The predictive validity of the General Scholastic Aptitude Test (GSAT) for first year students in Information Technology

By

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THE PREDICTIVE VALIDITY OF THE GENERAL SCHOLASTIC APTITUDE TEST (GSAT) FOR FIRST YEAR STUDENTS IN INFORMATION TECHNOLOGY

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SUMMARY

This study investigates the validity of the General Scholastic Aptitude Test as a tool for predicting academic success for first year Information Technology (IT) students. Secondly it seeks to establish if it is an equally good predictor for the various racial groups in South Africa. Thirdly it investigates it's usefulness as a predictor for the different gender groups. The final aim is to establish whether the GSAT correlates with the Swedish Rating (SR) and English language ability in terms of predicting academic success for first year IT students.

The student group that served as the sample was the first year IT student group over the three year peroid from 2000 to 2002 at the Port Elizabeth (PE) Technikon. The study found that there was a weak link between GSAT and academic success across the entire sample. It however proved not to be an equally good predictor across all the racial groups, where it proved to be a far more useful tool for white students than for students from the other racial groups. Insofar as the gender groups were concerned it appeared to have some predictive power across the whole sample but not necessarily equally for the different gender and racial groups. There appeared to be a positive correlation between GSAT and Swedish Rating but not between GSAT and English language ability.

From this study it appears that the GSAT has some merit in predicting academic success, although with differing rates of usefulness across different demographic groupings in South Africa. In addition there are many other factors that may militate against academic success in a student's life which may hinder the usefulness of the GSAT as a predictive tool. If such assessments are to be used it would seem that they should be used very carefully, that factors reducing the chances of academic success need to be identified, and that institutions ensure that programmes are in place to empower students to maximize their potential.

DECLARATION

I hereby declare that the work on "The predictive validity of the General Scholastic Aptitude Test (GSAT) for first year students in Information Technology" is my own work, both in conception and in execution and that all the sources that I have used or quoted have been indicated and acknowledged by means of a complete reference.

SIGNATURE DATE

(D.J. Jenkings)

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CHAPTER 1

INTRODUCTION TO STUDY

1.1 MOTIVATION FOR THE STUDY TO BE UNDERTAKEN

In the past decade there has been much pressure from the state, students and community organizations to improve the opportunity of access for all South African students to tertiary institutions (Louw, Meyer & van Schalkwyk, 1998; Zaaiman, van der Flier & Thijs, 1998 & 2000). In opposition to this pressure there has been an equal pressure from the management of institutions, the state and sponsors that the throughput and retention rates at institutions should improve markedly (Asmal, 2003; Zaaiman, van der Flier & Thijs, 1998). Ethical issues too are a source of debate as the registration of students who are not likely to succeed at tertiary level is viewed as highly unethical (Hoefer & Gould, 2000; Zaaiman, van der Flier & Thijs, 2000). In this same period the perception has developed that the predictive value, for academic success at tertiary institutions, of the grade 12 school-leaving certificate has declined (Beecher & Fischer, 1999; Miller & Bradbury, 1999; PE Technikon, 2003; Watson, A, Foxcroft, Seymour, Kock & Streicher, 2001). Tertiary education is expensive for the student, their family and for the government of the day. Therefore in order:

- to improve the throughput and retention rates at institutions,
- not to waste the individual's nor the state's money on students who are unlikely to succeed and
- not to destroy the individual's self image,

alternative methods of selection are being sought, although to date most South African institutions have yet to find adequate solutions to this problem (Dawes, Yeld & Smith, 1999; Skuy, Zolezzi, Mentis, Fridjhon & Cockroft, 1996; Zaaiman, van der Flier & Thijs, 1998 & 2000).

Two strategic tasks teams were appointed to address the issue of first year student selection at the Port Elizabeth Technikon (PET). These were the "Refining the Admissions Policy" and "Attracting and Supporting Students with the Potential to Succeed" (Naude, 1995; PET

Admissions Policy 2003). The aim of these teams was to find alternative selection tools to ensure an improved selection and placement policy. The "Refining of Admissions Policy Team" selected the General Scholastic Aptitude Test (GSAT) (Naude, 1995; PE Technikon, 2003; Vogel, 1995) as their preferred assessment tool for predicting academic potential. The GSAT developed out of a comprehensive revision of existing group intelligence tests that were published by the Institute of Psychological and Edumetric Research (Claassen, de Beer, Hugo & Meyer, 1998:1). The manual explains that although this series of tests may be used as an intelligence test under certain circumstances, its prime role is that of estimating general scholastic aptitude. The estimate of general scholastic aptitude is useful for both environmentally disadvantaged and non-environmentally disadvantaged students. The norm score gives a relatively good estimate of an individual's present level of reasoning ability in respect of scholastic material and hence is a reasonable predictor of scholastic aptitude and therefore scholastic performance (Claassen et al., 1998:25). When this test was revised, in the early 1990's, this revision was based on learners who had received their school education in either English or Afrikaans. The norm group thus was derived from pupils from the previous House of Assembly, House of Delegates and House of Representatives education departments, that is, White, Coloured and Indian pupils (Claassen et al., 1998:5). Vogel (1995:49) contends that this test can be administered to all learners who have been promoted to grade 6 or higher and who have received their education in either English or Afrikaans.

During the course of 1999 PET decided that, in principle, all students would in future undergo selection testing to assist with access and placement (PET Admissions Policy, 2003). Although this decision was taken the necessary capacity is not yet in place and the policy will be slowly phased in. Many of the departments of the PET use this as an extra selection/placement tool for students whose school leaving results do not grant them access, or when there is uncertainty into which programme a student should be placed. In 1999 the Information Technology (IT) Department decided that all its prospective students, who meet the minimum academic criteria, would sit for the GSAT as part of their selection/placement procedure (PET IT Admission Criteria, 2003). This has meant that all IT students, registered since 2000, have GSAT scores but the validity of the test as a tool predicting academic success has yet to be fully verified. This makes the present study relevant not only to the

broader body of knowledge in this field but also to the selection/access/placement policy of the Port Elizabeth Technikon.

This study focuses on students studying in the field of Information Technology where they are required to apply logical, cognitive processes in solving the problems at hand. In order to do this a student must have sound abstract thinking skills and good verbal abilities, basically good scholastic abilities. School leaving (grade 12) academic results, particularly in academic subjects like languages, mathematics, the sciences and accounting, are perceived as a good indicator of these scholastic abilities (Dawes, Yeld & Smith, 1999; Mulvenon, Stegman, Thorn & Thomas, 1999). Academic aptitude tests too are seen as good predictors of success at tertiary institutions (Louw, Meyer & van Schalkwyk, 1998; Miller & Bradbury, 1999; Watson M, Calitz & de Kock, 2001).

World wide there seems to be an overall shortage of people with good IT skills, and this is equally true in South Africa. Unfortunately many students perceive IT skills as merely the manipulation of software rather than the logical, persistent and dogged patience required of a programmer. Sound selection is therefore a critical factor both for the psychological and emotional health of the student, the financial welfare of the student's family and the continued financial support of the institution by the state. This study thus seeks to establish the validity of the GSAT as a predictive tool for academic success and to consider other factors that may influence the prediction of academic success of a prospective first year student.

1.2 THE PROBLEM STATEMENT

The primary research problem is to establish if there is an answer to the question: "What is the predictive value of the General Scholastic Aptitude Test for students registering for their first year of study in Information Technology?"

Secondary problems arising out of this research problem can be stated as follows:

1.2.1 Is the GSAT an equally good predictor of academic performance for students from the different racial groups enrolled in the IT course?

1.2.2 Is the GSAT an equally good predictor of academic success for the different gender groups?

1.2.3 Does the GSAT correlate with the following in predicting academic success:

1.2.3.1 The Swedish Rating System?

1.2.3.2 English language ability?

1.3 RESEARCH AIMS

The research aims arise out of the problem statements and can be defined as follows:

1.3.1 To establish the validity of the GSAT as a predictor of academic success for first year IT students.

1.3.2 To establish whether the GSAT can be used as an equally good predictor of academic success for IT students from all races in South African society.

1.3.3 To establish whether the GSAT is suitable predictor for academic success for the different gender groups.

1.3.4 To determine the extent to which the GSAT correlates with:

1.3.4.1 The Swedish Rating System,

1.3.4.2 English language ability.

1.4 HYPOTHESES

1.4.1 The GSAT is a valid predictor of academic success for first year IT students.

1.4.2 The GSAT is a valid predictor of academic success for students from all racial groups in South Africa.

1.4.3 The GSAT is a valid predictor of academic success for the different gender groups.

1.4.4 There is a positive correlation between GSAT scores and the Swedish Rating System and English language ability.

1.5 DEFINITION OF TERMS

The General Scholastic Aptitude Test (GSAT) is a standardized South African aptitude test giving a measure of academic potential. It is designed to measure both verbal and non-verbal (performance) potential and gives a global score of scholastic aptitude. It is designed for use amongst secondary school learners. For selection purposes students must score in the above average range for their group in this test.

Swedish Rating System (SRS) is a procedure whereby points are allocated to academic symbols and where certain subjects carry a weighted value if they are perceived as important subjects for a course of study. Students need to achieve a predetermined sub minimum to obtain selection to a specific course.

Information Technology (IT) is a diploma course offered at tertiary education level whose primary focus is to teach the student computer programming skills. The student requires insight, mathematical perseverance and an above average scholastic aptitude in order to successfully complete this course.

Predictive validity refers to the accuracy of the GSAT in predicting which students will make a successful academic adjustment from their previous academic environment to the demands of the IT classroom. This will be measured by the successful completion of the first year of studies, which entails passing at least three of the four first year subjects and at least one of the two core subjects.

First year students are students who are enrolling for their first year of study in the IT course. They may have been at school, working, traveling or enrolled for another course of study in the previous year, but were not enrolled for a formal IT course at PE Technikon or any other tertiary institution.

1.6 THE RESEARCH METHOD

1.6.1 Research design

The research will be a descriptive, statistical study in the form of a case study, comparing the academic results of the first year IT students at PE Technikon in the years 2000, 2001 and 2002 with their GSAT scores and other relevant information collected at selection and registration (Vogel 1995). A correlation analysis will be made of these variables to establish if there are any significant correlations.

1.6.2 Sampling

The sample is a non-probability sample and will consist of all students who registered for the full load of first year IT subjects at one of the PET campuses. This excludes students who were admitted on marginal academic results and thus enrolled on an extended programme, which did not include a full academic load in their first year. These are first year students who registered in January 2000, January 2001 and January 2002.

1.6.3 Literature Review

A literature survey will be undertaken to examine theoretical view points and approaches to the main research problem and the secondary problems, and to highlight relevant research findings in this regard.

1.6.4 Instruments

The instruments used in determining the significance of the GSAT as a prime predictor of academic success for IT students were as follows:

1.6.4.1 The GSAT battery, senior shortened power form,

1.6.4.2 Scholastic achievement in the school leaving exam at the end of grade 12 as evaluated by the Swedish Rating System as described in the PET IT Admissions Criteria 2003,

1.6.4.3 English Language ability as assessed in subtest 4 of the AAT.

1.6.5 Scoring and Analysis of Data

1.6.5.1 The global GSAT score and academic success.

1.6.5.2 The global GSAT and the success of students from differing racial groups.

1.6.5.3 The global GSAT and gender ability

1.6.5.4 The Swedish Rating and academic success.

1.6.5.5 English ability and academic success.

1.7 THE RESEARCH PLAN

Chapter 1 explains the nature of the research, the research design methodology to be followed and the practical steps to be followed in completing this research.

Chapter 2 will consist of a theoretical overview of the problem of selecting first year IT students. In doing this a review of the literature covering the topics related to the aims of the present study will be made.

In chapter 3 the method of research will be discussed in detail under the following headings:

3.1 Section 1.6 of chapter one will form the basis of a detailed discussion of the problem statement and research aims.

3.2 A discussion of the formal measuring instruments, namely, the General Scholastic Aptitude Test, the Swedish Rating System (SRS) and the Academic Aptitude Test (AAT) English ability test (subtest 4).

3.3 The testing procedure and the statistical techniques adopted for the analysis of the results will be described.

Chapter 4 will be a presentation of the research data. This will include both quantitative and qualitative interpretations of the results and conclusions derived from these results.

In chapter 5 discussions of findings and recommendations will be made. The findings will be reported in the same sequence as they appear in the aims of the study.

5.1.1 Findings with regard to the predictive validity of the GSAT in relation to the academic success of first year IT students at PE Technikon.

5.1.2 Findings with regard to whether the GSAT is a good predictor of academic success for the various racial groups at PET.

5.1.3 Findings with regard to whether the GSAT is a good predictor of academic success for the gender groups at PET.

5.1.4 Findings with regard to whether the GSAT correlates well with:

5.1.4.1 The Swedish Rating System,

5.1.4.2 English language ability.

5.2 Limitations of this study will be highlighted.

5.3 Recommendations will be made about the selection policy of IT students and about the use of the GSAT in the broader selection policy of the PET.

5.4 Avenues of further research will be suggested.

CHAPTER 2

VARIABLES INFLUENCING THE PREDICTION OF ACADEMIC SUCCESS – A LITERATURE REVIEW.

2.1 INTRODUCTION

Testing as a form of selection and placement has been used for thousands of years, the earliest records going back to the selection of civil servants in about 2200B.C. (Anastasi & Urbana, 1997:32, Gregory, 1996:15). Modern psychological tests and more specifically the testing of mental abilities began in earnest in Europe and the USA in the late 1800's and became popular as a technique for selection and placement during the past century (Anastasi & Urbana, 1997:33; Foxcroft & Roodt, 2001:19; Gregory, 1996:30). Testing for educational purposes has become a major area of interest and by the middle of the 20th century tests like the Scholastic Aptitude Test and the Graduate Record Exam had become well accepted in the USA as a tool for selection and placement at educational institutions (Gregory, 1996:31).

In South Africa the traditional admission criteria to tertiary institutions has been the matriculation results. However there is a growing body of evidence that suggests that these results are becoming increasingly unreliable for selection purposes (Foxcroft & Roodt, 2001; Greyling, 2000; Miller & Bradbury, 1999). This is especially true for learners who come from an educationally disadvantaged background, who frequently have poor school leaving results that do not reflect their true scholastic potential. Furthermore the pressure is increasing that there should be wider access to higher education in South Africa (Koch, Foxcroft, Watson, Seymour & Streicher, 2002). International research supports the use of assessment tests as a means of improving the selection and placement process for students. There are many South African tertiary institutions that are thus investigating alternative assessment programmes (Foxcroft, 2001:275). The Employment Equity Act (1998:8) only permits the use of psychometric assessments if they can be shown to scientifically valid and reliable, they can be fairly applied to all employees (in this case applicants) and if they are not biased against any employee or group. Institutions that thus are looking to these as

alternative modes of selection and placement of students need to be sure that their assessment tools adhere to these criteria.

The multicultural nature of South African society further complicates this complex issue. Chapter 2 therefore reviews a selection of books and research articles in order to gain a better insight into what selection and prediction entails, what the complexities of selection are, what the accepted international procedures and trends are and to gain an understanding of the procedure and process used at Port Elizabeth Technikon.

2.2 STUDIES ON PREDICTIVE VALIDITY AND PSYCHOLOGICAL TESTS (PREDICTION AND SELECTION)

2.2.1 Prediction and Selection – concepts and reasons

Until the later part of the twentieth century it was widely accepted that academic performance at secondary school level was a suitable predictor of academic performance at tertiary level (Ayaya, 1996; Dawes, Yeld & Smith, 1999; Faulkner, 2002; Greyling, 2000; Huysamen & Roozendaal, 1999; Lindblom-Ylanne, Lonka & Leskinen, 1999; Louw, Meyer & van Schalkwyk, 1998). The implication of this was that selection of students for tertiary education and the prediction of their academic success was perceived largely as two sides of the same coin. However, many studies began to show that the selection of so-called top academic students at secondary level did not always translate into academic success at tertiary level (Ayaya, 1996; Cavanagh, 2003; Miller & Bradbury, 1999; Huysamen, 1999; Lindblom-Ylanne et al., 1999). The predictive validity thus of the selection tool was brought into question and alternative selection tools were sought which would have a better predictive potential (Ayaya, 1996; Lau, 2003; Larose, Robertson, Roy & Legault, 1998; Lindblom-Ylanne et al., 1999; Miller & Bradbury, 1999; Zaaiman, van der Flier & Thijs, 2000). Further complicating this complex question was the changing social mix of tertiary institutions and the fact that institutions were now serving a vast multicultural and diverse population. In addition this diverse learning community came from vastly differing educational backgrounds and a means of assessing the potential of this educationally diverse

pool has become a vexing question. Similar trends are experienced in the South African educational environment but with the establishment of our new democracy came an increased demand for access to tertiary education. Selection and prediction has therefore become an increasingly relevant and critical South African issue (Greyling, 2000; Venter, 1995; Zaaiman et al., 2000).

Selection is described as the process whereby students are identified who have the necessary potential to succeed, in specified courses, at tertiary education level and it should be based on sound psychological theory and practice (Lindblom-Ylanne et al., 1999; Miller & Bradbury, 1999; Zaaiman et al., 2000). The process must serve the purpose for which it is designed and be perceived as fair, effective and efficient (Zaaiman et al., 2000). Effective selection will result in the selection of a high percentage of successful students but at the same time may restrict access for a large number of school leavers who perceive themselves as potential students. The pivotal factor here is the ability of the selection process to select students who will be academically successful and to exclude students who will not be academically successful. It is this balance that is controversial and the process therefore needs to be able to stand up to both legal and political scrutiny and challenge and be supported by sound empirical evidence (Miller & Bradbury, 1999; Zaaiman et al., 2000). In the opinion of Greyling (2000) the selection process increases the prospect of there being conflict between finding the right social composition of the student body and preventing the negative and possibly destructive impact on inadequately prepared students. To a large extent selection in the current environment, especially in South Africa, involves finding an alternative to the method of selection based on matriculation marks. This is of critical importance due to the fact that many studies have suggested that the final school leaving mark is no longer a valid predictor of academic success at tertiary level, particularly for students coming out of schools that are in disadvantaged communities, but increasingly for students in all South African schools. Furthermore the introduction of the new schools curriculum means those learners entering the senior secondary phase of education in 2006 will not matriculate with the traditional matriculation certificate. Their marks will not be recorded in the traditional form and may not be useful for selection nor prediction. This development adds urgency to the

need to develop and verify sound selection tools (Engelbrecht & Kotze, 2003; Huysamen, 1999; Zaaiman, 2000).

Prediction on the other hand refers to the accuracy of the selection process in terms of identifying correctly the students who will make a success of their tertiary studies. Lau (2003) notes with concern the high percentage of students who are selected but who withdraw (dropout) either during the course of the first year or at the end of the first year because they are not coping with the academic demands of their chosen course. Ayaya (1996) and Larose et al., (1998) point out that there are many conflicting results and suggestions as to what factors are relevant in predicting academic success. The range of factors included in this debate include school leaving results, psychometric tests (both traditional and dynamic), school attended, study habits, English competence, writing skills, critical thinking skills, falling in the top 10% of academic achievers in the secondary school, the ability to make a qualitative shift as the learning demands change and the academic demands of the subjects selected at secondary level are amongst some of the most frequently listed factors explaining the prediction of academic success in the literature (Ayaya, 1996; Cavanagh, 2003; Dawes et al., 1999; Faulkner, 2002; Gehring, 2001; Greyling, 2000; Huysamen, 1999; Huysamen & Roozendaal, 1999; Lindblom-Ylanne et al., 1999; Louw et al, 1998; Miller & Bradbury, 1999; US Department of Education, 2000). With this wide range of possible factors the challenge is to select those factors that give the best correlation between the predictors and academic success, bearing in mind that it is nigh impossible to achieve a correlation of one with any predictor or combination of predictors. It is therefore up to each individual institution to select the factors that they perceive best suit their goals, fully understanding the risks that their choice implies (Shochet, 1994). An ideal predictor would therefore be a selection process which is able to measure both the skills needed to be a successful student, understanding that these skills change with different phases of the study programme, and those required in later professional life. From an academic perspective this would involve assessing cognitive skills which enhance knowledge processing and construction and thus predict learning potential (Lindblom-Ylanne et al., 1999).

2.2.2 The predictive validity of psychological tests for academic success – general terms and with special reference to the GSAT

The use of psychological tests for the purposes of selection and prediction has been and is a hotly contested and debated area. Probably one of the most researched of psychological tests is the Scholastic Aptitude Test (SAT) used in the United States of America (USA) for the selection of tertiary level students. Protagonists from both sides of the debate are able to produce research evidence that supports their point of view. What seems to be clear from the literature is that there are valid correlations between SAT scores and academic success (Barro, 2001; Gehring, 2001; Larose et al., 1998; Skuy, Zolezzi, Mentis, Fridjhon & Cockcroft, 1996; Sedlacek & Adams-Gaston, 1992). Gehring (2001), after surveying 1700 studies that cover a period of 58 years, highlights the fact that the SAT has proved to be a reliable predictor of academic success, both at first year level and for longer-term success. The higher the SAT scores the longer the student generally stays in the tertiary education system. What this study further highlights is that although the SAT is a useful predictor it is not a perfect predictor. Sedlacek et al., (1992) and Skuy et al., (1996) point out that these tests are not nearly as good predictors of academic success with non-traditional and disadvantaged students as they are with traditional advantaged students. These results are supported by other studies (Barro, 2001; Engelbrecht & Kotze, 2003; Larose et al., 1998; Shochet, 1994) and thus highlight one of the dilemmas of using psychometric assessments for selection purposes. They may well predict success for traditional and advantaged students but their applicability is not as clear cut when it comes to their use with non traditional and disadvantaged students.

In South Africa there are a number of psychometric tests that are in use. The use of all these assessments is questioned on the basis of their applicability to the population at large. One of the more frequently used assessments is the General Scholastic Aptitude Test (GSAT) and a number of studies have been conducted examining its suitability as a selection tool in South Africa.

Clarke (1998), Kotze and Diedricks (2003), Nel (1997), Venter (1995), Vogel (1995) suggest from their own studies and studies that they have consulted that South African psychometric tests and especially the GSAT do have predictive validity in the South African educational arena. These authors agree that although these tests predict academic achievement the degree of variance accounted for by these assessments alone varies considerably and that other factors therefore also play a role. Clarke (1998:160) suggests that psychometric assessments may account for between 14% and 62% of variance in predicting academic achievement. Venter (1995:146) concludes that psychometric tests have predictive potential provided that the multi-cultural problems can be adequately resolved. He suggests that the GSAT may be used as a valid predictor of academic success across multi-cultural settings despite the fact that it was not initially designed for such use, although one may need to be careful of the role that English or Afrikaans language competence may play in its effectiveness**.**

2.2.3 Psychological tests, academic success and racial differences.

Stocks (2000:5) suggests that scholastic aptitude tests have a valuable role to play in equalizing opportunities for student selection. What is suggested is that the correct use of such tests may provide better and increased opportunities for selection than previous selection methods, which exclude certain segments of the potential student population. International research (Barro, 2001; Larose et al., 1998:292; Shochet, 1998) although not questioning this potential does highlight the fact that more often than not psychometric tests are less effective predictors for minorities, under prepared and disadvantaged students than for the student population they were initially designed to serve. Shochet (1998) explains this poorer performance as a result of reduced opportunities to mediate the learning experiences and therefore proposes that cut off points may be adjusted for different groups on a basis determined by an institution through sound research.

In South Africa the research results of Engelbrecht and Kotze (2003) suggest that although psychometric assessments are effective predictors of academic success they do appear to be more effective with advantaged than disadvantaged students. In their opinion with increased diversity in the South African system and in the light of the changing educational system

there is a need to further pursue the research of such tools for selection and predictive purposes. Huysamen (1996) concludes that although different groups in South Africa do perform differently on standardized tests, which may indicate test bias, this does not necessarily, translate into predictive bias. In fact careful use of such tests may allow them to be used for predictive purposes. Clarke (1998, p97) notes that the GSAT is generally suitable for all South African race groups and most socio-economic groups, provided scores are not compared across groups. Under such conditions the GSAT has proved to be a reasonably good predictor of academic success (Clarke, 1998; Venter, 1995; Vogel, 1995).

2.2.4 Psychological tests, academic success and gender differences

Barro's (2001) findings were that the SAT under predicts academic success for women and over predicts academic success for men students. Huysamen and Roozendaal (1999) in a study conducted at the University of the Orange Free State initially had similar findings. However when the curriculum chosen was factored in there seemed to be less gender effect suggesting that the GSAT was an equal predictor of academic success for both male and female students.

Coley (2001) in looking at the selection of Information Technology students found that the gender difference was far more pronounced between black male and female students than in other groups. This difference was slowly eradicated with the number of years spent in tertiary education. What was noted in this study was that there was no systematic disenfranchisement of students on the basis of gender but that this could cause a difference in access based on race or ethnicity. In an earlier South African study Greyling (2000) noted that there were no significant gender differences in predicting academic success in the general population. However when the gender scores were analysed on a racial basis, there were significant differences between males and females in the groups of black students. Overall it would appear that there are no major differences in the predictive ability of psychometric tests for students of either gender but that the differences that do occur in their predictive power may be largely a function of the difficulty of courses traditionally chosen by the different genders. However it does appear that differences of predictive ability that may appear within

disadvantaged groups of students are compounded in these groups between male and female students.

