.02	1.1.3(ALG)
1	-0.16	0.05	2	-0.16	0.04	0	1.2.1(ALG)
1	-0.16	0.05	3	-0.16	0.03	0	1.2.1(ALG)
2	-0.16	0.04	1	-0.16	0.05	0	1.2.1(ALG)
2	-0.16	0.04	3	-0.16	0.03	0	1.2.1(ALG)
3	-0.16	0.03	1	-0.16	0.05	0	1.2.1(ALG)
3	-0.16	0.03	2	-0.16	0.04	0	1.2.1(ALG)
1	-0.13	0.04	2	-0.17	0.04	0.05	1.2.2(ALG)
1	-0.13	0.04	3	-0.17	0.03	0.05	1.2.2(ALG)
2	-0.17	0.04	1	-0.13	0.04	-0.05	1.2.2(ALG)
2	-0.17	0.04	3	-0.17	0.03	0	1.2.2(ALG)
3	-0.17	0.03	1	-0.13	0.04	-0.05	1.2.2(ALG)
3	-0.17	0.03	2	-0.17	0.04	0	1.2.2(ALG)
1	-0.25	0.08	2	-0.35	0.1	0.1	1.3.1(ALG)
1	-0.25	0.08	3	-0.18	0.03	-0.07	1.3.1(ALG)

2	-0.35	0.1	1	-0.25	0.08	-0.1	1.3.1(ALG)
2	-0.35	0.1	3	-0.18	0.03	-0.17	1.3.1(ALG)
3	-0.18	0.03	1	-0.25	0.08	0.07	1.3.1(ALG)
3	-0.18	0.03	2	-0.35	0.1	0.17	1.3.1(ALG)
1	-0.16	0.05	2	-0.32	0.09	0.16	1.3.2(ALG)
1	-0.16	0.05	3	-0.19	0.03	0.04	1.3.2(ALG)
2	-0.32	0.09	1	-0.16	0.05	-0.16	1.3.2(ALG)
2	-0.32	0.09	3	-0.19	0.03	-0.13	1.3.2(ALG)
3	-0.19	0.03	1	-0.16	0.05	-0.04	1.3.2(ALG)
3	-0.19	0.03	2	-0.32	0.09	0.13	1.3.2(ALG)
1	-0.09	0.04	2	-0.09	0.03	0	1.4.2(ALG)
1	-0.09	0.04	3	-0.09	0.02	0	1.4.2(ALG)
2	-0.09	0.03	1	-0.09	0.04	0	1.4.2(ALG)
2	-0.09	0.03	3	-0.09	0.02	0	1.4.2(ALG)
3	-0.09	0.02	1	-0.09	0.04	0	1.4.2(ALG)
3	-0.09	0.02	2	-0.09	0.03	0	1.4.2(ALG)
1	0.07	0.02	2	0.01	0.02	0.06	2.1.(ALG)
1	0.07	0.02	3	0.09	0.01	-0.02	2.1.(ALG)
2	0.01	0.02	1	0.07	0.02	-0.06	2.1.(ALG)
2	0.01	0.02	3	0.09	0.01	-0.08	2.1.(ALG)
3	0.09	0.01	1	0.07	0.02	0.02	2.1.(ALG)
3	0.09	0.01	2	0.01	0.02	0.08	2.1.(ALG)
1	-0.02	0.03	2	-0.05	0.03	0.04	2.2.1(ALG)
1	-0.02	0.03	3	-0.02	0.01	0	2.2.1(ALG)
2	-0.05	0.03	1	-0.02	0.03	-0.04	2.2.1(ALG)
2	-0.05	0.03	3	-0.02	0.01	-0.04	2.2.1(ALG)
3	-0.02	0.01	1	-0.02	0.03	0	2.2.1(ALG)
3	-0.02	0.01	2	-0.05	0.03	0.04	2.2.1(ALG)
1	-0.05	0.03	2	-0.11	0.03	0.06	2.2.2(ALG)
1	-0.05	0.03	3	-0.05	0.01	0	2.2.2(ALG)
2	-0.11	0.03	1	-0.05	0.03	-0.06	2.2.2(ALG)
2	-0.11	0.03	3	-0.05	0.01	-0.06	2.2.2(ALG)
3	-0.05	0.01	1	-0.05	0.03	0	2.2.2(ALG)
3	-0.05	0.01	2	-0.11	0.03	0.06	2.2.2(ALG)
1	-0.01	0.03	2	-0.01	0.02	0	2.3(ALG)
1	-0.01	0.03	3	-0.01	0.01	0	2.3(ALG)
2	-0.01	0.02	1	-0.01	0.03	0	2.3(ALG)
2	-0.01	0.02	3	-0.01	0.01	0	2.3(ALG)
3	-0.01	0.01	1	-0.01	0.03	0	2.3(ALG)
3	-0.01	0.01	2	-0.01	0.02	0	2.3(ALG)
1	-0.03	0.03	2	-0.09	0.03	0.06	3.1(ALG)
1	-0.03	0.03	3	-0.03	0.01	0	3.1(ALG)
2	-0.09	0.03	1	-0.03	0.03	-0.06	3.1(ALG)
2	-0.09	0.03	3	-0.03	0.01	-0.06	3.1(ALG)
3	-0.03	0.01	1	-0.03	0.03	0	3.1(ALG)

3	-0.03	0.01	2	-0.09	0.03	0.06	3.1(ALG)
1	-0.1	0.04	2	-0.1	0.03	0	3.2.1(ALG)
1	-0.1	0.04	3	-0.1	0.02	0	3.2.1(ALG)
2	-0.1	0.03	1	-0.1	0.04	0	3.2.1(ALG)
2	-0.1	0.03	3	-0.1	0.02	0	3.2.1(ALG)
3	-0.1	0.02	1	-0.1	0.04	0	3.2.1(ALG)
3	-0.1	0.02	2	-0.1	0.03	0	3.2.1(ALG)
1	-0.02	0.03	2	-0.02	0.02	0	3.2.2(ALG)
1	-0.02	0.03	3	-0.02	0.01	0	3.2.2(ALG)
2	-0.02	0.02	1	-0.02	0.03	0	3.2.2(ALG)
2	-0.02	0.02	3	-0.02	0.01	0	3.2.2(ALG)
3	-0.02	0.01	1	-0.02	0.03	0	3.2.2(ALG)
3	-0.02	0.01	2	-0.02	0.02	0	3.2.2(ALG)
1	-0.02	0.03	2	0	0.02	-0.02	3.3(ALG)
1	-0.02	0.03	3	-0.02	0.01	0	3.3(ALG)
2	0	0.02	1	-0.02	0.03	0.02	3.3(ALG)
2	0	0.02	3	-0.02	0.01	0.02	3.3(ALG)
3	-0.02	0.01	1	-0.02	0.03	0	3.3(ALG)
3	-0.02	0.01	2	0	0.02	-0.02	3.3(ALG)
1	-0.01	0.03	2	0.07	0.02	-0.08	3.4(ALG)
1	-0.01	0.03	3	0.02	0.01	-0.03	3.4(ALG)
2	0.07	0.02	1	-0.01	0.03	0.08	3.4(ALG)
2	0.07	0.02	3	0.02	0.01	0.05	3.4(ALG)
3	0.02	0.01	1	-0.01	0.03	0.03	3.4(ALG)
3	0.02	0.01	2	0.07	0.02	-0.05	3.4(ALG)
1	-0.22	0.07	2	-0.18	0.04	-0.04	4.1.1(PAT)
1	-0.22	0.07	3	-0.11	0.02	-0.11	4.1.1(PAT)
2	-0.18	0.04	1	-0.22	0.07	0.04	4.1.1(PAT)
2	-0.18	0.04	3	-0.11	0.02	-0.07	4.1.1(PAT)
3	-0.11	0.02	1	-0.22	0.07	0.11	4.1.1(PAT)
3	-0.11	0.02	2	-0.18	0.04	0.07	4.1.1(PAT)
1	-0.12	0.04	2	-0.15	0.04	0.03	4.1.2(PAT)
1	-0.12	0.04	3	-0.12	0.02	0	4.1.2(PAT)
2	-0.15	0.04	1	-0.12	0.04	-0.03	4.1.2(PAT)
2	-0.15	0.04	3	-0.12	0.02	-0.03	4.1.2(PAT)
3	-0.12	0.02	1	-0.12	0.04	0	4.1.2(PAT)
3	-0.12	0.02	2	-0.15	0.04	0.03	4.1.2(PAT)
1	-0.09	0.04	2	-0.06	0.03	-0.04	4.2(PAT)
1	-0.09	0.04	3	-0.06	0.02	-0.04	4.2(PAT)
2	-0.06	0.03	1	-0.09	0.04	0.04	4.2(PAT)
2	-0.06	0.03	3	-0.06	0.02	0	4.2(PAT)
3	-0.06	0.02	1	-0.09	0.04	0.04	4.2(PAT)
3	-0.06	0.02	2	-0.06	0.03	0	4.2(PAT)
1	-0.17	0.06	2	-0.17	0.04	0	4.3.1(PAT)
1	-0.17	0.06	3	-0.17	0.03	0	4.3.1(PAT)

2	-0.17	0.04	1	-0.17	0.06	0	4.3.1(PAT)
2	-0.17	0.04	3	-0.17	0.03	0	4.3.1(PAT)
3	-0.17	0.03	1	-0.17	0.06	0	4.3.1(PAT)
3	-0.17	0.03	2	-0.17	0.04	0	4.3.1(PAT)
1	-0.06	0.03	2	-0.07	0.03	0	4.3.2(PAT)
1	-0.06	0.03	3	-0.12	0.02	0.06	4.3.2(PAT)
2	-0.07	0.03	1	-0.06	0.03	0	4.3.2(PAT)
2	-0.07	0.03	3	-0.12	0.02	0.06	4.3.2(PAT)
3	-0.12	0.02	1	-0.06	0.03	-0.06	4.3.2(PAT)
3	-0.12	0.02	2	-0.07	0.03	-0.06	4.3.2(PAT)
1	-0.09	0.04	2	-0.11	0.04	0.02	4.3.3(PAT)
1	-0.09	0.04	3	-0.11	0.02	0.02	4.3.3(PAT)
2	-0.11	0.04	1	-0.09	0.04	-0.02	4.3.3(PAT)
2	-0.11	0.04	3	-0.11	0.02	0	4.3.3(PAT)
3	-0.11	0.02	1	-0.09	0.04	-0.02	4.3.3(PAT)
3	-0.11	0.02	2	-0.11	0.04	0	4.3.3(PAT)
1	-0.1	0.04	2	-0.12	0.03	0.02	4.3.4(PAT)
1	-0.1	0.04	3	-0.1	0.02	0	4.3.4(PAT)
2	-0.12	0.03	1	-0.1	0.04	-0.02	4.3.4(PAT)
2	-0.12	0.03	3	-0.1	0.02	-0.02	4.3.4(PAT)
3	-0.1	0.02	1	-0.1	0.04	0	4.3.4(PAT)
3	-0.1	0.02	2	-0.12	0.03	0.02	4.3.4(PAT)
1	0.17	0.02	2	0.14	0.02	0.03	5.1(FIN)
1	0.17	0.02	3	0.17	0.01	0	5.1(FIN)
2	0.14	0.02	1	0.17	0.02	-0.03	5.1(FIN)
2	0.14	0.02	3	0.17	0.01	-0.03	5.1(FIN)
3	0.17	0.01	1	0.17	0.02	0	5.1(FIN)
3	0.17	0.01	2	0.14	0.02	0.03	5.1(FIN)
1	0.01	0.03	2	-0.01	0.02	0.02	5.2(FIN)
1	0.01	0.03	3	0.01	0.01	0	5.2(FIN)
2	-0.01	0.02	1	0.01	0.03	-0.02	5.2(FIN)
2	-0.01	0.02	3	0.01	0.01	-0.02	5.2(FIN)
3	0.01	0.01	1	0.01	0.03	0	5.2(FIN)
3	0.01	0.01	2	-0.01	0.02	0.02	5.2(FIN)
1	0.02	0.02	2	-0.12	0.03	0.14	5.3(FIN)
1	0.02	0.02	3	-0.05	0.01	0.06	5.3(FIN)
2	-0.12	0.03	1	0.02	0.02	-0.14	5.3(FIN)
2	-0.12	0.03	3	-0.05	0.01	-0.07	5.3(FIN)
3	-0.05	0.01	1	0.02	0.02	-0.06	5.3(FIN)
3	-0.05	0.01	2	-0.12	0.03	0.07	5.3(FIN)
1	-0.13	0.04	2	-0.01	0.02	-0.11	6.1.1(FUN)
1	-0.13	0.04	3	-0.05	0.02	-0.08	6.1.1(FUN)
2	-0.01	0.02	1	-0.13	0.04	0.11	6.1.1(FUN)
2	-0.01	0.02	3	-0.05	0.02	0.03	6.1.1(FUN)
3	-0.05	0.02	1	-0.13	0.04	0.08	6.1.1(FUN)

3	-0.05	0.02	2	-0.01	0.02	-0.03	6.1.1(FUN)
1	-0.08	0.04	2	0.06	0.02	-0.14	6.1.2(FUN)
1	-0.08	0.04	3	0.01	0.01	-0.09	6.1.2(FUN)
2	0.06	0.02	1	-0.08	0.04	0.14	6.1.2(FUN)
2	0.06	0.02	3	0.01	0.01	0.05	6.1.2(FUN)
3	0.01	0.01	1	-0.08	0.04	0.09	6.1.2(FUN)
3	0.01	0.01	2	0.06	0.02	-0.05	6.1.2(FUN)
1	0.14	0.02	2	0.1	0.02	0.03	6.2.1(FUN)
1	0.14	0.02	3	0.1	0.01	0.03	6.2.1(FUN)
2	0.1	0.02	1	0.14	0.02	-0.03	6.2.1(FUN)
2	0.1	0.02	3	0.1	0.01	0	6.2.1(FUN)
3	0.1	0.01	1	0.14	0.02	-0.03	6.2.1(FUN)
3	0.1	0.01	2	0.1	0.02	0	6.2.1(FUN)
1	0	0.03	2	0.13	0.02	-0.13	6.2.2(FUN)
1	0	0.03	3	0.07	0.01	-0.07	6.2.2(FUN)
2	0.13	0.02	1	0	0.03	0.13	6.2.2(FUN)
2	0.13	0.02	3	0.07	0.01	0.06	6.2.2(FUN)
3	0.07	0.01	1	0	0.03	0.07	6.2.2(FUN)
3	0.07	0.01	2	0.13	0.02	-0.06	6.2.2(FUN)
1	0.08	0.02	2	0.15	0.02	-0.07	6.2.3(FUN)
1	0.08	0.02	3	0.05	0.01	0.03	6.2.3(FUN)
2	0.15	0.02	1	0.08	0.02	0.07	6.2.3(FUN)
2	0.15	0.02	3	0.05	0.01	0.1	6.2.3(FUN)
3	0.05	0.01	1	0.08	0.02	-0.03	6.2.3(FUN)
3	0.05	0.01	2	0.15	0.02	-0.1	6.2.3(FUN)
1	0.08	0.02	2	0.1	0.02	-0.02	7.1.1(FUN)
1	0.08	0.02	3	0.02	0.01	0.06	7.1.1(FUN)
2	0.1	0.02	1	0.08	0.02	0.02	7.1.1(FUN)
2	0.1	0.02	3	0.02	0.01	0.08	7.1.1(FUN)
3	0.02	0.01	1	0.08	0.02	-0.06	7.1.1(FUN)
3	0.02	0.01	2	0.1	0.02	-0.08	7.1.1(FUN)
1	0.08	0.02	2	0.12	0.02	-0.04	7.1.2(FUN)
1	0.08	0.02	3	0.08	0.01	0	7.1.2(FUN)
2	0.12	0.02	1	0.08	0.02	0.04	7.1.2(FUN)
2	0.12	0.02	3	0.08	0.01	0.04	7.1.2(FUN)
3	0.08	0.01	1	0.08	0.02	0	7.1.2(FUN)
3	0.08	0.01	2	0.12	0.02	-0.04	7.1.2(FUN)
1	0.14	0.02	2	0.14	0.02	0	7.2(FUN)
1	0.14	0.02	3	0.14	0.01	0	7.2(FUN)
2	0.14	0.02	1	0.14	0.02	0	7.2(FUN)
2	0.14	0.02	3	0.14	0.01	0	7.2(FUN)
3	0.14	0.01	1	0.14	0.02	0	7.2(FUN)
3	0.14	0.01	2	0.14	0.02	0	7.2(FUN)
1	0.14	0.02	2	0.13	0.02	0.01	7.3(FUN)
1	0.14	0.02	3	0.11	0.01	0.03	7.3(FUN)

2	0.13	0.02	1	0.14	0.02	-0.01	7.3(FUN)
2	0.13	0.02	3	0.11	0.01	0.02	7.3(FUN)
3	0.11	0.01	1	0.14	0.02	-0.03	7.3(FUN)
3	0.11	0.01	2	0.13	0.02	-0.02	7.3(FUN)
1	0.15	0.02	2	0.15	0.02	0.01	7.4(FUN)
1	0.15	0.02	3	0.12	0.01	0.04	7.4(FUN)
2	0.15	0.02	1	0.15	0.02	-0.01	7.4(FUN)
2	0.15	0.02	3	0.12	0.01	0.03	7.4(FUN)
3	0.12	0.01	1	0.15	0.02	-0.04	7.4(FUN)
3	0.12	0.01	2	0.15	0.02	-0.03	7.4(FUN)
1	0.15	0.02	2	0.18	0.02	-0.03	7.5(FUN)
1	0.15	0.02	3	0.15	0.01	0	7.5(FUN)
2	0.18	0.02	1	0.15	0.02	0.03	7.5(FUN)
2	0.18	0.02	3	0.15	0.01	0.03	7.5(FUN)
3	0.15	0.01	1	0.15	0.02	0	7.5(FUN)
3	0.15	0.01	2	0.18	0.02	-0.03	7.5(FUN)
1	0.01	0.03	2	0.03	0.02	-0.03	8.1.1(PRO)
1	0.01	0.03	3	0.01	0.01	0	8.1.1(PRO)
2	0.03	0.02	1	0.01	0.03	0.03	8.1.1(PRO)
2	0.03	0.02	3	0.01	0.01	0.03	8.1.1(PRO)
3	0.01	0.01	1	0.01	0.03	0	8.1.1(PRO)
3	0.01	0.01	2	0.03	0.02	-0.03	8.1.1(PRO)
1	0.05	0.02	2	0.01	0.02	0.04	8.1.2(PRO)
1	0.05	0.02	3	0.01	0.01	0.04	8.1.2(PRO)
2	0.01	0.02	1	0.05	0.02	-0.04	8.1.2(PRO)
2	0.01	0.02	3	0.01	0.01	0	8.1.2(PRO)
3	0.01	0.01	1	0.05	0.02	-0.04	8.1.2(PRO)
3	0.01	0.01	2	0.01	0.02	0	8.1.2(PRO)
1	0.08	0.02	2	0.14	0.02	-0.05	8.1.3(PRO)
1	0.08	0.02	3	0.08	0.01	0	8.1.3(PRO)
2	0.14	0.02	1	0.08	0.02	0.05	8.1.3(PRO)
2	0.14	0.02	3	0.08	0.01	0.05	8.1.3(PRO)
3	0.08	0.01	1	0.08	0.02	0	8.1.3(PRO)
3	0.08	0.01	2	0.14	0.02	-0.05	8.1.3(PRO)
1	0.16	0.02	2	0.16	0.02	0	8.2(PRO)
1	0.16	0.02	3	0.16	0.01	0	8.2(PRO)
2	0.16	0.02	1	0.16	0.02	0	8.2(PRO)
2	0.16	0.02	3	0.16	0.01	0	8.2(PRO)
3	0.16	0.01	1	0.16	0.02	0	8.2(PRO)
3	0.16	0.01	2	0.16	0.02	0	8.2(PRO)
1	0.24	0.03	2	0.04	0.02	0.2	8.3.1(PRO)
1	0.24	0.03	3	0.12	0.01	0.12	8.3.1(PRO)
2	0.04	0.02	1	0.24	0.03	-0.2	8.3.1(PRO)
2	0.04	0.02	3	0.12	0.01	-0.09	8.3.1(PRO)
3	0.12	0.01	1	0.24	0.03	-0.12	8.3.1(PRO)

3	0.12	0.01	2	0.04	0.02	0.09	8.3.1(PRO)
1	0.06	0.02	2	0.1	0.02	-0.04	8.3.2(PRO)
1	0.06	0.02	3	0.06	0.01	0	8.3.2(PRO)
2	0.1	0.02	1	0.06	0.02	0.04	8.3.2(PRO)
2	0.1	0.02	3	0.06	0.01	0.04	8.3.2(PRO)
3	0.06	0.01	1	0.06	0.02	0	8.3.2(PRO)
3	0.06	0.01	2	0.1	0.02	-0.04	8.3.2(PRO)
1	0.06	0.02	2	0.08	0.02	-0.02	8.3.3(PRO)
1	0.06	0.02	3	0.06	0.01	0	8.3.3(PRO)
2	0.08	0.02	1	0.06	0.02	0.02	8.3.3(PRO)
2	0.08	0.02	3	0.06	0.01	0.02	8.3.3(PRO)
3	0.06	0.01	1	0.06	0.02	0	8.3.3(PRO)
3	0.06	0.01	2	0.08	0.02	-0.02	8.3.3(PRO)
1	0.06	0.02	2	0.06	0.02	0	1.1.1(STA)
1	0.06	0.02	3	0.06	0.01	0	1.1.1(STA)
2	0.06	0.02	1	0.06	0.02	0	1.1.1(STA)
2	0.06	0.02	3	0.06	0.01	0	1.1.1(STA)
3	0.06	0.01	1	0.06	0.02	0	1.1.1(STA)
3	0.06	0.01	2	0.06	0.02	0	1.1.1(STA)
1	-0.05	0.03	2	0.05	0.02	-0.11	1.1.4(STA)
1	-0.05	0.03	3	0.07	0.01	-0.13	1.1.4(STA)
2	0.05	0.02	1	-0.05	0.03	0.11	1.1.4(STA)
2	0.05	0.02	3	0.07	0.01	-0.02	1.1.4(STA)
3	0.07	0.01	1	-0.05	0.03	0.13	1.1.4(STA)
3	0.07	0.01	2	0.05	0.02	0.02	1.1.4(STA)
1	-0.14	0.05	2	-0.08	0.03	-0.06	1.2.1(STA)
1	-0.14	0.05	3	-0.08	0.02	-0.06	1.2.1(STA)
2	-0.08	0.03	1	-0.14	0.05	0.06	1.2.1(STA)
2	-0.08	0.03	3	-0.08	0.02	0	1.2.1(STA)
3	-0.08	0.02	1	-0.14	0.05	0.06	1.2.1(STA)
3	-0.08	0.02	2	-0.08	0.03	0	1.2.1(STA)
1	-0.08	0.03	2	-0.08	0.03	0	1.2.2(STA)
1	-0.08	0.03	3	-0.05	0.01	-0.03	1.2.2(STA)
2	-0.08	0.03	1	-0.08	0.03	0	1.2.2(STA)
2	-0.08	0.03	3	-0.05	0.01	-0.03	1.2.2(STA)
3	-0.05	0.01	1	-0.08	0.03	0.03	1.2.2(STA)
3	-0.05	0.01	2	-0.08	0.03	0.03	1.2.2(STA)
1	-0.17	0.05	2	0.01	0.02	-0.19	1.2.3(STA)
1	-0.17	0.05	3	0.03	0.01	-0.21	1.2.3(STA)
2	0.01	0.02	1	-0.17	0.05	0.19	1.2.3(STA)
2	0.01	0.02	3	0.03	0.01	-0.02	1.2.3(STA)
3	0.03	0.01	1	-0.17	0.05	0.21	1.2.3(STA)
3	0.03	0.01	2	0.01	0.02	0.02	1.2.3(STA)
1	-0.09	0.03	2	-0.09	0.03	0	2.1(AN G)
1	-0.09	0.03	3	-0.09	0.02	0	2.1(AN G)

2	-0.09	0.03	1	-0.09	0.03	0	2.1(AN G)
2	-0.09	0.03	3	-0.09	0.02	0	2.1(AN G)
3	-0.09	0.02	1	-0.09	0.03	0	2.1(AN G)
3	-0.09	0.02	2	-0.09	0.03	0	2.1(AN G)
1	0.05	0.02	2	0.05	0.02	0	2.2(AN G)
1	0.05	0.02	3	0.05	0.01	0	2.2(AN G)
2	0.05	0.02	1	0.05	0.02	0	2.2(AN G)
2	0.05	0.02	3	0.05	0.01	0	2.2(AN G)
3	0.05	0.01	1	0.05	0.02	0	2.2(AN G)
3	0.05	0.01	2	0.05	0.02	0	2.2(AN G)
1	-0.06	0.03	2	-0.06	0.03	0	2.3(AN G)
1	-0.06	0.03	3	-0.06	0.02	0	2.3(AN G)
2	-0.06	0.03	1	-0.06	0.03	0	2.3(AN G)
2	-0.06	0.03	3	-0.06	0.02	0	2.3(AN G)
3	-0.06	0.02	1	-0.06	0.03	0	2.3(AN G)
3	-0.06	0.02	2	-0.06	0.03	0	2.3(AN G)
1	-0.03	0.03	2	-0.03	0.02	0	2.4(AN G)
1	-0.03	0.03	3	-0.03	0.01	0	2.4(AN G)
2	-0.03	0.02	1	-0.03	0.03	0	2.4(AN G)
2	-0.03	0.02	3	-0.03	0.01	0	2.4(AN G)
3	-0.03	0.01	1	-0.03	0.03	0	2.4(AN G)
3	-0.03	0.01	2	-0.03	0.02	0	2.4(AN G)
1	0.16	0.02	2	0.04	0.02	0.12	2.5(AN G)
1	0.16	0.02	3	0.1	0.01	0.06	2.5(AN G)
2	0.04	0.02	1	0.16	0.02	-0.12	2.5(AN G)
2	0.04	0.02	3	0.1	0.01	-0.06	2.5(AN G)
3	0.1	0.01	1	0.16	0.02	-0.06	2.5(AN G)
3	0.1	0.01	2	0.04	0.02	0.06	2.5(AN G)
1	-0.04	0.03	2	-0.01	0.02	-0.02	2.6(AN G)
1	-0.04	0.03	3	-0.01	0.01	-0.02	2.6(AN G)
2	-0.01	0.02	1	-0.04	0.03	0.02	2.6(AN G)
2	-0.01	0.02	3	-0.01	0.01	0	2.6(AN G)
3	-0.01	0.01	1	-0.04	0.03	0.02	2.6(AN G)
3	-0.01	0.01	2	-0.01	0.02	0	2.6(AN G)
1	0.02	0.02	2	0.16	0.02	-0.13	2.7(AN G)
1	0.02	0.02	3	0.12	0.01	-0.09	2.7(AN G)
2	0.16	0.02	1	0.02	0.02	0.13	2.7(AN G)
2	0.16	0.02	3	0.12	0.01	0.04	2.7(AN G)
3	0.12	0.01	1	0.02	0.02	0.09	2.7(AN G)
3	0.12	0.01	2	0.16	0.02	-0.04	2.7(AN G)
1	0.12	0.02	2	-0.01	0.02	0.14	3.1.1(TRI)
1	0.12	0.02	3	0.06	0.01	0.07	3.1.1(TRI)
2	-0.01	0.02	1	0.12	0.02	-0.14	3.1.1(TRI)
2	-0.01	0.02	3	0.06	0.01	-0.07	3.1.1(TRI)
3	0.06	0.01	1	0.12	0.02	-0.07	3.1.1(TRI)

3	0.06	0.01	2	-0.01	0.02	0.07	3.1.1(TRI)
1	-0.06	0.03	2	-0.09	0.03	0.03	3.1.2(TRI)
1	-0.06	0.03	3	-0.06	0.02	0	3.1.2(TRI)
2	-0.09	0.03	1	-0.06	0.03	-0.03	3.1.2(TRI)
2	-0.09	0.03	3	-0.06	0.02	-0.03	3.1.2(TRI)
3	-0.06	0.02	1	-0.06	0.03	0	3.1.2(TRI)
3	-0.06	0.02	2	-0.09	0.03	0.03	3.1.2(TRI)
1	-0.11	0.04	2	-0.05	0.02	-0.06	3.1.3(TRI)
1	-0.11	0.04	3	-0.05	0.02	-0.06	3.1.3(TRI)
2	-0.05	0.02	1	-0.11	0.04	0.06	3.1.3(TRI)
2	-0.05	0.02	3	-0.05	0.02	0	3.1.3(TRI)
3	-0.05	0.02	1	-0.11	0.04	0.06	3.1.3(TRI)
3	-0.05	0.02	2	-0.05	0.02	0	3.1.3(TRI)
1	-0.1	0.04	2	0.02	0.02	-0.12	3.2.1(TRI)
1	-0.1	0.04	3	0.02	0.01	-0.12	3.2.1(TRI)
2	0.02	0.02	1	-0.1	0.04	0.12	3.2.1(TRI)
2	0.02	0.02	3	0.02	0.01	0	3.2.1(TRI)
3	0.02	0.01	1	-0.1	0.04	0.12	3.2.1(TRI)
3	0.02	0.01	2	0.02	0.02	0	3.2.1(TRI)
1	0.02	0.02	2	0.08	0.02	-0.06	3.2.2(TRI)
1	0.02	0.02	3	0.08	0.01	-0.06	3.2.2(TRI)
2	0.08	0.02	1	0.02	0.02	0.06	3.2.2(TRI)
2	0.08	0.02	3	0.08	0.01	0	3.2.2(TRI)
3	0.08	0.01	1	0.02	0.02	0.06	3.2.2(TRI)
3	0.08	0.01	2	0.08	0.02	0	3.2.2(TRI)
1	-0.01	0.03	2	0.01	0.02	-0.02	3.3.1(TRI)
1	-0.01	0.03	3	-0.01	0.01	0	3.3.1(TRI)
2	0.01	0.02	1	-0.01	0.03	0.02	3.3.1(TRI)
2	0.01	0.02	3	-0.01	0.01	0.02	3.3.1(TRI)
3	-0.01	0.01	1	-0.01	0.03	0	3.3.1(TRI)
3	-0.01	0.01	2	0.01	0.02	-0.02	3.3.1(TRI)
1	0.02	0.02	2	0.02	0.02	0	3.3.2(TRI)
1	0.02	0.02	3	0.05	0.01	-0.02	3.3.2(TRI)
2	0.02	0.02	1	0.02	0.02	0	3.3.2(TRI)
2	0.02	0.02	3	0.05	0.01	-0.02	3.3.2(TRI)
3	0.05	0.01	1	0.02	0.02	0.02	3.3.2(TRI)
3	0.05	0.01	2	0.02	0.02	0.02	3.3.2(TRI)
1	0	0.03	2	0.04	0.02	-0.04	3.3.3(TRI)
1	0	0.03	3	0.02	0.01	-0.02	3.3.3(TRI)
2	0.04	0.02	1	0	0.03	0.04	3.3.3(TRI)
2	0.04	0.02	3	0.02	0.01	0.02	3.3.3(TRI)
3	0.02	0.01	1	0	0.03	0.02	3.3.3(TRI)
3	0.02	0.01	2	0.04	0.02	-0.02	3.3.3(TRI)
1	-0.04	0.03	2	-0.07	0.03	0.03	4.1(TRI)
1	-0.04	0.03	3	-0.04	0.01	0	4.1(TRI)

2	-0.07	0.03	1	-0.04	0.03	-0.03	4.1(TRI)
2	-0.07	0.03	3	-0.04	0.01	-0.03	4.1(TRI)
3	-0.04	0.01	1	-0.04	0.03	0	4.1(TRI)
3	-0.04	0.01	2	-0.07	0.03	0.03	4.1(TRI)
1	0.11	0.02	2	0	0.02	0.11	4.2(TRI)
1	0.11	0.02	3	0.05	0.01	0.06	4.2(TRI)
2	0	0.02	1	0.11	0.02	-0.11	4.2(TRI)
2	0	0.02	3	0.05	0.01	-0.05	4.2(TRI)
3	0.05	0.01	1	0.11	0.02	-0.06	4.2(TRI)
3	0.05	0.01	2	0	0.02	0.05	4.2(TRI)
1	0.06	0.02	2	-0.02	0.02	0.08	5.1.1(TRI)
1	0.06	0.02	3	0.02	0.01	0.04	5.1.1(TRI)
2	-0.02	0.02	1	0.06	0.02	-0.08	5.1.1(TRI)
2	-0.02	0.02	3	0.02	0.01	-0.05	5.1.1(TRI)
3	0.02	0.01	1	0.06	0.02	-0.04	5.1.1(TRI)
3	0.02	0.01	2	-0.02	0.02	0.05	5.1.1(TRI)
1	0.03	0.02	2	0.08	0.02	-0.05	5.1.2(TRI)
1	0.03	0.02	3	0.06	0.01	-0.03	5.1.2(TRI)
2	0.08	0.02	1	0.03	0.02	0.05	5.1.2(TRI)
2	0.08	0.02	3	0.06	0.01	0.02	5.1.2(TRI)
3	0.06	0.01	1	0.03	0.02	0.03	5.1.2(TRI)
3	0.06	0.01	2	0.08	0.02	-0.02	5.1.2(TRI)
1	0.07	0.02	2	0.03	0.02	0.04	5.2(TRI)
1	0.07	0.02	3	0.07	0.01	0	5.2(TRI)
2	0.03	0.02	1	0.07	0.02	-0.04	5.2(TRI)
2	0.03	0.02	3	0.07	0.01	-0.04	5.2(TRI)
3	0.07	0.01	1	0.07	0.02	0	5.2(TRI)
3	0.07	0.01	2	0.03	0.02	0.04	5.2(TRI)
1	-0.01	0.03	2	0.03	0.02	-0.04	6.1(EU G)
1	-0.01	0.03	3	0.03	0.01	-0.04	6.1(EU G)
2	0.03	0.02	1	-0.01	0.03	0.04	6.1(EU G)
2	0.03	0.02	3	0.03	0.01	0	6.1(EU G)
3	0.03	0.01	1	-0.01	0.03	0.04	6.1(EU G)
3	0.03	0.01	2	0.03	0.02	0	6.1(EU G)
1	0.04	0.02	2	0.02	0.02	0.02	6.2(EU G)
1	0.04	0.02	3	0.04	0.01	0	6.2(EU G)
2	0.02	0.02	1	0.04	0.02	-0.02	6.2(EU G)
2	0.02	0.02	3	0.04	0.01	-0.02	6.2(EU G)
3	0.04	0.01	1	0.04	0.02	0	6.2(EU G)
3	0.04	0.01	2	0.02	0.02	0.02	6.2(EU G)
1	0.3	0.03	2	0.35	0.03	-0.04	7(EU G)
1	0.3	0.03	3	0.32	0.02	-0.02	7(EU G)
2	0.35	0.03	1	0.3	0.03	0.04	7(EU G)
2	0.35	0.03	3	0.32	0.02	0.02	7(EU G)
3	0.32	0.02	1	0.3	0.03	0.02	7(EU G)

3	0.32	0.02	2	0.35	0.03	-0.02	7(EU G)
1	-0.04	0.03	2	0.02	0.02	-0.06	8(EU G)
1	-0.04	0.03	3	0.02	0.01	-0.06	8(EU G)
2	0.02	0.02	1	-0.04	0.03	0.06	8(EU G)
2	0.02	0.02	3	0.02	0.01	0	8(EU G)
3	0.02	0.01	1	-0.04	0.03	0.06	8(EU G)
3	0.02	0.01	2	0.02	0.02	0	8(EU G)

Appendix D2: DIF measures for 2013 high-stakes examinations

Table D2.1: *SES Differential Item Functioning in 2013 examinations*

TABLE 30.1 C:\Documents and Settings\User\Desktop ZOU948WS.TXT Apr 21 15:07 2015
INPUT: 381 PERSONS 82 ITEMS MEASURED: 381 PERSONS 82 ITEMS 656 CATS
DIF class specification is: @SES2013

PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	ITEM
1	-0.06	0.04	2	-0.23	0.09	0.18	1.1.1(ALG)
1	-0.06	0.04	3	-0.3	0.05	0.24	1.1.1(ALG)
2	-0.23	0.09	1	-0.06	0.04	-0.18	1.1.1(ALG)
2	-0.23	0.09	3	-0.3	0.05	0.06	1.1.1(ALG)
3	-0.3	0.05	1	-0.06	0.04	-0.24	1.1.1(ALG)
3	-0.3	0.05	2	-0.23	0.09	-0.06	1.1.1(ALG)
1	-0.05	0.04	2	-0.13	0.07	0.08	1.1.2(ALG)
1	-0.05	0.04	3	-0.19	0.04	0.14	1.1.2(ALG)
2	-0.13	0.07	1	-0.05	0.04	-0.08	1.1.2(ALG)
2	-0.13	0.07	3	-0.19	0.04	0.05	1.1.2(ALG)
3	-0.19	0.04	1	-0.05	0.04	-0.14	1.1.2(ALG)
3	-0.19	0.04	2	-0.13	0.07	-0.05	1.1.2(ALG)
1	-0.02	0.04	2	-0.11	0.06	0.09	1.1.3(ALG)
1	-0.02	0.04	3	-0.17	0.04	0.16	1.1.3(ALG)
2	-0.11	0.06	1	-0.02	0.04	-0.09	1.1.3(ALG)
2	-0.11	0.06	3	-0.17	0.04	0.07	1.1.3(ALG)
3	-0.17	0.04	1	-0.02	0.04	-0.16	1.1.3(ALG)
3	-0.17	0.04	2	-0.11	0.06	-0.07	1.1.3(ALG)
1	0	0.04	2	-0.1	0.06	0.1	1.1.4(ALG)
1	0	0.04	3	-0.17	0.04	0.18	1.1.4(ALG)
2	-0.1	0.06	1	0	0.04	-0.1	1.1.4(ALG)
2	-0.1	0.06	3	-0.17	0.04	0.07	1.1.4(ALG)
3	-0.17	0.04	1	0	0.04	-0.18	1.1.4(ALG)
3	-0.17	0.04	2	-0.1	0.06	-0.07	1.1.4(ALG)
1	-0.3	0.11	2	-0.29	0.14	0	1.2.1(ALG)
1	-0.3	0.11	3	-0.24	0.06	-0.06	1.2.1(ALG)
2	-0.29	0.14	1	-0.3	0.11	0	1.2.1(ALG)
2	-0.29	0.14	3	-0.24	0.06	-0.06	1.2.1(ALG)
3	-0.24	0.06	1	-0.3	0.11	0.06	1.2.1(ALG)
3	-0.24	0.06	2	-0.29	0.14	0.06	1.2.1(ALG)
1	-0.43	0.1	2	-0.31	0.1	-0.11	1.2.2(ALG)
1	-0.43	0.1	3	-0.28	0.05	-0.15	1.2.2(ALG)
2	-0.31	0.1	1	-0.43	0.1	0.11	1.2.2(ALG)
2	-0.31	0.1	3	-0.28	0.05	-0.03	1.2.2(ALG)
3	-0.28	0.05	1	-0.43	0.1	0.15	1.2.2(ALG)

3	-0.28	0.05	2	-0.31	0.1	0.03	1.2.2(ALG)
1	-0.36	0.09	2	-0.28	0.1	-0.08	1.3.1(ALG)
1	-0.36	0.09	3	-0.33	0.06	-0.03	1.3.1(ALG)
2	-0.28	0.1	1	-0.36	0.09	0.08	1.3.1(ALG)
2	-0.28	0.1	3	-0.33	0.06	0.05	1.3.1(ALG)
3	-0.33	0.06	1	-0.36	0.09	0.03	1.3.1(ALG)
3	-0.33	0.06	2	-0.28	0.1	-0.05	1.3.1(ALG)
1	-0.23	0.07	2	-0.26	0.1	0.03	1.3.2(ALG)
1	-0.23	0.07	3	-0.26	0.05	0.03	1.3.2(ALG)
2	-0.26	0.1	1	-0.23	0.07	-0.03	1.3.2(ALG)
2	-0.26	0.1	3	-0.26	0.05	0	1.3.2(ALG)
3	-0.26	0.05	1	-0.23	0.07	-0.03	1.3.2(ALG)
3	-0.26	0.05	2	-0.26	0.1	0	1.3.2(ALG)
1	-0.18	0.06	2	-0.15	0.07	-0.03	1.4.1(ALG)
1	-0.18	0.06	3	-0.15	0.04	-0.03	1.4.1(ALG)
2	-0.15	0.07	1	-0.18	0.06	0.03	1.4.1(ALG)
2	-0.15	0.07	3	-0.15	0.04	0	1.4.1(ALG)
3	-0.15	0.04	1	-0.18	0.06	0.03	1.4.1(ALG)
3	-0.15	0.04	2	-0.15	0.07	0	1.4.1(ALG)
1	-0.1	0.05	2	-0.1	0.07	0	1.4.2(ALG)
1	-0.1	0.05	3	-0.1	0.04	0	1.4.2(ALG)
2	-0.1	0.07	1	-0.1	0.05	0	1.4.2(ALG)
2	-0.1	0.07	3	-0.1	0.04	0	1.4.2(ALG)
3	-0.1	0.04	1	-0.1	0.05	0	1.4.2(ALG)
3	-0.1	0.04	2	-0.1	0.07	0	1.4.2(ALG)
1	-0.34	0.07	2	-0.13	0.07	-0.21	2.1(ALG)
1	-0.34	0.07	3	-0.26	0.05	-0.07	2.1(ALG)
2	-0.13	0.07	1	-0.34	0.07	0.21	2.1(ALG)
2	-0.13	0.07	3	-0.26	0.05	0.14	2.1(ALG)
3	-0.26	0.05	1	-0.34	0.07	0.07	2.1(ALG)
3	-0.26	0.05	2	-0.13	0.07	-0.14	2.1(ALG)
1	-0.24	0.05	2	-0.1	0.06	-0.15	2.2.1(ALG)
1	-0.24	0.05	3	-0.04	0.03	-0.21	2.2.1(ALG)
2	-0.1	0.06	1	-0.24	0.05	0.15	2.2.1(ALG)
2	-0.1	0.06	3	-0.04	0.03	-0.06	2.2.1(ALG)
3	-0.04	0.03	1	-0.24	0.05	0.21	2.2.1(ALG)
3	-0.04	0.03	2	-0.1	0.06	0.06	2.2.1(ALG)
1	-0.14	0.04	2	-0.02	0.05	-0.13	2.2.2(ALG)
1	-0.14	0.04	3	-0.08	0.03	-0.06	2.2.2(ALG)
2	-0.02	0.05	1	-0.14	0.04	0.13	2.2.2(ALG)
2	-0.02	0.05	3	-0.08	0.03	0.07	2.2.2(ALG)
3	-0.08	0.03	1	-0.14	0.04	0.06	2.2.2(ALG)
3	-0.08	0.03	2	-0.02	0.05	-0.07	2.2.2(ALG)
1	-0.12	0.04	2	0.01	0.05	-0.13	2.3(ALG)
1	-0.12	0.04	3	-0.04	0.03	-0.07	2.3(ALG)

2	0.01	0.05	1	-0.12	0.04	0.13	2.3(ALG)
2	0.01	0.05	3	-0.04	0.03	0.06	2.3(ALG)
3	-0.04	0.03	1	-0.12	0.04	0.07	2.3(ALG)
3	-0.04	0.03	2	0.01	0.05	-0.06	2.3(ALG)
1	-0.1	0.05	2	-0.02	0.06	-0.08	3.1(ALG)
1	-0.1	0.05	3	-0.05	0.03	-0.05	3.1(ALG)
2	-0.02	0.06	1	-0.1	0.05	0.08	3.1(ALG)
2	-0.02	0.06	3	-0.05	0.03	0.03	3.1(ALG)
3	-0.05	0.03	1	-0.1	0.05	0.05	3.1(ALG)
3	-0.05	0.03	2	-0.02	0.06	-0.03	3.1(ALG)
1	-0.1	0.04	2	-0.05	0.05	-0.05	3.2.1(ALG)
1	-0.1	0.04	3	-0.1	0.03	0	3.2.1(ALG)
2	-0.05	0.05	1	-0.1	0.04	0.05	3.2.1(ALG)
2	-0.05	0.05	3	-0.1	0.03	0.05	3.2.1(ALG)
3	-0.1	0.03	1	-0.1	0.04	0	3.2.1(ALG)
3	-0.1	0.03	2	-0.05	0.05	-0.05	3.2.1(ALG)
1	-0.01	0.03	2	0.09	0.04	-0.11	3.2.2(ALG)
1	-0.01	0.03	3	0.03	0.03	-0.04	3.2.2(ALG)
2	0.09	0.04	1	-0.01	0.03	0.11	3.2.2(ALG)
2	0.09	0.04	3	0.03	0.03	0.07	3.2.2(ALG)
3	0.03	0.03	1	-0.01	0.03	0.04	3.2.2(ALG)
3	0.03	0.03	2	0.09	0.04	-0.07	3.2.2(ALG)
1	-0.02	0.04	2	0.05	0.05	-0.07	3.3(ALG)
1	-0.02	0.04	3	0.05	0.03	-0.07	3.3(ALG)
2	0.05	0.05	1	-0.02	0.04	0.07	3.3(ALG)
2	0.05	0.05	3	0.05	0.03	0	3.3(ALG)
3	0.05	0.03	1	-0.02	0.04	0.07	3.3(ALG)
3	0.05	0.03	2	0.05	0.05	0	3.3(ALG)
1	0.02	0.04	2	0.19	0.05	-0.18	3.4(ALG)
1	0.02	0.04	3	0.13	0.03	-0.12	3.4(ALG)
2	0.19	0.05	1	0.02	0.04	0.18	3.4(ALG)
2	0.19	0.05	3	0.13	0.03	0.06	3.4(ALG)
3	0.13	0.03	1	0.02	0.04	0.12	3.4(ALG)
3	0.13	0.03	2	0.19	0.05	-0.06	3.4(ALG)
1	-0.36	0.09	2	-0.16	0.09	-0.2	4.1.1(PAT)
1	-0.36	0.09	3	-0.05	0.04	-0.31	4.1.1(PAT)
2	-0.16	0.09	1	-0.36	0.09	0.2	4.1.1(PAT)
2	-0.16	0.09	3	-0.05	0.04	-0.11	4.1.1(PAT)
3	-0.05	0.04	1	-0.36	0.09	0.31	4.1.1(PAT)
3	-0.05	0.04	2	-0.16	0.09	0.11	4.1.1(PAT)
1	-0.18	0.05	2	-0.29	0.09	0.11	4.1.2(PAT)
1	-0.18	0.05	3	-0.15	0.04	-0.03	4.1.2(PAT)
2	-0.29	0.09	1	-0.18	0.05	-0.11	4.1.2(PAT)
2	-0.29	0.09	3	-0.15	0.04	-0.13	4.1.2(PAT)
3	-0.15	0.04	1	-0.18	0.05	0.03	4.1.2(PAT)