2.2.5 Other predictors of academic success (SR & English ability) and their correlation with psychological tests

There seems to be wide agreement that school leaving results are still amongst the best predictors of academic success (Ayaya, 1996; Cavanagh, 2003; Clarke, 1998; Greyling, 2000; Larose et al., 1998; Kotze & Diedricks, 2003; Miller & Bradbury, 1999; Zaaiman et al., 2000). This is particularly true for students who come out of advantaged backgrounds but there seems to some uncertainty when it comes to the predictive power of school leaving marks for disadvantaged students. Greyling (2000) and Miller & Bradbury (1999) agree that there is in fact little correlation between the school leaving results of disadvantaged students and their success or lack of success at tertiary institutions. Ayaya (1996), Greyling (2000), Miller and Bradbury (1999) and Venter (1995) are of the opinion that the students' ability with the English language is perhaps the key when using the school leaving results. Students who have been comprehensively taught in English or who are English First Language users seem to have better rates of prediction for academic success than students with similar or even better school leaving marks but who are not as competent in the use of the English language. A number of the authors suggest that competence in a language, especially English, in mathematics and a science or a number of science subjects coupled with psychometric assessment results may be a better predictor of academic success than either marks alone or psychometric tests alone (Greyling, 2000; Miller & Bradbury, 1999; Zaaiman et al., 2000). Kotze and Diedricks (2003) on the other hand suggest that marks rather than reflecting academic potential reflect the conditions of teaching and learning within a school.

Other authors although not disputing that some of these factors may be important are of the opinion that predictors of academic success lie in completely different directions. These include non intellectual factors that promote a sense of ability and self esteem within the students (Larose et al., 1998). Cavanagh (2003) suggests that school marks may predict the reading, writing and comprehension skills but that they fail in the area of writing and critical

thinking skills. Miller and Bradbury (1999) have postulated that matriculation marks only serve to increase the number of students who are excluded from tertiary institution without making a significant difference to the failure rate.

In concluding these findings then it would seem that there is no one factor that alone predicts the success of students at tertiary level. Many authors are of the opinion that perhaps the best predictor is school leaving results. Unfortunately it would appear that the usefulness of these results is being brought more and more into question around the world. This is especially true in South Africa amongst disadvantaged communities and is being compounded in South Africa by the fact that the changes that are occurring in the secondary school system may make these results less useful in this regard over the next decade or so. Psychometric tests appear too, to have some merit insofar as their predictive abilities are concerned but there are many questions about their applicability to all subgroups within the school leaving population and whether or not they in fact measure academic potential or some other latent factors. Furthermore it appears that there may be a host of other factors that to a smaller or greater degree play a role in predicting academic success.

2.2.6 Selection procedures around the World

Around the world selection is a topical issue and is always linked to the predictive power of the selection tool or mechanism. Generally speaking procedures are very similar in a number of countries. Examples of selection procedures include the well-known procedures used in the USA, which is a combination of high school marks and the Scholastic Aptitude Test (Greyling, 2000). In Portugal the procedures involve a combination of secondary school results and the average of a national examination which evaluates reading and language skills (Greyling, 2000 ; Rego & Sousa, 1998). Rego and Sousa (1998) highlight the fact that in Portugal various regression analyses have shown a weak link between these selection procedures and academic results and therefore alternatives are being investigated. In Sweden a combination of school achievement, which is deemed an insufficient predictor, and entrance level tests that evaluate specific course relevant skills are used for selection purposes (Huysamen, 1996; Lindblom –Ylanne et al., 1999). Lindblom-Ylanne (1999) report

that in Finland an entrance exam is the only tool used to select students for tertiary study. In the UK on the other hand only performance in the final A-level examination is used but currently the effectiveness of this system is being questioned (Greyling, 2000). According to Greyling (2000) the Asian countries base their student selection process purely on the secondary school performance. There is however great concern as to the efficacy of such a procedure because the Asian institutions perceive their students as being poorly prepared for study at tertiary level (Greyling, 2000). Procedures around the world therefore appear to focus on one or more of final secondary school results, entrance tests and psychometric assessments.

2.2.7 Selection procedures in South Africa

The current Higher Educational Act (1997:27) in South Africa allows educational institutions to set their own selection criteria provided that it broadens access rather than restricting it and that it addresses past educational inequalities without discriminating (Koch, Foxcroft & Watson, 2001; Zaaiman et al., 2000). Traditionally these criteria have been based on the marks obtained for the matriculation certificate on leaving school, certain prerequisites, usually based on subject selection, and psychometric tests, especially for students from disadvantaged backgrounds. These may either be used as stand alone criteria or they are combined in combinations that the institution perceives as being helpful to the selection process (Miller & Bradbury, 1999; Greyling, 2000; Zaaiman et al., 2000). Unfortunately in recent years the reliability of the school leaving certificate has been questioned, particularly so for students who come out of traditionally disadvantaged backgrounds (Foxcroft & Roodt, 2001; Greyling, 2000; Miller & Bradbury, 1999). Greyling (2000) points out that additional problems in the selection process arise because of past inequalities in the educational system and the strong social and political pressures to change the student demography on tertiary campuses, which further complicate the selection process. Current selection strategies may not be valid for large percentages of potential students due to the fact that there are major questions about the validity of matriculation marks, the low numbers of black students who have mathematics at matriculation level, the lack of exposure to technology in many rural areas and the low competency levels in technical and scientific English. Furthermore this

scenario is being further complicated by the introduction of curriculum 2005 which will probably result in there being no school leaving marks which will be effective for use for selection purposes (Engelbrecht & Kotze, 2003). This creates an urgency to find alternative selection criteria.

2.2.8 Predictors of academic success for IT students – with a focus on psychological tests

Greyling (2000:20) and Watson, Calitz and de Kock (2001) sum up a wide range of research on the factors that predict success, for information technology students, at tertiary level. This research suggests that the psychometric assessments combined with the students' Mathematics and English competence accounts for up to 62% of the variance that explains IT success. Furthermore aspects such as study habits, thinking skills, problem translation skills, spatial ability skills, motivation, personality type and locus of control, all to some degree, impact upon the success of the IT student. Factors such as having completed computer science at school level; computer familiarity and levels of computer anxiety may play additional roles in contributing towards the students' success. This success is complicated by the fact that programming languages are continuously changing and the ability to adapt to these changes is crucial to the IT student. A further complicating factor in the South African environment is the role that traditional rural culture plays in the thinking processes that it encourages. These are largely circular thinking processes that to a large extent inhibit critical and innovative thinking tendencies (Greyling 2000:20). In addition many of the students that come out of such environments have low academic self-confidence (Greyling 2000:20).

2.3 A PREDICTION AND SELECTION MODEL FOR PORT ELIZABTH TECHNIKON (PET)

In the light of the difficulties that changes in the political and education environment have created in selecting students who will make a success of their academic courses Dr Naude was tasked by the Port Elizabeth Technikon to chair an admissions policy research team. In line with the research findings of Huysamen (1996) and Venter (1995) that the General

Scholastic Aptitude Test may be suitable for use across most population groups in South Africa it was decided to pursue this as an alternative admissions tool, combined with an assessment of English language ability and a brief interest survey. Naude (1995) established justifiable cut off points for students from various groups and for different courses based on data collected from the student body (Shochet, 1994). This research was then used to draw up an admissions policy that was approved by senate. Basically what this policy proposes is that students, who do not qualify for selection for a course based on their academic merit but whose Swedish Rating falls within a predetermined range from the cut off point, are referred for selection testing by the Department of Student Counseling and Development. Should these students meet the cut off points based on these selection tests they are recommended to the Heads of Department (HOD) as having suitable scholastic aptitude for their chosen course. The HODs' then decide whether to enroll these students or not. They may enroll students into the full academic programme or an extended or foundation programme on the basis of this recommendation and any other proficiency tests that the department may require the student to undergo.

In addition to the GSAT, students are assessed for English Comprehension on subtest 4 of the Academic Aptitude Test (AAT). The results of this subtest are used as an additional factor for consideration in situations where students are still borderline cases in terms of their cut off score. Should they have good English comprehension, they may be recommended for the course but should their English comprehension be poor they are not recommended, as this is perceived as an additional factor confirming that they may need to follow an alternative academic route. A brief interest questionnaire is completed at the same time and this may be used as additional information should the student need further career counseling.

The IT department, because of the high drop out rate in the first year, extended this procedure to include all students selected by them on the basis of their Swedish Rating (as laid out in the prospectus) and those falling within the borderline range of the Swedish Rating. Technically students who are enrolled for the full programme should fulfill both the Swedish Rating criteria and the selection test criteria. Students who meet only one of these criteria, usually the selection test criteria, are enrolled for the extended or foundation

programme. This would allow the student to make up for any academic gaps that the Swedish Rating appears to highlight.

2.4 THE GENERAL SCHOLASTIC APTITUDE TEST (GSAT)

2.4.1 Background

Claassen et al., (1998) in their "Manual for the General Scholastic Aptitude Test" explain that this test is a comprehensive revision of group intelligence tests that existed and were published by the Institute for Psychological and Edumetric Research (IPER). The needs and requirements of the South African population had changed quite considerably and in attempt to fulfill these needs the GSAT was developed.

This is a group test and the aim in developing it was to construct a measure of academic intelligence or scholastic aptitude. The test does not give a differential picture of intellectual abilities but does serve as a good screening test of academic aptitude (p2). It was initially developed for South African's who speak or had received most of their schooling in English or Afrikaans. The testee should be at least 13 years and 6 months old and have a familiarity with scholastic material. The original design of the test included six subtests but in the interests of time and efficiency a shortened power form was developed. This shortened form of the test consists of 4 subtests, two of which assess verbal ability and two of which assess non-verbal ability. The verbal grouping is made up of the Word Analogies and Verbal Reasoning sub tests, while the Non-Verbal assessments include Number Series and Pattern Completion (p4).

For purposes of establishing norms it was assumed that language probably played a crucial role in the development of intellectual ability. Therefore it was decided that only learners who had been educated throughout their school careers in English or Afrikaans were used. These were therefore largely students who came from White, Coloured and Indian population groups. Furthermore those learners used to norm the tests had to be comfortable in a modern scientific-technological society. However for both environmentally advantaged and non-

environmentally disadvantaged learners the norm score provides a good estimate of general scholastic aptitude (p25). The norm score thus provides an indication of an individual's current level of reasoning ability in respect of scholastic material and in relation to individual's of a similar age. Thus, provided that they are not used as an intelligent test, the GSAT has a valid application as a measure of scholastic aptitude and may therefore provide useful scores for predicting scholastic success in the whole population. It needs to therefore be borne in mind that environmentally disadvantaged individuals who initially perform poorly on the GSAT may, with appropriate intervention, improve their scholastic aptitude scores, if retested after a period of such intervention (Venter 1995), and thus for these individuals the GSAT scores may not be stable over a long period of time.

Clarke (1998:97) and Venter (1995) noted that recent studies in the cross-cultural use of the GSAT generally found it to be suitable for use amongst all race groups in South Africa, and most socio-economic groups but that comparisons of results between different racial and socio-economic groups was not appropriate. Clarke (1998:151) further notes that the stability coefficients for the GSAT are high, in other words the same construct has been measured over time and individual scores remain relatively stable over time.

2.4.2 Use at PET

Insofar as the use of the GSAT is concerned at the PE Technikon, it is used for purposes of assessing scholastic aptitude for all population groups. Groups and courses of study are compared within themselves to establish suitable cut off points that are likely to predict academic success in the specific instance. In most cases this assessment is used as an additional tool in broadening access for students who would be rejected on the basis of school leaving criteria alone. However, in IT this as an additional screening and placement mechanism used in conjunction with school leaving results. All applicants are assessed and the norms for environmentally disadvantaged students are used with cut off points suitable to different groups of students, based on research conducted by Naude (1995) on technology students at the Technikon from 1992 to 1995.

2.5 DIRECTION OF THIS RESEARCH

This research thus seeks to assess the validity of the GSAT as a predictive tool for IT students as opposed to the selection criteria based on school leaving results. In addition to this primary question it seeks to see if there are variations in its predictive ability based on race and gender.

CHAPTER 3

RESEARCH METHOD

3.1 INTRODUCTION

When investigating the relationship between a predictor and its validity, similar research both internationally and in South Africa, in which the predictive validity of various selection methods has been researched, have used procedures that have been followed in this dissertation. Miller and Bradbury (1999) define this validity as being illustrated by the percentage of the number of students who are selected, as compared to those who pass a later assessment in the course. In establishing this validity the following data seem to be universally agreed upon as being what is necessary for the calculation. Most studies agree that the sample that should be examined is the students in their first year of study. These students' results are most often drawn at the end of either the first semester or the first academic year and compared with the criteria used to select the students (Ayaya, 1996; Dawes, Yeld & Smith, 1999; Engelbrecht & Kotze, 2003; Greyling, 2000; Huysamen, 1999; Larose et al., 1998; Lindblom-Ylanne et al., 1999; Louw et al., 1998; Miller & Bradbury, 1999; Shochet, 1994; Sedlacek & Adams-Gaston, 1992; Venter, 1995; Vogel, 1995; Zaaiman et al., 2000). The selection criteria most often used are school leaving results and/or selection test results. Very few studies compared results at the end of tertiary studies with the selection criteria at the beginning of tertiary studies (Huysamen & Roozandaal, 1999; Louw et al., 1998). These data are then analyzed by having correlation and regression analyses (both linear and multiple) performed on them to establish the strength of the relationship(s) between the data that is analyzed and to establish whether there are certain predictors that play a stronger role than other predictors in predicting academic success (Engelbrecht & Kotze, 2003; Greyling, 2000; Huysamen, 1999; Huysamen & Roozandaal, 1999; Larose et al., 1998; Lindblom-Ylanne et al., 1999; Miller & Bradbury, 1999; Sedlacek & Adams-Gaston, 1992; Skuy et al., 1996 ; Venter, 1995; Vogel, 1995; Zaaiman et al., 2000).

3.2 THE RESEARCH METHOD

3.2.1 Research design

A descriptive, statistical study in the form of a case study of the selection procedure of first year IT students and their correlation with academic success at the end of the first academic year was conducted. The selection criteria data were collected for all the first year IT students at PE Technikon who registered for the first time for this course in the years 2000, 2001 and 2002. The data collected at this time were the students' GSAT scores (verbal, non verbal and total), the amount by which they cleared the minimum GSAT cut off point, their score for English Comprehension, as measured by sub test 4 of the AAT and their Swedish Rating score based on their final matriculation results and the criteria laid out in the IT departments admissions criteria (PE Technikon, 2003). This data was stored from the end of 1999 on a central database of the PE Technikon and is available through the computer services department of the PE Technikon. At the end of first academic year the students' academic progress was recorded. Before this study was conducted permission to obtain and analyze this data was obtained from both the head of the Student Counseling and Development Department, who supervise the collection of the psychometric data and the head of the computer services department, who store all the data. A series of correlation analyses were conducted on these variables to establish if there are any significant correlations. These analyses were conducted with the assistance of the resident statistician (Dr Jacques Pietersen) of the PE Technikon.

3.2.2 Sampling

The sample is a non-probability sample and consisted of all the students who registered for the full load of first year IT subjects at one of the PE Technikon campuses in one of the three years identified for the purposes of this study. At the beginning of this sampling period there were three campuses offering this course and by 2002 there were two campuses offering this course. The same selection criteria were used at all three campuses and the students wrote a common examination at the end of each academic year. This study excluded students who

were admitted on marginal academic results and were thus enrolled on an extended programme, which therefore did not include a full academic load in their first year. The sample consists of first year students who registered for IT for the first time in January 2000, January 2001 and January 2002 and who at the end of each of these years were still registered for the full academic load. A full academic load consisted of four subjects, two of which were offered on a semester basis but for which the student was given the average of the two semesters. A successful student was defined as a student who had passed 3 or 4 of the first year subjects that they had registered for and thus would be in a position to register for all or most of their second year subjects. Such students are perceived as standing a good chance of successfully obtaining their National Diplomas by the end of their third year (minimum time granted to complete this course) or within four years from first registration. A student failing two or more subjects would be unable to finish the course in less than four years and many do not reregister for the course.

3.2.3 Instruments

The instruments used in determining the usefulness of the GSAT as a prime predictor of academic success for IT students were as follows:

3.2.3.1 The GSAT battery, senior shortened power form,

3.2.3.2 Scholastic achievement in the school leaving exam at the end of grade 12 as evaluated by the Swedish Rating System and described in the PET IT Admissions Criteria 2003,

3.2.3.3 English Language ability as assessed in subtest 4 of the AAT.

3.2.4 Scoring and Analysis of Data

3.2.4.1 A comparison of the amount by which the students cleared the GSAT cut off score and academic success of all selected students.

3.2.4.2 A comparison of the amount by which the students cleared the GSAT cut off score and the success of students from differing racial groups.

3.2.4.3 A comparison of the amount by which the students cleared the GSAT cut off score and the success of students from the different gender groups.

3.2.4.4 A comparison of the students' Swedish Rating scores and the academic success of the selected group of students.

3.2.4.5 A comparison of the students' English comprehension ability and academic success of the selected group of students.

3.3 EXPLANATION OF THE USE OF THE MEASURING INSTRUMENTS

3.3.1 The General Scholastic Aptitude Test (GSAT)

As already explained in section 2.5 of the previous chapter this is a measure of scholastic aptitude and predicts the probability of academic success. The results of this test are used to select students who meet or clear the predetermined minimum cut off point. A student who achieves the cut off point is given a rating of 0. For each point above the cut off point the student is rated +1, +2 etc depending on the GSAT score above the minimum score. Technically students with scores below the cut off point should not be selected but occasionally students have other motivating factors that may gain them selection and therefore there may be a few students who are selected with minus scores (Naude, 1995).

3.3.2 The Swedish Rating System (SRS)

The SRS is a system whereby points are awarded to the symbol achieved for the best six subjects completed in the final school leaving examination. An exception to this rule would be the student who has more than six subjects and who does not have a required subject in the list of top six subjects. The required subject then replaces a subject for which a better symbol was achieved. Furthermore the points awarded for certain subjects, namely Mathematics and English which are prerequisite subjects for IT and a number of other selected subjects, are doubled. For selection to IT, students must score a minimum of 35 points but all students who score above 32 are referred for testing. Should a student who scores between 32 and 35 meet the GSAT criteria the student is given the option of joining

the extended programme and in a few select cases where the student has other strengths that promote them they may be enrolled for the full course (PE Technikon, 2003).

3.3.3 The Academic Aptitude Test (AAT) English Comprehension (subtest 4)

The AAT is a measure of the student's English comprehension ability and is only used in cases where both the SR and GSAT give borderline assessments. In such cases where the student appears to have a high level of English competency they may be given the opportunity to register for the course (Naude, 1995).

3.4 THE TESTING PROCEDURE

All students applying for IT who are currently learners at the time of application and who on the basis of their final grade 11 marks or marks achieved during the course of grade 12 fulfill the academic requirements for IT selection, or who have completed grade 12 and meet these requirements are referred for testing. The Department of Student Counselling and Development of the PE Technikon assess the majority of students (at either one of the Port Elizabeth campuses or the George Campus) but those who are unable to be assessed by this department are given the names of a list of approved assessment centers in various parts of the country and may be assessed there. Students who fulfill both sets of requirements are recommended for the course while those partially fulfilling these requirements are reviewed individually. The assessment results of all recommended students are then entered into the database of the PE Technikon.

3.5 THE STATISTICAL TECHNIQUES

The data of all IT students who registered from 2000 to 2002 were accessed from the department storing student records during the course of 2003. All students who were registered for all their subjects at the end of the first academic year were selected and their academic record, Swedish Rating and selection test data entered onto one table, see example table 3.1. A series of correlation analyses were performed on this data to confirm if there are

any correlations between GSAT and academic success and Swedish Rating and academic success. Once these relationships had been established the strength of the correlations were examined, by means of a Spearman rank correlation, to establish if any of these relationships are statistically significant. Finally a series of logistic regressions were conducted in an attempt to establish whether any of the variables play a significant role in predicting academic success.

Table 3.1 First year student data

FIRST YEAR IT STUDENTS AT PE TECHNIKON FOR 2002									
Stud.No	Ethnic	Swedish Rating	SP	GSAT	V	NV	T	AAT	Gender
	1	42	3	12	111	140	126		M
	1	49	3	32	130	144	145	9	M
	3	38	4	22	120	125	125	7	M
	1	43	4	3	116	116	117	7	F
	4	43	2	-4	94	91	93	9	F
	1	41	4	1	111	117	115	9	M
	2	43	4	1	107	109	108	7	F
	2	49	4	3	114	106	110	9	F
	2	0	4	0	109	103	106	7	M
	4	32	4	7	104	115	110	6	M
	1	59	4	14	131	121	128	9	F
	2	35	2	0	102	94	98	6	F

SP – number of subjects passed at the end of the academic year.

GSAT – the number of points above or below the cut off point.

Table 3.1 is an example of the data collected for students in each year of study. This is a sample of the 2002 group.

CHAPTER 4
STATISTICAL ANALYSIS

4.1 INTRODUCTION

This chapter presents the statistical analysis of the research data. This includes both quantitative and qualitative interpretations of the results and conclusions derived from these results. In line with acceptable practice in the literature (Engelbrecht & Kotze, 2003; Greyling, 2000; Huysamen, 1999; Huysamen & Roozendaal, 1999; Larose et al., 1998; Lindblom-Ylanne et al., 1999; Miller & Bradbury, 1999; Sedlacek & Adams-Gaston, 1992; Skuy et al., 1996; Venter, 1995; Vogel, 1995; Zaaiman et al., 2000) the following operations were performed on the data. Firstly a series of descriptive statistics were performed to look at the relationship between the GSAT cut off score and the number of subjects passed and the Swedish Rating and the number of subjects passed. In each series of analyses the variables were compared for the whole group, for each ethnic group and for each gender group. In this chapter only the results of the total group for both GSAT cut off score and Swedish Rating will be discussed in detail and interesting results in the other groups highlighted. The complete descriptive statistical analysis is available in annexure 1 (GSAT) and annexure 2 (Swedish Rating). This is followed by an analysis of the strength of the correlations and comments will be made only on those correlations that were statistically significant. Finally a series of logistic regressions were applied to the data to establish which, if any, of the correlations seem to influence the prediction of the pass rates.

4.2 DESCRIPTIVE STATISTICS

4.2.1 The relationship between GSAT and the number of subjects passed

4.2.1.1 The dichotomized variable

In the initial analysis of this data the sample was divided into two groups, those who had passed less than 3 subjects (group 0) and those who had passed 3 or 4 subjects (group 1). This division is the deciding factor as to whether or not students are able to enroll for their second year of study. In other words students who have passed less than 3 subjects are

described as unsuccessful students and those who pass 3 or 4 subjects are described as successful students in terms of the academic requirements of this course.

Table 4.1 Summary of GSAT cut off means of unsuccessful (group 0) and successful (group 1) students.

Breakdown Table of Descriptive Statistics Smallest N for any variable: 371			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.650307	163	7.383276
1	7.639423	208	8.231540
All Grps	5.886792	371	8.105928

In this particular sample (table 4.1), over the three years included in this study, there were 371 candidates who were registered for all four subjects, at the end of their first year of study. Of this group 208 students or 56% of the sample can be described as successful students while 163 students or 44% of the sample can be described as unsuccessful students. When the GSAT cut off means for each of these groups is considered it is clear from this table that the mean of the successful students is considerably higher than the mean for the unsuccessful students, suggesting that there may be a relationship between higher GSAT cut off scores and academic success.

This data was then displayed in a graphical form, firstly as a box and whisker plot (figure 4.1) and secondly as a histogram (figure 4.2). The box and whisker plot graphically displays the range of the GSAT cut off scores for the successful and unsuccessful students and illustrates the median values of these groups. The histogram gives a more detailed graphical breakdown of each group and one is thus able to obtain a more detailed picture of what the two groups look like in terms of their GSAT cut off scores.

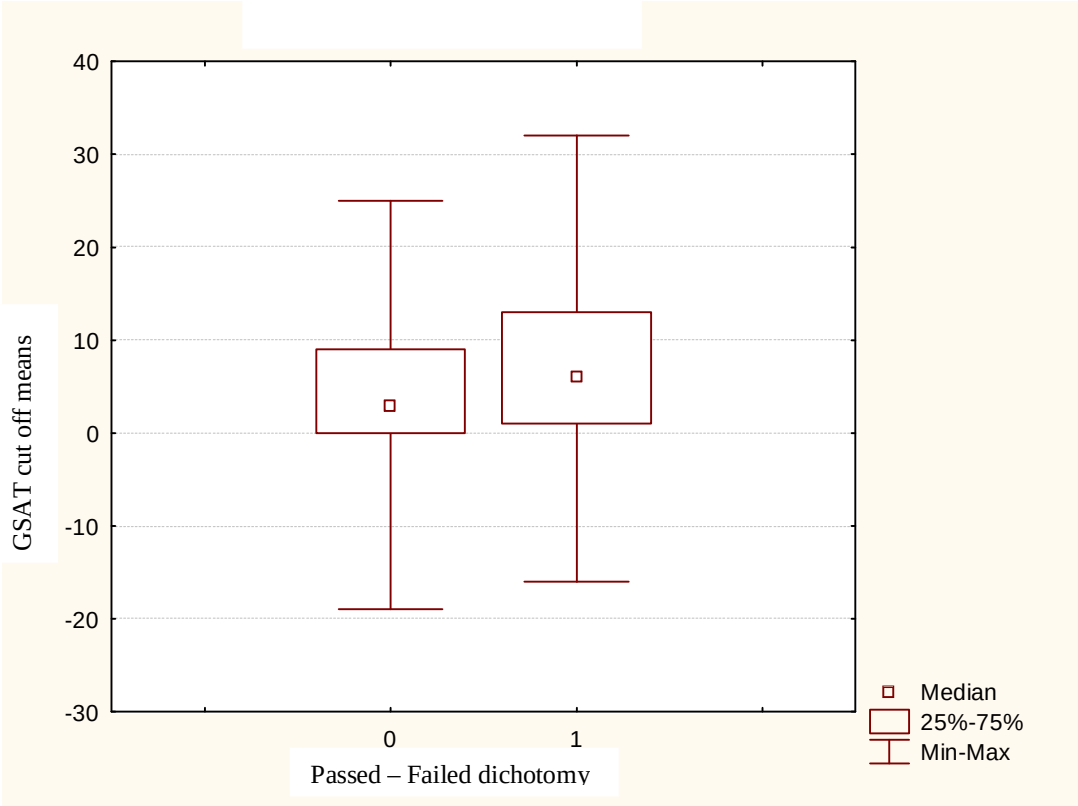

Figure 4.1 Box & Whisker Plot: The range of GSAT cut off scores for the whole sample.