3	-0.15	0.04	2	-0.29	0.09	0.13	4.1.2(PAT)
1	-0.09	0.05	2	-0.06	0.06	-0.03	4.2(PAT)
1	-0.09	0.05	3	-0.09	0.03	0	4.2(PAT)
2	-0.06	0.06	1	-0.09	0.05	0.03	4.2(PAT)
2	-0.06	0.06	3	-0.09	0.03	0.03	4.2(PAT)
3	-0.09	0.03	1	-0.09	0.05	0	4.2(PAT)
3	-0.09	0.03	2	-0.06	0.06	-0.03	4.2(PAT)
1	-0.05	0.04	2	-0.11	0.06	0.05	4.3.1(PAT)
1	-0.05	0.04	3	-0.14	0.03	0.09	4.3.1(PAT)
2	-0.11	0.06	1	-0.05	0.04	-0.05	4.3.1(PAT)
2	-0.11	0.06	3	-0.14	0.03	0.03	4.3.1(PAT)
3	-0.14	0.03	1	-0.05	0.04	-0.09	4.3.1(PAT)
3	-0.14	0.03	2	-0.11	0.06	-0.03	4.3.1(PAT)
1	-0.04	0.03	2	-0.04	0.05	0	4.3.2(PAT)
1	-0.04	0.03	3	-0.04	0.03	0	4.3.2(PAT)
2	-0.04	0.05	1	-0.04	0.03	0	4.3.2(PAT)
2	-0.04	0.05	3	-0.04	0.03	0	4.3.2(PAT)
3	-0.04	0.03	1	-0.04	0.03	0	4.3.2(PAT)
3	-0.04	0.03	2	-0.04	0.05	0	4.3.2(PAT)
1	0.05	0.03	2	-0.03	0.05	0.08	4.3.3(PAT)
1	0.05	0.03	3	-0.02	0.03	0.07	4.3.3(PAT)
2	-0.03	0.05	1	0.05	0.03	-0.08	4.3.3(PAT)
2	-0.03	0.05	3	-0.02	0.03	-0.01	4.3.3(PAT)
3	-0.02	0.03	1	0.05	0.03	-0.07	4.3.3(PAT)
3	-0.02	0.03	2	-0.03	0.05	0.01	4.3.3(PAT)
1	-0.01	0.03	2	-0.08	0.05	0.07	4.3.4(PAT)
1	-0.01	0.03	3	-0.01	0.03	0	4.3.4(PAT)
2	-0.08	0.05	1	-0.01	0.03	-0.07	4.3.4(PAT)
2	-0.08	0.05	3	-0.01	0.03	-0.07	4.3.4(PAT)
3	-0.01	0.03	1	-0.01	0.03	0	4.3.4(PAT)
3	-0.01	0.03	2	-0.08	0.05	0.07	4.3.4(PAT)
1	0.09	0.03	2	0.03	0.05	0.06	5.1.1(FUN)
1	0.09	0.03	3	0.03	0.03	0.06	5.1.1(FUN)
2	0.03	0.05	1	0.09	0.03	-0.06	5.1.1(FUN)
2	0.03	0.05	3	0.03	0.03	0	5.1.1(FUN)
3	0.03	0.03	1	0.09	0.03	-0.06	5.1.1(FUN)
3	0.03	0.03	2	0.03	0.05	0	5.1.1(FUN)
1	-0.04	0.04	2	0.09	0.04	-0.13	5.1.2(FUN)
1	-0.04	0.04	3	0.06	0.03	-0.1	5.1.2(FUN)
2	0.09	0.04	1	-0.04	0.04	0.13	5.1.2(FUN)
2	0.09	0.04	3	0.06	0.03	0.03	5.1.2(FUN)
3	0.06	0.03	1	-0.04	0.04	0.1	5.1.2(FUN)
3	0.06	0.03	2	0.09	0.04	-0.03	5.1.2(FUN)
1	0.08	0.03	2	0.17	0.04	-0.09	5.1.3(FUN)
1	0.08	0.03	3	0.17	0.02	-0.1	5.1.3(FUN)

2	0.17	0.04	1	0.08	0.03	0.09	5.1.3(FUN)
2	0.17	0.04	3	0.17	0.02	0	5.1.3(FUN)
3	0.17	0.02	1	0.08	0.03	0.1	5.1.3(FUN)
3	0.17	0.02	2	0.17	0.04	0	5.1.3(FUN)
1	0.12	0.03	2	0.31	0.04	-0.19	5.1.4(FUN)
1	0.12	0.03	3	0.3	0.02	-0.18	5.1.4(FUN)
2	0.31	0.04	1	0.12	0.03	0.19	5.1.4(FUN)
2	0.31	0.04	3	0.3	0.02	0.01	5.1.4(FUN)
3	0.3	0.02	1	0.12	0.03	0.18	5.1.4(FUN)
3	0.3	0.02	2	0.31	0.04	-0.01	5.1.4(FUN)
1	0.16	0.03	2	0.33	0.04	-0.18	5.1.5(FUN)
1	0.16	0.03	3	0.21	0.02	-0.05	5.1.5(FUN)
2	0.33	0.04	1	0.16	0.03	0.18	5.1.5(FUN)
2	0.33	0.04	3	0.21	0.02	0.12	5.1.5(FUN)
3	0.21	0.02	1	0.16	0.03	0.05	5.1.5(FUN)
3	0.21	0.02	2	0.33	0.04	-0.12	5.1.5(FUN)
1	0.09	0.03	2	0.12	0.04	-0.03	6.1.1(FUN)
1	0.09	0.03	3	0.07	0.03	0.02	6.1.1(FUN)
2	0.12	0.04	1	0.09	0.03	0.03	6.1.1(FUN)
2	0.12	0.04	3	0.07	0.03	0.05	6.1.1(FUN)
3	0.07	0.03	1	0.09	0.03	-0.02	6.1.1(FUN)
3	0.07	0.03	2	0.12	0.04	-0.05	6.1.1(FUN)
1	0.08	0.03	2	0.22	0.04	-0.14	6.1.2(FUN)
1	0.08	0.03	3	0.13	0.02	-0.04	6.1.2(FUN)
2	0.22	0.04	1	0.08	0.03	0.14	6.1.2(FUN)
2	0.22	0.04	3	0.13	0.02	0.09	6.1.2(FUN)
3	0.13	0.02	1	0.08	0.03	0.04	6.1.2(FUN)
3	0.13	0.02	2	0.22	0.04	-0.09	6.1.2(FUN)
1	0.18	0.03	2	0.31	0.05	-0.13	6.1.3(FUN)
1	0.18	0.03	3	0.15	0.03	0.03	6.1.3(FUN)
2	0.31	0.05	1	0.18	0.03	0.13	6.1.3(FUN)
2	0.31	0.05	3	0.15	0.03	0.16	6.1.3(FUN)
3	0.15	0.03	1	0.18	0.03	-0.03	6.1.3(FUN)
3	0.15	0.03	2	0.31	0.05	-0.16	6.1.3(FUN)
1	0.14	0.03	2	0.22	0.04	-0.07	6.1.4(FUN)
1	0.14	0.03	3	0.14	0.02	0	6.1.4(FUN)
2	0.22	0.04	1	0.14	0.03	0.07	6.1.4(FUN)
2	0.22	0.04	3	0.14	0.02	0.07	6.1.4(FUN)
3	0.14	0.02	1	0.14	0.03	0	6.1.4(FUN)
3	0.14	0.02	2	0.22	0.04	-0.07	6.1.4(FUN)
1	0.17	0.03	2	0.23	0.04	-0.05	6.1.5(FUN)
1	0.17	0.03	3	0.17	0.02	0	6.1.5(FUN)
2	0.23	0.04	1	0.17	0.03	0.05	6.1.5(FUN)
2	0.23	0.04	3	0.17	0.02	0.05	6.1.5(FUN)
3	0.17	0.02	1	0.17	0.03	0	6.1.5(FUN)

3	0.17	0.02	2	0.23	0.04	-0.05	6.1.5(FUN)
1	0.19	0.03	2	0.28	0.04	-0.09	6.1.6(FUN)
1	0.19	0.03	3	0.17	0.02	0.03	6.1.6(FUN)
2	0.28	0.04	1	0.19	0.03	0.09	6.1.6(FUN)
2	0.28	0.04	3	0.17	0.02	0.11	6.1.6(FUN)
3	0.17	0.02	1	0.19	0.03	-0.03	6.1.6(FUN)
3	0.17	0.02	2	0.28	0.04	-0.11	6.1.6(FUN)
1	0.23	0.03	2	0.1	0.05	0.13	7.1.1(FIN)
1	0.23	0.03	3	-0.12	0.04	0.35	7.1.1(FIN)
2	0.1	0.05	1	0.23	0.03	-0.13	7.1.1(FIN)
2	0.1	0.05	3	-0.12	0.04	0.22	7.1.1(FIN)
3	-0.12	0.04	1	0.23	0.03	-0.35	7.1.1(FIN)
3	-0.12	0.04	2	0.1	0.05	-0.22	7.1.1(FIN)
1	0.18	0.03	2	0.08	0.04	0.1	7.1.2(FIN)
1	0.18	0.03	3	0	0.03	0.17	7.1.2(FIN)
2	0.08	0.04	1	0.18	0.03	-0.1	7.1.2(FIN)
2	0.08	0.04	3	0	0.03	0.07	7.1.2(FIN)
3	0	0.03	1	0.18	0.03	-0.17	7.1.2(FIN)
3	0	0.03	2	0.08	0.04	-0.07	7.1.2(FIN)
1	0.17	0.03	2	0.1	0.05	0.07	7.1.3(FIN)
1	0.17	0.03	3	0.05	0.03	0.12	7.1.3(FIN)
2	0.1	0.05	1	0.17	0.03	-0.07	7.1.3(FIN)
2	0.1	0.05	3	0.05	0.03	0.05	7.1.3(FIN)
3	0.05	0.03	1	0.17	0.03	-0.12	7.1.3(FIN)
3	0.05	0.03	2	0.1	0.05	-0.05	7.1.3(FIN)
1	0.06	0.04	2	0	0.06	0.06	7.2(FIN)
1	0.06	0.04	3	0.06	0.03	0	7.2(FIN)
2	0	0.06	1	0.06	0.04	-0.06	7.2(FIN)
2	0	0.06	3	0.06	0.03	-0.06	7.2(FIN)
3	0.06	0.03	1	0.06	0.04	0	7.2(FIN)
3	0.06	0.03	2	0	0.06	0.06	7.2(FIN)
1	0.09	0.04	2	0.04	0.06	0.04	8.1.1(PRO)
1	0.09	0.04	3	-0.09	0.04	0.18	8.1.1(PRO)
2	0.04	0.06	1	0.09	0.04	-0.04	8.1.1(PRO)
2	0.04	0.06	3	-0.09	0.04	0.14	8.1.1(PRO)
3	-0.09	0.04	1	0.09	0.04	-0.18	8.1.1(PRO)
3	-0.09	0.04	2	0.04	0.06	-0.14	8.1.1(PRO)
1	0.1	0.03	2	-0.04	0.05	0.14	8.1.2(PRO)
1	0.1	0.03	3	-0.17	0.04	0.26	8.1.2(PRO)
2	-0.04	0.05	1	0.1	0.03	-0.14	8.1.2(PRO)
2	-0.04	0.05	3	-0.17	0.04	0.13	8.1.2(PRO)
3	-0.17	0.04	1	0.1	0.03	-0.26	8.1.2(PRO)
3	-0.17	0.04	2	-0.04	0.05	-0.13	8.1.2(PRO)
1	0.15	0.03	2	0	0.05	0.15	8.1.3(PRO)
1	0.15	0.03	3	-0.13	0.03	0.28	8.1.3(PRO)

2	0	0.05	1	0.15	0.03	-0.15	8.1.3(PRO)
2	0	0.05	3	-0.13	0.03	0.13	8.1.3(PRO)
3	-0.13	0.03	1	0.15	0.03	-0.28	8.1.3(PRO)
3	-0.13	0.03	2	0	0.05	-0.13	8.1.3(PRO)
1	0.19	0.03	2	0.19	0.04	0.01	8.2.1(PRO)
1	0.19	0.03	3	-0.02	0.03	0.21	8.2.1(PRO)
2	0.19	0.04	1	0.19	0.03	-0.01	8.2.1(PRO)
2	0.19	0.04	3	-0.02	0.03	0.2	8.2.1(PRO)
3	-0.02	0.03	1	0.19	0.03	-0.21	8.2.1(PRO)
3	-0.02	0.03	2	0.19	0.04	-0.2	8.2.1(PRO)
1	0.16	0.03	2	0.09	0.04	0.07	8.2.2(PRO)
1	0.16	0.03	3	-0.02	0.03	0.18	8.2.2(PRO)
2	0.09	0.04	1	0.16	0.03	-0.07	8.2.2(PRO)
2	0.09	0.04	3	-0.02	0.03	0.11	8.2.2(PRO)
3	-0.02	0.03	1	0.16	0.03	-0.18	8.2.2(PRO)
3	-0.02	0.03	2	0.09	0.04	-0.11	8.2.2(PRO)
1	0.18	0.03	2	0.2	0.04	-0.01	8.2.3(PRO)
1	0.18	0.03	3	0.06	0.03	0.12	8.2.3(PRO)
2	0.2	0.04	1	0.18	0.03	0.01	8.2.3(PRO)
2	0.2	0.04	3	0.06	0.03	0.13	8.2.3(PRO)
3	0.06	0.03	1	0.18	0.03	-0.12	8.2.3(PRO)
3	0.06	0.03	2	0.2	0.04	-0.13	8.2.3(PRO)
1	0.01	0.04	2	-0.03	0.06	0.04	1.1(STA)
1	0.01	0.04	3	-0.06	0.03	0.07	1.1(STA)
2	-0.03	0.06	1	0.01	0.04	-0.04	1.1(STA)
2	-0.03	0.06	3	-0.06	0.03	0.03	1.1(STA)
3	-0.06	0.03	1	0.01	0.04	-0.07	1.1(STA)
3	-0.06	0.03	2	-0.03	0.06	-0.03	1.1(STA)
1	-0.08	0.04	2	0.09	0.04	-0.17	1.1.1(STA)
1	-0.08	0.04	3	-0.09	0.03	0.01	1.1.1(STA)
2	0.09	0.04	1	-0.08	0.04	0.17	1.1.1(STA)
2	0.09	0.04	3	-0.09	0.03	0.18	1.1.1(STA)
3	-0.09	0.03	1	-0.08	0.04	-0.01	1.1.1(STA)
3	-0.09	0.03	2	0.09	0.04	-0.18	1.1.1(STA)
1	-0.05	0.04	2	0.09	0.04	-0.15	1.1.2(STA)
1	-0.05	0.04	3	-0.12	0.03	0.07	1.1.2(STA)
2	0.09	0.04	1	-0.05	0.04	0.15	1.1.2(STA)
2	0.09	0.04	3	-0.12	0.03	0.22	1.1.2(STA)
3	-0.12	0.03	1	-0.05	0.04	-0.07	1.1.2(STA)
3	-0.12	0.03	2	0.09	0.04	-0.22	1.1.2(STA)
1	-0.01	0.04	2	0.1	0.04	-0.12	1.1.3(STA)
1	-0.01	0.04	3	-0.06	0.03	0.05	1.1.3(STA)
2	0.1	0.04	1	-0.01	0.04	0.12	1.1.3(STA)
2	0.1	0.04	3	-0.06	0.03	0.16	1.1.3(STA)
3	-0.06	0.03	1	-0.01	0.04	-0.05	1.1.3(STA)

3	-0.06	0.03	2	0.1	0.04	-0.16	1.1.3(STA)
1	-0.06	0.1	2	-0.15	0.17	0.1	2.1(STA)
1	-0.06	0.1	3	0.06	0.05	-0.12	2.1(STA)
2	-0.15	0.17	1	-0.06	0.1	-0.1	2.1(STA)
2	-0.15	0.17	3	0.06	0.05	-0.21	2.1(STA)
3	0.06	0.05	1	-0.06	0.1	0.12	2.1(STA)
3	0.06	0.05	2	-0.15	0.17	0.21	2.1(STA)
1	-0.22	0.13	2	-0.23	0.18	0	2.2(STA)
1	-0.22	0.13	3	0.02	0.05	-0.24	2.2(STA)
2	-0.23	0.18	1	-0.22	0.13	0	2.2(STA)
2	-0.23	0.18	3	0.02	0.05	-0.25	2.2(STA)
3	0.02	0.05	1	-0.22	0.13	0.24	2.2(STA)
3	0.02	0.05	2	-0.23	0.18	0.25	2.2(STA)
1	-0.15	0.06	2	-0.6	0.2	0.45	2.3(STA)
1	-0.15	0.06	3	-0.26	0.06	0.1	2.3(STA)
2	-0.6	0.2	1	-0.15	0.06	-0.45	2.3(STA)
2	-0.6	0.2	3	-0.26	0.06	-0.35	2.3(STA)
3	-0.26	0.06	1	-0.15	0.06	-0.1	2.3(STA)
3	-0.26	0.06	2	-0.6	0.2	0.35	2.3(STA)
1	-0.09	0.05	2	-0.32	0.12	0.23	2.4(STA)
1	-0.09	0.05	3	-0.17	0.05	0.07	2.4(STA)
2	-0.32	0.12	1	-0.09	0.05	-0.23	2.4(STA)
2	-0.32	0.12	3	-0.17	0.05	-0.15	2.4(STA)
3	-0.17	0.05	1	-0.09	0.05	-0.07	2.4(STA)
3	-0.17	0.05	2	-0.32	0.12	0.15	2.4(STA)
1	0.06	0.04	2	-0.36	0.14	0.42	2.5(STA)
1	0.06	0.04	3	-0.11	0.04	0.16	2.5(STA)
2	-0.36	0.14	1	0.06	0.04	-0.42	2.5(STA)
2	-0.36	0.14	3	-0.11	0.04	-0.25	2.5(STA)
3	-0.11	0.04	1	0.06	0.04	-0.16	2.5(STA)
3	-0.11	0.04	2	-0.36	0.14	0.25	2.5(STA)
1	-0.02	0.05	2	-0.52	0.18	**0.5**	**2.6(STA)**
1	-0.02	0.05	3	-0.08	0.04	0.06	2.6(STA)
2	-0.52	0.18	1	-0.02	0.05	**-0.5**	**2.6(STA)**
2	-0.52	0.18	3	-0.08	0.04	-0.44	2.6(STA)
3	-0.08	0.04	1	-0.02	0.05	-0.06	2.6(STA)
3	-0.08	0.04	2	-0.52	0.18	0.44	2.6(STA)
1	-0.05	0.04	2	0.08	0.04	-0.13	2.7(STA)
1	-0.05	0.04	3	0.13	0.02	-0.18	2.7(STA)
2	0.08	0.04	1	-0.05	0.04	0.13	2.7(STA)
2	0.08	0.04	3	0.13	0.02	-0.06	2.7(STA)
3	0.13	0.02	1	-0.05	0.04	0.18	2.7(STA)
3	0.13	0.02	2	0.08	0.04	0.06	2.7(STA)
1	0.16	0.04	2	0.09	0.06	0.07	2.8(STA)
1	0.16	0.04	3	0.09	0.03	0.07	2.8(STA)

2	0.09	0.06	1	0.16	0.04	-0.07	2.8(STA)
2	0.09	0.06	3	0.09	0.03	0	2.8(STA)
3	0.09	0.03	1	0.16	0.04	-0.07	2.8(STA)
3	0.09	0.03	2	0.09	0.06	0	2.8(STA)
1	-0.04	0.04	2	0.03	0.05	-0.07	2.9(STA)
1	-0.04	0.04	3	0.07	0.03	-0.11	2.9(STA)
2	0.03	0.05	1	-0.04	0.04	0.07	2.9(STA)
2	0.03	0.05	3	0.07	0.03	-0.04	2.9(STA)
3	0.07	0.03	1	-0.04	0.04	0.11	2.9(STA)
3	0.07	0.03	2	0.03	0.05	0.04	2.9(STA)
1	0.09	0.03	2	0.03	0.04	0.06	2,10(STA)
1	0.09	0.03	3	0.09	0.02	0	2,10(STA)
2	0.03	0.04	1	0.09	0.03	-0.06	2,10(STA)
2	0.03	0.04	3	0.09	0.02	-0.06	2,10(STA)
3	0.09	0.02	1	0.09	0.03	0	2,10(STA)
3	0.09	0.02	2	0.03	0.04	0.06	2,10(STA)
1	0.15	0.03	2	0.04	0.05	0.11	2,11(STA)
1	0.15	0.03	3	0.06	0.02	0.09	2,11(STA)
2	0.04	0.05	1	0.15	0.03	-0.11	2,11(STA)
2	0.04	0.05	3	0.06	0.02	-0.02	2,11(STA)
3	0.06	0.02	1	0.15	0.03	-0.09	2,11(STA)
3	0.06	0.02	2	0.04	0.05	0.02	2,11(STA)
1	0.06	0.04	2	0.06	0.06	0	3.1(AN
1	0.06	0.04	3	0.06	0.03	0	3.1(AN
2	0.06	0.06	1	0.06	0.04	0	3.1(AN
2	0.06	0.06	3	0.06	0.03	0	3.1(AN
3	0.06	0.03	1	0.06	0.04	0	3.1(AN
3	0.06	0.03	2	0.06	0.06	0	3.1(AN
1	-0.03	0.04	2	-0.06	0.05	0.03	3.2(AN
1	-0.03	0.04	3	0.09	0.03	-0.12	3.2(AN
2	-0.06	0.05	1	-0.03	0.04	-0.03	3.2(AN
2	-0.06	0.05	3	0.09	0.03	-0.15	3.2(AN
3	0.09	0.03	1	-0.03	0.04	0.12	3.2(AN
3	0.09	0.03	2	-0.06	0.05	0.15	3.2(AN
1	0.03	0.03	2	0.05	0.04	-0.03	3.3(AN
1	0.03	0.03	3	0.05	0.02	-0.03	3.3(AN
2	0.05	0.04	1	0.03	0.03	0.03	3.3(AN
2	0.05	0.04	3	0.05	0.02	0	3.3(AN
3	0.05	0.02	1	0.03	0.03	0.03	3.3(AN
3	0.05	0.02	2	0.05	0.04	0	3.3(AN
1	-0.13	0.05	2	-0.21	0.07	0.08	4.1.1(TRI)
1	-0.13	0.05	3	-0.06	0.03	-0.07	4.1.1(TRI)
2	-0.21	0.07	1	-0.13	0.05	-0.08	4.1.1(TRI)
2	-0.21	0.07	3	-0.06	0.03	-0.15	4.1.1(TRI)
3	-0.06	0.03	1	-0.13	0.05	0.07	4.1.1(TRI)

3	-0.06	0.03	2	-0.21	0.07	0.15	4.1.1(TRI)
1	-0.08	0.04	2	-0.15	0.06	0.08	4.1.2(TRI)
1	-0.08	0.04	3	-0.01	0.03	-0.07	4.1.2(TRI)
2	-0.15	0.06	1	-0.08	0.04	-0.08	4.1.2(TRI)
2	-0.15	0.06	3	-0.01	0.03	-0.15	4.1.2(TRI)
3	-0.01	0.03	1	-0.08	0.04	0.07	4.1.2(TRI)
3	-0.01	0.03	2	-0.15	0.06	0.15	4.1.2(TRI)
1	-0.01	0.03	2	-0.02	0.05	0.01	4.13(TRI)
1	-0.01	0.03	3	0.04	0.02	-0.05	4.13(TRI)
2	-0.02	0.05	1	-0.01	0.03	-0.01	4.13(TRI)
2	-0.02	0.05	3	0.04	0.02	-0.05	4.13(TRI)
3	0.04	0.02	1	-0.01	0.03	0.05	4.13(TRI)
3	0.04	0.02	2	-0.02	0.05	0.05	4.13(TRI)
1	0.06	0.03	2	-0.11	0.05	0.18	4.3(TRI)
1	0.06	0.03	3	0.02	0.02	0.04	4.3(TRI)
2	-0.11	0.05	1	0.06	0.03	-0.18	4.3(TRI)
2	-0.11	0.05	3	0.02	0.02	-0.13	4.3(TRI)
3	0.02	0.02	1	0.06	0.03	-0.04	4.3(TRI)
3	0.02	0.02	2	-0.11	0.05	0.13	4.3(TRI)
1	0.03	0.03	2	-0.08	0.05	0.11	4.4.1(TRI)
1	0.03	0.03	3	0.12	0.02	-0.08	4.4.1(TRI)
2	-0.08	0.05	1	0.03	0.03	-0.11	4.4.1(TRI)
2	-0.08	0.05	3	0.12	0.02	-0.2	4.4.1(TRI)
3	0.12	0.02	1	0.03	0.03	0.08	4.4.1(TRI)
3	0.12	0.02	2	-0.08	0.05	0.2	4.4.1(TRI)
1	0.09	0.03	2	-0.08	0.05	0.17	4.4.2(TRI)
1	0.09	0.03	3	0.13	0.03	-0.05	4.4.2(TRI)
2	-0.08	0.05	1	0.09	0.03	-0.17	4.4.2(TRI)
2	-0.08	0.05	3	0.13	0.03	-0.22	4.4.2(TRI)
3	0.13	0.03	1	0.09	0.03	0.05	4.4.2(TRI)
3	0.13	0.03	2	-0.08	0.05	0.22	4.4.2(TRI)
1	0.1	0.04	2	0.13	0.05	-0.02	5.1(TRI)
1	0.1	0.04	3	0.13	0.03	-0.02	5.1(TRI)
2	0.13	0.05	1	0.1	0.04	0.02	5.1(TRI)
2	0.13	0.05	3	0.13	0.03	0	5.1(TRI)
3	0.13	0.03	1	0.1	0.04	0.02	5.1(TRI)
3	0.13	0.03	2	0.13	0.05	0	5.1(TRI)
1	-0.04	0.04	2	0.1	0.05	-0.15	5.2(TRI)
1	-0.04	0.04	3	0.05	0.03	-0.1	5.2(TRI)
2	0.1	0.05	1	-0.04	0.04	0.15	5.2(TRI)
2	0.1	0.05	3	0.05	0.03	0.05	5.2(TRI)
3	0.05	0.03	1	-0.04	0.04	0.1	5.2(TRI)
3	0.05	0.03	2	0.1	0.05	-0.05	5.2(TRI)
1	-0.08	0.04	2	0	0.05	-0.08	6.1(EU
1	-0.08	0.04	3	0.11	0.02	-0.19	6.1(EU

2	0	0.05	1	-0.08	0.04	0.08	6.1(EU
2	0	0.05	3	0.11	0.02	-0.11	6.1(EU
3	0.11	0.02	1	-0.08	0.04	0.19	6.1(EU
3	0.11	0.02	2	0	0.05	0.11	6.1(EU
1	0.02	0.03	2	0.13	0.04	-0.11	6.2.i(EU
1	0.02	0.03	3	0.19	0.02	-0.17	6.2.i(EU
2	0.13	0.04	1	0.02	0.03	0.11	6.2.i(EU
2	0.13	0.04	3	0.19	0.02	-0.06	6.2.i(EU
3	0.19	0.02	1	0.02	0.03	0.17	6.2.i(EU
3	0.19	0.02	2	0.13	0.04	0.06	6.2.i(EU
1	0.09	0.03	2	0.19	0.04	-0.1	6.2.ii(EU
1	0.09	0.03	3	0.2	0.02	-0.11	6.2.ii(EU
2	0.19	0.04	1	0.09	0.03	0.1	6.2.ii(EU
2	0.19	0.04	3	0.2	0.02	-0.01	6.2.ii(EU
3	0.2	0.02	1	0.09	0.03	0.11	6.2.ii(EU
3	0.2	0.02	2	0.19	0.04	0.01	6.2.ii(EU
1	0.1	0.03	2	0.04	0.05	0.06	7.1(EU
1	0.1	0.03	3	0.06	0.03	0.03	7.1(EU
2	0.04	0.05	1	0.1	0.03	-0.06	7.1(EU
2	0.04	0.05	3	0.06	0.03	-0.03	7.1(EU
3	0.06	0.03	1	0.1	0.03	-0.03	7.1(EU
3	0.06	0.03	2	0.04	0.05	0.03	7.1(EU
1	0.01	0.03	2	0.03	0.05	-0.03	7.2(EU
1	0.01	0.03	3	0.06	0.03	-0.05	7.2(EU
2	0.03	0.05	1	0.01	0.03	0.03	7.2(EU
2	0.03	0.05	3	0.06	0.03	-0.02	7.2(EU
3	0.06	0.03	1	0.01	0.03	0.05	7.2(EU
3	0.06	0.03	2	0.03	0.05	0.02	7.2(EU
1	0.08	0.03	2	0.01	0.05	0.07	7.3(EU
1	0.08	0.03	3	0.1	0.02	-0.02	7.3(EU
2	0.01	0.05	1	0.08	0.03	-0.07	7.3(EU
2	0.01	0.05	3	0.1	0.02	-0.09	7.3(EU
3	0.1	0.02	1	0.08	0.03	0.02	7.3(EU
3	0.1	0.02	2	0.01	0.05	0.09	7.3(EU
1	0.07	0.03	2	-0.21	0.07	0.28	8.1(MEA)
1	0.07	0.03	3	0.14	0.02	-0.07	8.1(MEA)
2	-0.21	0.07	1	0.07	0.03	-0.28	8.1(MEA)
2	-0.21	0.07	3	0.14	0.02	-0.35	8.1(MEA)
3	0.14	0.02	1	0.07	0.03	0.07	8.1(MEA)
3	0.14	0.02	2	-0.21	0.07	0.35	8.1(MEA)
1	0.13	0.03	2	-0.13	0.06	0.27	8.2(MEA)
1	0.13	0.03	3	0.14	0.02	-0.01	8.2(MEA)
2	-0.13	0.06	1	0.13	0.03	-0.27	8.2(MEA)
2	-0.13	0.06	3	0.14	0.02	-0.28	8.2(MEA)
3	0.14	0.02	1	0.13	0.03	0.01	8.2(MEA)

3	0.14	0.02	2	-0.13	0.06	0.28	8.2(MEA)
1	0.18	0.03	2	-0.05	0.05	0.24	8.3(MEA)
1	0.18	0.03	3	0.24	0.02	-0.06	8.3(MEA)
2	-0.05	0.05	1	0.18	0.03	-0.24	8.3(MEA)
2	-0.05	0.05	3	0.24	0.02	-0.3	8.3(MEA)
3	0.24	0.02	1	0.18	0.03	0.06	8.3(MEA)
3	0.24	0.02	2	-0.05	0.05	0.3	8.3(MEA)

Table D2.2: *SES Differential Item Functioning in 2013 examinations after excluding2.6 (STA)*

TABLE 30.1 F2013p1p2forSES with mea no 26sta.xls ZOU660WS.TXT Mar 11 15:08 2015INPUT: 381 PERSONS 81 ITEMS MEASURED: 381 PERSONS 81 ITEMS							
PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	ITEM
1	-0.11	0.04	2	-0.28	0.08	0.17	1.1.1(ALG)
1	-0.11	0.04	3	-0.34	0.05	0.23	1.1.1(ALG)
2	-0.28	0.08	1	-0.11	0.04	-0.17	1.1.1(ALG)
2	-0.28	0.08	3	-0.34	0.05	0.05	1.1.1(ALG)
3	-0.34	0.05	1	-0.11	0.04	-0.23	1.1.1(ALG)
3	-0.34	0.05	2	-0.28	0.08	-0.05	1.1.1(ALG)
1	-0.1	0.04	2	-0.18	0.07	0.08	1.1.2(ALG)
1	-0.1	0.04	3	-0.23	0.04	0.13	1.1.2(ALG)
2	-0.18	0.07	1	-0.1	0.04	-0.08	1.1.2(ALG)
2	-0.18	0.07	3	-0.23	0.04	0.05	1.1.2(ALG)
3	-0.23	0.04	1	-0.1	0.04	-0.13	1.1.2(ALG)
3	-0.23	0.04	2	-0.18	0.07	-0.05	1.1.2(ALG)
1	-0.06	0.04	2	-0.16	0.06	0.1	1.1.3(ALG)
1	-0.06	0.04	3	-0.22	0.04	0.16	1.1.3(ALG)
2	-0.16	0.06	1	-0.06	0.04	-0.1	1.1.3(ALG)
2	-0.16	0.06	3	-0.22	0.04	0.06	1.1.3(ALG)
3	-0.22	0.04	1	-0.06	0.04	-0.16	1.1.3(ALG)
3	-0.22	0.04	2	-0.16	0.06	-0.06	1.1.3(ALG)
1	-0.03	0.04	2	-0.14	0.06	0.11	1.1.4(ALG)
1	-0.03	0.04	3	-0.22	0.04	0.19	1.1.4(ALG)
2	-0.14	0.06	1	-0.03	0.04	-0.11	1.1.4(ALG)
2	-0.14	0.06	3	-0.22	0.04	0.08	1.1.4(ALG)
3	-0.22	0.04	1	-0.03	0.04	-0.19	1.1.4(ALG)
3	-0.22	0.04	2	-0.14	0.06	-0.08	1.1.4(ALG)
1	-0.24	0.05	2	-0.24	0.08	0	1.2.1(ALG)
1	-0.24	0.05	3	-0.24	0.04	0	1.2.1(ALG)
2	-0.24	0.08	1	-0.24	0.05	0	1.2.1(ALG)
2	-0.24	0.08	3	-0.24	0.04	0	1.2.1(ALG)
3	-0.24	0.04	1	-0.24	0.05	0	1.2.1(ALG)
3	-0.24	0.04	2	-0.24	0.08	0	1.2.1(ALG)
1	-0.45	0.09	2	-0.35	0.1	-0.09	1.2.2(ALG)
1	-0.45	0.09	3	-0.32	0.05	-0.13	1.2.2(ALG)
2	-0.35	0.1	1	-0.45	0.09	0.09	1.2.2(ALG)
2	-0.35	0.1	3	-0.32	0.05	-0.04	1.2.2(ALG)
3	-0.32	0.05	1	-0.45	0.09	0.13	1.2.2(ALG)
3	-0.32	0.05	2	-0.35	0.1	0.04	1.2.2(ALG)
1	-0.35	0.07	2	-0.3	0.09	-0.04	1.3.1(ALG)

1	-0.35	0.07	3	-0.35	0.05	0	1.3.1(ALG)
2	-0.3	0.09	1	-0.35	0.07	0.04	1.3.1(ALG)
2	-0.3	0.09	3	-0.35	0.05	0.04	1.3.1(ALG)
3	-0.35	0.05	1	-0.35	0.07	0	1.3.1(ALG)
3	-0.35	0.05	2	-0.3	0.09	-0.04	1.3.1(ALG)
1	-0.25	0.06	2	-0.28	0.08	0.03	1.3.2(ALG)
1	-0.25	0.06	3	-0.28	0.05	0.03	1.3.2(ALG)
2	-0.28	0.08	1	-0.25	0.06	-0.03	1.3.2(ALG)
2	-0.28	0.08	3	-0.28	0.05	0	1.3.2(ALG)
3	-0.28	0.05	1	-0.25	0.06	-0.03	1.3.2(ALG)
3	-0.28	0.05	2	-0.28	0.08	0	1.3.2(ALG)
1	-0.22	0.06	2	-0.2	0.07	-0.02	1.4.1(ALG)
1	-0.22	0.06	3	-0.2	0.04	-0.02	1.4.1(ALG)
2	-0.2	0.07	1	-0.22	0.06	0.02	1.4.1(ALG)
2	-0.2	0.07	3	-0.2	0.04	0	1.4.1(ALG)
3	-0.2	0.04	1	-0.22	0.06	0.02	1.4.1(ALG)
3	-0.2	0.04	2	-0.2	0.07	0	1.4.1(ALG)
1	-0.15	0.05	2	-0.15	0.06	0	1.4.2(ALG)
1	-0.15	0.05	3	-0.15	0.03	0	1.4.2(ALG)
2	-0.15	0.06	1	-0.15	0.05	0	1.4.2(ALG)
2	-0.15	0.06	3	-0.15	0.03	0	1.4.2(ALG)
3	-0.15	0.03	1	-0.15	0.05	0	1.4.2(ALG)
3	-0.15	0.03	2	-0.15	0.06	0	1.4.2(ALG)
1	-0.15	0.05	2	-0.08	0.05	-0.08	2.1(ALG)
1	-0.15	0.05	3	-0.15	0.04	0	2.1(ALG)
2	-0.08	0.05	1	-0.15	0.05	0.08	2.1(ALG)
2	-0.08	0.05	3	-0.15	0.04	0.08	2.1(ALG)
3	-0.15	0.04	1	-0.15	0.05	0	2.1(ALG)
3	-0.15	0.04	2	-0.08	0.05	-0.08	2.1(ALG)
1	-0.21	0.05	2	-0.07	0.05	-0.14	2.2.1(ALG)
1	-0.21	0.05	3	-0.02	0.03	-0.19	2.2.1(ALG)
2	-0.07	0.05	1	-0.21	0.05	0.14	2.2.1(ALG)
2	-0.07	0.05	3	-0.02	0.03	-0.05	2.2.1(ALG)
3	-0.02	0.03	1	-0.21	0.05	0.19	2.2.1(ALG)
3	-0.02	0.03	2	-0.07	0.05	0.05	2.2.1(ALG)
1	-0.18	0.05	2	-0.02	0.05	-0.16	2.2.2(ALG)
1	-0.18	0.05	3	-0.09	0.03	-0.08	2.2.2(ALG)
2	-0.02	0.05	1	-0.18	0.05	0.16	2.2.2(ALG)
2	-0.02	0.05	3	-0.09	0.03	0.08	2.2.2(ALG)
3	-0.09	0.03	1	-0.18	0.05	0.08	2.2.2(ALG)
3	-0.09	0.03	2	-0.02	0.05	-0.08	2.2.2(ALG)
1	-0.05	0.04	2	0.04	0.05	-0.09	2.3(ALG)
1	-0.05	0.04	3	0	0.03	-0.05	2.3(ALG)
2	0.04	0.05	1	-0.05	0.04	0.09	2.3(ALG)
2	0.04	0.05	3	0	0.03	0.05	2.3(ALG)

3	0	0.03	1	-0.05	0.04	0.05	2.3(ALG)
3	0	0.03	2	0.04	0.05	-0.05	2.3(ALG)
1	-0.1	0.04	2	-0.04	0.05	-0.06	3.1(ALG)
1	-0.1	0.04	3	-0.07	0.03	-0.03	3.1(ALG)
2	-0.04	0.05	1	-0.1	0.04	0.06	3.1(ALG)
2	-0.04	0.05	3	-0.07	0.03	0.03	3.1(ALG)
3	-0.07	0.03	1	-0.1	0.04	0.03	3.1(ALG)
3	-0.07	0.03	2	-0.04	0.05	-0.03	3.1(ALG)
1	-0.12	0.04	2	-0.04	0.05	-0.08	3.2.1(ALG)
1	-0.12	0.04	3	-0.1	0.03	-0.02	3.2.1(ALG)
2	-0.04	0.05	1	-0.12	0.04	0.08	3.2.1(ALG)
2	-0.04	0.05	3	-0.1	0.03	0.05	3.2.1(ALG)
3	-0.1	0.03	1	-0.12	0.04	0.02	3.2.1(ALG)
3	-0.1	0.03	2	-0.04	0.05	-0.05	3.2.1(ALG)
1	0	0.04	2	0.11	0.04	-0.11	3.2.2(ALG)
1	0	0.04	3	0.04	0.03	-0.04	3.2.2(ALG)
2	0.11	0.04	1	0	0.04	0.11	3.2.2(ALG)
2	0.11	0.04	3	0.04	0.03	0.07	3.2.2(ALG)
3	0.04	0.03	1	0	0.04	0.04	3.2.2(ALG)
3	0.04	0.03	2	0.11	0.04	-0.07	3.2.2(ALG)
1	0.05	0.03	2	0.08	0.04	-0.03	3.3(ALG)
1	0.05	0.03	3	0.08	0.02	-0.03	3.3(ALG)
2	0.08	0.04	1	0.05	0.03	0.03	3.3(ALG)
2	0.08	0.04	3	0.08	0.02	0	3.3(ALG)
3	0.08	0.02	1	0.05	0.03	0.03	3.3(ALG)
3	0.08	0.02	2	0.08	0.04	0	3.3(ALG)
1	0.04	0.03	2	0.15	0.04	-0.11	3.4(ALG)
1	0.04	0.03	3	0.09	0.02	-0.05	3.4(ALG)
2	0.15	0.04	1	0.04	0.03	0.11	3.4(ALG)
2	0.15	0.04	3	0.09	0.02	0.06	3.4(ALG)
3	0.09	0.02	1	0.04	0.03	0.05	3.4(ALG)
3	0.09	0.02	2	0.15	0.04	-0.06	3.4(ALG)
1	-0.21	0.05	2	-0.13	0.06	-0.08	4.1.1(PAT)
1	-0.21	0.05	3	-0.09	0.03	-0.12	4.1.1(PAT)
2	-0.13	0.06	1	-0.21	0.05	0.08	4.1.1(PAT)
2	-0.13	0.06	3	-0.09	0.03	-0.04	4.1.1(PAT)
3	-0.09	0.03	1	-0.21	0.05	0.12	4.1.1(PAT)
3	-0.09	0.03	2	-0.13	0.06	0.04	4.1.1(PAT)
1	-0.19	0.05	2	-0.29	0.09	0.1	4.1.2(PAT)
1	-0.19	0.05	3	-0.16	0.03	-0.03	4.1.2(PAT)
2	-0.29	0.09	1	-0.19	0.05	-0.1	4.1.2(PAT)
2	-0.29	0.09	3	-0.16	0.03	-0.13	4.1.2(PAT)
3	-0.16	0.03	1	-0.19	0.05	0.03	4.1.2(PAT)
3	-0.16	0.03	2	-0.29	0.09	0.13	4.1.2(PAT)
1	-0.12	0.05	2	-0.08	0.06	-0.03	4.2(PAT)

1	-0.12	0.05	3	-0.12	0.03	0	4.2(PAT)
2	-0.08	0.06	1	-0.12	0.05	0.03	4.2(PAT)
2	-0.08	0.06	3	-0.12	0.03	0.03	4.2(PAT)
3	-0.12	0.03	1	-0.12	0.05	0	4.2(PAT)
3	-0.12	0.03	2	-0.08	0.06	-0.03	4.2(PAT)
1	-0.09	0.04	2	-0.15	0.06	0.06	4.3.1(PAT)
1	-0.09	0.04	3	-0.18	0.04	0.09	4.3.1(PAT)
2	-0.15	0.06	1	-0.09	0.04	-0.06	4.3.1(PAT)
2	-0.15	0.06	3	-0.18	0.04	0.03	4.3.1(PAT)
3	-0.18	0.04	1	-0.09	0.04	-0.09	4.3.1(PAT)
3	-0.18	0.04	2	-0.15	0.06	-0.03	4.3.1(PAT)
1	-0.08	0.04	2	-0.03	0.05	-0.05	4.3.2(PAT)
1	-0.08	0.04	3	-0.05	0.03	-0.03	4.3.2(PAT)
2	-0.03	0.05	1	-0.08	0.04	0.05	4.3.2(PAT)
2	-0.03	0.05	3	-0.05	0.03	0.02	4.3.2(PAT)
3	-0.05	0.03	1	-0.08	0.04	0.03	4.3.2(PAT)
3	-0.05	0.03	2	-0.03	0.05	-0.02	4.3.2(PAT)
1	0.03	0.03	2	-0.06	0.05	0.09	4.3.3(PAT)
1	0.03	0.03	3	-0.02	0.03	0.05	4.3.3(PAT)
2	-0.06	0.05	1	0.03	0.03	-0.09	4.3.3(PAT)
2	-0.06	0.05	3	-0.02	0.03	-0.04	4.3.3(PAT)
3	-0.02	0.03	1	0.03	0.03	-0.05	4.3.3(PAT)
3	-0.02	0.03	2	-0.06	0.05	0.04	4.3.3(PAT)
1	-0.03	0.04	2	-0.12	0.06	0.09	4.3.4(PAT)
1	-0.03	0.04	3	-0.03	0.03	0	4.3.4(PAT)
2	-0.12	0.06	1	-0.03	0.04	-0.09	4.3.4(PAT)
2	-0.12	0.06	3	-0.03	0.03	-0.09	4.3.4(PAT)
3	-0.03	0.03	1	-0.03	0.04	0	4.3.4(PAT)
3	-0.03	0.03	2	-0.12	0.06	0.09	4.3.4(PAT)
1	0.07	0.03	2	0	0.05	0.07	5.1.1(FUN)
1	0.07	0.03	3	0.03	0.03	0.04	5.1.1(FUN)
2	0	0.05	1	0.07	0.03	-0.07	5.1.1(FUN)
2	0	0.05	3	0.03	0.03	-0.02	5.1.1(FUN)
3	0.03	0.03	1	0.07	0.03	-0.04	5.1.1(FUN)
3	0.03	0.03	2	0	0.05	0.02	5.1.1(FUN)
1	-0.06	0.04	2	0.09	0.04	-0.14	5.1.2(FUN)
1	-0.06	0.04	3	0.05	0.03	-0.11	5.1.2(FUN)
2	0.09	0.04	1	-0.06	0.04	0.14	5.1.2(FUN)
2	0.09	0.04	3	0.05	0.03	0.03	5.1.2(FUN)
3	0.05	0.03	1	-0.06	0.04	0.11	5.1.2(FUN)
3	0.05	0.03	2	0.09	0.04	-0.03	5.1.2(FUN)
1	0.07	0.03	2	0.17	0.04	-0.1	5.1.3(FUN)
1	0.07	0.03	3	0.17	0.02	-0.1	5.1.3(FUN)
2	0.17	0.04	1	0.07	0.03	0.1	5.1.3(FUN)
2	0.17	0.04	3	0.17	0.02	0	5.1.3(FUN)