0 = unsuccessful students

1 = successful students

On examination of figures 4.1 and 4.2 one's attention is drawn to the fact that there are a number of students who score above the GSAT cut off point and yet are not successful students and secondly that there are successful students who appear to score well below the cut off point. These two groups of students need closer examination.

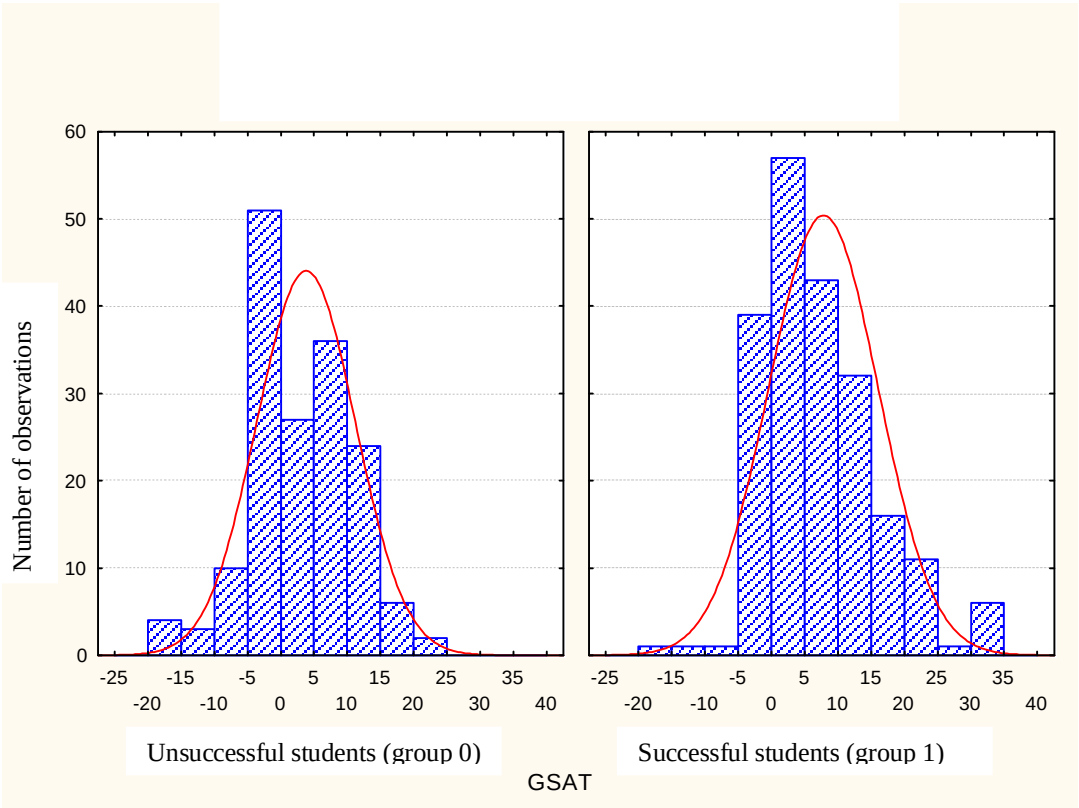

Figure 4.2 Histogram: A comparison of the distribution of GSAT cut off scores for unsuccessful (group 0, n = 163) and successful (group 1, n = 208) students

On further examination of the histograms (figure 4.2) about 19% of the successful group of students fall below the GSAT cut off. However on closer examination 92,5% of this group fall between 0 and -5 of the cut off point and 7,5% fall below -5. Of greater significance is the fact that of the unsuccessful group of students 58% of this group scored above the 0 cut off point and this needs further investigation.

Table 4.2 Analysis of Variance of GSAT for the dichotomous variable, significant at p< 0.05

	Analysis of Variance (IT Students 2000 TO 2002A1a.sta) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1454.221	1	1454.221	22857.02	369	61.94316	23.47670	0.000002

Table 4.2 (an Analysis of Variance) and table 4.3 (Levene Test of Homogeneity of Variances) confirms that the means of these two groups of students (table 4.1) are statistically significantly different at the 0,05 level of significance and that these groups are therefore different in nature. The higher GSAT cut off mean of the successful group is thus statistically significantly different from that of the unsuccessful group suggesting that the higher GSAT score is a predictor of academic success for first year IT students.

Table 4.3 Levene test of Homogeneity of Variance of GSAT for the dichotomous variable, significant at $p<0.05$

	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	61.27101	1	61.27101	8305.526	369	22.50820	2.722164	0.099815

4.2.1.2 The original variable

The analysis performed on this data is virtually the same as for the previous section except that instead of analyzing the successful and unsuccessful groups, an analysis in performed on five different groups defined by the number of subjects passed. The full spectrum of analyses is displayed in annexure 1.

Table 4.4 A breakdown of the GSAT cut off means ranging from students who passed no first year subjects (0) to students who passed all four first year subjects (4)

Breakdown Table of Descriptive Statistics Smallest N for any variable: 371			
Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	2.777778	90	7.846530
1	4.464286	28	6.774036
2	4.888889	45	6.668182
3	6.045455	44	7.897467
4	8.067073	164	8.290087
All Grps	5.886792	371	8.105928

Table 4.4 breaks the total sample of 371 candidates into five groups, each group identified by the number of subjects passed at the end of the first year of study. The 163 unsuccessful candidates are divided into those who passed zero subjects (90 students), those who passed one subject (28 students) and those who passed two subjects (45 students). The 208 successful students are divided into those who passed three subjects (44 students) and those who passed all four subjects (164 students).

Table 4.5 Analysis of Variance of GSAT for the original variable, significant at p< 0.05

	Analysis of Variance Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1752.110	4	438.0274	22559.14	366	61.63698	7.106568	0.000016

Table 4.5 (Analysis of Variance) and table 4.6 (Levene Test of Homogeneity of Variables) confirms that the means of these five groups of students (table 4.4) are statistically significantly different at the 0,05 level of significance. The higher GSAT cut off means of the two successful groups is thus statistically significantly different from that of the three unsuccessful groups, again suggesting that the higher GSAT cut off score is a predictor of academic success for IT students.

Table 4.6 Levene test of Homogeneity of Variance of GSAT for the dichotomous variable, significant at p<0.05

	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	111.3371	4	27.83427	8200.317	366	22.40524	1.242311	0.292543

.

Table 4.7 LSD test. A comparison of the GSAT cut off means and the number of subjects passed, significant at p<0.05

Subj Passed		LSD Test; Variable: GSAT Marked differences are significant at p < .05000				
		{1} M=2.7778	{2} M=4.4643	{3} M=4.8889	{4} M=6.0455	{5} M=8.0671
0	{1}		0.321502	0.141658	0.024244	0.000000
1	{2}	0.321502		0.822345	0.405332	0.025414
2	{3}	0.141658	0.822345		0.487594	0.016644
3	{4}	0.024244	0.405332	0.487594		0.130210
4	{5}	0.000000	0.025414	0.016644	0.130210	

Table 4.7 serves to further confirm that the successful and unsuccessful groups are statistically significantly different at the 0,05 level of significance, particularly if you consider columns 1 and 5, which appears to indicate that the grouping made up of subjects passed 0 to 2 is statistically significantly different to the grouping made up of subjects passed 3 and 4, thus confirming that higher GSAT cut off scores are associated with academic success for first year IT students

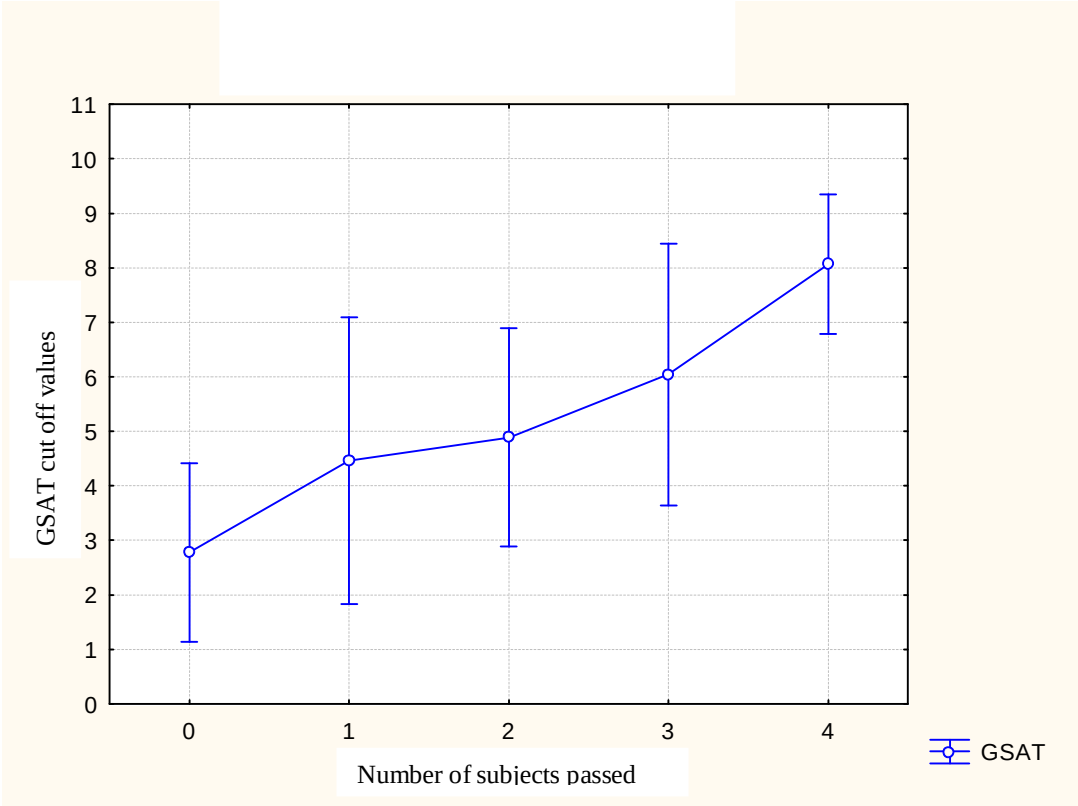

Figure 4.3 A comparison of the number of subjects passed and the GSAT cut off means at the 95% confidence level

Figure 4.3 illustrates the relationship between the GSAT cut off means and the number of subjects passed. Again the trend from these tables seems to support the idea that with an increasing GSAT cut off score there is an increasing chance of academic success.

4.2.1.3. Racial and gender groups.

For each of the main South African racial and gender groups a similar analysis was conducted. Only the main trends and anomalies for the dichotomized variable are highlighted in this section. The detailed analyses of all the variables can be seen in annexure 1. The White students, ethnic group 1, follow a trend very similar to the overall trend already described.

Table 4.8 A comparison of the GSAT cut off means for unsuccessful (group 0) and Successful (group 1) white students (ethnic 1)

Breakdown Table of Descriptive Statistics (ETHNIC=1) Smallest N for any variable: 200			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	4.000000	64	7.550886
1	9.073529	136	8.807936
All Grps	7.450000	200	8.735505

Table 4.8 is a summary of the difference between the GSAT cut off means of successful as opposed to unsuccessful white students. There were 200 students in this sample of which 64 (32%) were unsuccessful and 136 (68%) were successful.

Table 4.9 Analysis of Variance of GSAT for the white students, significant at $p< 0.05$

	Analysis of Variance (ETHNIC=1) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1120.235	1	1120.235	14065.26	198	71.03669	15.76981	0.000100

Table 4.10 Levene Test of Homogeneity of Variance of GSAT for the white students, significant at $p<0.05$

	Levene Test of Homogeneity of Variances (ETHNIC=1) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	78.46872	1	78.46872	4771.168	198	24.09681	3.256395	0.072665

Table 4.9 (Analysis of Variance) and table 4.10 (Levene Test of Homogeneity of Variance) confirm that the GSAT cut off means of the two groups are statistically significantly different at the 0,05 level of significance. Thus for the white students it can be concluded that the GSAT cut off mean is statistically significantly different from the unsuccessful students.

Higher GSAT cut off scores thus seem to be a predictor of academic success for first year IT students who are white.

Table 4.11 A comparison of the GSAT cut off means for unsuccessful (group 0) and successful (group 1) coloured students (ethnic 2)

Breakdown Table of Descriptive Statistics (ETHNIC=2) N=80 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	4.279070	43	5.658224
1	4.864865	37	5.623177
All Grps	4.550000	80	5.613952

For the Coloured students, ethnic group 2, the picture is rather different. Table 4.7 indicates that there were a total of 80 students in this group of whom 43 (54%) were unsuccessful and 37 (46%) were successful.

Table 4.12 Analysis of Variance of GSAT for the coloured students, significant at $p< 0.05$

	Analysis of Variance (ETHNIC=2) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	6.824513	1	6.824513	2482.975	78	31.83302	0.214385	0.644641

Table 4.13 Levene Test of Homogeneity of Variance of GSAT for the coloured students, significant at $p<0.05$

	Levene Test of Homogeneity of Variances (ETHNIC=2) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	5.227946	1	5.227946	857.3402	78	10.99154	0.475634	0.492454

The Analysis of Variance (table 4.12) and the Levene Test of Homogeneity of Variances (table 4.13) confirm that the means for the successful and unsuccessful groups are not statistically significantly different at the 0,05 level of significance, although there is a slightly higher GSAT cut off average for the successful than for the unsuccessful students.

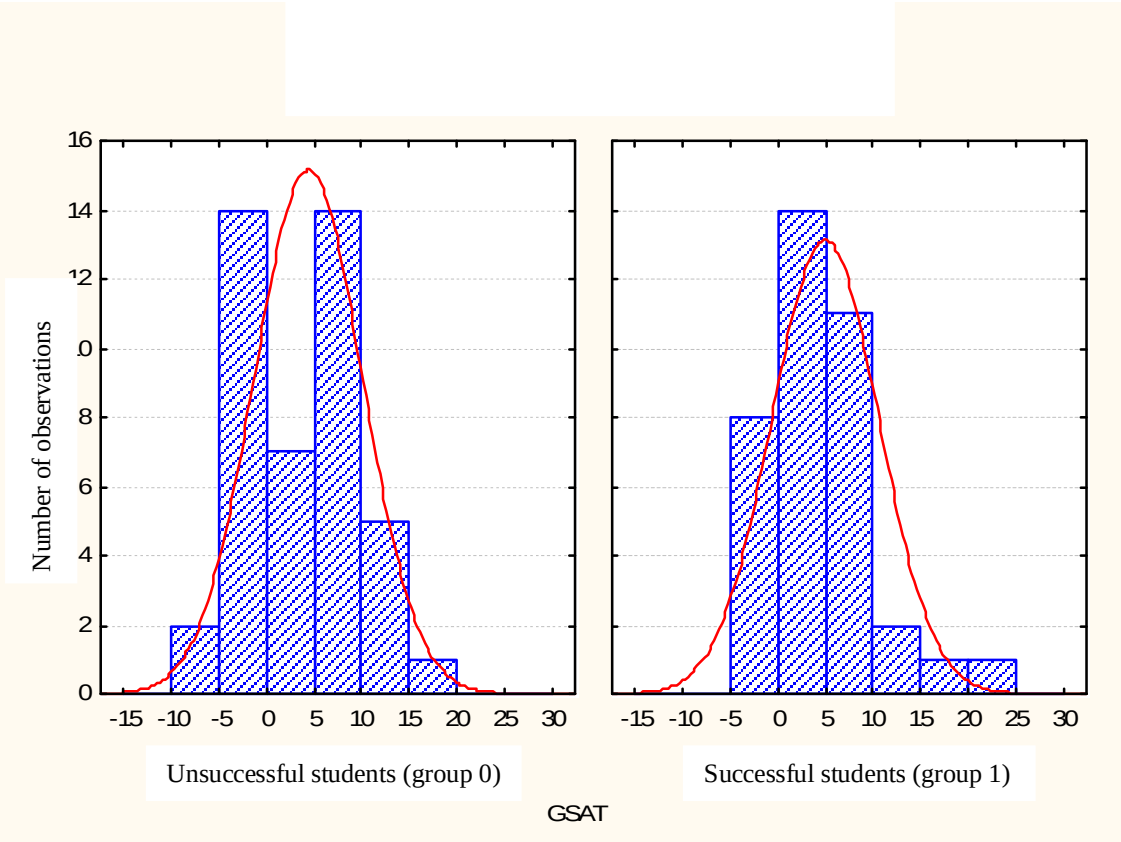

Figure 4.4 Histogram: A comparison of the distribution of GSAT cut off scores for unsuccessful (group 0, n = 43) and successful (group 1, n = 37) coloured students (ethnic 2).

On closer examination of the histogram for this group, figure 4.4, it is a concern to note that a greater percentage of the selected students were unsuccessful (54%) than successful (46%). It is interesting to note that all the successful students scored above -5 of the cut off point, 22% falling in the -5 to 0 bracket. Of greater concern is the fact that of the unsuccessful students 63% have GSAT cut off scores above the 0 cut off point, suggesting that either the GSAT is not a suitable predictor of academic success for this group or that there are other factors affecting the academic progress of these students rather than their academic potential.

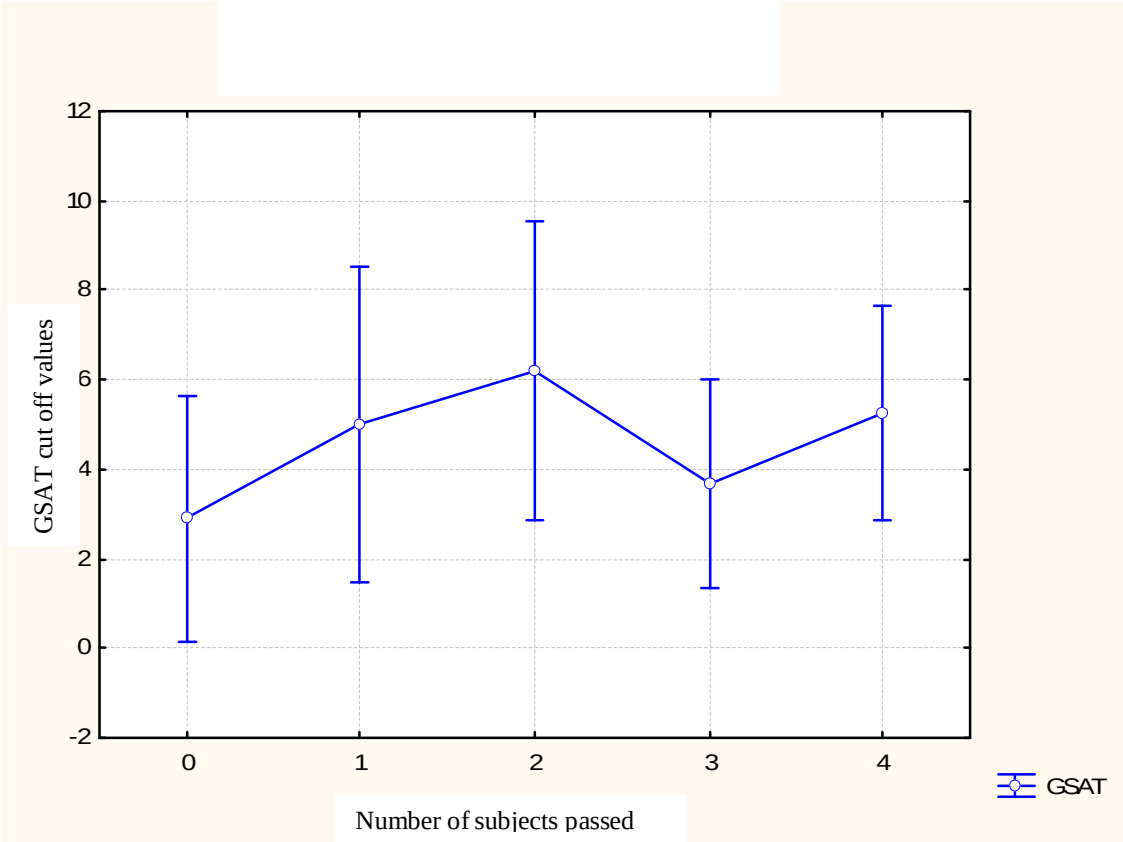

Figure 4.5 A comparison of the GSAT cut off means and the number of subjects passed for the coloured students (ethnic 2) at the 95% confidence level

Of further interest in this group is the trend best illustrated in the graph of the GSAT cut off means and the confidence levels, figure 4.5. The highest GSAT cut off mean is found in the unsuccessful group of students who pass only two subjects. The concern here is that the students in this group who appear to have the greatest academic potential are not successful. In addition the means for the two categories of successful students does not appear to differ too much from the least successful students.

For the Asian students, ethnic group 3, the trend appears to be similar to that of the general analysis but the number of Asian students in the sample is very small. This group is therefore not a representative sample and as a result no comments can be made on the results of this

group. The dichotomous analysis is included in the annexure 1 for those readers who may be interested to see the trends of this small sample with respect to GSAT cut off scores.

When it comes to the Black students, ethnic group 4, the trends are very similar to those of the coloured students. There are 74 Black students of whom 26 (35%) were successful and 48

Table 4.14 A comparison of the GSAT cut off means for unsuccessful (group 0) and successful (group 1) black students (ethnic 4)

Breakdown Table of Descriptive Statistics (ETHNIC=4) N=74 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.104167	48	8.372294
1	3.923077	26	6.752322
All Grps	3.391892	74	7.803788

(65%) were unsuccessful. Table 4.14 highlights the fact that the GSAT cut off means of the successful and unsuccessful students are very similar, although the mean of the successful group is marginally higher than the unsuccessful group.

Table 4.15 Analysis of Variance of GSAT for the black students, significant at $p < 0.05$

	Analysis of Variance (ETHNIC=4) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	11.30981	1	11.30981	4434.325	72	61.58785	0.183637	0.669545

Table 4.16 Levene Test of Homogeneity of Variance of GSAT for the black students, significant at $p<0.05$

	Levene Test of Homogeneity of Variances (ETHNIC=4) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	26.95683	1	26.95683	1916.015	72	26.61132	1.012984	0.317560

Table 4.15 (the analysis of variance) and table 4.16 (levene test of homogeneity of the variance) confirm that there is no statistically significant difference between the GSAT cut off means of the two groups at the 0,05 level of significance.