3	0.17	0.02	1	0.07	0.03	0.1	5.1.3(FUN)
3	0.17	0.02	2	0.17	0.04	0	5.1.3(FUN)
1	0.11	0.03	2	0.3	0.04	-0.19	5.1.4(FUN)
1	0.11	0.03	3	0.29	0.02	-0.18	5.1.4(FUN)
2	0.3	0.04	1	0.11	0.03	0.19	5.1.4(FUN)
2	0.3	0.04	3	0.29	0.02	0.01	5.1.4(FUN)
3	0.29	0.02	1	0.11	0.03	0.18	5.1.4(FUN)
3	0.29	0.02	2	0.3	0.04	-0.01	5.1.4(FUN)
1	0.16	0.03	2	0.34	0.04	-0.18	5.1.5(FUN)
1	0.16	0.03	3	0.22	0.02	-0.05	5.1.5(FUN)
2	0.34	0.04	1	0.16	0.03	0.18	5.1.5(FUN)
2	0.34	0.04	3	0.22	0.02	0.13	5.1.5(FUN)
3	0.22	0.02	1	0.16	0.03	0.05	5.1.5(FUN)
3	0.22	0.02	2	0.34	0.04	-0.13	5.1.5(FUN)
1	0.07	0.03	2	0.1	0.04	-0.03	6.1.1(FUN)
1	0.07	0.03	3	0.05	0.03	0.02	6.1.1(FUN)
2	0.1	0.04	1	0.07	0.03	0.03	6.1.1(FUN)
2	0.1	0.04	3	0.05	0.03	0.05	6.1.1(FUN)
3	0.05	0.03	1	0.07	0.03	-0.02	6.1.1(FUN)
3	0.05	0.03	2	0.1	0.04	-0.05	6.1.1(FUN)
1	0.07	0.03	2	0.22	0.04	-0.15	6.1.2(FUN)
1	0.07	0.03	3	0.12	0.02	-0.05	6.1.2(FUN)
2	0.22	0.04	1	0.07	0.03	0.15	6.1.2(FUN)
2	0.22	0.04	3	0.12	0.02	0.1	6.1.2(FUN)
3	0.12	0.02	1	0.07	0.03	0.05	6.1.2(FUN)
3	0.12	0.02	2	0.22	0.04	-0.1	6.1.2(FUN)
1	0.19	0.03	2	0.31	0.04	-0.12	6.1.3(FUN)
1	0.19	0.03	3	0.16	0.02	0.03	6.1.3(FUN)
2	0.31	0.04	1	0.19	0.03	0.12	6.1.3(FUN)
2	0.31	0.04	3	0.16	0.02	0.15	6.1.3(FUN)
3	0.16	0.02	1	0.19	0.03	-0.03	6.1.3(FUN)
3	0.16	0.02	2	0.31	0.04	-0.15	6.1.3(FUN)
1	0.14	0.03	2	0.25	0.04	-0.11	6.1.4(FUN)
1	0.14	0.03	3	0.16	0.02	-0.03	6.1.4(FUN)
2	0.25	0.04	1	0.14	0.03	0.11	6.1.4(FUN)
2	0.25	0.04	3	0.16	0.02	0.08	6.1.4(FUN)
3	0.16	0.02	1	0.14	0.03	0.03	6.1.4(FUN)
3	0.16	0.02	2	0.25	0.04	-0.08	6.1.4(FUN)
1	0.2	0.03	2	0.26	0.04	-0.06	6.1.5(FUN)
1	0.2	0.03	3	0.2	0.02	0	6.1.5(FUN)
2	0.26	0.04	1	0.2	0.03	0.06	6.1.5(FUN)
2	0.26	0.04	3	0.2	0.02	0.06	6.1.5(FUN)
3	0.2	0.02	1	0.2	0.03	0	6.1.5(FUN)
3	0.2	0.02	2	0.26	0.04	-0.06	6.1.5(FUN)
1	0.22	0.03	2	0.31	0.04	-0.1	6.1.6(FUN)

1	0.22	0.03	3	0.19	0.02	0.03	6.1.6(FUN)
2	0.31	0.04	1	0.22	0.03	0.1	6.1.6(FUN)
2	0.31	0.04	3	0.19	0.02	0.12	6.1.6(FUN)
3	0.19	0.02	1	0.22	0.03	-0.03	6.1.6(FUN)
3	0.19	0.02	2	0.31	0.04	-0.12	6.1.6(FUN)
1	0.11	0.03	2	-0.01	0.05	0.12	7.1.1(FIN)
1	0.11	0.03	3	-0.18	0.04	0.29	7.1.1(FIN)
2	-0.01	0.05	1	0.11	0.03	-0.12	7.1.1(FIN)
2	-0.01	0.05	3	-0.18	0.04	0.17	7.1.1(FIN)
3	-0.18	0.04	1	0.11	0.03	-0.29	7.1.1(FIN)
3	-0.18	0.04	2	-0.01	0.05	-0.17	7.1.1(FIN)
1	0.2	0.03	2	0.08	0.04	0.11	7.1.2(FIN)
1	0.2	0.03	3	0	0.03	0.19	7.1.2(FIN)
2	0.08	0.04	1	0.2	0.03	-0.11	7.1.2(FIN)
2	0.08	0.04	3	0	0.03	0.08	7.1.2(FIN)
3	0	0.03	1	0.2	0.03	-0.19	7.1.2(FIN)
3	0	0.03	2	0.08	0.04	-0.08	7.1.2(FIN)
1	0.15	0.03	2	0.09	0.04	0.06	7.1.3(FIN)
1	0.15	0.03	3	0.05	0.03	0.11	7.1.3(FIN)
2	0.09	0.04	1	0.15	0.03	-0.06	7.1.3(FIN)
2	0.09	0.04	3	0.05	0.03	0.05	7.1.3(FIN)
3	0.05	0.03	1	0.15	0.03	-0.11	7.1.3(FIN)
3	0.05	0.03	2	0.09	0.04	-0.05	7.1.3(FIN)
1	0.09	0.03	2	0.05	0.05	0.04	7.2(FIN)
1	0.09	0.03	3	0.09	0.02	0	7.2(FIN)
2	0.05	0.05	1	0.09	0.03	-0.04	7.2(FIN)
2	0.05	0.05	3	0.09	0.02	-0.04	7.2(FIN)
3	0.09	0.02	1	0.09	0.03	0	7.2(FIN)
3	0.09	0.02	2	0.05	0.05	0.04	7.2(FIN)
1	0	0.04	2	-0.04	0.05	0.04	8.1.1(PRO)
1	0	0.04	3	-0.16	0.03	0.16	8.1.1(PRO)
2	-0.04	0.05	1	0	0.04	-0.04	8.1.1(PRO)
2	-0.04	0.05	3	-0.16	0.03	0.12	8.1.1(PRO)
3	-0.16	0.03	1	0	0.04	-0.16	8.1.1(PRO)
3	-0.16	0.03	2	-0.04	0.05	-0.12	8.1.1(PRO)
1	0.05	0.03	2	-0.09	0.05	0.14	8.1.2(PRO)
1	0.05	0.03	3	-0.21	0.04	0.26	8.1.2(PRO)
2	-0.09	0.05	1	0.05	0.03	-0.14	8.1.2(PRO)
2	-0.09	0.05	3	-0.21	0.04	0.12	8.1.2(PRO)
3	-0.21	0.04	1	0.05	0.03	-0.26	8.1.2(PRO)
3	-0.21	0.04	2	-0.09	0.05	-0.12	8.1.2(PRO)
1	0.12	0.03	2	-0.04	0.05	0.16	8.1.3(PRO)
1	0.12	0.03	3	-0.18	0.04	0.29	8.1.3(PRO)
2	-0.04	0.05	1	0.12	0.03	-0.16	8.1.3(PRO)
2	-0.04	0.05	3	-0.18	0.04	0.13	8.1.3(PRO)

3	-0.18	0.04	1	0.12	0.03	-0.29	8.1.3(PRO)
3	-0.18	0.04	2	-0.04	0.05	-0.13	8.1.3(PRO)
1	0.2	0.03	2	0.19	0.04	0.01	8.2.1(PRO)
1	0.2	0.03	3	0	0.03	0.2	8.2.1(PRO)
2	0.19	0.04	1	0.2	0.03	-0.01	8.2.1(PRO)
2	0.19	0.04	3	0	0.03	0.19	8.2.1(PRO)
3	0	0.03	1	0.2	0.03	-0.2	8.2.1(PRO)
3	0	0.03	2	0.19	0.04	-0.19	8.2.1(PRO)
1	0.16	0.03	2	0.09	0.04	0.07	8.2.2(PRO)
1	0.16	0.03	3	-0.03	0.03	0.19	8.2.2(PRO)
2	0.09	0.04	1	0.16	0.03	-0.07	8.2.2(PRO)
2	0.09	0.04	3	-0.03	0.03	0.12	8.2.2(PRO)
3	-0.03	0.03	1	0.16	0.03	-0.19	8.2.2(PRO)
3	-0.03	0.03	2	0.09	0.04	-0.12	8.2.2(PRO)
1	0.17	0.03	2	0.18	0.04	-0.01	8.2.3(PRO)
1	0.17	0.03	3	0.05	0.03	0.12	8.2.3(PRO)
2	0.18	0.04	1	0.17	0.03	0.01	8.2.3(PRO)
2	0.18	0.04	3	0.05	0.03	0.13	8.2.3(PRO)
3	0.05	0.03	1	0.17	0.03	-0.12	8.2.3(PRO)
3	0.05	0.03	2	0.18	0.04	-0.13	8.2.3(PRO)
1	0.04	0.03	2	0	0.05	0.04	1.1(STA)
1	0.04	0.03	3	-0.02	0.03	0.06	1.1(STA)
2	0	0.05	1	0.04	0.03	-0.04	1.1(STA)
2	0	0.05	3	-0.02	0.03	0.02	1.1(STA)
3	-0.02	0.03	1	0.04	0.03	-0.06	1.1(STA)
3	-0.02	0.03	2	0	0.05	-0.02	1.1(STA)
1	-0.09	0.04	2	0.09	0.04	-0.18	1.1.1(STA)
1	-0.09	0.04	3	-0.1	0.03	0	1.1.1(STA)
2	0.09	0.04	1	-0.09	0.04	0.18	1.1.1(STA)
2	0.09	0.04	3	-0.1	0.03	0.19	1.1.1(STA)
3	-0.1	0.03	1	-0.09	0.04	0	1.1.1(STA)
3	-0.1	0.03	2	0.09	0.04	-0.19	1.1.1(STA)
1	-0.07	0.04	2	0.1	0.04	-0.17	1.1.2(STA)
1	-0.07	0.04	3	-0.15	0.03	0.08	1.1.2(STA)
2	0.1	0.04	1	-0.07	0.04	0.17	1.1.2(STA)
2	0.1	0.04	3	-0.15	0.03	0.25	1.1.2(STA)
3	-0.15	0.03	1	-0.07	0.04	-0.08	1.1.2(STA)
3	-0.15	0.03	2	0.1	0.04	-0.25	1.1.2(STA)
1	-0.02	0.04	2	0.1	0.04	-0.12	1.1.3(STA)
1	-0.02	0.04	3	-0.07	0.03	0.05	1.1.3(STA)
2	0.1	0.04	1	-0.02	0.04	0.12	1.1.3(STA)
2	0.1	0.04	3	-0.07	0.03	0.17	1.1.3(STA)
3	-0.07	0.03	1	-0.02	0.04	-0.05	1.1.3(STA)
3	-0.07	0.03	2	0.1	0.04	-0.17	1.1.3(STA)
1	-0.15	0.05	2	-0.18	0.07	0.03	2.1(STA)

1	-0.15	0.05	3	-0.15	0.03	0	2.1(STA)
2	-0.18	0.07	1	-0.15	0.05	-0.03	2.1(STA)
2	-0.18	0.07	3	-0.15	0.03	-0.03	2.1(STA)
3	-0.15	0.03	1	-0.15	0.05	0	2.1(STA)
3	-0.15	0.03	2	-0.18	0.07	0.03	2.1(STA)
1	-0.17	0.05	2	-0.2	0.07	0.03	2.2(STA)
1	-0.17	0.05	3	-0.17	0.03	0	2.2(STA)
2	-0.2	0.07	1	-0.17	0.05	-0.03	2.2(STA)
2	-0.2	0.07	3	-0.17	0.03	-0.03	2.2(STA)
3	-0.17	0.03	1	-0.17	0.05	0	2.2(STA)
3	-0.17	0.03	2	-0.2	0.07	0.03	2.2(STA)
1	-0.19	0.05	2	-0.4	0.11	0.21	2.3(STA)
1	-0.19	0.05	3	-0.27	0.04	0.08	2.3(STA)
2	-0.4	0.11	1	-0.19	0.05	-0.21	2.3(STA)
2	-0.4	0.11	3	-0.27	0.04	-0.13	2.3(STA)
3	-0.27	0.04	1	-0.19	0.05	-0.08	2.3(STA)
3	-0.27	0.04	2	-0.4	0.11	0.13	2.3(STA)
1	-0.15	0.05	2	-0.3	0.09	0.15	2.4(STA)
1	-0.15	0.05	3	-0.21	0.04	0.06	2.4(STA)
2	-0.3	0.09	1	-0.15	0.05	-0.15	2.4(STA)
2	-0.3	0.09	3	-0.21	0.04	-0.09	2.4(STA)
3	-0.21	0.04	1	-0.15	0.05	-0.06	2.4(STA)
3	-0.21	0.04	2	-0.3	0.09	0.09	2.4(STA)
1	-0.04	0.04	2	-0.29	0.09	0.25	2.5(STA)
1	-0.04	0.04	3	-0.17	0.04	0.13	2.5(STA)
2	-0.29	0.09	1	-0.04	0.04	-0.25	2.5(STA)
2	-0.29	0.09	3	-0.17	0.04	-0.12	2.5(STA)
3	-0.17	0.04	1	-0.04	0.04	-0.13	2.5(STA)
3	-0.17	0.04	2	-0.29	0.09	0.12	2.5(STA)
1	-0.09	0.04	2	0.05	0.05	-0.14	2.7(STA)
1	-0.09	0.04	3	0.11	0.02	-0.2	2.7(STA)
2	0.05	0.05	1	-0.09	0.04	0.14	2.7(STA)
2	0.05	0.05	3	0.11	0.02	-0.06	2.7(STA)
3	0.11	0.02	1	-0.09	0.04	0.2	2.7(STA)
3	0.11	0.02	2	0.05	0.05	0.06	2.7(STA)
1	0.48	0.04	2	0.3	0.04	0.18	2.8(STA)
1	0.48	0.04	3	0.31	0.03	0.17	2.8(STA)
2	0.3	0.04	1	0.48	0.04	-0.18	2.8(STA)
2	0.3	0.04	3	0.31	0.03	0	2.8(STA)
3	0.31	0.03	1	0.48	0.04	-0.17	2.8(STA)
3	0.31	0.03	2	0.3	0.04	0	2.8(STA)
1	0.06	0.03	2	0.16	0.04	-0.1	2.9(STA)
1	0.06	0.03	3	0.12	0.02	-0.05	2.9(STA)
2	0.16	0.04	1	0.06	0.03	0.1	2.9(STA)
2	0.16	0.04	3	0.12	0.02	0.04	2.9(STA)

3	0.12	0.02	1	0.06	0.03	0.05	2.9(STA)
3	0.12	0.02	2	0.16	0.04	-0.04	2.9(STA)
1	0.07	0.03	2	0.02	0.05	0.06	2,10(STA)
1	0.07	0.03	3	0.05	0.03	0.03	2,10(STA)
2	0.02	0.05	1	0.07	0.03	-0.06	2,10(STA)
2	0.02	0.05	3	0.05	0.03	-0.03	2,10(STA)
3	0.05	0.03	1	0.07	0.03	-0.03	2,10(STA)
3	0.05	0.03	2	0.02	0.05	0.03	2,10(STA)
1	0.22	0.03	2	0.13	0.04	0.09	2,11(STA)
1	0.22	0.03	3	0.13	0.02	0.1	2,11(STA)
2	0.13	0.04	1	0.22	0.03	-0.09	2,11(STA)
2	0.13	0.04	3	0.13	0.02	0.01	2,11(STA)
3	0.13	0.02	1	0.22	0.03	-0.1	2,11(STA)
3	0.13	0.02	2	0.13	0.04	-0.01	2,11(STA)
1	0.13	0.03	2	0.15	0.04	-0.01	3.1(AN G)
1	0.13	0.03	3	0.09	0.02	0.04	3.1(AN G)
2	0.15	0.04	1	0.13	0.03	0.01	3.1(AN G)
2	0.15	0.04	3	0.09	0.02	0.06	3.1(AN G)
3	0.09	0.02	1	0.13	0.03	-0.04	3.1(AN G)
3	0.09	0.02	2	0.15	0.04	-0.06	3.1(AN G)
1	-0.01	0.04	2	-0.03	0.05	0.02	3.2(AN G)
1	-0.01	0.04	3	0.12	0.02	-0.12	3.2(AN G)
2	-0.03	0.05	1	-0.01	0.04	-0.02	3.2(AN G)
2	-0.03	0.05	3	0.12	0.02	-0.15	3.2(AN G)
3	0.12	0.02	1	-0.01	0.04	0.12	3.2(AN G)
3	0.12	0.02	2	-0.03	0.05	0.15	3.2(AN G)
1	0	0.04	2	0.03	0.05	-0.03	3.3(AN G)
1	0	0.04	3	0	0.03	0	3.3(AN G)
2	0.03	0.05	1	0	0.04	0.03	3.3(AN G)
2	0.03	0.05	3	0	0.03	0.03	3.3(AN G)
3	0	0.03	1	0	0.04	0	3.3(AN G)
3	0	0.03	2	0.03	0.05	-0.03	3.3(AN G)
1	-0.04	0.04	2	-0.2	0.07	0.16	4.1.1(TRI)
1	-0.04	0.04	3	0	0.03	-0.04	4.1.1(TRI)
2	-0.2	0.07	1	-0.04	0.04	-0.16	4.1.1(TRI)
2	-0.2	0.07	3	0	0.03	-0.2	4.1.1(TRI)
3	0	0.03	1	-0.04	0.04	0.04	4.1.1(TRI)
3	0	0.03	2	-0.2	0.07	0.2	4.1.1(TRI)
1	-0.08	0.04	2	-0.16	0.06	0.08	4.1.2(TRI)
1	-0.08	0.04	3	0	0.03	-0.08	4.1.2(TRI)
2	-0.16	0.06	1	-0.08	0.04	-0.08	4.1.2(TRI)
2	-0.16	0.06	3	0	0.03	-0.16	4.1.2(TRI)
3	0	0.03	1	-0.08	0.04	0.08	4.1.2(TRI)
3	0	0.03	2	-0.16	0.06	0.16	4.1.2(TRI)
1	-0.01	0.04	2	-0.02	0.05	0.01	4.13(TRI)

1	-0.01	0.04	3	0.05	0.03	-0.06	4.13(TRI)
2	-0.02	0.05	1	-0.01	0.04	-0.01	4.13(TRI)
2	-0.02	0.05	3	0.05	0.03	-0.06	4.13(TRI)
3	0.05	0.03	1	-0.01	0.04	0.06	4.13(TRI)
3	0.05	0.03	2	-0.02	0.05	0.06	4.13(TRI)
1	0.07	0.03	2	-0.14	0.06	0.21	4.3(TRI)
1	0.07	0.03	3	0.02	0.03	0.05	4.3(TRI)
2	-0.14	0.06	1	0.07	0.03	-0.21	4.3(TRI)
2	-0.14	0.06	3	0.02	0.03	-0.16	4.3(TRI)
3	0.02	0.03	1	0.07	0.03	-0.05	4.3(TRI)
3	0.02	0.03	2	-0.14	0.06	0.16	4.3(TRI)
1	0.03	0.03	2	-0.09	0.06	0.12	4.4.1(TRI)
1	0.03	0.03	3	0.12	0.02	-0.09	4.4.1(TRI)
2	-0.09	0.06	1	0.03	0.03	-0.12	4.4.1(TRI)
2	-0.09	0.06	3	0.12	0.02	-0.21	4.4.1(TRI)
3	0.12	0.02	1	0.03	0.03	0.09	4.4.1(TRI)
3	0.12	0.02	2	-0.09	0.06	0.21	4.4.1(TRI)
1	0.13	0.03	2	-0.03	0.05	0.16	4.4.2(TRI)
1	0.13	0.03	3	0.31	0.03	-0.18	4.4.2(TRI)
2	-0.03	0.05	1	0.13	0.03	-0.16	4.4.2(TRI)
2	-0.03	0.05	3	0.31	0.03	-0.33	4.4.2(TRI)
3	0.31	0.03	1	0.13	0.03	0.18	4.4.2(TRI)
3	0.31	0.03	2	-0.03	0.05	0.33	4.4.2(TRI)
1	0.17	0.03	2	0.17	0.04	0	5.1(TRI)
1	0.17	0.03	3	0.17	0.02	0	5.1(TRI)
2	0.17	0.04	1	0.17	0.03	0	5.1(TRI)
2	0.17	0.04	3	0.17	0.02	0	5.1(TRI)
3	0.17	0.02	1	0.17	0.03	0	5.1(TRI)
3	0.17	0.02	2	0.17	0.04	0	5.1(TRI)
1	0.08	0.03	2	0.22	0.04	-0.14	5.2(TRI)
1	0.08	0.03	3	0.13	0.02	-0.05	5.2(TRI)
2	0.22	0.04	1	0.08	0.03	0.14	5.2(TRI)
2	0.22	0.04	3	0.13	0.02	0.09	5.2(TRI)
3	0.13	0.02	1	0.08	0.03	0.05	5.2(TRI)
3	0.13	0.02	2	0.22	0.04	-0.09	5.2(TRI)
1	-0.09	0.04	2	0.01	0.05	-0.1	6.1(EU G)
1	-0.09	0.04	3	0.13	0.02	-0.23	6.1(EU G)
2	0.01	0.05	1	-0.09	0.04	0.1	6.1(EU G)
2	0.01	0.05	3	0.13	0.02	-0.12	6.1(EU G)
3	0.13	0.02	1	-0.09	0.04	0.23	6.1(EU G)
3	0.13	0.02	2	0.01	0.05	0.12	6.1(EU G)
1	0.02	0.03	2	0.14	0.04	-0.12	6.2.i(EU G)
1	0.02	0.03	3	0.21	0.02	-0.19	6.2.i(EU G)
2	0.14	0.04	1	0.02	0.03	0.12	6.2.i(EU G)
2	0.14	0.04	3	0.21	0.02	-0.07	6.2.i(EU G)

3	0.21	0.02	1	0.02	0.03	0.19	6.2.i(EU G)
3	0.21	0.02	2	0.14	0.04	0.07	6.2.i(EU G)
1	0.1	0.03	2	0.21	0.04	-0.11	6.2.ii(EU G)
1	0.1	0.03	3	0.22	0.02	-0.12	6.2.ii(EU G)
2	0.21	0.04	1	0.1	0.03	0.11	6.2.ii(EU G)
2	0.21	0.04	3	0.22	0.02	-0.01	6.2.ii(EU G)
3	0.22	0.02	1	0.1	0.03	0.12	6.2.ii(EU G)
3	0.22	0.02	2	0.21	0.04	0.01	6.2.ii(EU G)
1	0	0.03	2	0	0.05	0	7.1(EU G)
1	0	0.03	3	0	0.03	0	7.1(EU G)
2	0	0.05	1	0	0.03	0	7.1(EU G)
2	0	0.05	3	0	0.03	0	7.1(EU G)
3	0	0.03	1	0	0.03	0	7.1(EU G)
3	0	0.03	2	0	0.05	0	7.1(EU G)
1	0.05	0.03	2	0.05	0.05	0	7.2(EU G)
1	0.05	0.03	3	0.21	0.02	-0.16	7.2(EU G)
2	0.05	0.05	1	0.05	0.03	0	7.2(EU G)
2	0.05	0.05	3	0.21	0.02	-0.16	7.2(EU G)
3	0.21	0.02	1	0.05	0.03	0.16	7.2(EU G)
3	0.21	0.02	2	0.05	0.05	0.16	7.2(EU G)
1	0.08	0.03	2	0.01	0.05	0.07	7.3(EU G)
1	0.08	0.03	3	0.1	0.02	-0.02	7.3(EU G)
2	0.01	0.05	1	0.08	0.03	-0.07	7.3(EU G)
2	0.01	0.05	3	0.1	0.02	-0.09	7.3(EU G)
3	0.1	0.02	1	0.08	0.03	0.02	7.3(EU G)
3	0.1	0.02	2	0.01	0.05	0.09	7.3(EU G)
1	0.08	0.03	2	-0.25	0.08	0.33	8.1(MEA)
1	0.08	0.03	3	0.21	0.02	-0.13	8.1(MEA)
2	-0.25	0.08	1	0.08	0.03	-0.33	8.1(MEA)
2	-0.25	0.08	3	0.21	0.02	-0.46	8.1(MEA)
3	0.21	0.02	1	0.08	0.03	0.13	8.1(MEA)
3	0.21	0.02	2	-0.25	0.08	0.46	8.1(MEA)
1	0.15	0.03	2	-0.18	0.07	0.33	8.2(MEA)
1	0.15	0.03	3	0.17	0.02	-0.01	8.2(MEA)
2	-0.18	0.07	1	0.15	0.03	-0.33	8.2(MEA)
2	-0.18	0.07	3	0.17	0.02	-0.34	8.2(MEA)
3	0.17	0.02	1	0.15	0.03	0.01	8.2(MEA)
3	0.17	0.02	2	-0.18	0.07	0.34	8.2(MEA)
1	0.21	0.03	2	-0.07	0.05	0.28	8.3(MEA)
1	0.21	0.03	3	0.29	0.02	-0.08	8.3(MEA)
2	-0.07	0.05	1	0.21	0.03	-0.28	8.3(MEA)
2	-0.07	0.05	3	0.29	0.02	-0.36	8.3(MEA)
3	0.29	0.02	1	0.21	0.03	0.08	8.3(MEA)
3	0.29	0.02	2	-0.07	0.05	0.36	8.3(MEA)

Appendix D3: DIF measures for 2014 high-stakes examinations

Table D3.1: *SES Differential Item Functioning in 2014examinations*

TABLE 30.1 2014p1p2 R before DIF excluded 62fun 2 ZOU779WS.TXT Mar 30 10:32
2015INPUT: 407 PERSONS 62 ITEMS MEASURED: 407 PERSONS 62 ITEMS
DIF class specification is: DIF=@SES2014

PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	ITEM
1	0.12	0.04	2	-0.09	0.04	0.22	1.1(ALG)
1	0.12	0.04	3	0.22	0.02	-0.1	1.1(ALG)
2	-0.09	0.04	1	0.12	0.04	-0.22	1.1(ALG)
2	-0.09	0.04	3	0.22	0.02	-0.31	1.1(ALG)
3	0.22	0.02	1	0.12	0.04	0.1	1.1(ALG)
3	0.22	0.02	2	-0.09	0.04	0.31	1.1(ALG)
1	-0.13	0.04	2	-0.03	0.04	-0.1	1.2(ALG)
1	-0.13	0.04	3	-0.14	0.03	0.01	1.2(ALG)
2	-0.03	0.04	1	-0.13	0.04	0.1	1.2(ALG)
2	-0.03	0.04	3	-0.14	0.03	0.1	1.2(ALG)
3	-0.14	0.03	1	-0.13	0.04	-0.01	1.2(ALG)
3	-0.14	0.03	2	-0.03	0.04	-0.1	1.2(ALG)
1	-0.08	0.04	2	-0.06	0.04	-0.02	1.3(ALG)
1	-0.08	0.04	3	0.09	0.02	-0.17	1.3(ALG)
2	-0.06	0.04	1	-0.08	0.04	0.02	1.3(ALG)
2	-0.06	0.04	3	0.09	0.02	-0.15	1.3(ALG)
3	0.09	0.02	1	-0.08	0.04	0.17	1.3(ALG)
3	0.09	0.02	2	-0.06	0.04	0.15	1.3(ALG)
1	-0.14	0.04	2	-0.3	0.05	0.17	1.4.1(ALG)
1	-0.14	0.04	3	-0.2	0.03	0.07	1.4.1(ALG)
2	-0.3	0.05	1	-0.14	0.04	-0.17	1.4.1(ALG)
2	-0.3	0.05	3	-0.2	0.03	-0.1	1.4.1(ALG)
3	-0.2	0.03	1	-0.14	0.04	-0.07	1.4.1(ALG)
3	-0.2	0.03	2	-0.3	0.05	0.1	1.4.1(ALG)
1	-0.26	0.06	2	-0.19	0.04	-0.07	1.4.2(ALG)
1	-0.26	0.06	3	-0.3	0.04	0.04	1.4.2(ALG)
2	-0.19	0.04	1	-0.26	0.06	0.07	1.4.2(ALG)
2	-0.19	0.04	3	-0.3	0.04	0.1	1.4.2(ALG)
3	-0.3	0.04	1	-0.26	0.06	-0.04	1.4.2(ALG)
3	-0.3	0.04	2	-0.19	0.04	-0.1	1.4.2(ALG)
1	-0.09	0.04	2	-0.37	0.06	0.28	1.5.1(ALG)
1	-0.09	0.04	3	-0.22	0.03	0.13	1.5.1(ALG)
2	-0.37	0.06	1	-0.09	0.04	-0.28	1.5.1(ALG)
2	-0.37	0.06	3	-0.22	0.03	-0.15	1.5.1(ALG)
3	-0.22	0.03	1	-0.09	0.04	-0.13	1.5.1(ALG)
3	-0.22	0.03	2	-0.37	0.06	0.15	1.5.1(ALG)
1	-0.2	0.05	2	-0.36	0.06	0.17	1.5.2(ALG)
1	-0.2	0.05	3	-0.2	0.03	0	1.5.2(ALG)
2	-0.36	0.06	1	-0.2	0.05	-0.17	1.5.2(ALG)
2	-0.36	0.06	3	-0.2	0.03	-0.16	1.5.2(ALG)

3	-0.2	0.03	1	-0.2	0.05	0	1.5.2(ALG)
3	-0.2	0.03	2	-0.36	0.06	0.16	1.5.2(ALG)
1	-0.14	0.04	2	-0.36	0.06	0.22	2.1.1(ALG)
1	-0.14	0.04	3	-0.24	0.03	0.11	2.1.1(ALG)
2	-0.36	0.06	1	-0.14	0.04	-0.22	2.1.1(ALG)
2	-0.36	0.06	3	-0.24	0.03	-0.12	2.1.1(ALG)
3	-0.24	0.03	1	-0.14	0.04	-0.11	2.1.1(ALG)
3	-0.24	0.03	2	-0.36	0.06	0.12	2.1.1(ALG)
1	0.05	0.04	2	-0.12	0.04	0.17	2.1.2(ALG)
1	0.05	0.04	3	0.05	0.02	-0.01	2.1.2(ALG)
2	-0.12	0.04	1	0.05	0.04	-0.17	2.1.2(ALG)
2	-0.12	0.04	3	0.05	0.02	-0.17	2.1.2(ALG)
3	0.05	0.02	1	0.05	0.04	0.01	2.1.2(ALG)
3	0.05	0.02	2	-0.12	0.04	0.17	2.1.2(ALG)
1	-0.37	0.07	2	-0.2	0.04	-0.17	2.1.3(ALG)
1	-0.37	0.07	3	-0.24	0.03	-0.12	2.1.3(ALG)
2	-0.2	0.04	1	-0.37	0.07	0.17	2.1.3(ALG)
2	-0.2	0.04	3	-0.24	0.03	0.04	2.1.3(ALG)
3	-0.24	0.03	1	-0.37	0.07	0.12	2.1.3(ALG)
3	-0.24	0.03	2	-0.2	0.04	-0.04	2.1.3(ALG)
1	-0.12	0.04	2	-0.1	0.04	-0.02	2.1.4(ALG)
1	-0.12	0.04	3	-0.03	0.02	-0.09	2.1.4(ALG)
2	-0.1	0.04	1	-0.12	0.04	0.02	2.1.4(ALG)
2	-0.1	0.04	3	-0.03	0.02	-0.06	2.1.4(ALG)
3	-0.03	0.02	1	-0.12	0.04	0.09	2.1.4(ALG)
3	-0.03	0.02	2	-0.1	0.04	0.06	2.1.4(ALG)
1	0.05	0.04	2	-0.09	0.04	0.14	2.2(ALG)
1	0.05	0.04	3	-0.03	0.02	0.08	2.2(ALG)
2	-0.09	0.04	1	0.05	0.04	-0.14	2.2(ALG)
2	-0.09	0.04	3	-0.03	0.02	-0.06	2.2(ALG)
3	-0.03	0.02	1	0.05	0.04	-0.08	2.2(ALG)
3	-0.03	0.02	2	-0.09	0.04	0.06	2.2(ALG)
1	-0.05	0.04	2	-0.16	0.04	0.11	3.1.1(PAT)
1	-0.05	0.04	3	-0.09	0.03	0.04	3.1.1(PAT)
2	-0.16	0.04	1	-0.05	0.04	-0.11	3.1.1(PAT)
2	-0.16	0.04	3	-0.09	0.03	-0.07	3.1.1(PAT)
3	-0.09	0.03	1	-0.05	0.04	-0.04	3.1.1(PAT)
3	-0.09	0.03	2	-0.16	0.04	0.07	3.1.1(PAT)
1	0.13	0.04	2	-0.11	0.04	0.24	3.1.2(PAT)
1	0.13	0.04	3	0.03	0.02	0.1	3.1.2(PAT)
2	-0.11	0.04	1	0.13	0.04	-0.24	3.1.2(PAT)
2	-0.11	0.04	3	0.03	0.02	-0.14	3.1.2(PAT)
3	0.03	0.02	1	0.13	0.04	-0.1	3.1.2(PAT)
3	0.03	0.02	2	-0.11	0.04	0.14	3.1.2(PAT)
1	-0.09	0.04	2	-0.19	0.04	0.1	3.1.3(PAT)
1	-0.09	0.04	3	-0.09	0.03	0	3.1.3(PAT)
2	-0.19	0.04	1	-0.09	0.04	-0.1	3.1.3(PAT)
2	-0.19	0.04	3	-0.09	0.03	-0.1	3.1.3(PAT)
3	-0.09	0.03	1	-0.09	0.04	0	3.1.3(PAT)
3	-0.09	0.03	2	-0.19	0.04	0.1	3.1.3(PAT)
1	0	0.04	2	-0.16	0.04	0.16	3.2(PAT)
1	0	0.04	3	-0.09	0.03	0.1	3.2(PAT)

2	-0.16	0.04	1	0	0.04	-0.16	3.2(PAT)
2	-0.16	0.04	3	-0.09	0.03	-0.07	3.2(PAT)
3	-0.09	0.03	1	0	0.04	-0.1	3.2(PAT)
3	-0.09	0.03	2	-0.16	0.04	0.07	3.2(PAT)
1	0.03	0.04	2	-0.26	0.05	0.29	4.1(FIN)
1	0.03	0.04	3	-0.03	0.02	0.06	4.1(FIN)
2	-0.26	0.05	1	0.03	0.04	-0.29	4.1(FIN)
2	-0.26	0.05	3	-0.03	0.02	-0.23	4.1(FIN)
3	-0.03	0.02	1	0.03	0.04	-0.06	4.1(FIN)
3	-0.03	0.02	2	-0.26	0.05	0.23	4.1(FIN)
1	-0.28	0.06	2	-0.08	0.04	-0.19	4.2.1(FIN)
1	-0.28	0.06	3	-0.28	0.03	0	4.2.1(FIN)
2	-0.08	0.04	1	-0.28	0.06	0.19	4.2.1(FIN)
2	-0.08	0.04	3	-0.28	0.03	0.2	4.2.1(FIN)
3	-0.28	0.03	1	-0.28	0.06	0	4.2.1(FIN)
3	-0.28	0.03	2	-0.08	0.04	-0.2	4.2.1(FIN)
1	0.06	0.04	2	0.17	0.04	-0.1	4.2.2(FIN)
1	0.06	0.04	3	-0.06	0.02	0.12	4.2.2(FIN)
2	0.17	0.04	1	0.06	0.04	0.1	4.2.2(FIN)
2	0.17	0.04	3	-0.06	0.02	0.23	4.2.2(FIN)
3	-0.06	0.02	1	0.06	0.04	-0.12	4.2.2(FIN)
3	-0.06	0.02	2	0.17	0.04	-0.23	4.2.2(FIN)
1	-0.21	0.05	2	-0.05	0.04	-0.16	4.2.3(FIN)
1	-0.21	0.05	3	-0.22	0.03	0.01	4.2.3(FIN)
2	-0.05	0.04	1	-0.21	0.05	0.16	4.2.3(FIN)
2	-0.05	0.04	3	-0.22	0.03	0.16	4.2.3(FIN)
3	-0.22	0.03	1	-0.21	0.05	-0.01	4.2.3(FIN)
3	-0.22	0.03	2	-0.05	0.04	-0.16	4.2.3(FIN)
1	-0.26	0.05	2	-0.07	0.04	-0.18	4.3(FIN)
1	-0.26	0.05	3	-0.1	0.03	-0.16	4.3(FIN)
2	-0.07	0.04	1	-0.26	0.05	0.18	4.3(FIN)
2	-0.07	0.04	3	-0.1	0.03	0.03	4.3(FIN)
3	-0.1	0.03	1	-0.26	0.05	0.16	4.3(FIN)
3	-0.1	0.03	2	-0.07	0.04	-0.03	4.3(FIN)
1	-0.22	0.05	2	-0.11	0.04	-0.11	5.1(PRO)
1	-0.22	0.05	3	-0.15	0.03	-0.07	5.1(PRO)
2	-0.11	0.04	1	-0.22	0.05	0.11	5.1(PRO)
2	-0.11	0.04	3	-0.15	0.03	0.04	5.1(PRO)
3	-0.15	0.03	1	-0.22	0.05	0.07	5.1(PRO)
3	-0.15	0.03	2	-0.11	0.04	-0.04	5.1(PRO)
1	0.04	0.04	2	0.08	0.04	-0.05	5.2.1(PRO)
1	0.04	0.04	3	-0.04	0.02	0.08	5.2.1(PRO)
2	0.08	0.04	1	0.04	0.04	0.05	5.2.1(PRO)
2	0.08	0.04	3	-0.04	0.02	0.13	5.2.1(PRO)
3	-0.04	0.02	1	0.04	0.04	-0.08	5.2.1(PRO)
3	-0.04	0.02	2	0.08	0.04	-0.13	5.2.1(PRO)
1	-0.24	0.05	2	-0.17	0.04	-0.07	5.2.2(PRO)
1	-0.24	0.05	3	-0.14	0.03	-0.1	5.2.2(PRO)
2	-0.17	0.04	1	-0.24	0.05	0.07	5.2.2(PRO)
2	-0.17	0.04	3	-0.14	0.03	-0.03	5.2.2(PRO)
3	-0.14	0.03	1	-0.24	0.05	0.1	5.2.2(PRO)
3	-0.14	0.03	2	-0.17	0.04	0.03	5.2.2(PRO)

1	0.09	0.04	2	0.04	0.04	0.04	5.2.3(PRO)
1	0.09	0.04	3	0.09	0.02	0	5.2.3(PRO)
2	0.04	0.04	1	0.09	0.04	-0.04	5.2.3(PRO)
2	0.04	0.04	3	0.09	0.02	-0.04	5.2.3(PRO)
3	0.09	0.02	1	0.09	0.04	0	5.2.3(PRO)
3	0.09	0.02	2	0.04	0.04	0.04	5.2.3(PRO)
1	-0.01	0.04	2	0.18	0.04	-0.19	6.1(FUN)
1	-0.01	0.04	3	0.01	0.02	-0.02	6.1(FUN)
2	0.18	0.04	1	-0.01	0.04	0.19	6.1(FUN)
2	0.18	0.04	3	0.01	0.02	0.17	6.1(FUN)
3	0.01	0.02	1	-0.01	0.04	0.02	6.1(FUN)
3	0.01	0.02	2	0.18	0.04	-0.17	6.1(FUN)
1	0.04	0.04	2	.65<	0.06	**-0.61**	**6.2(FUN)**
1	0.04	0.04	3	0.06	0.02	-0.02	6.2(FUN)
2	.65<	0.06	1	0.04	0.04	**0.61**	**6.2(FUN)**
2	.65<	0.06	3	0.06	0.02	**0.59**	**6.2(FUN)**
3	0.06	0.02	1	0.04	0.04	0.02	6.2(FUN)
3	0.06	0.02	2	.65<	0.06	**-0.59**	**6.2(FUN)**
1	0.05	0.04	2	0.09	0.04	-0.04	6.3(FUN)
1	0.05	0.04	3	0.05	0.02	0	6.3(FUN)
2	0.09	0.04	1	0.05	0.04	0.04	6.3(FUN)
2	0.09	0.04	3	0.05	0.02	0.04	6.3(FUN)
3	0.05	0.02	1	0.05	0.04	0	6.3(FUN)
3	0.05	0.02	2	0.09	0.04	-0.04	6.3(FUN)
1	0.11	0.04	2	0.02	0.04	0.1	6.4(FUN)
1	0.11	0.04	3	0.09	0.02	0.03	6.4(FUN)
2	0.02	0.04	1	0.11	0.04	-0.1	6.4(FUN)
2	0.02	0.04	3	0.09	0.02	-0.07	6.4(FUN)
3	0.09	0.02	1	0.11	0.04	-0.03	6.4(FUN)
3	0.09	0.02	2	0.02	0.04	0.07	6.4(FUN)
1	-0.23	0.05	2	-0.04	0.04	-0.18	7.1(FUN)
1	-0.23	0.05	3	-0.23	0.03	0	7.1(FUN)
2	-0.04	0.04	1	-0.23	0.05	0.18	7.1(FUN)
2	-0.04	0.04	3	-0.23	0.03	0.19	7.1(FUN)
3	-0.23	0.03	1	-0.23	0.05	0	7.1(FUN)
3	-0.23	0.03	2	-0.04	0.04	-0.19	7.1(FUN)
1	-0.13	0.04	2	-0.17	0.04	0.05	7.2(FUN)
1	-0.13	0.04	3	-0.03	0.02	-0.1	7.2(FUN)
2	-0.17	0.04	1	-0.13	0.04	-0.05	7.2(FUN)
2	-0.17	0.04	3	-0.03	0.02	-0.15	7.2(FUN)
3	-0.03	0.02	1	-0.13	0.04	0.1	7.2(FUN)
3	-0.03	0.02	2	-0.17	0.04	0.15	7.2(FUN)
1	-0.04	0.04	2	0.03	0.04	-0.06	7.3(FUN)
1	-0.04	0.04	3	-0.02	0.02	-0.02	7.3(FUN)
2	0.03	0.04	1	-0.04	0.04	0.06	7.3(FUN)
2	0.03	0.04	3	-0.02	0.02	0.04	7.3(FUN)
3	-0.02	0.02	1	-0.04	0.04	0.02	7.3(FUN)
3	-0.02	0.02	2	0.03	0.04	-0.04	7.3(FUN)
1	-0.06	0.04	2	-0.03	0.04	-0.03	7.4(FUN)
1	-0.06	0.04	3	0.09	0.02	-0.15	7.4(FUN)
2	-0.03	0.04	1	-0.06	0.04	0.03	7.4(FUN)
2	-0.03	0.04	3	0.09	0.02	-0.12	7.4(FUN)

3	0.09	0.02	1	-0.06	0.04	0.15	7.4(FUN)
3	0.09	0.02	2	-0.03	0.04	0.12	7.4(FUN)
1	0.15	0.04	2	-0.17	0.04	0.32	7.5(FUN)
1	0.15	0.04	3	0.2	0.02	-0.05	7.5(FUN)
2	-0.17	0.04	1	0.15	0.04	-0.32	7.5(FUN)
2	-0.17	0.04	3	0.2	0.02	-0.37	7.5(FUN)
3	0.2	0.02	1	0.15	0.04	0.05	7.5(FUN)
3	0.2	0.02	2	-0.17	0.04	0.37	7.5(FUN)
1	0.13	0.04	2	0.25	0.04	-0.12	1.1(STA)
1	0.13	0.04	3	0.09	0.02	0.05	1.1(STA)
2	0.25	0.04	1	0.13	0.04	0.12	1.1(STA)
2	0.25	0.04	3	0.09	0.02	0.17	1.1(STA)
3	0.09	0.02	1	0.13	0.04	-0.05	1.1(STA)
3	0.09	0.02	2	0.25	0.04	-0.17	1.1(STA)
1	0.03	0.04	2	0.32	0.04	-0.28	1.2(STA)
1	0.03	0.04	3	0.14	0.02	-0.11	1.2(STA)
2	0.32	0.04	1	0.03	0.04	0.28	1.2(STA)
2	0.32	0.04	3	0.14	0.02	0.17	1.2(STA)
3	0.14	0.02	1	0.03	0.04	0.11	1.2(STA)
3	0.14	0.02	2	0.32	0.04	-0.17	1.2(STA)
1	-0.27	0.06	2	-0.33	0.05	0.06	2.1(STA)
1	-0.27	0.06	3	-0.31	0.04	0.04	2.1(STA)
2	-0.33	0.05	1	-0.27	0.06	-0.06	2.1(STA)
2	-0.33	0.05	3	-0.31	0.04	-0.02	2.1(STA)
3	-0.31	0.04	1	-0.27	0.06	-0.04	2.1(STA)
3	-0.31	0.04	2	-0.33	0.05	0.02	2.1(STA)
1	0.16	0.04	2	0.14	0.04	0.02	2.2(STA)
1	0.16	0.04	3	0.05	0.02	0.11	2.2(STA)
2	0.14	0.04	1	0.16	0.04	-0.02	2.2(STA)
2	0.14	0.04	3	0.05	0.02	0.09	2.2(STA)
3	0.05	0.02	1	0.16	0.04	-0.11	2.2(STA)
3	0.05	0.02	2	0.14	0.04	-0.09	2.2(STA)
1	0.24	0.04	2	-0.09	0.04	0.33	2.3(STA)
1	0.24	0.04	3	0.19	0.02	0.05	2.3(STA)
2	-0.09	0.04	1	0.24	0.04	-0.33	2.3(STA)
2	-0.09	0.04	3	0.19	0.02	-0.28	2.3(STA)
3	0.19	0.02	1	0.24	0.04	-0.05	2.3(STA)
3	0.19	0.02	2	-0.09	0.04	0.28	2.3(STA)
1	0.21	0.04	2	0.39	0.05	-0.18	2.4(STA)
1	0.21	0.04	3	0.19	0.02	0.02	2.4(STA)
2	0.39	0.05	1	0.21	0.04	0.18	2.4(STA)
2	0.39	0.05	3	0.19	0.02	0.2	2.4(STA)
3	0.19	0.02	1	0.21	0.04	-0.02	2.4(STA)
3	0.19	0.02	2	0.39	0.05	-0.2	2.4(STA)
1	0.6	0.05	2	-0.09	0.04	**0.69**	**2.5(STA)**
1	0.6	0.05	3	0.08	0.02	**0.52**	**2.5(STA)**
2	-0.09	0.04	1	0.6	0.05	**-0.69**	**2.5(STA)**
2	-0.09	0.04	3	0.08	0.02	-0.17	2.5(STA)
3	0.08	0.02	1	0.6	0.05	**-0.52**	**2.5(STA)**
3	0.08	0.02	2	-0.09	0.04	0.17	2.5(STA)
1	0.21	0.04	2	-0.13	0.04	0.34	3.1(AN G)
1	0.21	0.04	3	0.11	0.02	0.1	3.1(AN G)