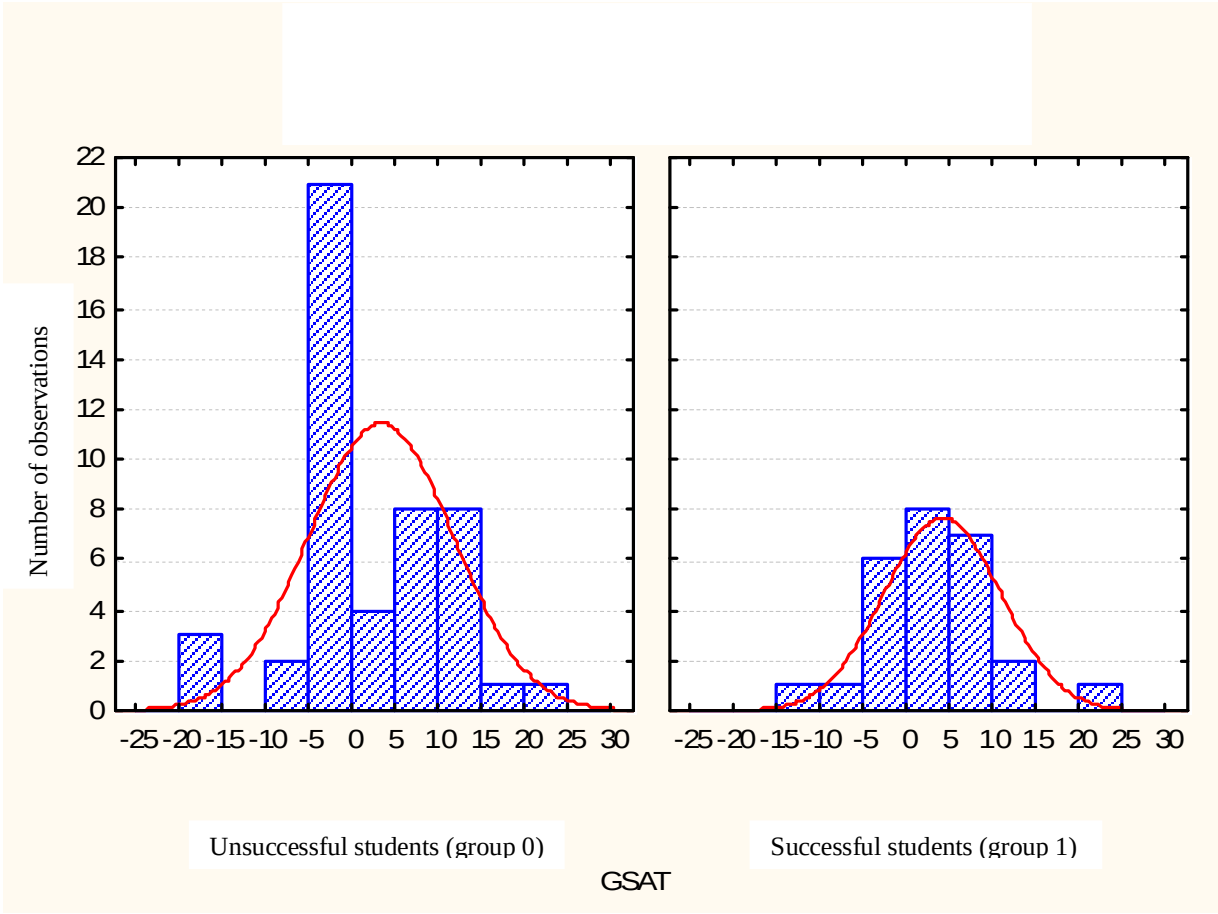

Figure 4.6 Histogram: A comparison of the distribution of GSAT cut off scores for unsuccessful (group 0, n = 48) and successful (group 1, n = 26) black students (ethnic 4)

The histogram, figure 4.6, again highlights the fact that the majority of successful students score above -5 below the cut off point, although in this group there are two students who have scores well below the cut off point. However the majority, 69%, of students in the successful group have scores above the cut off point. The concern again is the high number of students, 45% of the unsuccessful group, who scored higher than the minimum cut off point and the fact that more of the selected students were unsuccessful (65%) than successful.

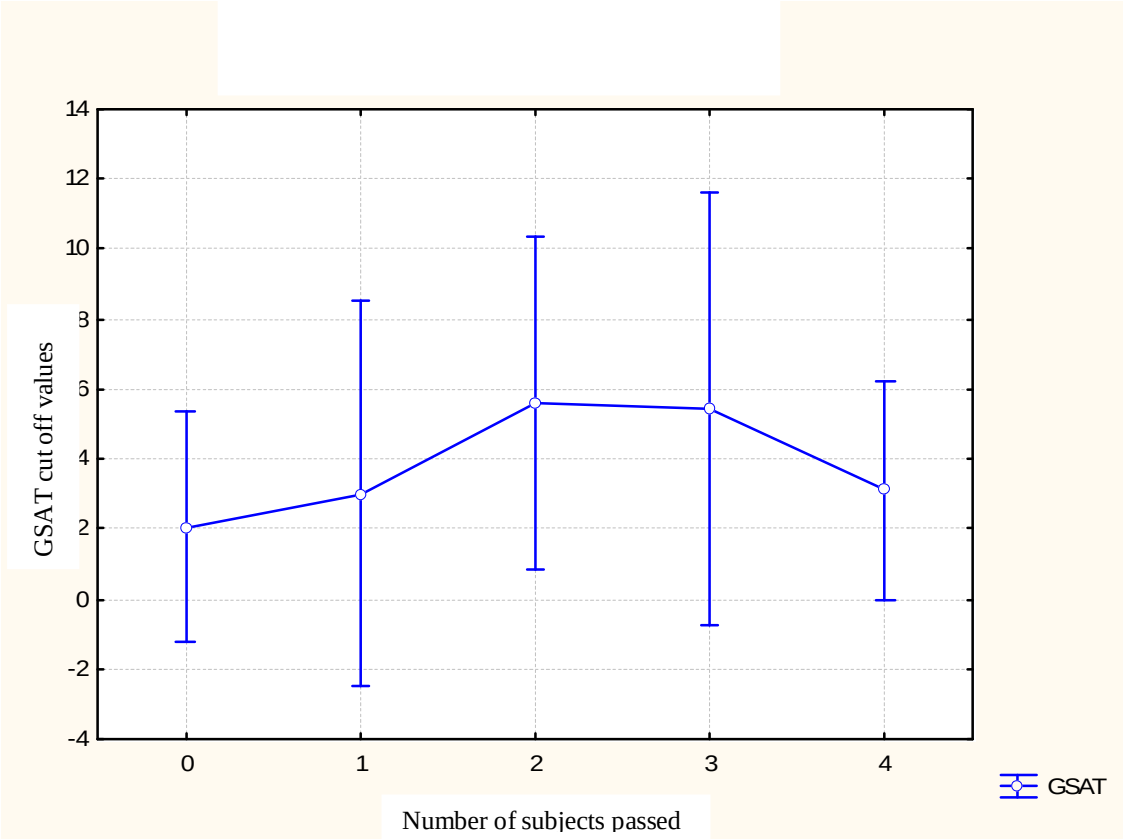

Figure 4.7 A comparison of the GSAT cut off means and the number of subjects passed for the black students (ethnic 4) at the 95% confidence level

Figure 4.7 further highlights the anomaly seen amongst the coloured students where the highest GSAT cut off mean is not necessary found amongst the most successful students, but amongst those passing only two subjects. This again begs the question that if these students have been identified as having the potential to succeed why are they not succeeding?

When analysing the results for gender and GSAT cut off means the overall trends were similar to the trends for the entire sample. As far as the males, who made up 70% (262 students) of the total sample, were concerned the general trend was very similar to that of the entire sample, with the 61% (161 students) of the selected male students being successful and 39% (101 students) being unsuccessful.

Table 4.17 A comparison of the GSAT cut off means for unsuccessful (group 0) and successful (group 1) male students (gender = M)

Passed_dichotomy	2-Way Tables of Descriptive Statistics (Gender=M) Smallest N for any variable: 262		
	GSAT Means	GSAT N	GSAT Std.Dev.
0	5.227723	101	6.943891
1	8.354037	161	8.503977
All Grps	7.148855	262	8.070379

Table 4.17 depicts the cut off means and the standard deviations of the successful and unsuccessful groups of male students.

Table 4.18 Analysis of Variance of GSAT for the male students, significant at p< 0.05

Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	606.6124	1	606.6124	16392.58	260	63.04839	9.621378	0.002135

Table 4.19 Levene Test of Homogeneity of Variance of GSAT for the male students, significant at p<0.05

Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	103.6704	1	103.6704	5492.458	260	21.12484	4.907514	0.027607

The Analysis of Variance (table 4.18) and the Levene Test of Homogeneity of Variance (table 4.19) confirms that the cut off means of these two groups are statistically significantly different at the 0,05 level of significance, again supporting the idea that the GSAT cut off mean may have some predictive value for the first year IT students.

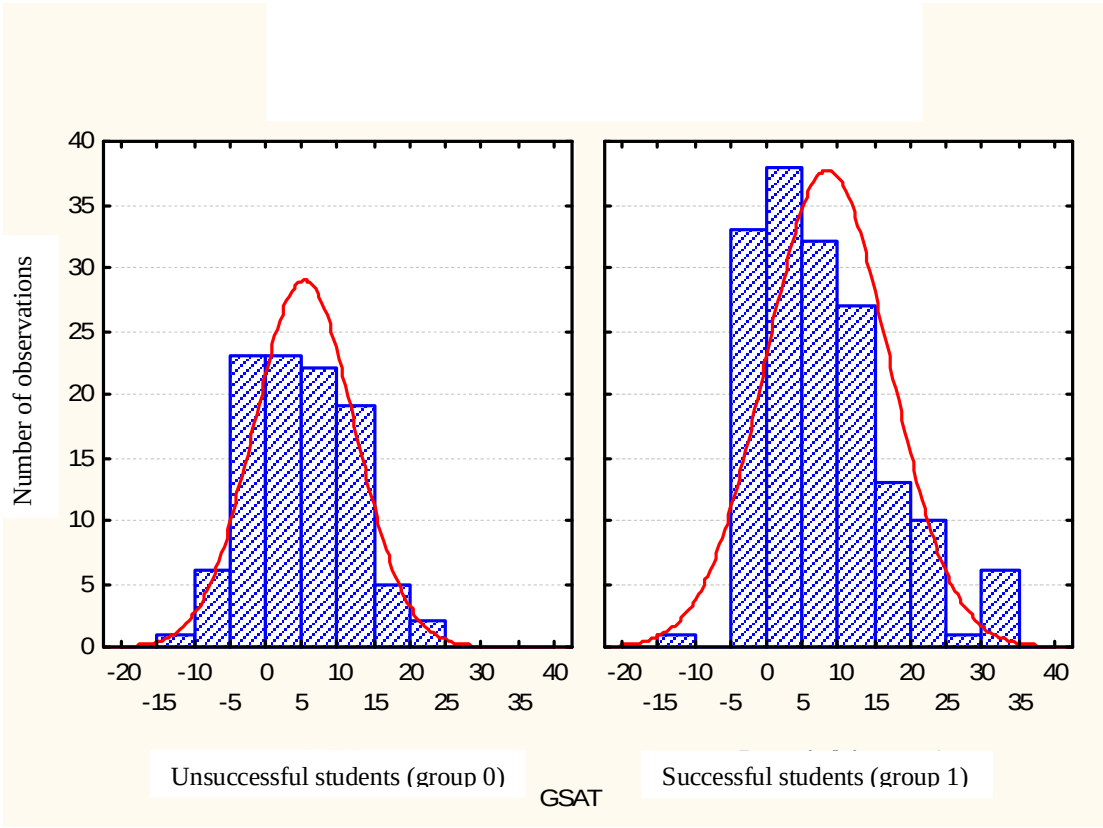

Figure 4.8 Histogram: A comparison of the distribution of GSAT cut off scores for unsuccessful (group 0, n = 101) and successful (group 1, n = 161) male students (gender =M)

On closer examination of the histogram of the successful and unsuccessful male students, figure 4.8, it is interesting to note that over 99% of the successful male students fall into the category scoring above -5 of the cut off point and that 79% of the successful male students score above 0. However on examination of the unsuccessful group of male students it is interesting to note that 71% of these unsuccessful students scored above the cut off point for selection. This again raises the question of why students who appear to have academic potential are not succeeding in their chosen field of study. Is it because the assessment instrument is incorrectly identifying students with potential from these groups or is it because there are other factors preventing these students from achieving their potential?

Table 4.20 A comparison of the GSAT cut off means for unsuccessful (group 0) and successful (group 1) female students (gender = F)

Breakdown Table of Descriptive Statistics (Gender=F) N=109 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	1.080645	62	7.409118
1	5.191489	47	6.742591
All Grps	2.853211	109	7.385955

The analysis of the results of the female students follows a trend similar to that of the general pattern. Table 4.20 indicates that in a sample of 109 first year female IT students 62 (57%) were unsuccessful and 47 (43%) were successful. Although the mean of the successful group is considerably higher than the unsuccessful group, the fact that a greater number of female students were unsuccessful than were successful is a major source of concern.

Table 4.21 Analysis of Variance of GSAT for the female students, significant at $p< 0.05$

	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	451.7780	1	451.7780	5439.873	107	50.83994	8.886282	0.003557

Table 4.22 Levene Test of Homogeneity of Variance of GSAT for the female students, significant at $p<0.05$

	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	3.114063	1	3.114063	2511.916	107	23.47585	0.132650	0.716419

The Analysis of Variance (Table 4.21) and the Levene Test of Homogeneity of Variances (Table 4.22) confirms the GSAT cut off mean of the successful female students is

statistically significantly higher than the GSAT cut off mean for the unsuccessful female students at the 0,05 level of significance.

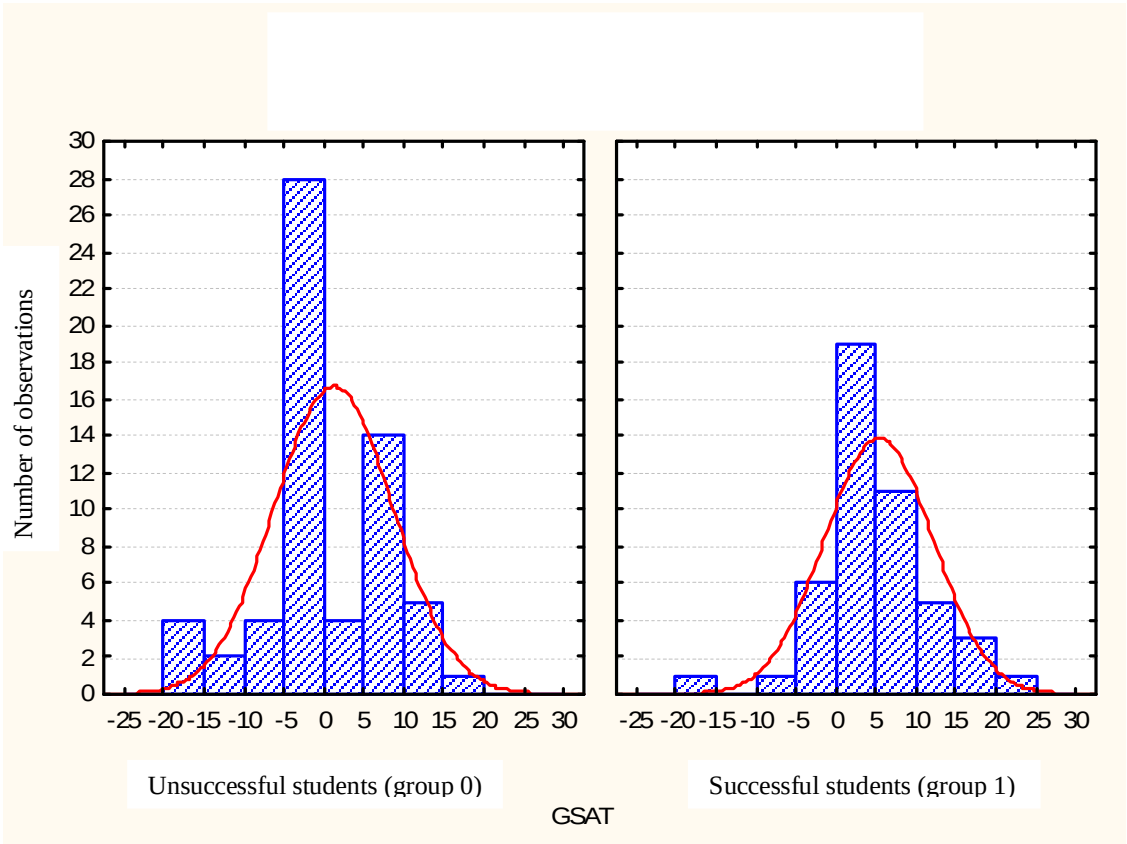

Figure 4.9 Histogram: A comparison of the distribution of GSAT cut off scores for unsuccessful (group 0, n = 62) and successful (group 1, n = 47) female students (gender =F)

When the histogram, figure 4.9, of the two groups of female students is examined it is noted that 96% of the successful female students score above -5 of the cut off point and that 83% scored above the cut off point. On examination of the unsuccessful group of female students 39% of this group scored above the cut off point but a further 45% of this group fell into the -5 to 0 range. It is interesting to note that 61% of the unsuccessful female students fell below the cut off point, with 16% of this group falling well below the cut off point. In total 11% of the female students as opposed to 3% of the male students who were selected fell in the range below -5 of the cut off point.

4.2.2 The relationship between Swedish Rating (SR) and the number of subjects passed.

The complete analysis of the trends for SR and the number of subjects passed can be viewed in annexure 2. The trends are similar to those of the GSAT cut off means and only the data that confirms these trends or highlights other interesting trends will be illustrated in this section. Although this group of students comprises largely the same group as for the GSAT sample it has 19 fewer observations in it due to the fact that the SR record was not available for some of the students that were in the GSAT group. The sample group consists of 352 students as opposed to the 371 students of the GSAT group. The analysis of variance confirmed that the SR means for the successful and unsuccessful students was statistically significantly different in all the groupings for which there was a valid sample, except for the group comprising of the Black students, ethnic group 4. The Asian student group, ethnic group 3, is again too small to be able to analyse their results with any statistically significant meaning and their results will therefore not be commented on.

4.2.2.1 The dichotomized variable.

Table 4.23 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) students

	2-Way Tables of Descriptive Statistics Smallest N for any variable: 352		
Passed_dichotomy	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.75839	149	6.759029
1	43.19704	203	9.052684
All Grps	40.89489	352	8.582947

The dichotomous analysis of the successful and unsuccessful students shows that the 58% (203 students) of the students were successful and had a SR mean considerably higher than the unsuccessful students who made up 42% (149 students) of the sample. See table 4.23.

Table 4.24 Analysis of Variance of SR for all the students, significant at p< 0.05

Variable	Analysis of Variance Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2541.691	1	2541.691	23315.42	350	66.61549	38.15465	0.000000

Table 4.25 Levene Test of Homogeneity of Variance of SR for all the students, significant at p<0.05

Variable	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	165.7571	1	165.7571	10477.57	350	29.93592	5.537062	0.019171

The Analysis of Variance (table 4.24) confirms that the SR mean of the successful group of students is statistically significantly different from the unsuccessful group at the 0,05 significance level. The Levene Test of Homogeneity of Variances (table 4.25) is also significant which raises a small amount of doubt about the significance of the Analysis of Variance in this instance.

The histogram figure 4.10 (over the page) reflects the fact that only 14% of the successful group scored a SR of less than 35 points and 86% had a rating above 35 points. Only 7% of this group fell into the grey area between 30 and 35 points. However in the unsuccessful group, 66% of the group had a SR above 35 points with 34% of the total group falling into the range below 35 points. Of the total group 20% fell into the grey area between 30 and 35 points. The concern again is the high percentage of unsuccessful students who fall in the range indicating that they have the potential to succeed.

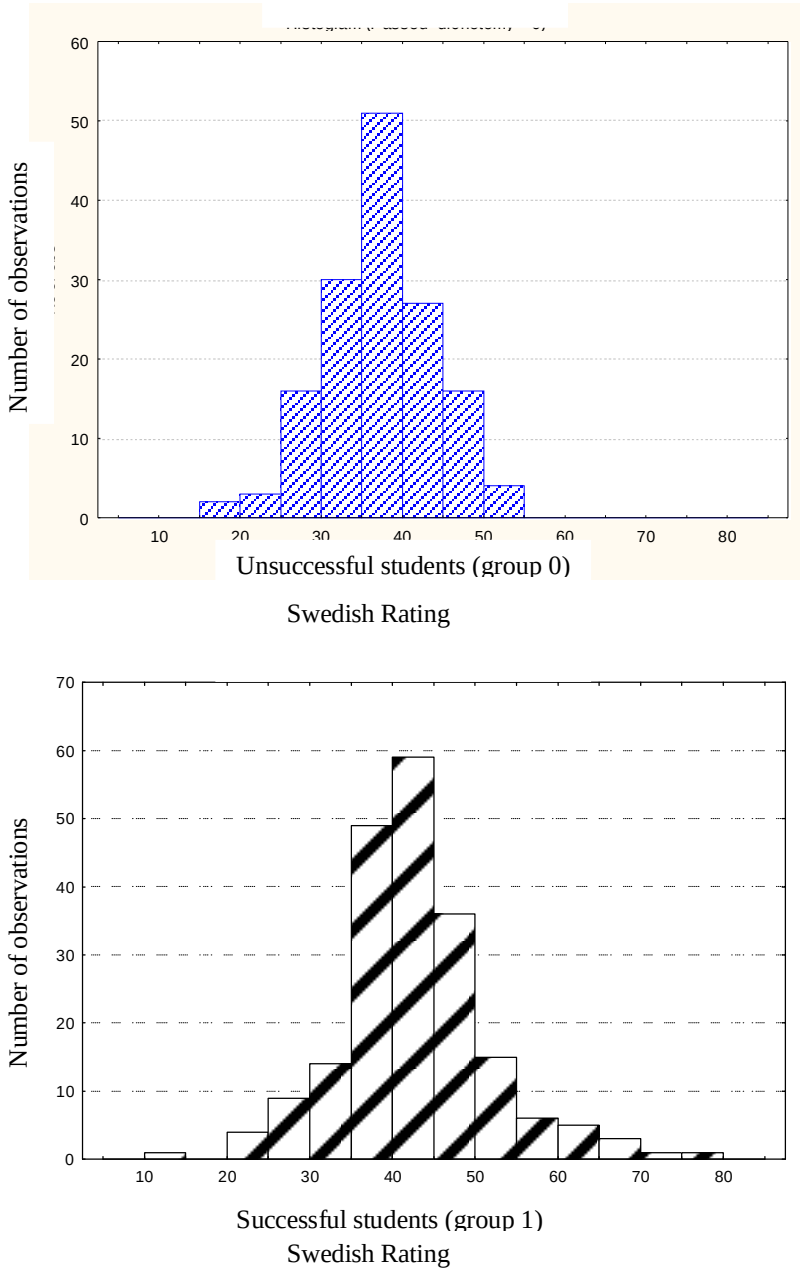

Figure 4.10 A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 149) and successful (group 1, n = 203) students

4.2.2.2 The original variable.

Insofar as the original variable is concerned there is very little that needs additional comment

Table 4.26 LSD test. A comparison of the Swedish Rating means and the number of subjects passed, significant at $p<0.05$

Subj Passed		LSD Test; Variable: Swedish Rating Marked differences are significant at p < .05000				
		{1} M=37.114	{2} M=36.654	{3} M=39.568	{4} M=40.114	{5} M=44.050
0	{1}		0.800962	0.106650	0.048816	0.000000
1	{2}	0.800962		0.144988	0.083779	0.000019
2	{3}	0.106650	0.144988		0.751277	0.001215
3	{4}	0.048816	0.083779	0.751277		0.004419
4	{5}	0.000000	0.000019	0.001215	0.004419	

except to highlight that from the LSD test, table 4.26, there is a trend (see columns 1 and 5), although not as clear cut as for GSAT, suggesting that the successful group is statistically significantly different from the unsuccessful group in terms of SR means.

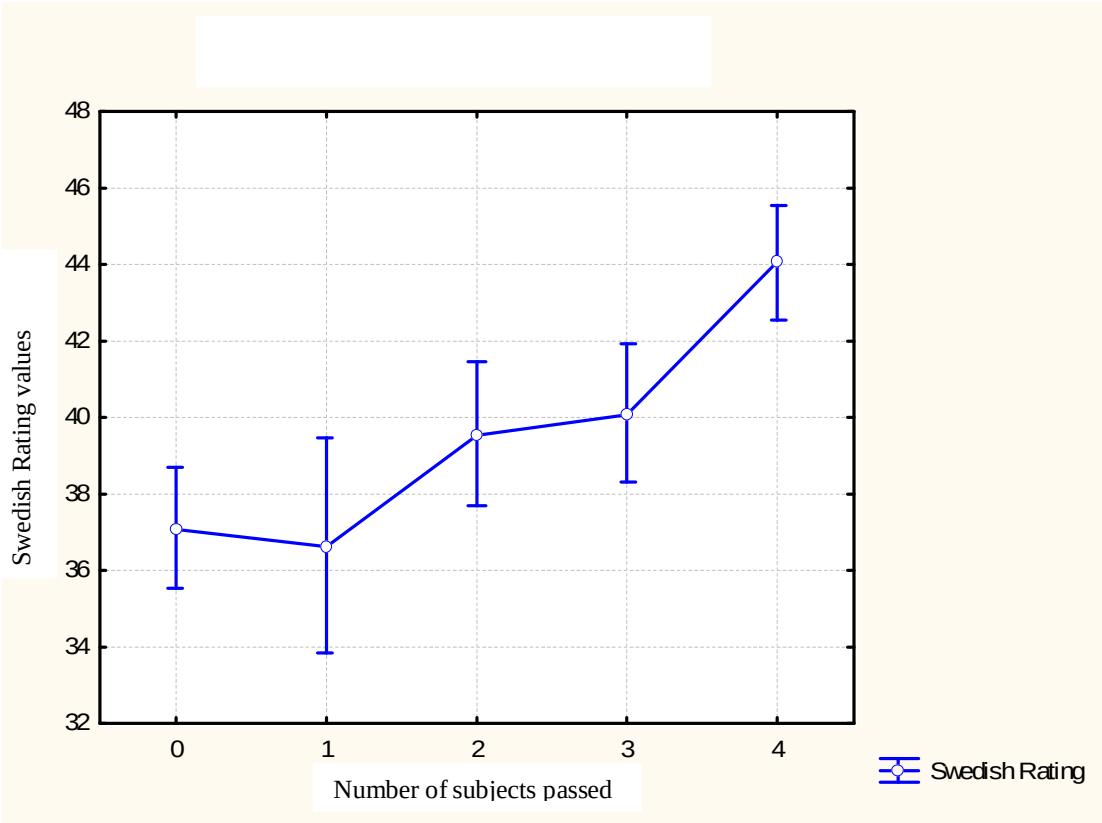

Figure 4.11 A comparison of the Swedish Rating means and the number of subjects passed at the 95% confidence level

Figure 4.11 graphically illustrates how the SR mean rises with increasing number of subjects passed, suggesting that as SR increases so do the chances of academic success.