2	-0.13	0.04	1	0.21	0.04	-0.34	3.1(AN G)
2	-0.13	0.04	3	0.11	0.02	-0.25	3.1(AN G)
3	0.11	0.02	1	0.21	0.04	-0.1	3.1(AN G)
3	0.11	0.02	2	-0.13	0.04	0.25	3.1(AN G)
1	-0.05	0.04	2	0.16	0.04	-0.21	3.2(AN G)
1	-0.05	0.04	3	0.05	0.02	-0.09	3.2(AN G)
2	0.16	0.04	1	-0.05	0.04	0.21	3.2(AN G)
2	0.16	0.04	3	0.05	0.02	0.11	3.2(AN G)
3	0.05	0.02	1	-0.05	0.04	0.09	3.2(AN G)
3	0.05	0.02	2	0.16	0.04	-0.11	3.2(AN G)
1	0.05	0.04	2	0.45	0.05	-0.4	3.3(AN G)
1	0.05	0.04	3	0.16	0.02	-0.11	3.3(AN G)
2	0.45	0.05	1	0.05	0.04	0.4	3.3(AN G)
2	0.45	0.05	3	0.16	0.02	0.29	3.3(AN G)
3	0.16	0.02	1	0.05	0.04	0.11	3.3(AN G)
3	0.16	0.02	2	0.45	0.05	-0.29	3.3(AN G)
1	0.09	0.04	2	-0.11	0.04	0.2	4.1(AN G)
1	0.09	0.04	3	-0.01	0.02	0.1	4.1(AN G)
2	-0.11	0.04	1	0.09	0.04	-0.2	4.1(AN G)
2	-0.11	0.04	3	-0.01	0.02	-0.1	4.1(AN G)
3	-0.01	0.02	1	0.09	0.04	-0.1	4.1(AN G)
3	-0.01	0.02	2	-0.11	0.04	0.1	4.1(AN G)
1	0.33	0.04	2	0.38	0.05	-0.05	4.2(AN G)
1	0.33	0.04	3	0.18	0.02	0.16	4.2(AN G)
2	0.38	0.05	1	0.33	0.04	0.05	4.2(AN G)
2	0.38	0.05	3	0.18	0.02	0.2	4.2(AN G)
3	0.18	0.02	1	0.33	0.04	-0.16	4.2(AN G)
3	0.18	0.02	2	0.38	0.05	-0.2	4.2(AN G)
1	0.21	0.04	2	0.39	0.05	-0.18	4.3(AN G)
1	0.21	0.04	3	0.16	0.02	0.05	4.3(AN G)
2	0.39	0.05	1	0.21	0.04	0.18	4.3(AN G)
2	0.39	0.05	3	0.16	0.02	0.23	4.3(AN G)
3	0.16	0.02	1	0.21	0.04	-0.05	4.3(AN G)
3	0.16	0.02	2	0.39	0.05	-0.23	4.3(AN G)
1	0.06	0.04	2	0.03	0.04	0.04	4.4(AN G)
1	0.06	0.04	3	0.06	0.02	0	4.4(AN G)
2	0.03	0.04	1	0.06	0.04	-0.04	4.4(AN G)
2	0.03	0.04	3	0.06	0.02	-0.04	4.4(AN G)
3	0.06	0.02	1	0.06	0.04	0	4.4(AN G)
3	0.06	0.02	2	0.03	0.04	0.04	4.4(AN G)
1	0.05	0.04	2	-0.22	0.04	0.28	5(AN G)
1	0.05	0.04	3	0.1	0.02	-0.05	5(AN G)
2	-0.22	0.04	1	0.05	0.04	-0.28	5(AN G)
2	-0.22	0.04	3	0.1	0.02	-0.32	5(AN G)
3	0.1	0.02	1	0.05	0.04	0.05	5(AN G)
3	0.1	0.02	2	-0.22	0.04	0.32	5(AN G)
1	0.02	0.04	2	-0.02	0.04	0.04	6.1.1(TRI)
1	0.02	0.04	3	0.05	0.02	-0.02	6.1.1(TRI)
2	-0.02	0.04	1	0.02	0.04	-0.04	6.1.1(TRI)
2	-0.02	0.04	3	0.05	0.02	-0.07	6.1.1(TRI)
3	0.05	0.02	1	0.02	0.04	0.02	6.1.1(TRI)
3	0.05	0.02	2	-0.02	0.04	0.07	6.1.1(TRI)

1	-0.01	0.04	2	-0.07	0.04	0.05	6.1.2(TRI)
1	-0.01	0.04	3	0.01	0.02	-0.02	6.1.2(TRI)
2	-0.07	0.04	1	-0.01	0.04	-0.05	6.1.2(TRI)
2	-0.07	0.04	3	0.01	0.02	-0.07	6.1.2(TRI)
3	0.01	0.02	1	-0.01	0.04	0.02	6.1.2(TRI)
3	0.01	0.02	2	-0.07	0.04	0.07	6.1.2(TRI)
1	0.17	0.04	2	0.32	0.04	-0.14	6.2.1(TRI)
1	0.17	0.04	3	0.06	0.02	0.11	6.2.1(TRI)
2	0.32	0.04	1	0.17	0.04	0.14	6.2.1(TRI)
2	0.32	0.04	3	0.06	0.02	0.26	6.2.1(TRI)
3	0.06	0.02	1	0.17	0.04	-0.11	6.2.1(TRI)
3	0.06	0.02	2	0.32	0.04	-0.26	6.2.1(TRI)
1	0.06	0.04	2	-0.03	0.04	0.08	6.2.2(TRI)
1	0.06	0.04	3	0.09	0.02	-0.03	6.2.2(TRI)
2	-0.03	0.04	1	0.06	0.04	-0.08	6.2.2(TRI)
2	-0.03	0.04	3	0.09	0.02	-0.12	6.2.2(TRI)
3	0.09	0.02	1	0.06	0.04	0.03	6.2.2(TRI)
3	0.09	0.02	2	-0.03	0.04	0.12	6.2.2(TRI)
1	0.01	0.04	2	-0.11	0.04	0.11	6.3(TRI)
1	0.01	0.04	3	0.05	0.02	-0.05	6.3(TRI)
2	-0.11	0.04	1	0.01	0.04	-0.11	6.3(TRI)
2	-0.11	0.04	3	0.05	0.02	-0.16	6.3(TRI)
3	0.05	0.02	1	0.01	0.04	0.05	6.3(TRI)
3	0.05	0.02	2	-0.11	0.04	0.16	6.3(TRI)
1	0.15	0.04	2	0.37	0.04	-0.22	7(TRI)
1	0.15	0.04	3	0.09	0.02	0.06	7(TRI)
2	0.37	0.04	1	0.15	0.04	0.22	7(TRI)
2	0.37	0.04	3	0.09	0.02	0.28	7(TRI)
3	0.09	0.02	1	0.15	0.04	-0.06	7(TRI)
3	0.09	0.02	2	0.37	0.04	-0.28	7(TRI)
1	-0.17	0.04	2	0.15	0.04	-0.31	8.1(MEA)
1	-0.17	0.04	3	0	0.02	-0.17	8.1(MEA)
2	0.15	0.04	1	-0.17	0.04	0.31	8.1(MEA)
2	0.15	0.04	3	0	0.02	0.14	8.1(MEA)
3	0	0.02	1	-0.17	0.04	0.17	8.1(MEA)
3	0	0.02	2	0.15	0.04	-0.14	8.1(MEA)
1	-0.08	0.04	2	0.06	0.04	-0.14	8.2(MEA)
1	-0.08	0.04	3	0.05	0.02	-0.13	8.2(MEA)
2	0.06	0.04	1	-0.08	0.04	0.14	8.2(MEA)
2	0.06	0.04	3	0.05	0.02	0.01	8.2(MEA)
3	0.05	0.02	1	-0.08	0.04	0.13	8.2(MEA)
3	0.05	0.02	2	0.06	0.04	-0.01	8.2(MEA)
1	0.02	0.04	2	0.07	0.04	-0.05	8.3(MEA)
1	0.02	0.04	3	0.02	0.02	0	8.3(MEA)
2	0.07	0.04	1	0.02	0.04	0.05	8.3(MEA)
2	0.07	0.04	3	0.02	0.02	0.05	8.3(MEA)
3	0.02	0.02	1	0.02	0.04	0	8.3(MEA)
3	0.02	0.02	2	0.07	0.04	-0.05	8.3(MEA)
1	0.22	0.04	2	0.15	0.04	0.07	8.4(MEA)
1	0.22	0.04	3	0.13	0.02	0.1	8.4(MEA)
2	0.15	0.04	1	0.22	0.04	-0.07	8.4(MEA)
2	0.15	0.04	3	0.13	0.02	0.03	8.4(MEA)

3	0.13	0.02	1	0.22	0.04	-0.1	8.4(MEA)
3	0.13	0.02	2	0.15	0.04	-0.03	8.4(MEA)
1	-0.2	0.05	2	0.15	0.04	-0.34	9.1.1(EU G)
1	-0.2	0.05	3	0.09	0.02	-0.29	9.1.1(EU G)
2	0.15	0.04	1	-0.2	0.05	0.34	9.1.1(EU G)
2	0.15	0.04	3	0.09	0.02	0.06	9.1.1(EU G)
3	0.09	0.02	1	-0.2	0.05	0.29	9.1.1(EU G)
3	0.09	0.02	2	0.15	0.04	-0.06	9.1.1(EU G)
1	-0.08	0.04	2	0.42	0.05	**-0.5**	**9.1.2(EU G)**
1	-0.08	0.04	3	0.14	0.02	-0.22	9.1.2(EU G)
2	0.42	0.05	1	-0.08	0.04	**0.5**	**9.1.2(EU G)**
2	0.42	0.05	3	0.14	0.02	0.28	9.1.2(EU G)
3	0.14	0.02	1	-0.08	0.04	0.22	9.1.2(EU G)
3	0.14	0.02	2	0.42	0.05	-0.28	9.1.2(EU G)
1	0.12	0.04	2	0.09	0.04	0.03	9.2(EU G)
1	0.12	0.04	3	0.12	0.02	0	9.2(EU G)
2	0.09	0.04	1	0.12	0.04	-0.03	9.2(EU G)
2	0.09	0.04	3	0.12	0.02	-0.03	9.2(EU G)
3	0.12	0.02	1	0.12	0.04	0	9.2(EU G)
3	0.12	0.02	2	0.09	0.04	0.03	9.2(EU G)

Table D3.2: *SES Differential Item Functioning in 2014examinations after excluding 6.2(FUN), 2.5(STA) and 9.1.2(EU G)*

TABLE 30.1 2014p1p2 R after DIF exclused 62fun 25 ZOU373WS.TXT Mar 30 11:40
2015INPUT: 407 PERSONS 59 ITEMS MEASURED: 407 PERSONS 59 ITEMS
DIF class specification is: DIF=@SES2014

PERSON CLASS	DIF MEASURE	DIF S.E.	PERSON CLASS	DIF MEASURE	DIF S.E.	DIF CONTRAST	ITEM
1	0.1	0.04	2	-0.11	0.04	0.21	1.1(ALG)
1	0.1	0.04	3	0.19	0.02	-0.09	1.1(ALG)
2	-0.11	0.04	1	0.1	0.04	-0.21	1.1(ALG)
2	-0.11	0.04	3	0.19	0.02	-0.29	1.1(ALG)
3	0.19	0.02	1	0.1	0.04	0.09	1.1(ALG)
3	0.19	0.02	2	-0.11	0.04	0.29	1.1(ALG)
1	-0.12	0.04	2	-0.05	0.04	-0.07	1.2(ALG)
1	-0.12	0.04	3	-0.15	0.03	0.03	1.2(ALG)
2	-0.05	0.04	1	-0.12	0.04	0.07	1.2(ALG)
2	-0.05	0.04	3	-0.15	0.03	0.1	1.2(ALG)
3	-0.15	0.03	1	-0.12	0.04	-0.03	1.2(ALG)
3	-0.15	0.03	2	-0.05	0.04	-0.1	1.2(ALG)
1	-0.08	0.04	2	-0.07	0.04	-0.01	1.3(ALG)
1	-0.08	0.04	3	0.07	0.02	-0.15	1.3(ALG)
2	-0.07	0.04	1	-0.08	0.04	0.01	1.3(ALG)
2	-0.07	0.04	3	0.07	0.02	-0.14	1.3(ALG)
3	0.07	0.02	1	-0.08	0.04	0.15	1.3(ALG)
3	0.07	0.02	2	-0.07	0.04	0.14	1.3(ALG)
1	-0.14	0.04	2	-0.31	0.05	0.16	1.4.1(ALG)
1	-0.14	0.04	3	-0.21	0.03	0.07	1.4.1(ALG)
2	-0.31	0.05	1	-0.14	0.04	-0.16	1.4.1(ALG)
2	-0.31	0.05	3	-0.21	0.03	-0.1	1.4.1(ALG)
3	-0.21	0.03	1	-0.14	0.04	-0.07	1.4.1(ALG)
3	-0.21	0.03	2	-0.31	0.05	0.1	1.4.1(ALG)
1	-0.26	0.05	2	-0.2	0.04	-0.06	1.4.2(ALG)
1	-0.26	0.05	3	-0.3	0.03	0.03	1.4.2(ALG)
2	-0.2	0.04	1	-0.26	0.05	0.06	1.4.2(ALG)
2	-0.2	0.04	3	-0.3	0.03	0.09	1.4.2(ALG)
3	-0.3	0.03	1	-0.26	0.05	-0.03	1.4.2(ALG)
3	-0.3	0.03	2	-0.2	0.04	-0.09	1.4.2(ALG)
1	-0.09	0.04	2	-0.37	0.05	0.28	1.5.1(ALG)
1	-0.09	0.04	3	-0.22	0.03	0.13	1.5.1(ALG)
2	-0.37	0.05	1	-0.09	0.04	-0.28	1.5.1(ALG)
2	-0.37	0.05	3	-0.22	0.03	-0.15	1.5.1(ALG)
3	-0.22	0.03	1	-0.09	0.04	-0.13	1.5.1(ALG)
3	-0.22	0.03	2	-0.37	0.05	0.15	1.5.1(ALG)
1	-0.2	0.05	2	-0.36	0.05	0.16	1.5.2(ALG)
1	-0.2	0.05	3	-0.21	0.03	0.01	1.5.2(ALG)
2	-0.36	0.05	1	-0.2	0.05	-0.16	1.5.2(ALG)
2	-0.36	0.05	3	-0.21	0.03	-0.15	1.5.2(ALG)
3	-0.21	0.03	1	-0.2	0.05	-0.01	1.5.2(ALG)
3	-0.21	0.03	2	-0.36	0.05	0.15	1.5.2(ALG)
1	-0.14	0.04	2	-0.36	0.05	0.22	2.1.1(ALG)

1	-0.14	0.04	3	-0.25	0.03	0.1	2.1.1(ALG)
2	-0.36	0.05	1	-0.14	0.04	-0.22	2.1.1(ALG)
2	-0.36	0.05	3	-0.25	0.03	-0.11	2.1.1(ALG)
3	-0.25	0.03	1	-0.14	0.04	-0.1	2.1.1(ALG)
3	-0.25	0.03	2	-0.36	0.05	0.11	2.1.1(ALG)
1	0.03	0.04	2	-0.13	0.04	0.17	2.1.2(ALG)
1	0.03	0.04	3	0.03	0.02	0	2.1.2(ALG)
2	-0.13	0.04	1	0.03	0.04	-0.17	2.1.2(ALG)
2	-0.13	0.04	3	0.03	0.02	-0.16	2.1.2(ALG)
3	0.03	0.02	1	0.03	0.04	0	2.1.2(ALG)
3	0.03	0.02	2	-0.13	0.04	0.16	2.1.2(ALG)
1	-0.35	0.06	2	-0.21	0.04	-0.15	2.1.3(ALG)
1	-0.35	0.06	3	-0.24	0.03	-0.11	2.1.3(ALG)
2	-0.21	0.04	1	-0.35	0.06	0.15	2.1.3(ALG)
2	-0.21	0.04	3	-0.24	0.03	0.04	2.1.3(ALG)
3	-0.24	0.03	1	-0.35	0.06	0.11	2.1.3(ALG)
3	-0.24	0.03	2	-0.21	0.04	-0.04	2.1.3(ALG)
1	-0.12	0.04	2	-0.11	0.04	-0.01	2.1.4(ALG)
1	-0.12	0.04	3	-0.05	0.02	-0.07	2.1.4(ALG)
2	-0.11	0.04	1	-0.12	0.04	0.01	2.1.4(ALG)
2	-0.11	0.04	3	-0.05	0.02	-0.06	2.1.4(ALG)
3	-0.05	0.02	1	-0.12	0.04	0.07	2.1.4(ALG)
3	-0.05	0.02	2	-0.11	0.04	0.06	2.1.4(ALG)
1	0.04	0.04	2	-0.1	0.04	0.14	2.2(ALG)
1	0.04	0.04	3	-0.04	0.02	0.08	2.2(ALG)
2	-0.1	0.04	1	0.04	0.04	-0.14	2.2(ALG)
2	-0.1	0.04	3	-0.04	0.02	-0.06	2.2(ALG)
3	-0.04	0.02	1	0.04	0.04	-0.08	2.2(ALG)
3	-0.04	0.02	2	-0.1	0.04	0.06	2.2(ALG)
1	-0.06	0.04	2	-0.17	0.04	0.11	3.1.1(PAT)
1	-0.06	0.04	3	-0.11	0.02	0.05	3.1.1(PAT)
2	-0.17	0.04	1	-0.06	0.04	-0.11	3.1.1(PAT)
2	-0.17	0.04	3	-0.11	0.02	-0.06	3.1.1(PAT)
3	-0.11	0.02	1	-0.06	0.04	-0.05	3.1.1(PAT)
3	-0.11	0.02	2	-0.17	0.04	0.06	3.1.1(PAT)
1	0.11	0.04	2	-0.12	0.04	0.24	3.1.2(PAT)
1	0.11	0.04	3	0.01	0.02	0.1	3.1.2(PAT)
2	-0.12	0.04	1	0.11	0.04	-0.24	3.1.2(PAT)
2	-0.12	0.04	3	0.01	0.02	-0.14	3.1.2(PAT)
3	0.01	0.02	1	0.11	0.04	-0.1	3.1.2(PAT)
3	0.01	0.02	2	-0.12	0.04	0.14	3.1.2(PAT)
1	-0.09	0.04	2	-0.2	0.04	0.1	3.1.3(PAT)
1	-0.09	0.04	3	-0.12	0.02	0.03	3.1.3(PAT)
2	-0.2	0.04	1	-0.09	0.04	-0.1	3.1.3(PAT)
2	-0.2	0.04	3	-0.12	0.02	-0.07	3.1.3(PAT)
3	-0.12	0.02	1	-0.09	0.04	-0.03	3.1.3(PAT)
3	-0.12	0.02	2	-0.2	0.04	0.07	3.1.3(PAT)
1	-0.01	0.04	2	-0.17	0.04	0.16	3.2(PAT)
1	-0.01	0.04	3	-0.11	0.03	0.1	3.2(PAT)
2	-0.17	0.04	1	-0.01	0.04	-0.16	3.2(PAT)
2	-0.17	0.04	3	-0.11	0.03	-0.06	3.2(PAT)
3	-0.11	0.03	1	-0.01	0.04	-0.1	3.2(PAT)

3	-0.11	0.03	2	-0.17	0.04	0.06	3.2(PAT)
1	0.02	0.04	2	-0.27	0.04	0.28	4.1(FIN)
1	0.02	0.04	3	-0.05	0.02	0.07	4.1(FIN)
2	-0.27	0.04	1	0.02	0.04	-0.28	4.1(FIN)
2	-0.27	0.04	3	-0.05	0.02	-0.22	4.1(FIN)
3	-0.05	0.02	1	0.02	0.04	-0.07	4.1(FIN)
3	-0.05	0.02	2	-0.27	0.04	0.22	4.1(FIN)
1	-0.27	0.05	2	-0.1	0.04	-0.17	4.2.1(FIN)
1	-0.27	0.05	3	-0.28	0.03	0.01	4.2.1(FIN)
2	-0.1	0.04	1	-0.27	0.05	0.17	4.2.1(FIN)
2	-0.1	0.04	3	-0.28	0.03	0.18	4.2.1(FIN)
3	-0.28	0.03	1	-0.27	0.05	-0.01	4.2.1(FIN)
3	-0.28	0.03	2	-0.1	0.04	-0.18	4.2.1(FIN)
1	0.05	0.04	2	0.14	0.04	-0.09	4.2.2(FIN)
1	0.05	0.04	3	-0.07	0.02	0.13	4.2.2(FIN)
2	0.14	0.04	1	0.05	0.04	0.09	4.2.2(FIN)
2	0.14	0.04	3	-0.07	0.02	0.22	4.2.2(FIN)
3	-0.07	0.02	1	0.05	0.04	-0.13	4.2.2(FIN)
3	-0.07	0.02	2	0.14	0.04	-0.22	4.2.2(FIN)
1	-0.21	0.05	2	-0.07	0.04	-0.14	4.2.3(FIN)
1	-0.21	0.05	3	-0.22	0.03	0.02	4.2.3(FIN)
2	-0.07	0.04	1	-0.21	0.05	0.14	4.2.3(FIN)
2	-0.07	0.04	3	-0.22	0.03	0.15	4.2.3(FIN)
3	-0.22	0.03	1	-0.21	0.05	-0.02	4.2.3(FIN)
3	-0.22	0.03	2	-0.07	0.04	-0.15	4.2.3(FIN)
1	-0.25	0.05	2	-0.09	0.04	-0.16	4.3(FIN)
1	-0.25	0.05	3	-0.13	0.03	-0.12	4.3(FIN)
2	-0.09	0.04	1	-0.25	0.05	0.16	4.3(FIN)
2	-0.09	0.04	3	-0.13	0.03	0.04	4.3(FIN)
3	-0.13	0.03	1	-0.25	0.05	0.12	4.3(FIN)
3	-0.13	0.03	2	-0.09	0.04	-0.04	4.3(FIN)
1	-0.22	0.05	2	-0.12	0.04	-0.1	5.1(PRO)
1	-0.22	0.05	3	-0.16	0.03	-0.06	5.1(PRO)
2	-0.12	0.04	1	-0.22	0.05	0.1	5.1(PRO)
2	-0.12	0.04	3	-0.16	0.03	0.04	5.1(PRO)
3	-0.16	0.03	1	-0.22	0.05	0.06	5.1(PRO)
3	-0.16	0.03	2	-0.12	0.04	-0.04	5.1(PRO)
1	0.02	0.04	2	0.06	0.03	-0.04	5.2.1(PRO)
1	0.02	0.04	3	-0.06	0.02	0.09	5.2.1(PRO)
2	0.06	0.03	1	0.02	0.04	0.04	5.2.1(PRO)
2	0.06	0.03	3	-0.06	0.02	0.13	5.2.1(PRO)
3	-0.06	0.02	1	0.02	0.04	-0.09	5.2.1(PRO)
3	-0.06	0.02	2	0.06	0.03	-0.13	5.2.1(PRO)
1	-0.23	0.05	2	-0.17	0.04	-0.06	5.2.2(PRO)
1	-0.23	0.05	3	-0.15	0.03	-0.08	5.2.2(PRO)
2	-0.17	0.04	1	-0.23	0.05	0.06	5.2.2(PRO)
2	-0.17	0.04	3	-0.15	0.03	-0.02	5.2.2(PRO)
3	-0.15	0.03	1	-0.23	0.05	0.08	5.2.2(PRO)
3	-0.15	0.03	2	-0.17	0.04	0.02	5.2.2(PRO)
1	0.06	0.04	2	0.03	0.03	0.04	5.2.3(PRO)
1	0.06	0.04	3	0.06	0.02	0	5.2.3(PRO)
2	0.03	0.03	1	0.06	0.04	-0.04	5.2.3(PRO)

2	0.03	0.03	3	0.06	0.02	-0.04	5.2.3(PRO)
3	0.06	0.02	1	0.06	0.04	0	5.2.3(PRO)
3	0.06	0.02	2	0.03	0.03	0.04	5.2.3(PRO)
1	-0.02	0.04	2	0.16	0.04	-0.18	6.1(FUN)
1	-0.02	0.04	3	-0.01	0.02	-0.01	6.1(FUN)
2	0.16	0.04	1	-0.02	0.04	0.18	6.1(FUN)
2	0.16	0.04	3	-0.01	0.02	0.17	6.1(FUN)
3	-0.01	0.02	1	-0.02	0.04	0.01	6.1(FUN)
3	-0.01	0.02	2	0.16	0.04	-0.17	6.1(FUN)
1	0.09	0.04	2	0.36	0.04	-0.26	6.3(FUN)
1	0.09	0.04	3	0.02	0.02	0.08	6.3(FUN)
2	0.36	0.04	1	0.09	0.04	0.26	6.3(FUN)
2	0.36	0.04	3	0.02	0.02	0.34	6.3(FUN)
3	0.02	0.02	1	0.09	0.04	-0.08	6.3(FUN)
3	0.02	0.02	2	0.36	0.04	-0.34	6.3(FUN)
1	0.1	0.04	2	0	0.03	0.1	6.4(FUN)
1	0.1	0.04	3	0.07	0.02	0.03	6.4(FUN)
2	0	0.03	1	0.1	0.04	-0.1	6.4(FUN)
2	0	0.03	3	0.07	0.02	-0.06	6.4(FUN)
3	0.07	0.02	1	0.1	0.04	-0.03	6.4(FUN)
3	0.07	0.02	2	0	0.03	0.06	6.4(FUN)
1	-0.22	0.05	2	-0.06	0.04	-0.17	7.1(FUN)
1	-0.22	0.05	3	-0.23	0.03	0.01	7.1(FUN)
2	-0.06	0.04	1	-0.22	0.05	0.17	7.1(FUN)
2	-0.06	0.04	3	-0.23	0.03	0.18	7.1(FUN)
3	-0.23	0.03	1	-0.22	0.05	-0.01	7.1(FUN)
3	-0.23	0.03	2	-0.06	0.04	-0.18	7.1(FUN)
1	-0.13	0.04	2	-0.12	0.04	-0.01	7.2(FUN)
1	-0.13	0.04	3	-0.03	0.02	-0.1	7.2(FUN)
2	-0.12	0.04	1	-0.13	0.04	0.01	7.2(FUN)
2	-0.12	0.04	3	-0.03	0.02	-0.09	7.2(FUN)
3	-0.03	0.02	1	-0.13	0.04	0.1	7.2(FUN)
3	-0.03	0.02	2	-0.12	0.04	0.09	7.2(FUN)
1	-0.03	0.04	2	0	0.03	-0.04	7.3(FUN)
1	-0.03	0.04	3	-0.03	0.02	0	7.3(FUN)
2	0	0.03	1	-0.03	0.04	0.04	7.3(FUN)
2	0	0.03	3	-0.03	0.02	0.04	7.3(FUN)
3	-0.03	0.02	1	-0.03	0.04	0	7.3(FUN)
3	-0.03	0.02	2	0	0.03	-0.04	7.3(FUN)
1	-0.07	0.04	2	0.03	0.03	-0.1	7.4(FUN)
1	-0.07	0.04	3	0.07	0.02	-0.14	7.4(FUN)
2	0.03	0.03	1	-0.07	0.04	0.1	7.4(FUN)
2	0.03	0.03	3	0.07	0.02	-0.03	7.4(FUN)
3	0.07	0.02	1	-0.07	0.04	0.14	7.4(FUN)
3	0.07	0.02	2	0.03	0.03	0.03	7.4(FUN)
1	0.13	0.04	2	-0.18	0.04	0.31	7.5(FUN)
1	0.13	0.04	3	0.17	0.02	-0.04	7.5(FUN)
2	-0.18	0.04	1	0.13	0.04	-0.31	7.5(FUN)
2	-0.18	0.04	3	0.17	0.02	-0.35	7.5(FUN)
3	0.17	0.02	1	0.13	0.04	0.04	7.5(FUN)
3	0.17	0.02	2	-0.18	0.04	0.35	7.5(FUN)
1	0.32	0.04	2	0.35	0.05	-0.03	1.1(STA)

1	0.32	0.04	3	0.26	0.02	0.07	1.1(STA)
2	0.35	0.05	1	0.32	0.04	0.03	1.1(STA)
2	0.35	0.05	3	0.26	0.02	0.09	1.1(STA)
3	0.26	0.02	1	0.32	0.04	-0.07	1.1(STA)
3	0.26	0.02	2	0.35	0.05	-0.09	1.1(STA)
1	0.01	0.04	2	0.28	0.04	-0.27	1.2(STA)
1	0.01	0.04	3	0.11	0.02	-0.1	1.2(STA)
2	0.28	0.04	1	0.01	0.04	0.27	1.2(STA)
2	0.28	0.04	3	0.11	0.02	0.16	1.2(STA)
3	0.11	0.02	1	0.01	0.04	0.1	1.2(STA)
3	0.11	0.02	2	0.28	0.04	-0.16	1.2(STA)
1	-0.26	0.05	2	-0.33	0.05	0.07	2.1(STA)
1	-0.26	0.05	3	-0.3	0.04	0.04	2.1(STA)
2	-0.33	0.05	1	-0.26	0.05	-0.07	2.1(STA)
2	-0.33	0.05	3	-0.3	0.04	-0.02	2.1(STA)
3	-0.3	0.04	1	-0.26	0.05	-0.04	2.1(STA)
3	-0.3	0.04	2	-0.33	0.05	0.02	2.1(STA)
1	0.14	0.04	2	0.12	0.04	0.02	2.2(STA)
1	0.14	0.04	3	0.03	0.02	0.12	2.2(STA)
2	0.12	0.04	1	0.14	0.04	-0.02	2.2(STA)
2	0.12	0.04	3	0.03	0.02	0.09	2.2(STA)
3	0.03	0.02	1	0.14	0.04	-0.12	2.2(STA)
3	0.03	0.02	2	0.12	0.04	-0.09	2.2(STA)
1	0.53	0.05	2	0.26	0.04	0.27	2.3(STA)
1	0.53	0.05	3	0.38	0.03	0.15	2.3(STA)
2	0.26	0.04	1	0.53	0.05	-0.27	2.3(STA)
2	0.26	0.04	3	0.38	0.03	-0.13	2.3(STA)
3	0.38	0.03	1	0.53	0.05	-0.15	2.3(STA)
3	0.38	0.03	2	0.26	0.04	0.13	2.3(STA)
1	0.2	0.04	2	0.36	0.05	-0.15	2.4(STA)
1	0.2	0.04	3	0.16	0.02	0.04	2.4(STA)
2	0.36	0.05	1	0.2	0.04	0.15	2.4(STA)
2	0.36	0.05	3	0.16	0.02	0.19	2.4(STA)
3	0.16	0.02	1	0.2	0.04	-0.04	2.4(STA)
3	0.16	0.02	2	0.36	0.05	-0.19	2.4(STA)
1	0.19	0.04	2	-0.14	0.04	0.34	3.1(AN G)
1	0.19	0.04	3	0.09	0.02	0.11	3.1(AN G)
2	-0.14	0.04	1	0.19	0.04	-0.34	3.1(AN G)
2	-0.14	0.04	3	0.09	0.02	-0.23	3.1(AN G)
3	0.09	0.02	1	0.19	0.04	-0.11	3.1(AN G)
3	0.09	0.02	2	-0.14	0.04	0.23	3.1(AN G)
1	-0.05	0.04	2	0.14	0.04	-0.19	3.2(AN G)
1	-0.05	0.04	3	0.02	0.02	-0.08	3.2(AN G)
2	0.14	0.04	1	-0.05	0.04	0.19	3.2(AN G)
2	0.14	0.04	3	0.02	0.02	0.11	3.2(AN G)
3	0.02	0.02	1	-0.05	0.04	0.08	3.2(AN G)
3	0.02	0.02	2	0.14	0.04	-0.11	3.2(AN G)
1	0.12	0.04	2	.72<	0.07	-0.6	3.3(AN G)
1	0.12	0.04	3	0.36	0.03	-0.24	3.3(AN G)
2	.72<	0.07	1	0.12	0.04	0.6	3.3(AN G)
2	.72<	0.07	3	0.36	0.03	0.36	3.3(AN G)
3	0.36	0.03	1	0.12	0.04	0.24	3.3(AN G)

3	0.36	0.03	2	.72<	0.07	-0.36	3.3(AN G)
1	0.33	0.04	2	-0.12	0.04	0.45	4.1(AN G)
1	0.33	0.04	3	0.12	0.02	0.22	4.1(AN G)
2	-0.12	0.04	1	0.33	0.04	-0.45	4.1(AN G)
2	-0.12	0.04	3	0.12	0.02	-0.24	4.1(AN G)
3	0.12	0.02	1	0.33	0.04	-0.22	4.1(AN G)
3	0.12	0.02	2	-0.12	0.04	0.24	4.1(AN G)
1	0.31	0.04	2	0.35	0.05	-0.04	4.2(AN G)
1	0.31	0.04	3	0.15	0.02	0.16	4.2(AN G)
2	0.35	0.05	1	0.31	0.04	0.04	4.2(AN G)
2	0.35	0.05	3	0.15	0.02	0.2	4.2(AN G)
3	0.15	0.02	1	0.31	0.04	-0.16	4.2(AN G)
3	0.15	0.02	2	0.35	0.05	-0.2	4.2(AN G)
1	0.19	0.04	2	0.36	0.05	-0.17	4.3(AN G)
1	0.19	0.04	3	0.14	0.02	0.05	4.3(AN G)
2	0.36	0.05	1	0.19	0.04	0.17	4.3(AN G)
2	0.36	0.05	3	0.14	0.02	0.22	4.3(AN G)
3	0.14	0.02	1	0.19	0.04	-0.05	4.3(AN G)
3	0.14	0.02	2	0.36	0.05	-0.22	4.3(AN G)
1	0.06	0.04	2	0.01	0.03	0.05	4.4(AN G)
1	0.06	0.04	3	0.04	0.02	0.02	4.4(AN G)
2	0.01	0.03	1	0.06	0.04	-0.05	4.4(AN G)
2	0.01	0.03	3	0.04	0.02	-0.03	4.4(AN G)
3	0.04	0.02	1	0.06	0.04	-0.02	4.4(AN G)
3	0.04	0.02	2	0.01	0.03	0.03	4.4(AN G)
1	0.04	0.04	2	-0.23	0.04	0.27	5(AN G)
1	0.04	0.04	3	0.08	0.02	-0.03	5(AN G)
2	-0.23	0.04	1	0.04	0.04	-0.27	5(AN G)
2	-0.23	0.04	3	0.08	0.02	-0.3	5(AN G)
3	0.08	0.02	1	0.04	0.04	0.03	5(AN G)
3	0.08	0.02	2	-0.23	0.04	0.3	5(AN G)
1	0.04	0.04	2	0.47	0.05	-0.43	6.1.1(TRI)
1	0.04	0.04	3	0.1	0.02	-0.05	6.1.1(TRI)
2	0.47	0.05	1	0.04	0.04	0.43	6.1.1(TRI)
2	0.47	0.05	3	0.1	0.02	0.38	6.1.1(TRI)
3	0.1	0.02	1	0.04	0.04	0.05	6.1.1(TRI)
3	0.1	0.02	2	0.47	0.05	-0.38	6.1.1(TRI)
1	-0.03	0.04	2	-0.08	0.04	0.05	6.1.2(TRI)
1	-0.03	0.04	3	-0.03	0.02	0	6.1.2(TRI)
2	-0.08	0.04	1	-0.03	0.04	-0.05	6.1.2(TRI)
2	-0.08	0.04	3	-0.03	0.02	-0.05	6.1.2(TRI)
3	-0.03	0.02	1	-0.03	0.04	0	6.1.2(TRI)
3	-0.03	0.02	2	-0.08	0.04	0.05	6.1.2(TRI)
1	0.15	0.04	2	0.28	0.04	-0.13	6.2.1(TRI)
1	0.15	0.04	3	0.04	0.02	0.11	6.2.1(TRI)
2	0.28	0.04	1	0.15	0.04	0.13	6.2.1(TRI)
2	0.28	0.04	3	0.04	0.02	0.24	6.2.1(TRI)
3	0.04	0.02	1	0.15	0.04	-0.11	6.2.1(TRI)
3	0.04	0.02	2	0.28	0.04	-0.24	6.2.1(TRI)
1	0.04	0.04	2	-0.04	0.04	0.08	6.2.2(TRI)
1	0.04	0.04	3	0.06	0.02	-0.03	6.2.2(TRI)
2	-0.04	0.04	1	0.04	0.04	-0.08	6.2.2(TRI)

2	-0.04	0.04	3	0.06	0.02	-0.11	6.2.2(TRI)
3	0.06	0.02	1	0.04	0.04	0.03	6.2.2(TRI)
3	0.06	0.02	2	-0.04	0.04	0.11	6.2.2(TRI)
1	0.09	0.04	2	0.09	0.03	0	6.3(TRI)
1	0.09	0.04	3	0.17	0.02	-0.08	6.3(TRI)
2	0.09	0.03	1	0.09	0.04	0	6.3(TRI)
2	0.09	0.03	3	0.17	0.02	-0.08	6.3(TRI)
3	0.17	0.02	1	0.09	0.04	0.08	6.3(TRI)
3	0.17	0.02	2	0.09	0.03	0.08	6.3(TRI)
1	0.32	0.04	2	0.47	0.06	-0.15	7(TRI)
1	0.32	0.04	3	0.21	0.02	0.11	7(TRI)
2	0.47	0.06	1	0.32	0.04	0.15	7(TRI)
2	0.47	0.06	3	0.21	0.02	0.26	7(TRI)
3	0.21	0.02	1	0.32	0.04	-0.11	7(TRI)
3	0.21	0.02	2	0.47	0.06	-0.26	7(TRI)
1	-0.21	0.05	2	0.12	0.04	-0.33	8.1(MEA)
1	-0.21	0.05	3	-0.02	0.02	-0.19	8.1(MEA)
2	0.12	0.04	1	-0.21	0.05	0.33	8.1(MEA)
2	0.12	0.04	3	-0.02	0.02	0.14	8.1(MEA)
3	-0.02	0.02	1	-0.21	0.05	0.19	8.1(MEA)
3	-0.02	0.02	2	0.12	0.04	-0.14	8.1(MEA)
1	-0.13	0.04	2	0.04	0.03	-0.18	8.2(MEA)
1	-0.13	0.04	3	-0.01	0.02	-0.12	8.2(MEA)
2	0.04	0.03	1	-0.13	0.04	0.18	8.2(MEA)
2	0.04	0.03	3	-0.01	0.02	0.05	8.2(MEA)
3	-0.01	0.02	1	-0.13	0.04	0.12	8.2(MEA)
3	-0.01	0.02	2	0.04	0.03	-0.05	8.2(MEA)
1	0	0.04	2	0.05	0.03	-0.05	8.3(MEA)
1	0	0.04	3	-0.02	0.02	0.02	8.3(MEA)
2	0.05	0.03	1	0	0.04	0.05	8.3(MEA)
2	0.05	0.03	3	-0.02	0.02	0.07	8.3(MEA)
3	-0.02	0.02	1	0	0.04	-0.02	8.3(MEA)
3	-0.02	0.02	2	0.05	0.03	-0.07	8.3(MEA)
1	0.2	0.04	2	0.13	0.04	0.07	8.4(MEA)
1	0.2	0.04	3	0.1	0.02	0.1	8.4(MEA)
2	0.13	0.04	1	0.2	0.04	-0.07	8.4(MEA)
2	0.13	0.04	3	0.1	0.02	0.03	8.4(MEA)
3	0.1	0.02	1	0.2	0.04	-0.1	8.4(MEA)
3	0.1	0.02	2	0.13	0.04	-0.03	8.4(MEA)
1	-0.19	0.04	2	0.1	0.04	-0.29	9.1.1(EU G)
1	-0.19	0.04	3	0.2	0.02	-0.38	9.1.1(EU G)
2	0.1	0.04	1	-0.19	0.04	0.29	9.1.1(EU G)
2	0.1	0.04	3	0.2	0.02	-0.09	9.1.1(EU G)
3	0.2	0.02	1	-0.19	0.04	0.38	9.1.1(EU G)
3	0.2	0.02	2	0.1	0.04	0.09	9.1.1(EU G)
1	0.09	0.04	2	0.07	0.03	0.02	9.2(EU G)
1	0.09	0.04	3	0.2	0.02	-0.11	9.2(EU G)
2	0.07	0.03	1	0.09	0.04	-0.02	9.2(EU G)
2	0.07	0.03	3	0.2	0.02	-0.13	9.2(EU G)
3	0.2	0.02	1	0.09	0.04	0.11	9.2(EU G)
3	0.2	0.02	2	0.07	0.03	0.13	9.2(EU G)

Appendix E

Instructions for the calculation of averages

As items are moved for misfitting Rasch principle, the maximum for the calculations of average is changing. Therefore, it is important to indicate how to proceed for calculating average for each case.

Before any exclusion of items, the maximum marks per year, after verification, are presented in the table E below:

Table E: *Maximum marks per year*

2012			2013			2014		
p1	p2	p1p2	p1	p2	p1p2	p1	p2	p1p2
100	110	210	98	102	200	100	101	201

In 2012, after excluded for misfitting items: 1.1.4(ALG) having a maximum of 1 mark, 1.4.1(ALG) having a maximum of 1 mark, 1.1.2(STA) having a maximum of 2 marks and 1.1.3(STA) having a maximum of 1 mark, then the maximum marks for paper 1 becomes 98, the maximum for paper 2 becomes 107 and the total becomes 205. Therefore in this case, I brought all calculations of averages in percentages as following:

- for paper 1 average, the total of the rest of items' marks of paper 1after elimination of 1.1.4(ALG), 1.4.1(ALG) is divided by 98 times 100;

- for paper 2 average, the total of the rest of items' marks of paper 2after elimination of 1.1.2(STA), and 1.1.3 (STA) is divided by 107 times 100;

-for the average of the total p1 and p2, the total of the rest of all items' marks of 2012 examinations after elimination of 1.1.4(ALG), 1.4.1(ALG), 1.1.2(STA), and 1.1.3 (STA) is divided by 205 times 100.

In 2013, all items were acceptable in terms of Rasch measures accept 2.6(STA) that was excluded in terms of DIF for good measures of SES performance. Therefore, before performance by SES analysis the average for paper 1 is the total marks of paper 1 divided by 98 times 100, the average for paper 2 is the total marks of paper 2 divided by 102 times 100, the average for paper 1 combined with paper 2 is the total marks of paper 1 plus total marks paper 2 divided by 200 times 100.

For performance by SES analysis in 2013, after the exclusion of 2.6(STA) having the maximum of 1 mark, the maximum of paper 2 becomes 101 and for paper 1 combined with paper 2 is 199. Since, the average of total paper 1 and paper 2 is calculated by taking the rest of marks of paper 1 and paper 2 divided by 199 times 100.

In 2014, calculations of average were similar as in 2013 because all items fitted Rasch measure. Therefore, the average for paper 1 is the same as the marks were given because the maximum mark for paper 1 is 100. The average for paper 2 is the total of marks for paper 2 divided by 101 times 100. The average of the total of both paper 1 and paper 2 is the total marks of the whole examinations of 2014 paper 1 and paper 2 combined divided by 201 times 100.

For performance by SES analysis in 2014, after the exclusion of 6.2(FUN) having 2 marks, 2.5(STA) having 4 marks, 9.1.2(EU G) having 2 marks, the maximum for total paper 1 and paper 2 is 201-8=193. Therefore, the average scores are calculated by taking the rest of marks after the exclusion of these four items divided by 193 times 100.

Appendix F

Effect size

Appendix F1: Guidelines for interpreting the value of effect size as proposed by Cohen (1988):

Table F1: *Interpretation of effect size*

Effect size	Use	Small	Medium	Large
Cohen's d	t-tests	0.2	0.5	0.8
	Significance	Marginal	Substantial	Dramatic

Appendix F2: Calculations of effect size for t-test

- ES of mean difference between cohorts 2012 and 2013

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(22.32) - (26.14)}{\sqrt[2]{\frac{(13.276)^2 + (13.483)^2}{2}}}$$

$$= -0.2855028744 \cong -0.29$$ **(small)**

- ES of mean difference between cohorts 2013 and 2014

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(35.42) - (22.32)}{\sqrt[2]{\frac{(16.478)^2 + (13.276)^2}{2}}}$$

$$= 0.8754988243 \cong 0.88$$ **(large)**

- ES of mean difference between cohorts 2012 and 2014

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(35.42) - (26.14)}{\sqrt[2]{\frac{(16.478)^2 + (13.483)^2}{2}}}$$

$= 0.6163998989 \cong 0.62$ **(medium)**

ES in mathematics achievement by SES from 2012 to 2013

- ES for mean difference of NFP

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(20.34) - (26.97)}{\sqrt[2]{\frac{(9.811)^2 + (15.931)^2}{2}}}$$

$= -0.5011433198 \cong$ _ 0.50 (**medium)**

- ES for mean difference of FPLT

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(15.24) - (16.54)}{\sqrt[2]{\frac{(7.224)^2 + (6.893)^2}{2}}}$$

$= -0.1841245031 \cong$ _ 0.18 **(trivial)**

- ES for mean difference of FPMET

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(26.36) - (29.57)}{\sqrt[2]{\frac{(15.490)^2 + (12.948)^2}{2}}}$$

$= -0.2248577402 \cong \_\ 0.22$ **(small)**

ES of mean difference for NFP, FPLT, FPMET from 2013 to 2014

- ES for NFP

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(33.05) - (20.34)}{\sqrt[2]{\frac{(16.37)^2 + (29.811)^2}{2}}}$$

$= 0.9417423311 \cong 0.94$ **(large)**

- ES for FPLT

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(37.65) - (15.24)}{\sqrt[2]{\frac{(11.401)^2 + (7.224)^2}{2}}}$$

$= 2.348116523 \cong 2.3$ **(large)**

- ES for FPMET

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(35.05) - (26.36)}{\sqrt[2]{\frac{(17.904)^2 + (15.490)^2}{2}}}$$

$$= 0.5190982387 \cong 0.52$$ **(medium)**

ES of mean difference for NFP, FPLT, FPMET from 2012 to 2014

- ES for NFP

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(33.05) - (26.97)}{\sqrt[2]{\frac{(16.372)^2 + (15.931)^2}{2}}}$$

$$= 0.3764005507 \cong 0.38$$ **(small)**

- ES for FPLT

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(37.65) - (16.54)}{\sqrt[2]{\frac{(11.40)^2 + (16.893)^2}{2}}}$$

$$= 2.240828607 \cong 2.24$$ **(large)**

- ES for FPMET

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(35.05) - (29.57)}{\sqrt[2]{\frac{(17.904)^2 + (12.948)^2}{2}}}$$

$$= 0.3507477754 \cong 0.35$$ **(small)**

Mathematics achievement along paper 1 and paper 2 from 2012 to 2013

- ES for PAPER1

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(22.73) - (26.06)}{\sqrt[2]{\frac{(17.723)^2 + (16.709)^2}{2}}}$$

$= -0.1933409005 \cong$ -0.19 **(trivial)**

- ES for PAPER2

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(21.94) - (26.09)}{\sqrt[2]{\frac{(16.337)^2 + (16.006)^2}{2}}}$$

$= -0.2566108704 \cong$ _ 0.26 **(small)**

Mathematics achievement in paper 1 and paper 2 in 2013 and 2014

- ES for PAPER1

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(28.53) - (22.73)}{\sqrt[2]{\frac{(16.184)^2 + (17.723)^2}{2}}}$$

$= 0.34176039 \cong 0.34$ **(small)**

- ES for PAPER2

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(42.44) - (21.94)}{\sqrt[2]{\frac{(20.558)^2 + (16.337)^2}{2}}}$$

$$= 1.104059838 \cong 1.10 \textbf{ (large)}$$

. Average of paper 1 and paper 2 from 2012 to2014

- ES for PAPER1

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(28.53) - (26.06)}{\sqrt[2]{\frac{(16.184)^2 + (16.709)^2}{2}}}$$

$$= 0.1532045772 \cong 0.15 \textbf{ (trivial)}$$

- ES for PAPER2

$$ES = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt[2]{\frac{s_1^2 + s_2^2}{2}}}$$

$$= \frac{(42.44) - (26.09)}{\sqrt[2]{\frac{(20.558)^2 + (16.006)^2}{2}}}$$

$$= 0.887471372 \cong 0.89 \textbf{ (large)}$$