4.2.2.3 Racial and gender groups.

Table 4.27 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) white students (ethnic 1)

Passed_dichotomy	2-Way Tables of Descriptive Statistics (Ethnic=1) Smallest N for any variable: 193		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.13115	61	7.36088
1	44.39394	132	10.05007
All Grps	42.09845	193	9.86448

The White students, ethnic group 1, mirrors the entire sample but with a higher percentage of students (68%) being successful than in the entire sample. This and the higher SR mean for the successful students is illustrated in table 4.27.

Table 4.28 Analysis of Variance of SR for the white students, significant at p< 0.05

Variable	Analysis of Variance (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2200.664	1	2200.664	16482.47	191	86.29563	25.50145	0.000001

Table 4.29 Levene Test of Homogeneity of Variance of SR for the white students, significant at p<0.05

Variable	Levene Test of Homogeneity of Variances (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	154.8341	1	154.8341	7341.191	191	38.43556	4.028407	0.046150

The Analysis of Variance (table 4.28) confirms that the SR mean of the successful group of students is statistically significantly different from the unsuccessful group at the 0,05 significance level. The Levene Test of Homogeneity of Variances (table 4.29) is again significant which again raises some doubt about the significance of the analysis of variance in this instance.

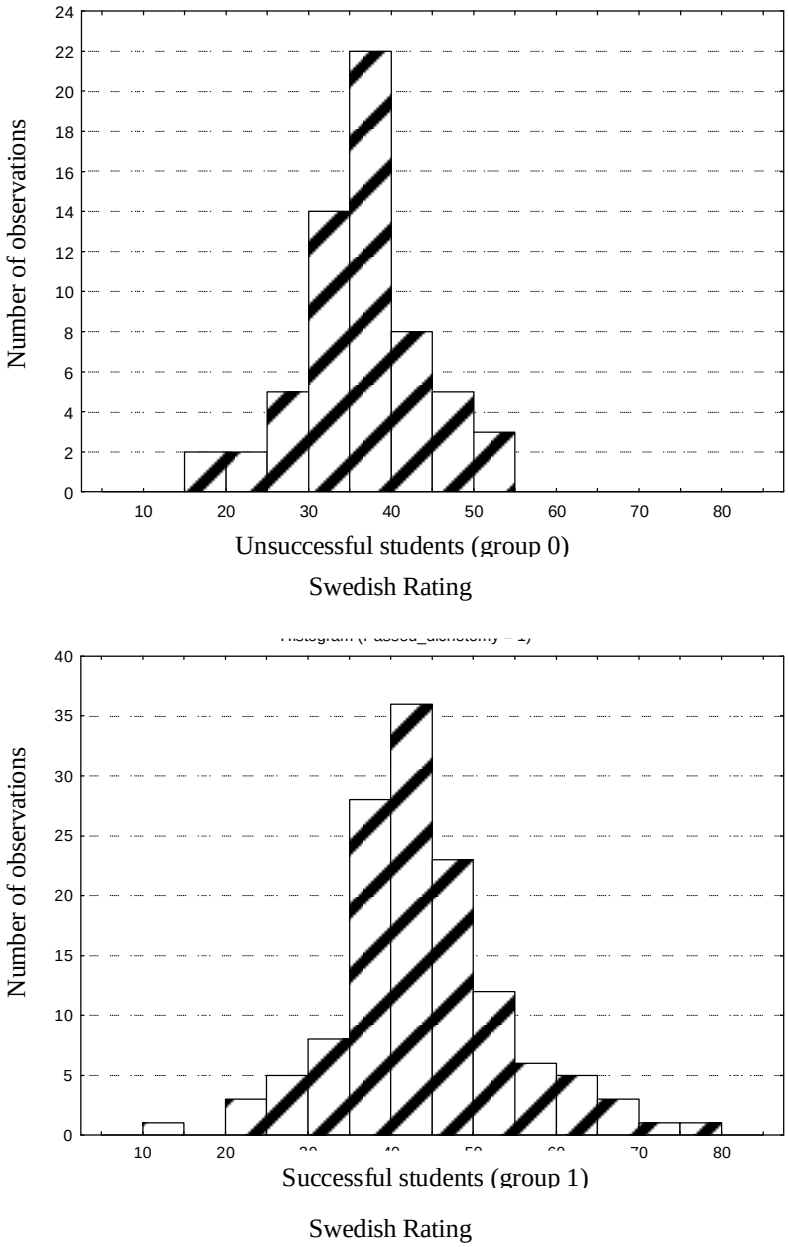

Figure 4.12 Histogram: A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 61) and successful (group 1, n = 132) white students (ethnic 1)

The histogram, figure 4.12, reflects the fact that only 13% of the successful group scored a SR of less than 35. Of this group 87% scored a SR above 35 with only 6% in the grey area between 30 and 35 SR points. In the unsuccessful group 38% scored a SR of less than 35, 62% have a SR above 35 with 8% of the unsuccessful group falling in the range 30 to 35 SR points.

Table 4.30 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) coloured students (ethnic 2)

	2-Way Tables of Descriptive Statistics (Ethnic=2) Smallest N for any variable: 78		
Passed_dichotomy	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	36.80952	42	5.960185
1	39.75000	36	6.429286
All Grps	38.16667	78	6.315137

When analyzing the results for the Coloured students, ethnic group 2, table 4.30 illustrates that as with the GSAT there are more unsuccessful (42) than successful (36) students in this group. The means too are not very different although the mean of the successful students is higher than for the unsuccessful students.

Table 4.31 Analysis of Variance of SR for the coloured students, significant at p< 0.05

	Analysis of Variance (Ethnic=2) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	167.6071	1	167.6071	2903.226	76	38.20034	4.387582	0.039534

Table 4.32 Levene Test of Homogeneity of Variance of SR for the coloured students, significant at p<0.05

	Levene Test of Homogeneity of Variances (Ethnic=2) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	5.663715	1	5.663715	968.6954	76	12.74599	0.444353	0.507048

The Analysis of Variance (table 4.31) and the Levene Test of Homogeneity (table 4.32) confirm that the means of the successful and unsuccessful students is not significantly different at the 0,05 level of significance.

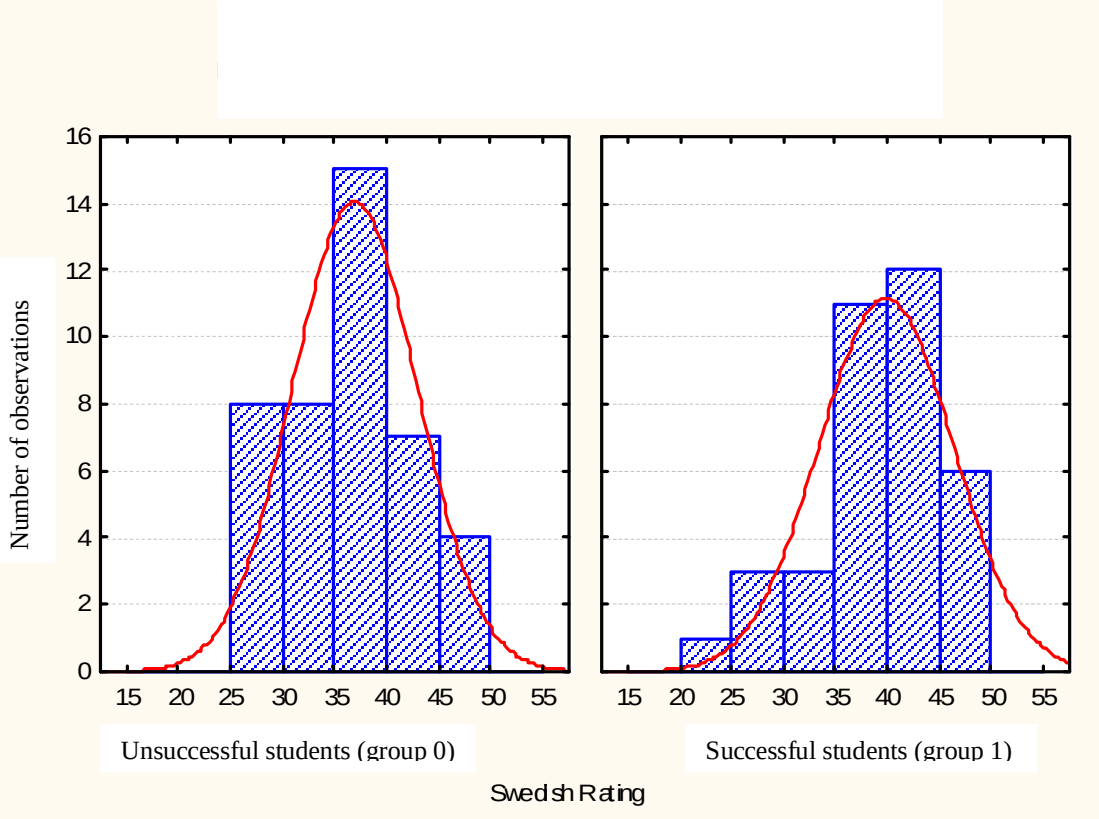

Figure 4.13 Histogram: A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 42) and successful (group 1, n = 36) coloured students (ethnic 2)

When the histogram, figure 4.13, for this group is examined the first concern is the fact that as with the GSAT results there were more unsuccessful (54%) than successful (46%) students in the selected group. In the successful group of students 81% of the students fall above the cut off point with only 11% well below the cut off point and 8% in the borderline area. However in the unsuccessful group 61% of this group falls above the cut off point of 35 SR points. The reason for these students who have been identified as having potential and yet not making a success of their studies needs further investigation.

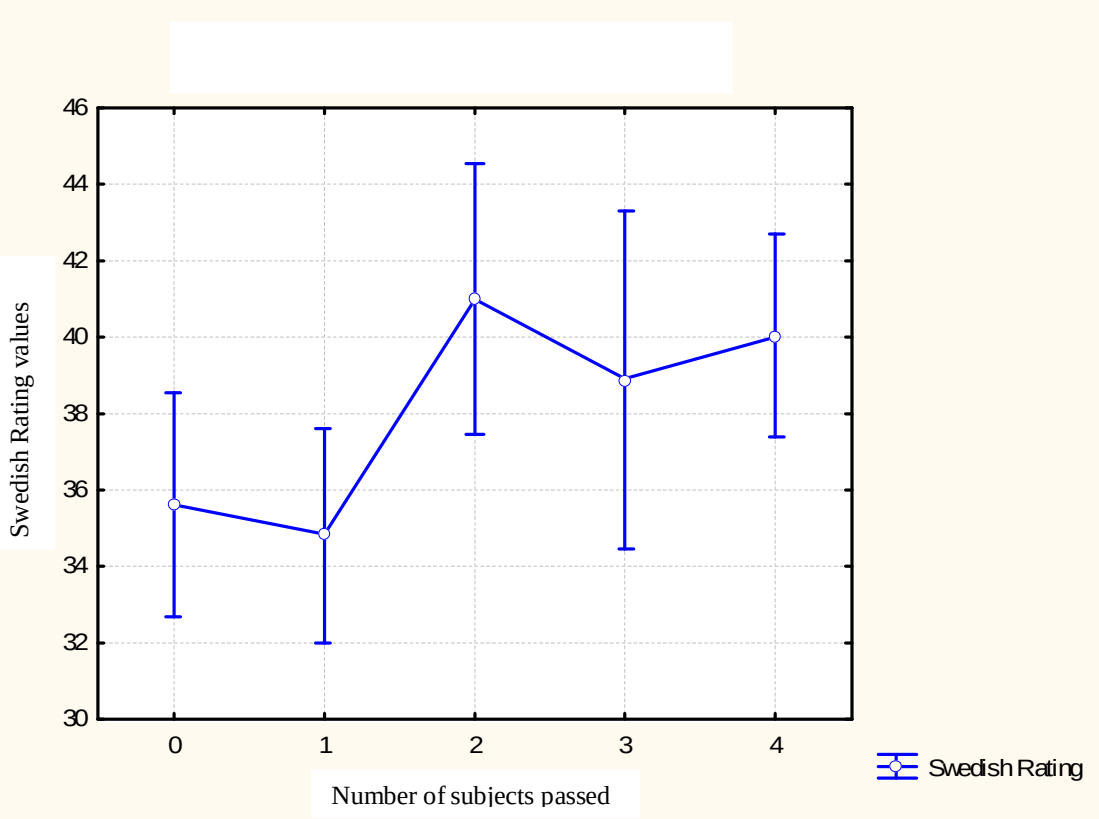

Figure 4.14 A comparison of the Swedish Rating means and the number of subjects passed for the coloured students (ethnic 2) at the 95% confidence level

Figure 4.14 again raises concerns over the fact, as with the GSAT scores in this group, that the group who only passed two subjects is the group with the highest SR mean, suggesting that there may be some other factor besides academic potential affecting the success of this group of students.

Table 4.33 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) black students (ethnic 4)

	2-Way Tables of Descriptive Statistics (Ethnic=4) Smallest N for any variable: 64		
Passed_dichotomy	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	39.23684	38	6.453301
1	42.26923	26	5.793498
All Grps	40.46875	64	6.326986

When one examines the results for the Black students, ethnic group 4, table 4.33 highlights the fact that the SR mean for the successful group is higher than that for the unsuccessful group. The number of unsuccessful students is greater than the number of successful students.

Table 4.34 Analysis of Variance of SR for the black students, significant at p< 0.05

	Analysis of Variance (Ethnic=4) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	141.9537	1	141.9537	2379.984	62	38.38684	3.697979	0.059074

Table 4.35 Levene Test of Homogeneity of Variance of SR for the black students, significant at p<0.05

	Levene Test of Homogeneity of Variances (Ethnic=4) Marked effects are significant at p < .05000							
Variable	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	0.000410	1	0.000410	815.6928	62	13.15634	0.000031	0.995563

The Analysis of Variance (Table 4.34) and the Levene Test of Homogeneity (table 4.35) confirm that the SR means of the successful and unsuccessful students is not statistically significant at the 0,05 level of significance.

The histogram, figure 4.15 (over the page), again raises concerns about the fact that there were more unsuccessful (59%) than successful (41%) students in this group of selected students. For the successful group 92% of these students scored above the 35 cut off point and the remaining 8% fell into the 30 to 35 borderline region. However in the unsuccessful group the concern is that 74% of this group have scores above the 35 cut off point and a further 22% fall into the 30 to 35 region, again pointing to the idea that there may be other factors beside academic potential affecting the academic success of these students.

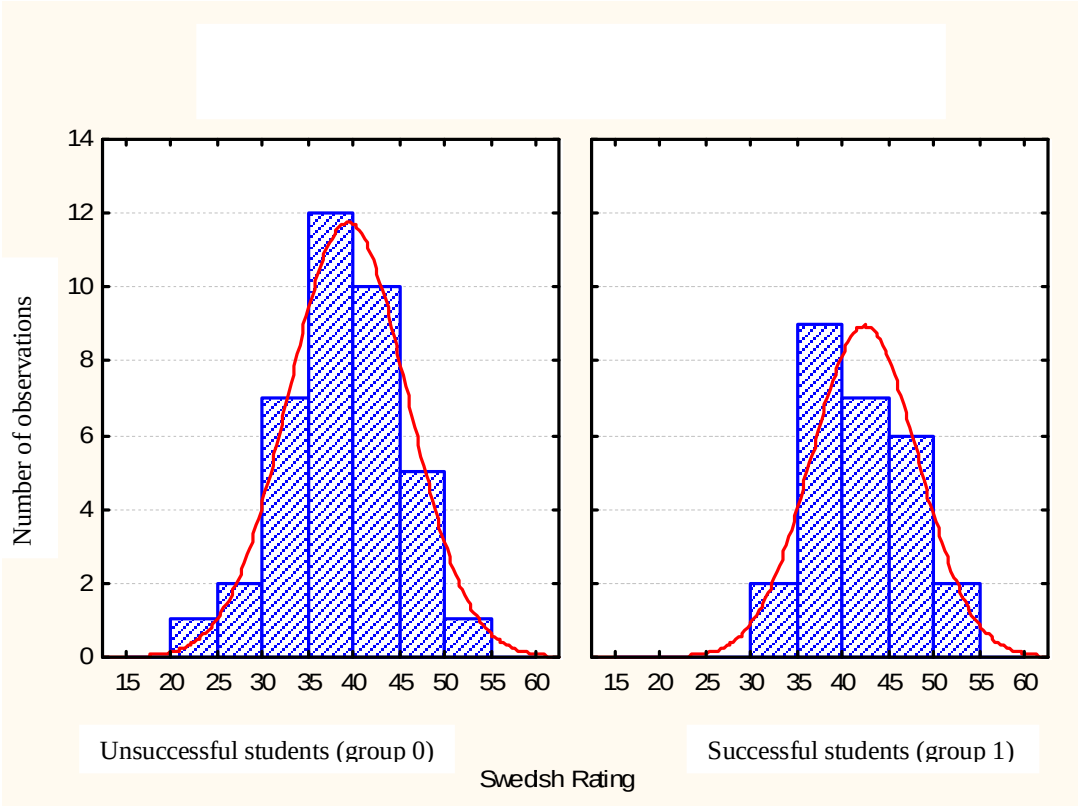

Figure 4.15 Histogram: A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 38) and successful (group , n = 26) black students (ethnic 4)

Table 4.36 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) male students (gender = M)

	2-Way Tables of Descriptive Statistics (Gender=M) Smallest N for any variable: 250		
Passed_dichotomy	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.18085	94	7.119506
1	42.69872	156	9.303083
All Grps	40.62400	250	8.943072

When it comes to the male portion of the sample the trend is similar to that of the entire sample with the mean for the successful group being higher than for the unsuccessful group, see table 4.36. There is a greater number of successful than unsuccessful students.

Table 4.37 Analysis of Variance of SR for the male students, significant at p< 0.05

Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	1785.891	1	1785.891	18128.77	248	73.09986	24.43084	0.000001

Table 4.38 Levene Test of Homogeneity of Variance of SR for the male students, significant at p<0.05

Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	117.8214	1	117.8214	8577.922	248	34.58840	3.406385	0.066136

The Analysis of Variance (table 4.37) and the Levene Test of Homogeneity (table 4.38) confirm that the SR means of the successful and unsuccessful groups are statistically different at the 0,05 level of significance.

The histogram, figure 4.16 (over the page), illustrates the fact that for the successful group 85% of the sample has a SR greater than 35 and only 15% have ratings below 35, with 7% falling into the grey area between 30 and 35 points. In the unsuccessful group 65% have a SR greater than 35 while 35% have a rating below 35 points. A total of 20% fall in the region between 30 and 35 points. Again the concern is the high number of students appearing to have potential but not making a success of their studies in IT.

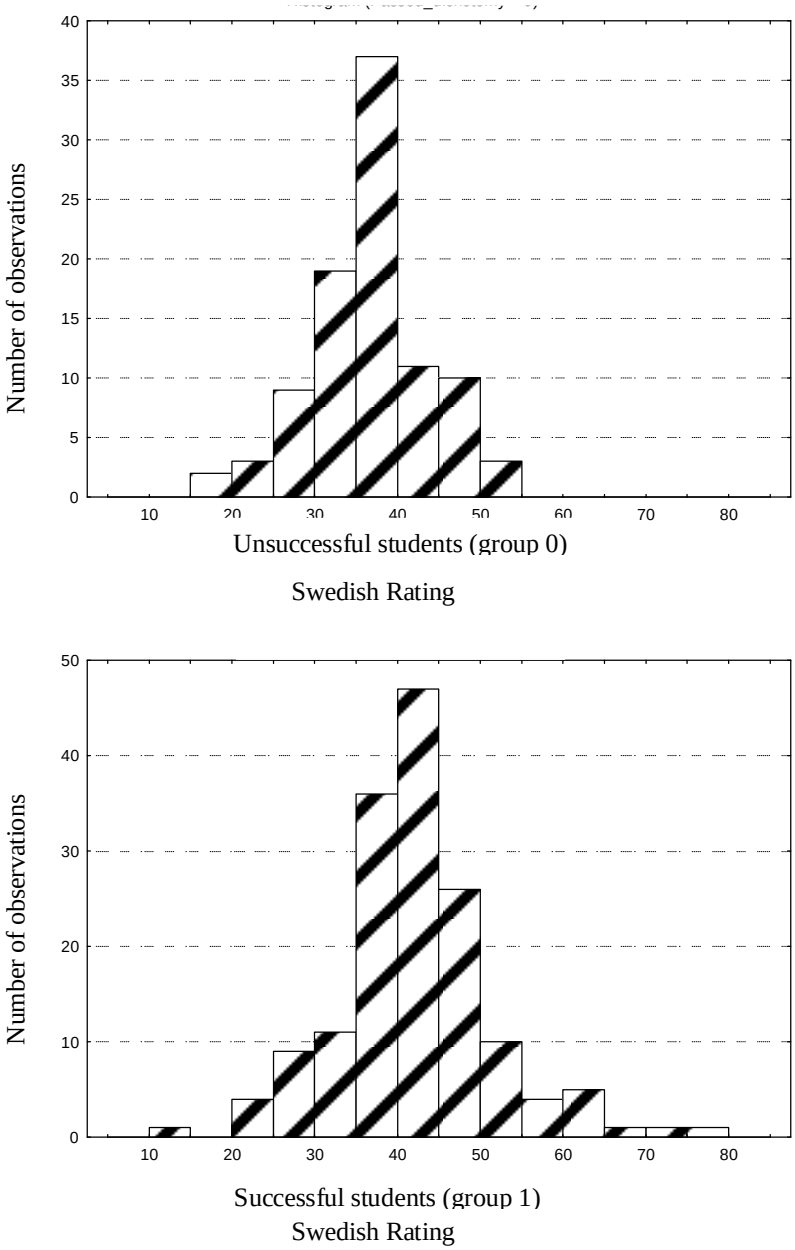

Figure 4.16 Histogram: A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 94) and successful (group, n = 132) male students (gender = M)

For the female sample there is a higher SR mean for the successful group of female students than in the unsuccessful group of female students, see table 4.39 over the page. However the number of unsuccessful students (55) is greater than the number of successful students (47).

Table 4.39 A comparison of the Swedish Rating means for unsuccessful (group 0) and successful (group 1) female students (gender = F)

Passed_dichotomy	2-Way Tables of Descriptive Statistics (Gender=F) Smallest N for any variable: 102		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	38.74545	55	6.028384
1	44.85106	47	8.037896
All Grps	41.55882	102	7.629507

Table 4.40 Analysis of Variance of SR for the female students, significant at p< 0.05

Variable	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	944.7532	1	944.7532	4934.394	100	49.34394	19.14629	0.000030

Table 4.41 Levene Test of Homogeneity of Variance of SR for the female students, significant at p<0.05

Variable	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	24.49493	1	24.49493	1830.757	100	18.30757	1.337967	0.250149

The Analysis of Variance (table 4.40) and the Levene Test of Homogeneity of the Variances (table 4.41) confirms the SR means of the successful and unsuccessful female students is significantly different at the 0,05 level of significance.

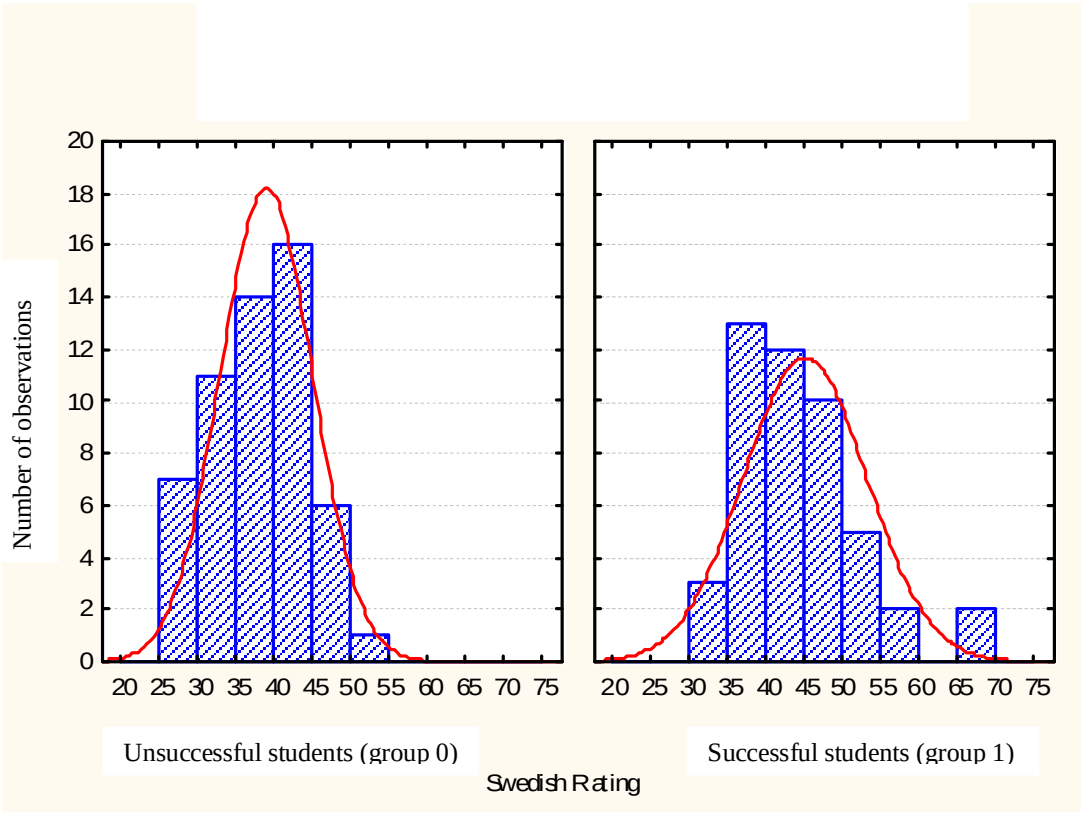

Figure 4.17 Histogram: A comparison of the distribution of the Swedish Rating scores for unsuccessful (group 0, n = 56) and successful (group 1, n = 47) female students (gender = F)

In the histogram, figure 4.17, the concern is again the fact the unsuccessful group of selected female students (54%) is greater than the successful group of female students (46%). Within the successful group 94% have a SR score greater than 35 and the remaining 6% fall in the 30 to 35 point range. However in the unsuccessful group 67% have SR scores above 35, again raising concerns about why so many students who appear to have potential are not succeeding. A further 20% fall in the 30 to 35 point range and the remaining 13% have scores below 30.

4.3 STRENGTH OF ASSOCIATIONS

To establish if any of these correlations were statistically significant a Spearman rank correlation was applied to the data, table 4.42 (over the page). Only those correlations that were statistically significant at the 0,05 level of significance will be commented upon. The statistically significant correlations between GSAT cut off means and subjects passed are; for the whole sample, white students (ethnic 1), males, females, white males (ethnic 1) and black females (ethnic 4). For the Swedish Rating and subjects passed the significant correlations are for; the whole sample, white students (ethnic 1), coloured students (ethnic 2), males, females, white males (ethnic 1), white females (ethnic 1) and coloured females (ethnic 2). Many of these correlations are weak, particularly for GSAT and suggest that Swedish Rating is a stronger predictor than GSAT. The interesting ones are perhaps the black female (ethnic 4) and GSAT and the coloured females (ethnic 2) and Swedish Rating.

The other concern that these correlations raise is again the fact that the samples dominated by white students are significant but that in the samples which focus on the racial groups generally the black and coloured students do not have statistically significant correlations. This however needs to be carefully investigated because there appears to be a trend linking higher GSAT cut off scores and higher SR scores with success even in this groups. The real problem seems to be the large number of students in these groups who are identified as having potential but who are not successful. The question that arises is, is the test incorrectly identifying potential or are there other factors which are reducing the chances of success for these students despite their potential?

Table 4.42 Strengths of Associations

Spearman rank correlations: (Bold values are statistically significant at the 5% level.)

Whole sample	GSAT	Swedish Rating
Subjects passed	**0.24** (n=371)	**0.36** (n=352)

Ethnic=1	GSAT	Swedish Rating
Subjects passed	**0.23** (n=200)	**0.40** (n=193)

Ethnic=2	GSAT	Swedish Rating
Subjects passed	0.10 (n=80)	**0.31** (n=78)

Ethnic=3	GSAT	Swedish Rating
Subjects passed	0.37 (n=15)	0.23 (n=15)

Ethnic=4	GSAT	Swedish Rating
Subjects passed	0.13 (n=74)	0.20 (n=64)

Gender=M	GSAT	Swedish Rating
Subjects passed	**0.15** (n=262)	**0.35** (n=250)

Gender=F	GSAT	Swedish Rating
Subjects passed	**0.38** (n=109)	**0.44** (n=102)

Gender=M, Ethnic=1	GSAT	Swedish Rating
Subjects passed	**0.21** (n=166)	**0.41** (n=159)

Gender=M, Ethnic=2	GSAT	Swedish Rating
Subjects passed	-0.01 (n=48)	0.10 (n=47)

Gender=M, Ethnic=4	GSAT	Swedish Rating
Subjects passed	-0.12 (n=36)	0.25 (n=32)

Gender=F, Ethnic=1	GSAT	Swedish Rating
Subjects passed	0.29 (n=34)	**0.47** (n=34)

Gender=F, Ethnic=2	GSAT	Swedish Rating
Subjects passed	0.18 (n=32)	**0.63** (n=31)

Gender=F, Ethnic=4	GSAT	Swedish Rating
Subjects passed	**0.43** (n=38)	0.16 (n=32)

4.4 LOGISTIC REGRESSIONS

Finally a series of logistic regressions were applied to the data to establish if any of the variables considered played a statistically significant role in terms of predicting academic success.

Table 4.43 Logistic regression for variables ethnic, gender and GSAT, significant at p<0,05

Effect	Passed_dichotomy - Parameter estimates Distribution : BINOMIAL Link function: LOGIT					
	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	p
Interc		1	0.222695	0.184564	1.45588	0.227587
Ethnic	1	2	-0.539469	0.200803	7.21758	0.007219
Ethnic	2	3	0.196269	0.230054	0.72785	0.393580
Ethnic	3	4	-0.252092	0.415516	0.36808	0.544053
Gender	M	5	-0.128748	0.128058	1.01080	0.314710
GSAT		6	-0.052735	0.015666	11.33158	0.000762
Scale			1.000000	0.000000		

Table 4.43 gives the results when Ethnic, Gender and GSAT are used as predictor variables for the pass rate. The effect of Ethnic and GSAT is statistically significant at the 5% level. In the case of Ethnic, each of the racial groups white (1), coloured (2) and Asian (3) is compared to the black students (4). Specifically, the parameter estimate of –0.539 means that the odds for white students (1) to pass are 1.7 times higher than it is for the black students (4) to pass. The other two ethnic groups do not differ statically significantly from the black students. In the case of GSAT, the parameter estimate of –0.0527 means that the odds to pass will increase 1.054 times with a unit increase in GSAT. However, since the range of GSAT is from –19 to 32, it makes more practical sense to look at the effect of GSAT in terms of an increase of 5 units. In such a case, the odds to pass will increase 1.3 times with a 5-unit increase in GSAT.

Table 4.44 is a classification table which illustrates the percentage of the sample that was correctly predicted by these three variables. These variables together correctly classified

approximately 65% of the sample. The pass rate classification was approximately 70% and the failure rate classification approximately 60%.

Table 4.44 Classification table for variables ethnic, gender and GSAT

	Predicted			
		Pass	Fail	TOTAL
Observed	Pass	146	62	208
	Fail	65	96	161
	TOTAL	211	158	369

Correct classification within Pass category = (146/208)*100 = 70.2%.

Correct classification within Fail category = (96/161)*100 = 59.6%.

Overall correct classification = [(146+96)/369]*100 = 65.6%.

Table 4.45 Logistic regression for variables ethnic, gender and Swedish Rating, significant at p<0,05

Effect	Passed_dichotomy - Parameter estimates Distribution : BINOMIAL Link function: LOGIT					
	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	p
Interc		1	3.641842	0.712857	26.09981	0.000000
Ethnic	1	2	-0.487887	0.209872	5.40418	0.020089
Ethnic	2	3	0.096097	0.240942	0.15907	0.690014
Ethnic	3	4	-0.101207	0.426874	0.05621	0.812589
Gender	M	5	-0.285960	0.135262	4.46950	0.034505
Swedish Rating		6	-0.091919	0.017075	28.98121	0.000000
Scale			1.000000	0.000000		

Table 4.45 is a logistic regression where Ethnic, Gender and Swedish Rating are used as predictors for the pass rate. All three predictors are statistically significant at the 5% level.

The parameter estimates indicate the following:

The odds for the white students (1) to pass are 1.63 times higher than the odds for the black students (4). The other two groups do not differ statistically significantly from the black students (4).

The odds for male students to pass are 1.33 times higher than for female students.

The odds of passing will increase 1.58 times with a 5-unit increase in Swedish Rating.
Table 4.46 is a classification table which illustrates the percentage of the sample that was correctly predicted by these three variables. These variables together correctly classified approximately 66% of the sample. The pass rate classification was approximately 70% and the failure rate classification approximately 61%.

Table 4.46 Classification table for variables ethnic, gender and Swedish Rating

		Predicted		
		Pass	Fail	TOTAL
Observed	Pass	141	62	203
	Fail	58	89	147
	TOTAL	199	151	350

Correct classification within Pass category = 69.5%.
Correct classification within Fail category = 60.5%.
Overall correct classification = 65.7%.

A stepwise logistic regression was conducted to see which variables from the list that was given, are the strongest predictors of academic success. Only two variables entered the model, namely Swedish rating first, followed by T which is the total GSAT score rather than just the amount above the cut off point, see table 4.47 over the page.

Table 4.47 Stepwise Logistic Regression for all variables, significant at p<0.05

Step	Passed_dichotomy - Model building results Distribution : BINOMIAL Link function: LOGIT						
	Effect	Degr. of Freedom	Wald Stat.	Wald p	Score Stat.	Score p	Var. Status
Step 1	Ethnic	3			20.99534	0.000106	Out
	Gender	1			4.85630	0.027545	Out
	Swedish Rating	1			33.48603	0.000000	Entered
	GSAT	1			13.33498	0.000261	Out
	T	1			26.26263	0.000000	Out
	AAT	1			7.74980	0.005372	Out
Step 2	Swedish Rating	1	29.48535	0.000000			In
	Gender	1			8.37480	0.003805	Out
	Ethnic	3			17.01163	0.000703	Out
	GSAT	1			4.02232	0.044902	Out
	T	1			14.60147	0.000133	Entered
	AAT	1			1.38847	0.238664	Out
Step 3	Swedish Rating	1	20.83235	0.000005			In
	T	1	13.96578	0.000186			In
	Ethnic	3			5.36519	0.146928	Out
	GSAT	1			3.20546	0.073393	Out
	Gender	1			2.66832	0.102364	Out
	AAT	1			0.30411	0.581317	Out

Table 4.48 Logistic Regression, Swedish Rating and total GSAT score (T), significant at p<0.05

Effect	Passed_dichotomy - Parameter estimates Distribution : BINOMIAL Link function: LOGIT					
	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	p
Interc		1	8.944198	1.566285	32.60929	0.000000
Swedish Rating		2	-0.089500	0.018248	24.05436	0.000001
T		3	-0.049251	0.013013	14.32502	0.000154
Scale			1.000000	0.000000		

Table 4.48 shows the results when only the two predictors from the stepwise procedure are used. Both predictors are statistically significant at the 0,05 level of significance, with parameters having the following meaning:

The odds of passing will increase 1.56 times with a 5-unit increase in Swedish Rating.

The odds of passing will increase 1.28 times with a 5-unit increase in total GSAT score (T).

Table 4.49 Classification table for Swedish Rating and total GSAT score

		Predicted		
		Pass	Fail	TOTAL
Observed	Pass	123	54	177
	Fail	37	99	136
	TOTAL	160	153	313

Correct classification within Pass category = 69.5%.

Correct classification within Fail category = 72.8%.

Overall correct classification = 70.9%.

Table 4.49 is a classification table for these two predictor variables. It would seem that for this sample these variables correctly classified approximately 71% of the entire sample, approximately 69% of the students who passed and 73% of the students who failed.

Table 4.50 Logistic Regression GSAT only, significant at p<0.05

Effect	Passed_dichotomy - Parameter estimates Distribution : BINOMIAL Link function: LOGIT					
	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	p
Interc		1	0.131121	0.133018	0.97168	0.324261
GSAT		2	-0.067350	0.014877	20.49402	0.000006
Scale			1.000000	0.000000		

Finally a series of logistic regressions were conducted to show the effect of GSAT and Swedish Rating as the only predictors of student success. Table 4.50 is the logistic regression for GSAT as the only predictor and this suggests that the odds of passing will increase 1.40 times with every 5-unit increase in GSAT.

Table 4.51 (over the page) is the classification table for this predictor and indicates that GSAT as a predictor correctly classified 55% of the sample, correctly classifying

approximately 52% of the successful students and approximately 58% of the unsuccessful students.

Table 4.51 Classification table GSAT only

	Predicted			
		Pass	Fail	TOTAL
Observed	Pass	109	99	208
	Fail	68	95	163
	TOTAL	177	194	371

Correct classification within Pass category = 52.4%.

Correct classification within Fail category = 58.3%.

Overall correct classification = 55.0%.

Table 4.52 Logistic Regression, Swedish Rating only, significant at $p<0.05$

Effect	Passed_dichotomy - Parameter estimates Distribution : BINOMIAL Link function: LOGIT					
	Level of Effect	Column	Estimate	Standard Error	Wald Stat.	p
Interc		1	3.308619	0.655830	25.45133	0.000000
Swedish Rating		2	-0.089634	0.016175	30.70819	0.000000
Scale			1.000000	0.000000		

Table 4.52 looks at the effect of Swedish Rating only as a predictor of academic success and it appears that the odds of passing will increase 1.57 times with a 5-unit increase in Swedish Rating.

Table 4.53 Classification table, Swedish Rating only

	Predicted			
		Pass	Fail	TOTAL
Observed	Pass	134	69	203
	Fail	57	92	149
	TOTAL	191	161	352

Correct classification within Pass category = 66.0%.

Correct classification within Fail category = 61.7%.

Overall correct classification = [(146+96)/369]*100 = 64.2%.

Table 4.53 is the classification table and suggests that this predictor correctly classified 64% of this sample, correctly classifying 66% of the successful students and 62% of the unsuccessful students.

From the above it seems that Swedish Rating has the greater correlation with the pass rate and thus in predicting academic success. However, since GSAT and Swedish Rating have different ranges, it may not be fair to use a 5-unit increase with both. It may be better to use something like *range*/10. For GSAT this value is 51/10=5.1, while for Swedish Rating it is 66/10=6.6. Using these values, we now have the following more comparable effects:
The odds of passing will increase 1.41 times with a 5.1-unit increase in GSAT.
The odds of passing will increase 1.81 times with a 6.6-unit increase in Swedish Rating.

Table 4.54 Summary of findings

Aim no.	Stated aims and findings
1	**To establish the validity of the GSAT as a predictor of academic success for first year IT students.**
	There is a weak positive correlation between GSAT and academic success in the first year IT class which is statistically significant at $p<0.05$, confirming that GSAT is a predictor of academic success but that it is a weak predictor – see tables 4.1; 4.2; 4.3; 4.4; 4.5; 4.6; 4.7; 4.42 and figures 4.1; 4.2; 4.3.
2	**To establish whether the GSAT can be used as an equally good predictor of academic success for IT students from all races in South African society.**
	For white students there is a statistically significant correlation (at $p<0.05$) between GSAT and academic success in the first year IT class – see tables 4.8; 4.9; 4.10. For the Asian students the sample size was too small to be able to conduct a statistical analysis that was significant but the trends appeared to be positive. For the black and coloured students the correlations were positive but not statistically significant at $p<0.05$ and therefore the GSAT cannot be regarded as

	an equally good predictor of academic success in the first year IT class for all races in South African society see tables 4.11; 4.12; 4.13; 4.14; 4.15; 4.16 and figures 4.4; 4.5; 4.6; 4.7.
3	**To establish whether the GSAT is suitable predictor for academic success for the different gender groups.**
	There is a statistically significant but weak positive correlation (at $p<0.05$) between both male and female gender groups suggesting that GSAT is a predictor of academic success in the first year IT class for different gender groups – see tables 4.17; 4.18; 4.19; 4.20; 4.21; 4.22 and figures 4.8; 4.9.
4	**To determine the extent to which the GSAT correlates with:**
Swedish Rating	There is a statistically significant positive correlation (at $p<0.05$) between GSAT and Swedish Rating, although Swedish Rating appears to be the stronger predictor of academic success in the first year IT class. The total GSAT score rather than the cut off score gives this positive correlation – see tables 4.43 through 4.53
English language ability	No statically significant positive correlation (at $p<0.05$) was found between English language ability and academic success in the first year IT class – see table 4.47

CHAPTER 5

DISCUSSION

5.1 FINDINGS

The findings will be reported in the same sequence as they appear in the aims of the study.

5.1.1 Findings with regard to the predictive validity of the GSAT in relation to the academic success of first year IT students at PE Technikon.

The statistical analysis presented in chapter 4 identifies a statistically significant positive correlation between the GSAT scores and academic success across the whole sample, which is consistent with the literature (Barro, 2001; Clarke, 1998; Gehring, 2001; Larose et al., 1998; Skuy, Zolezzi, Mentis, Fridjhon & Cockcroft, 1996; Sedlacek & Adams-Gaston, 1992; Venter, 1995; Vogel, 1995). This correlation is a weak correlation but suggests that the GSAT may be useful in helping to predict students who may make a success of their studies in IT. This weak correlation suggests that there are other factors which too affect the students' potential to succeed and that unless these factors are addressed this mode of prediction will always be tenuous. This matter will be addressed again later in the chapter.

5.1.2 Findings with regard to whether the GSAT is a good predictor of academic success for the various racial groups in South Africa.

In looking at the various racial groups it is clear that for the White students there is a statistically significant positive correlation between GSAT and academic success and that this correlation is stronger than for the overall sample. Unfortunately the sample for the Asian students was too small to draw any valid conclusions. However for Coloured and Black students the correlations are extremely weak and are not statistically significant, suggesting that the role that the GSAT plays in predicting successful IT students in these groups is not clear. This finding is consistent with the literature which suggests that such tests are more useful with traditional and advantaged students than with less traditional and disadvantaged

students (Barro, 2001; Engelbrecht & Kotze, 2003; Larose et al., 1998; Sedlacek et al., 1992; Skuy et al., 1996; Shochet, 1994).

However when the information pertaining to successful students in these groups is examined more carefully it is clear that a very high percentage of the successful students meet the minimum GSAT requirements that predict success and very few students who fall below the cut off point are found in this group. In the unsuccessful group a greater number of students are found who do not meet the minimum requirements. The problem therefore in the unsuccessful group is the large number of students who meet the minimum requirements and yet are not successful. This again suggests that perhaps the test is identifying students with potential but that there are other factors that are not addressed in the selection and teaching and learning process that play a significant role in the students' academic success. However in terms of the research aim this confusion means that the GSAT is not a good predictor of academic success for all the racial groups in South Africa.

5.1.3 Findings with regard to whether the GSAT is a good predictor of academic success for the gender groups at PET.

For both male and female students in the overall sample there is a statistically significant but weak positive correlation between GSAT and academic success which is consistent with the literature (Barro, 2001; Coley, 2001; Huysamen & Roozendaal, 1999; Greyling, 2000). This correlation is stronger for the female than the male students and suggests that the GSAT does play a role in predicting academic success for both male and female students. It is interesting to note that when one considers these results for ethnic and gender groups the GSAT appears to have the best correlations for academic success with White males and Black females. For the remainder of the sample they are not significant but it is worth noting for further investigation that for Black and Coloured males the correlation is marginally on the negative side.

5.1.4 Findings with regard to whether the GSAT correlates well with:

5.1.4.1 The Swedish Rating System.

Both Swedish Rating (SR) and GSAT proved to be statistically significant, although at a rather weak level, in terms of predicting academic success. Both followed similar trends but SR seemed to have a slightly better predictive ability than GSAT. When the stepwise logistic regression was conducted these were the only two factors which were statistically significant predictors of academic success. In other words there appears to be a correlation between GSAT and SR in terms of predicting academic success but in the current educational system SR appears to be the better predictor. This is consistent with the findings in the literature that both psychometric tests and school leaving results predict academic success but that school leaving results is the stronger predictor (Ayaya, 1996; Cavanagh, 2003; Clarke, 1998; Greyling, 2000; Larose et al., 1998; Kotze & Diedricks, 2003; Miller & Bradbury, 1999; Zaaiman et al., 2000). The concern in the long term is that the manner in which school leaving results will be released in the new curriculum may not enable institutions to calculate comparative results of school achievement. This tool for prediction is thus likely to fall away in the near future and the GSAT or similar assessments may be the only tools available for tertiary institutions to use in identifying students with the scholastic potential to succeed at tertiary level.

5.1.4.2 English language ability.

English language ability appeared to play no statistically significant role in this study and it seemed that there was no significant relationship between the level of English Comprehension, GSAT and the prediction of academic success. Ayaya (1996), Greyling (2000), Miller and Bradbury (1999) and Venter (1995) are of the opinion that English language ability plays an important role in predicting academic success but that this maybe secondary to other factors. This may be the case in this study and should this aspect be examined under a different research design it may play a significant role, especially if the direct link between English language usage and academic success is examined.

5.2 LIMITATIONS OF THIS STUDY.

Anastasi and Urbana (1997) in discussing validity suggests that a test is valid if it measures what it says it measures. One of the problems in using the GSAT for selection of IT students is that it is a valid test for measuring scholastic aptitude but it does not measure computer aptitude, motivation and interest and therefore these aspects limit its predictive ability. Many other factors are listed in the literature and at best it seems that a combination of psychometric testing and school leaving results will explain up to about 60% of variance in terms of predicting academic success (Ayaya, 1996; Cavanagh, 2003; Clarke 1998; Dawes et al., 1999; Faulkner, 2002; Gehring, 2001; Greyling, 2000; Huysamen, 1999; Huysamen & Roozendaal, 1999; Lindblom-Ylanne et al., 1999; Louw et al, 1998; Miller & Bradbury, 1999; US Department of Education, 2000; Watson, Calitz & de Kock, 2001). In any study of this nature, therefore, the inclusion of these other factors will have a limiting effect. It is therefore necessary to research and identify those factors which play a significant role in reducing academic success and to identify those that improve appropriate course selection. These factors used in conjunction with the assessment tools may provide a more appropriate manner to select and place students.

A further limiting factor is the sample that was used. All students in the sample had been through a selection process before enrolling for their studies. This process excluded students with low school leaving results and low GSAT scores, only a limited number of such students were enrolled in this group and that by default rather than design. If all students who applied had been given access and then the same study was undertaken on this group it is possible that the results would be more definitive.

The literature (Shochet, 1994; Venter, 1995) debates the effect of developmental programmes on students from disadvantaged communities and the effect that these programmes may have on the results of academic aptitude tests. Many of the students in this sample would come from such backgrounds and thus with appropriate intervention may perform differently. This is particularly true for the students in the black and coloured racial groups where, in the unsuccessful groups, many students who appeared to have the scholastic potential were not

successful. This lack of success may not be due to limitations of the assessment but rather to other factors that are inhibiting academic success. Bridging and foundation programmes is thus likely to have a positive effect on such research.

5.3 RECOMMENDATIONS FOR THE SELECTION POLICY OF IT STUDENTS AND THE USE OF THE GSAT IN THE BROADER SELECTION POLICY OF THE PE TECHNIKON.

In terms of the selection and placement policy of the Port Elizabeth Technikon it would seem that these tests have the potential to play a limited role in selecting and placing students, however it would seem that in the current education environment this is only necessary for students who do not perform well at secondary school. The Swedish Rating is currently a better predictor than the GSAT. The potential of the tests lies in providing access to students who may otherwise have been excluded from programmes based on other selection criteria. It is however quite clear, from the large number of students who are not successful, that although these tests provide assistance for identifying academic potential there is a need to further assess the academic achievement of students. Where gaps in the knowledge base are identified it will be necessary to provide the correct placement and academic support. This implies an extension of the current programme and will require research in conjunction with the various academic departments to develop the necessary additional course specific assessments.

In the light of the large numbers of students who appear to have academic potential, but who still do not make an academic success of their studies, it is clear that identifying potential and providing access is not sufficient in itself. Additional to selection and placement, there appears to be a great need for comprehensive career counseling as part of the selection process, as students' who enroll for courses to which they are not suited will have great difficulty motivating themselves when the work proves challenging. Furthermore a correctly placed student, although no guarantee of success, has a better chance of succeeding. Many students find the environment of a tertiary institution foreign to them and so a sound first year orientation programme which allows the student to feel at home and to understand the workings of the institution is imperative to the students academic success. This programme

should not just see to the initial well being of the student but should include an extended follow up programme which assists the student to acquire the necessary skills required to make a success of tertiary studies and even their future careers.

In other words for both the IT department and all other departments within the institution it would seem that it would be wise to use such assessments but use them with discretion, this is particularly true for black, coloured and female students. They should not be used in isolation but rather in conjunction with other available information in terms of selecting and placing students. Furthermore the process of selection and placement should not end after registration but should be supported by other academic and social programmes to support the student as acceptance into a programme raises an expectation of academic success (Zaaiman, van der Flier & Thijs, 2000).

5.4 AVENUES OF FURTHER RESEARCH.

The first area requiring further study is the group of students who are perceived as having potential but who have not been academically successful. This is a large group across the study but particularly so in the Black and Coloured male groups. There is a need to take a closer look at this group, and even the sub groups, and to establish if this reflects the poor predictive validity of the assessment tool or if there are other factors like poor course selection, academic under preparedness, poor time management skills, feelings of alienation in the tertiary environment, a lack of technological experience, language skills etc which play a more significant role in causing these students to be unsuccessful.

It would appear too from the available data that there a large number of successful students who fall into the 0 to -5 below the GSAT cut off point category. There are an equally large number of students in this category in the unsuccessful group but it seems that it may be useful and expedient to identify which factors from students who fall into this category make them successful students and which factors restrict success. This would enable a greater number of borderline students to gain access and success in this course. From personal observation it appears that further investigation on the link between the score on sub test 3 (verbal reasoning)

of the GSAT may provide a valuable area of further research. It appears that IT students who do well on this sub test do better in their IT studies than students who have lower scores on this sub test.

A further area requiring examination in the field of selection is the role that subject selection at secondary school level plays in enhancing success in the IT field of study. It would appear that certain subjects may prepare the student better for the disciplines required to successfully study IT and the identification of these subjects may enhance the selection process. A related area of study may be the examination and identification of personality type and interest that supports success in this field of study.

Matentjie (1999) points out that the assessment tools currently in use for selection and placement are based on the old school curriculum. In the immediate future matriculation candidates will come from a background of outcomes based education. The achievement and aptitude tests currently used are likely to be ineffective in selecting and placing students from an OBE background. It is therefore necessary for tertiary institutions to begin to grapple with the issues that are likely to arise in this respect and to research and design appropriate assessments which can be used for the selection and placement of students coming from such an educational background.

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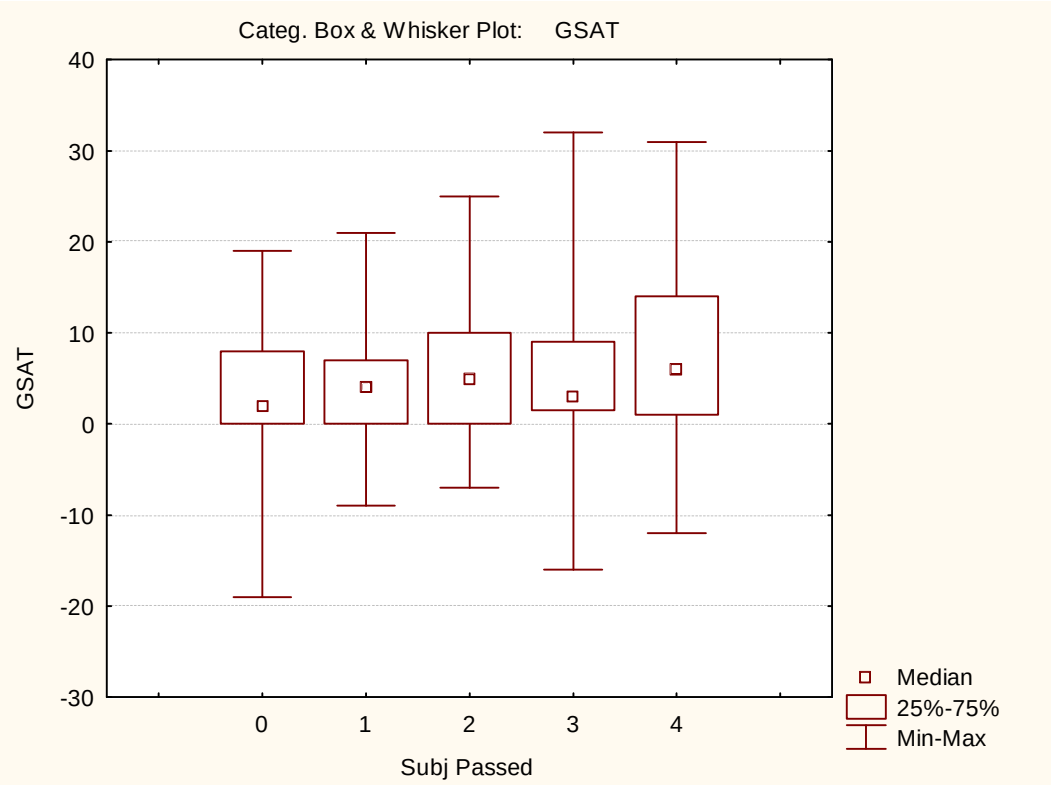
ANNEXURE 1

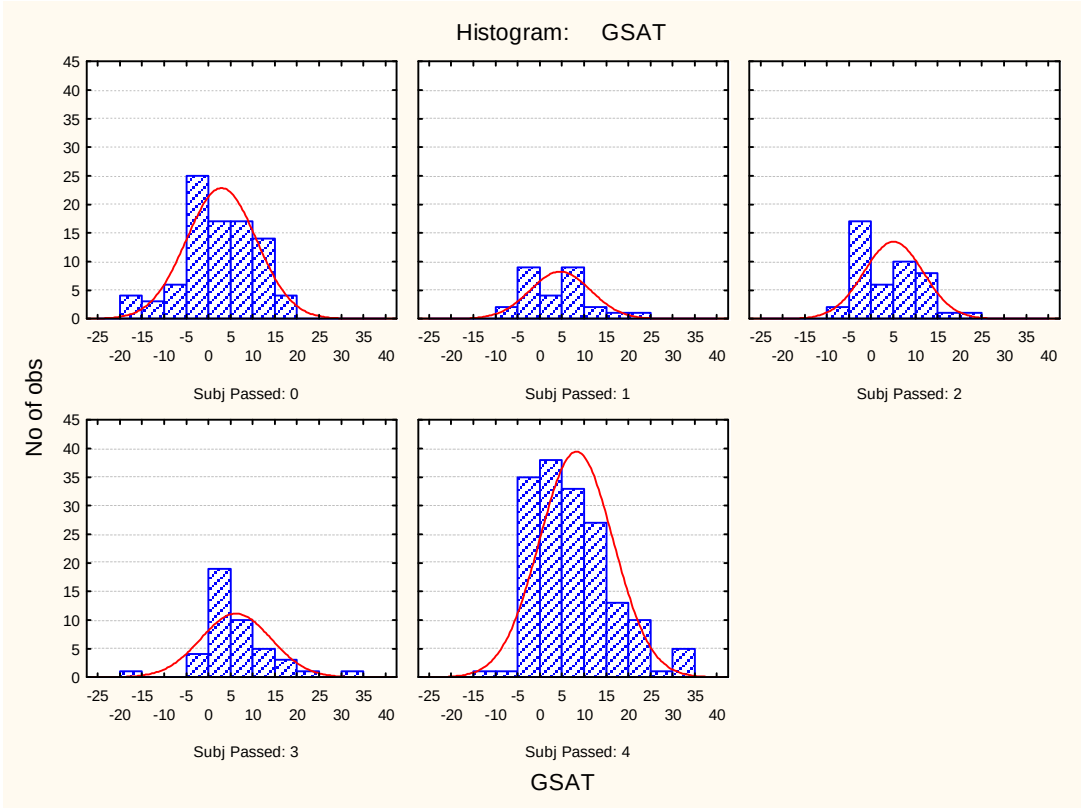
Analysis of GSAT data

The relationship between GSAT and the number of subjects passed (original variable).

Breakdown Table of Descriptive Statistics
Smallest N for any variable: 371

Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	2.777778	90	7.846530
1	4.464286	28	6.774036
2	4.888889	45	6.668182
3	6.045455	44	7.897467
4	8.067073	164	8.290087
All Grps	5.886792	371	8.105928

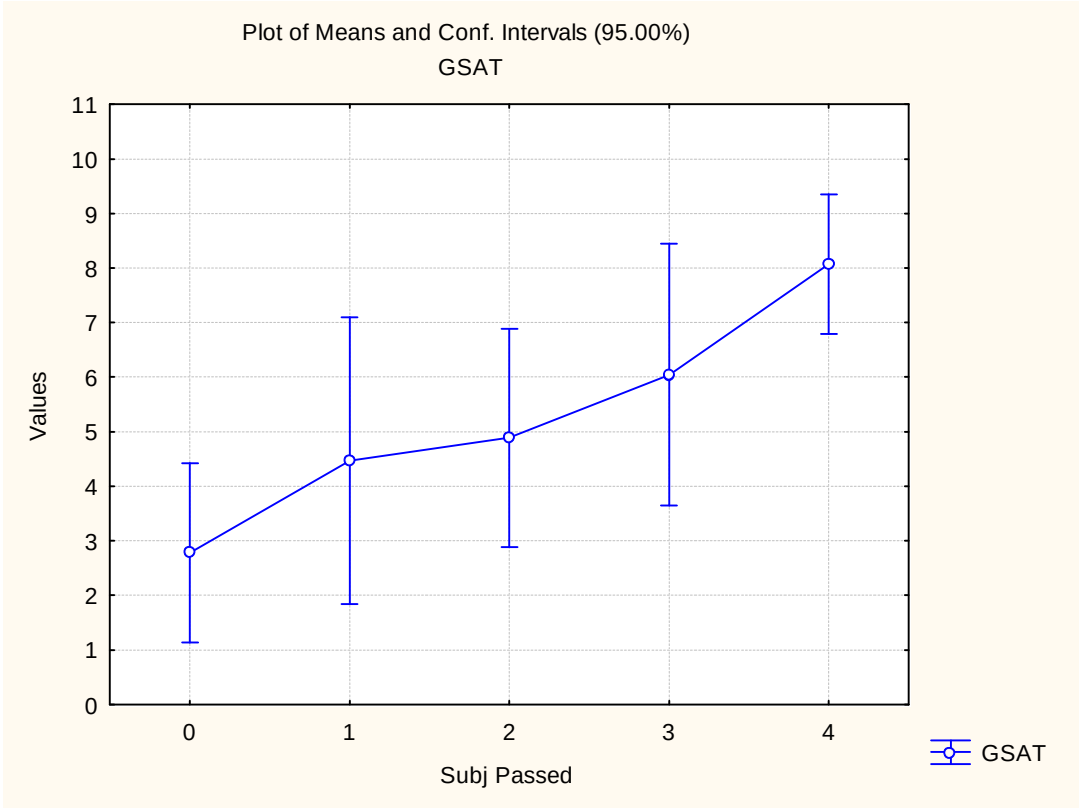




Variable	Analysis of Variance Marked effects are significant at p < .05000 SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1752.110	4	438.0274	22559.14	366	61.63698	7.106568	0.000016

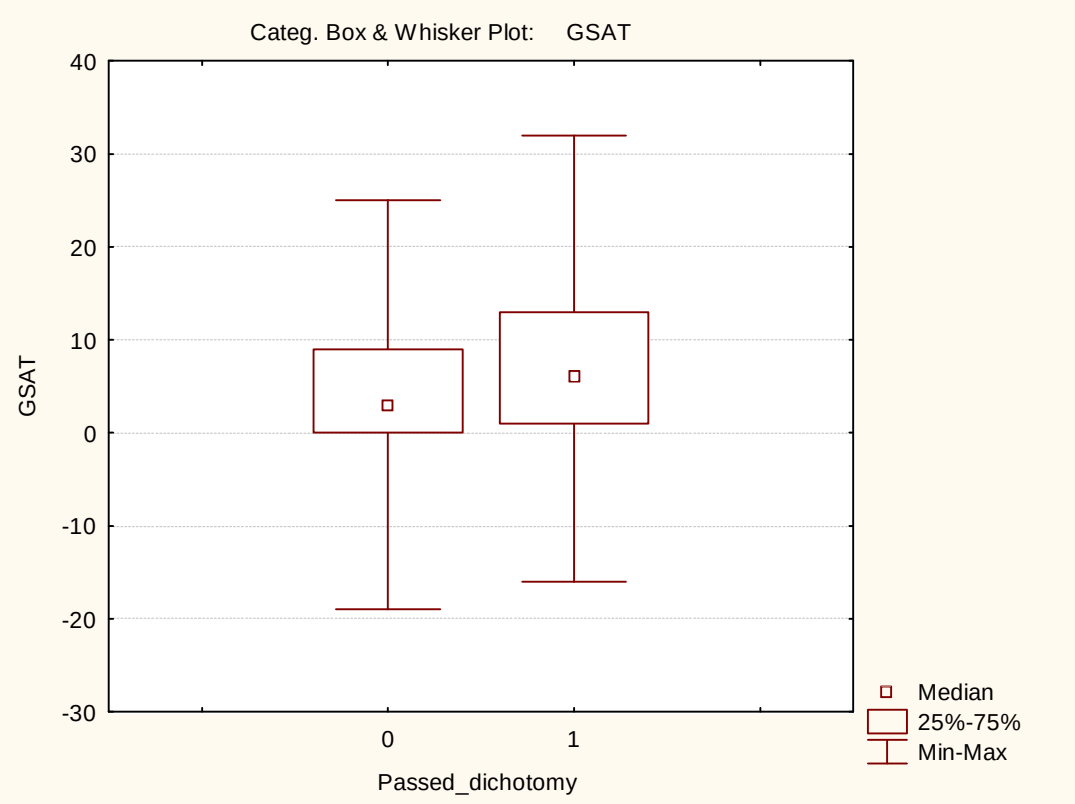
Variable	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000 SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	111.3371	4	27.83427	8200.317	366	22.40524	1.242311	0.292543

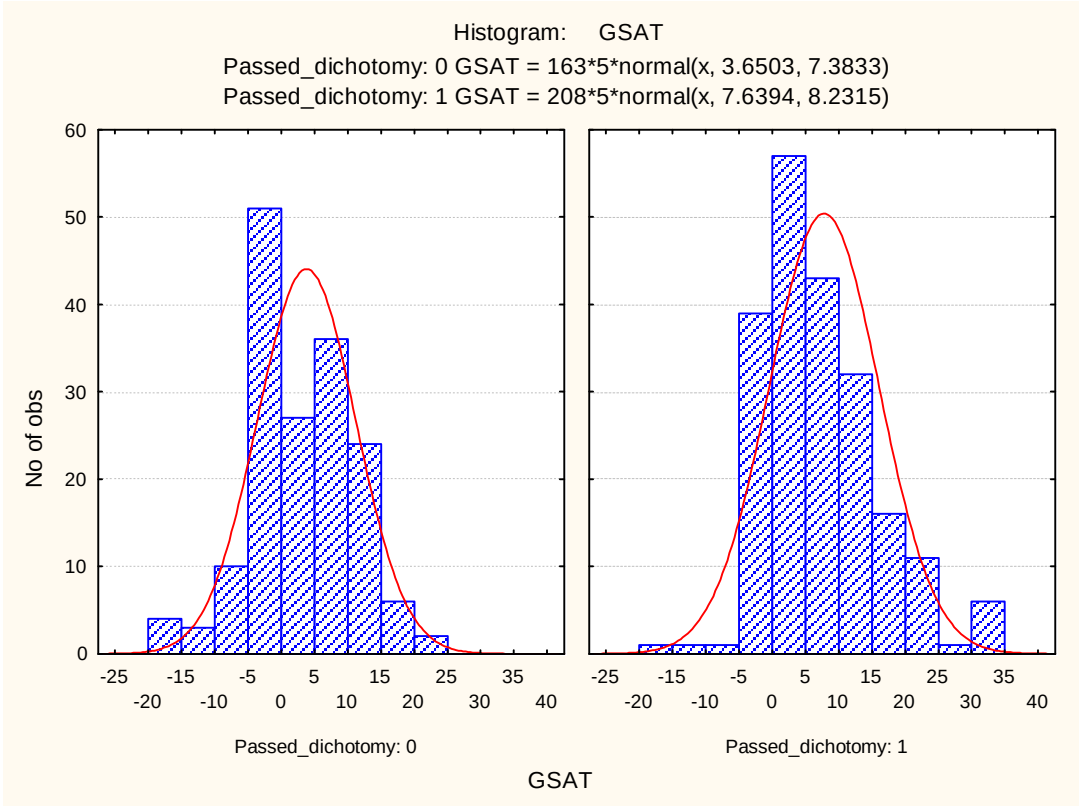
Subj Passed		LSD Test; Variable: GSAT Marked differences are significant at p < .05000 {1} M=2.7778	{2} M=4.4643	{3} M=4.8889	{4} M=6.0455	{5} M=8.0671
0	{1}		0.321502	0.141658	0.024244	0.000000
1	{2}	0.321502		0.822345	0.405332	0.025414
2	{3}	0.141658	0.822345		0.487594	0.016644
3	{4}	0.024244	0.405332	0.487594		0.130210
4	{5}	0.000000	0.025414	0.016644	0.130210	


Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
11
10
9
8
7
6
5
4
3
2
1
0
0
1
2
3
4
Subj Passed
GSAT

The relationship between GSAT and the number of subjects passed (dichotomized variable).

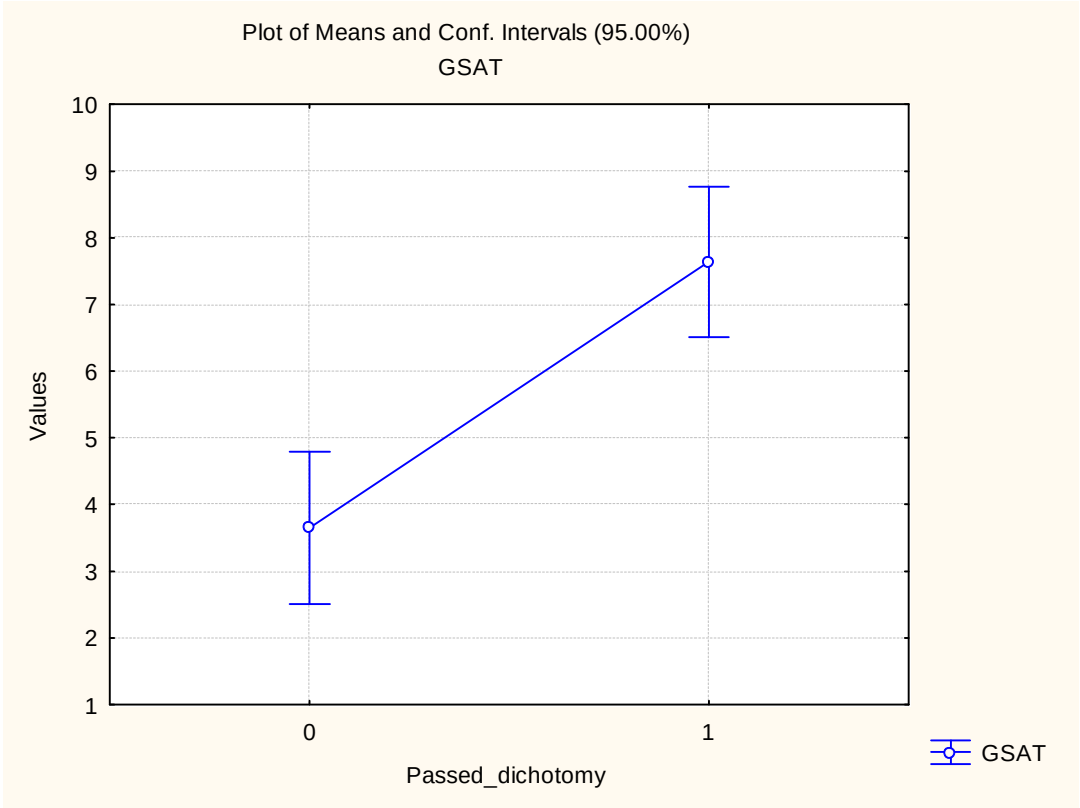
Breakdown Table of Descriptive Statistics Smallest N for any variable: 371			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.650307	163	7.383276
1	7.639423	208	8.231540
All Grps	5.886792	371	8.105928





Variable	Analysis of Variance (IT Students 2000 TO 2002A1a.sta) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1454.221	1	1454.221	22857.02	369	61.94316	23.47670	0.000002

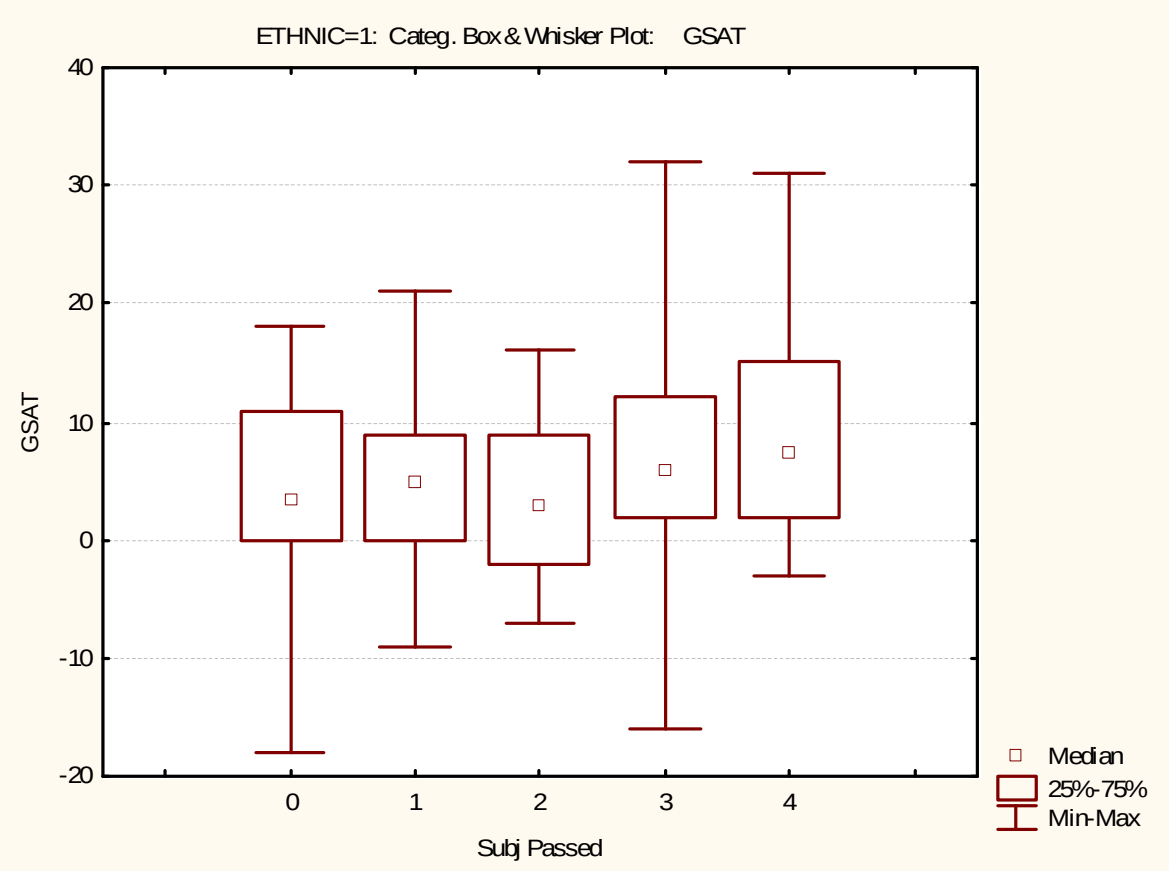
Variable	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	61.27101	1	61.27101	8305.526	369	22.50820	2.722164	0.099815

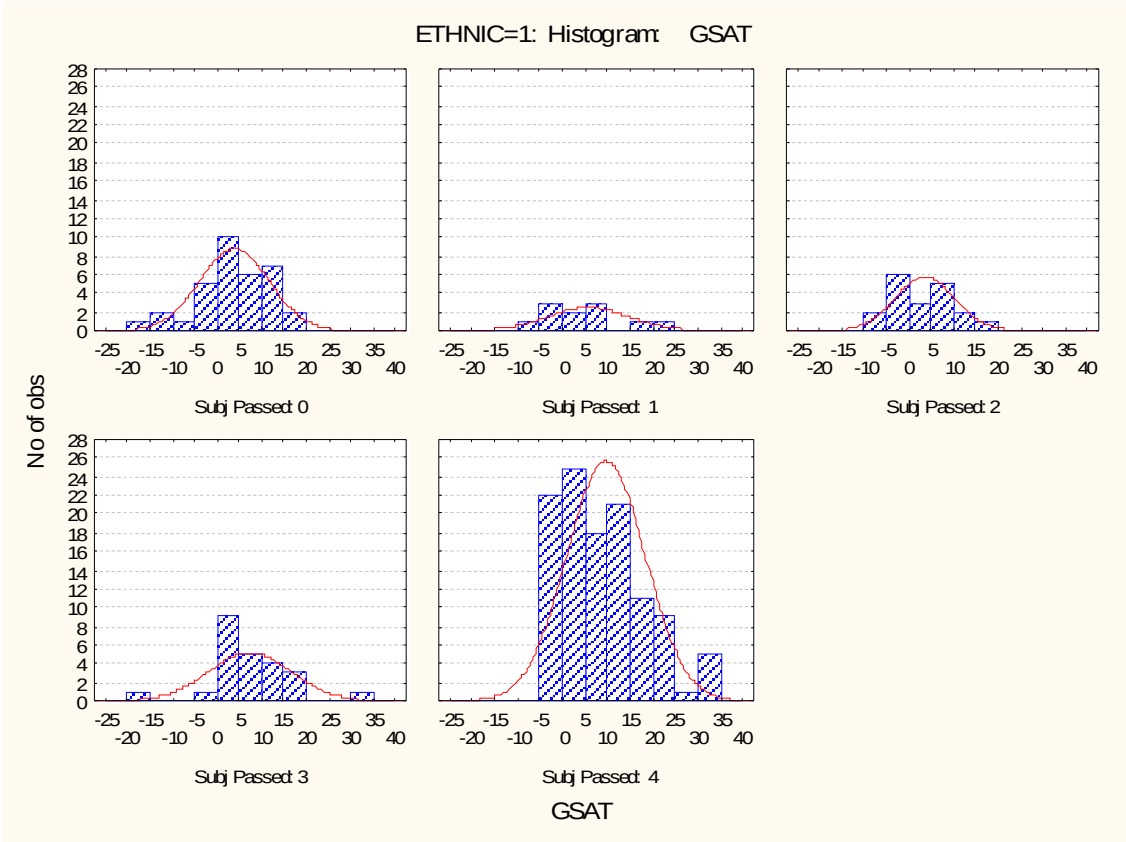

Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
10
9
8
7
6
5
4
3
2
1
0
1
Passed_dichotomy
GSAT

ETHNIC=1: Subjects passed raw

Breakdown Table of Descriptive Statistics (ETHNIC=1)
Smallest N for any variable: 200

Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.823529	34	7.755626
1	5.545455	11	8.881032
2	3.421053	19	6.602321
3	7.250000	24	9.256020
4	9.464286	112	8.702209
All Grps	7.450000	200	8.735505

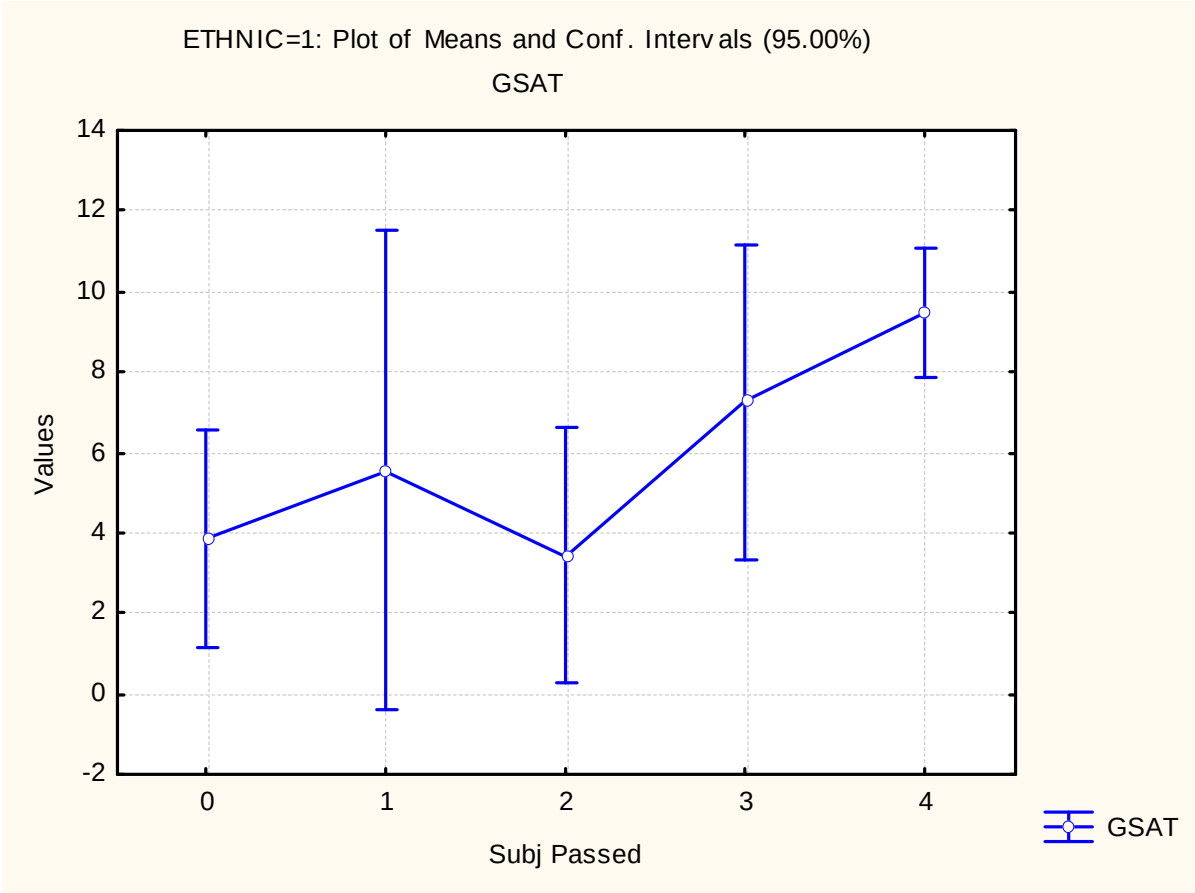




Variable	Analysis of Variance (ETHNIC=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1250.843	4	312.7107	13934.66	195	71.45978	4.376038	0.002069

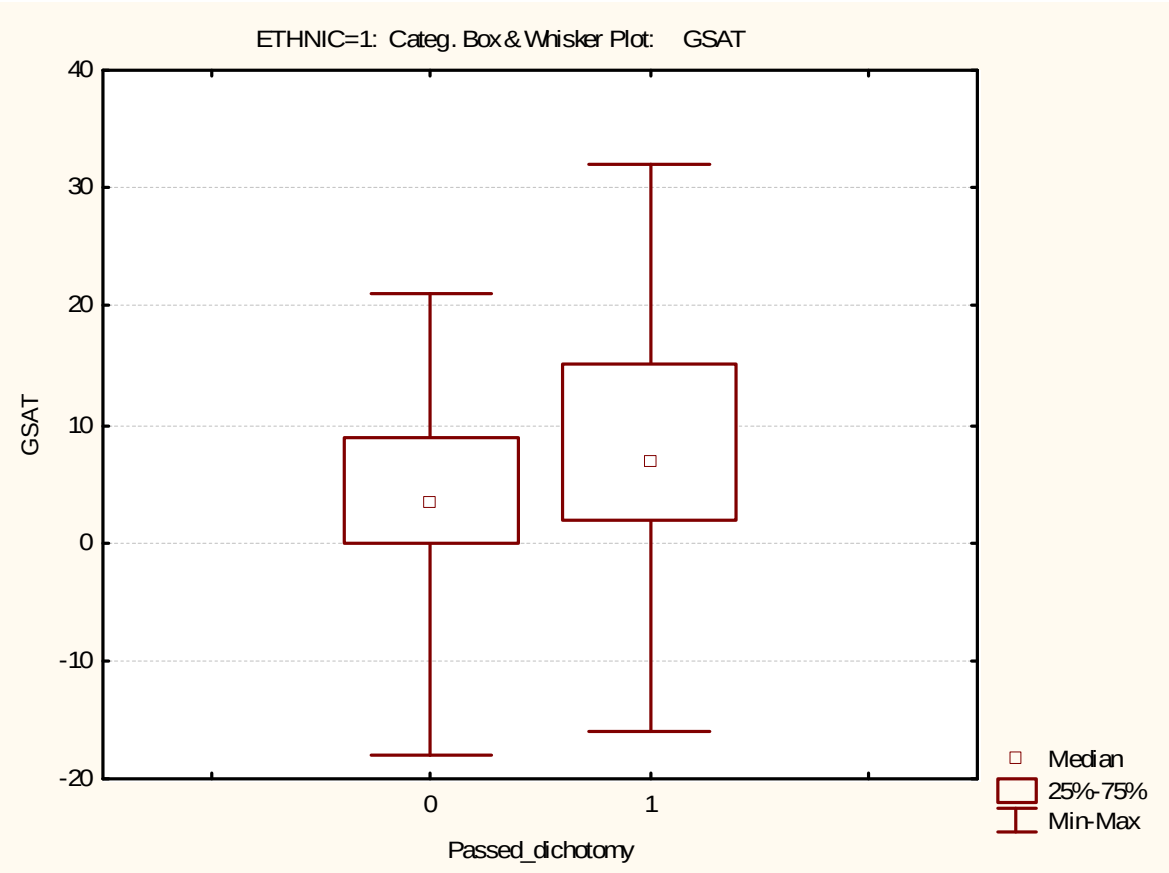
Variable	Levene Test of Homogeneity of Variances (ETHNIC=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	94.15348	4	23.53837	4620.139	195	23.69302	0.993473	0.412263

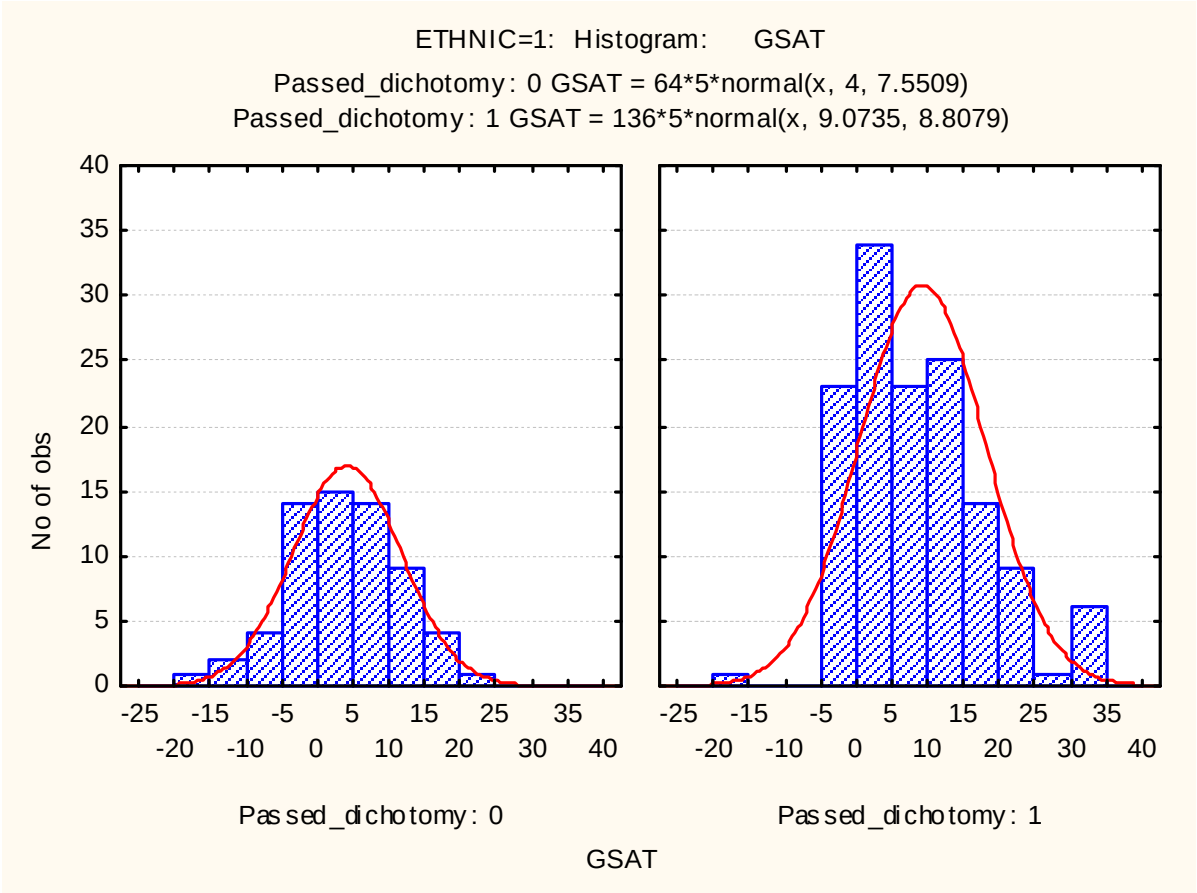
Subj Passed		LSD Test; Variable: GSAT (ETHNIC=1) Marked differences are significant at p < .05000				
		{1} M=3.8235	{2} M=5.5455	{3} M=3.4211	{4} M=7.2500	{5} M=9.4643
0	{1}		0.557724	0.868155	0.130040	0.000795
1	{2}	0.557724		0.507914	0.580357	0.143943
2	{3}	0.868155	0.507914		0.141821	0.004404
3	{4}	0.130040	0.580357	0.141821		0.245635
4	{5}	0.000795	0.143943	0.004404	0.245635	


ETHNIC=1: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
14
12
10
8
6
4
2
0
-2
0
1
2
3
4
Subj Passed
GSAT

ETHNIC=1: Subjects passed dichotomous

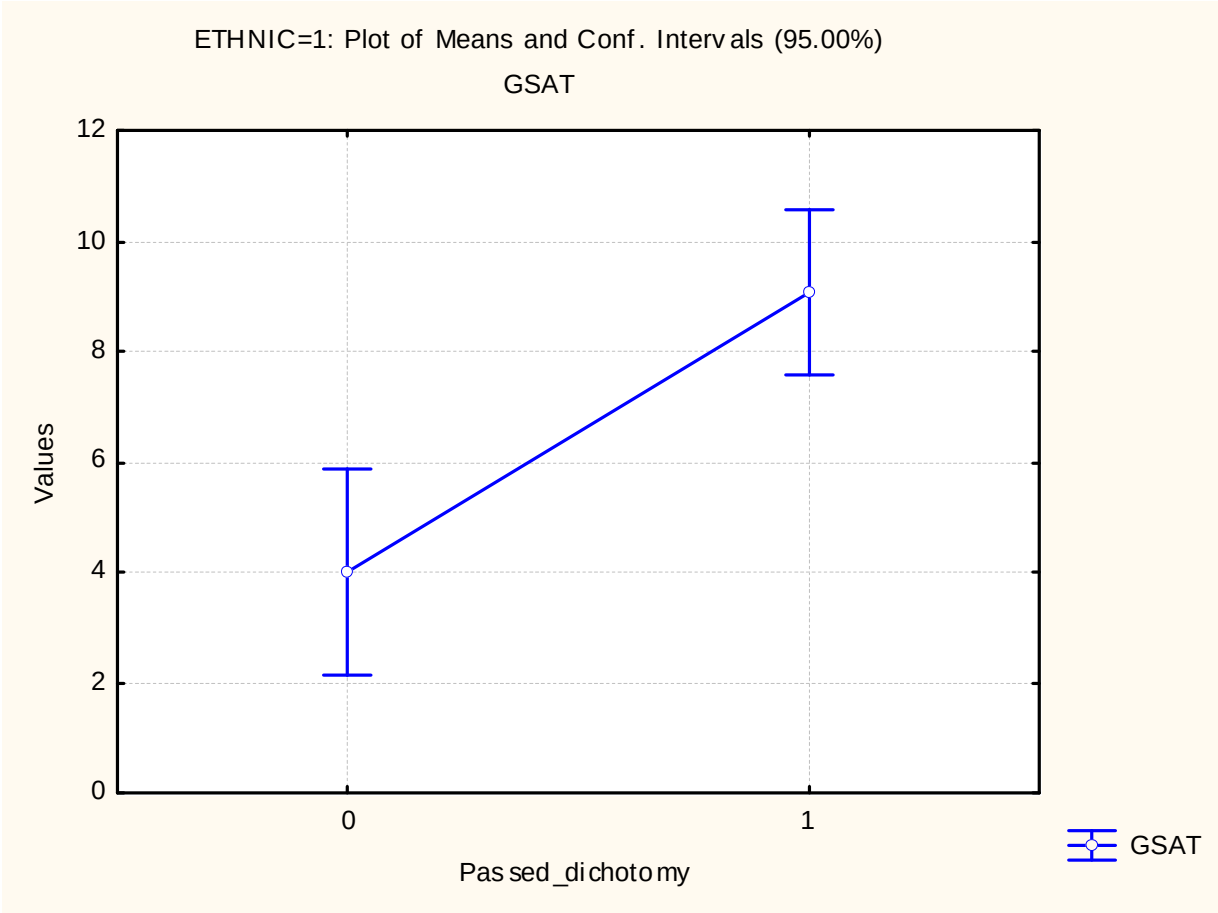
Breakdown Table of Descriptive Statistics (ETHNIC=1) Smallest N for any variable: 200			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	4.000000	64	7.550886
1	9.073529	136	8.807936
All Grps	7.450000	200	8.735505





Variable	Analysis of Variance (ETHNIC=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	1120.235	1	1120.235	14065.26	198	71.03669	15.76981	0.000100

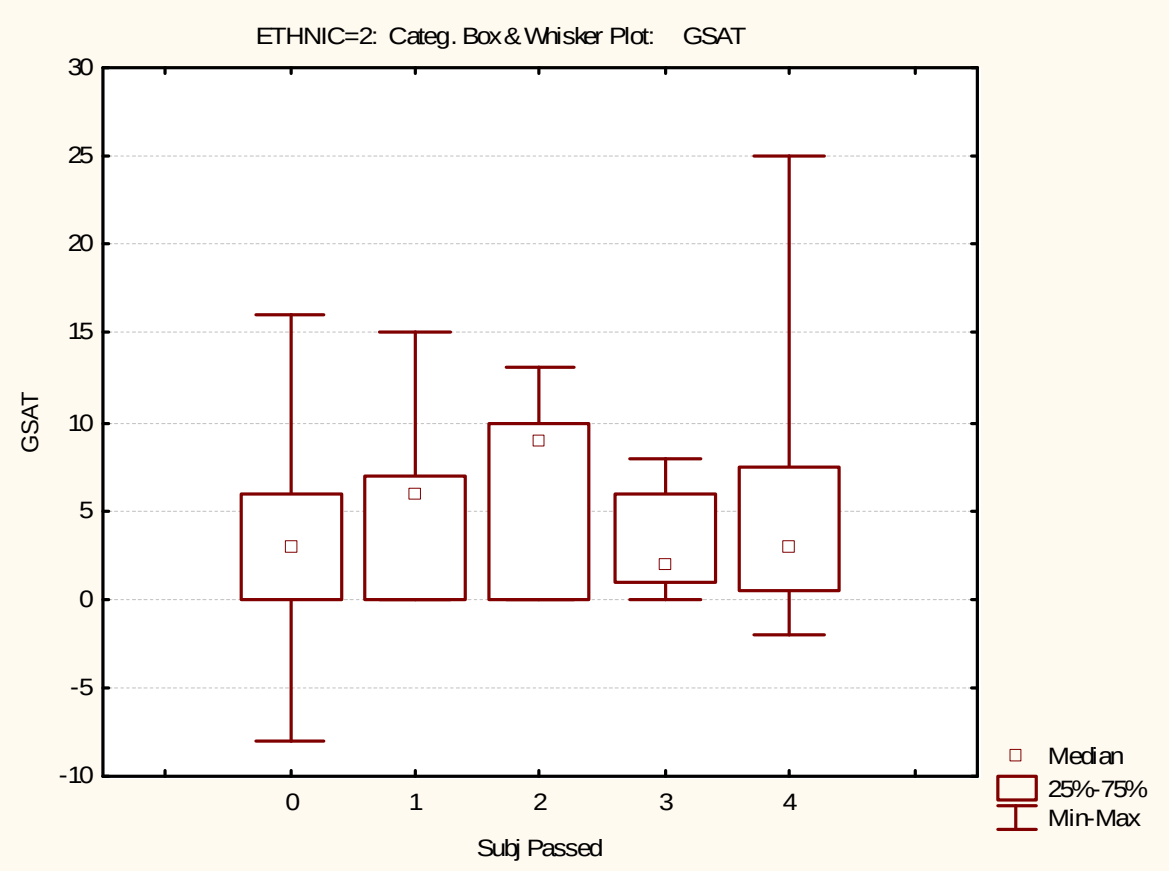
Variable	Levene Test of Homogeneity of Variances (ETHNIC=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	78.46872	1	78.46872	4771.168	198	24.09681	3.256395	0.072665

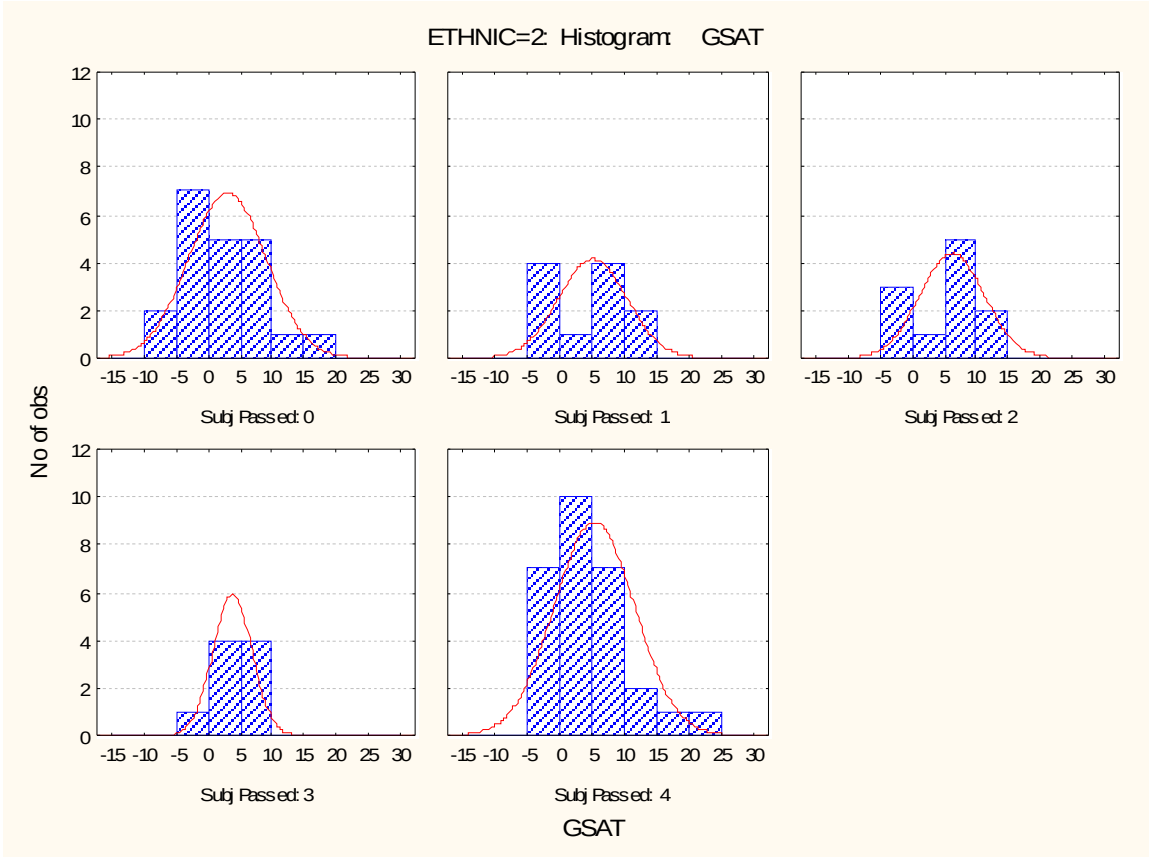

ETHNIC=1: Plot of Means and Conf. Intervals (95.00%)
GSAT
12
10
8
6
4
2
0
Values
0
1
Passed_dichotomy
GSAT

ETHNIC=2: Subjects passed raw

Breakdown Table of Descriptive Statistics (ETHNIC=2)
N=80 (No missing data in dep. var. list)

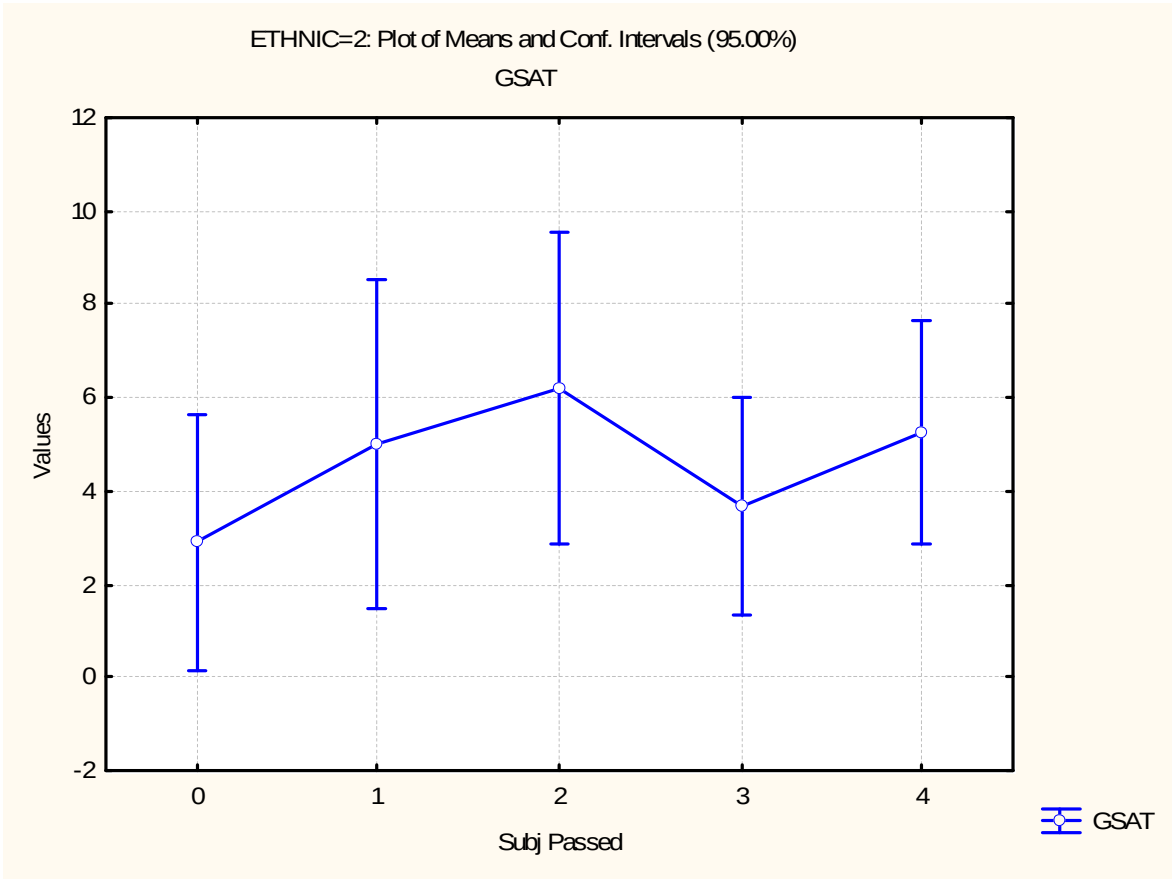
Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	2.904762	21	6.049006
1	5.000000	11	5.272571
2	6.181818	11	4.996362
3	3.666667	9	3.041381
4	5.250000	28	6.227924
All Grps	4.550000	80	5.613952





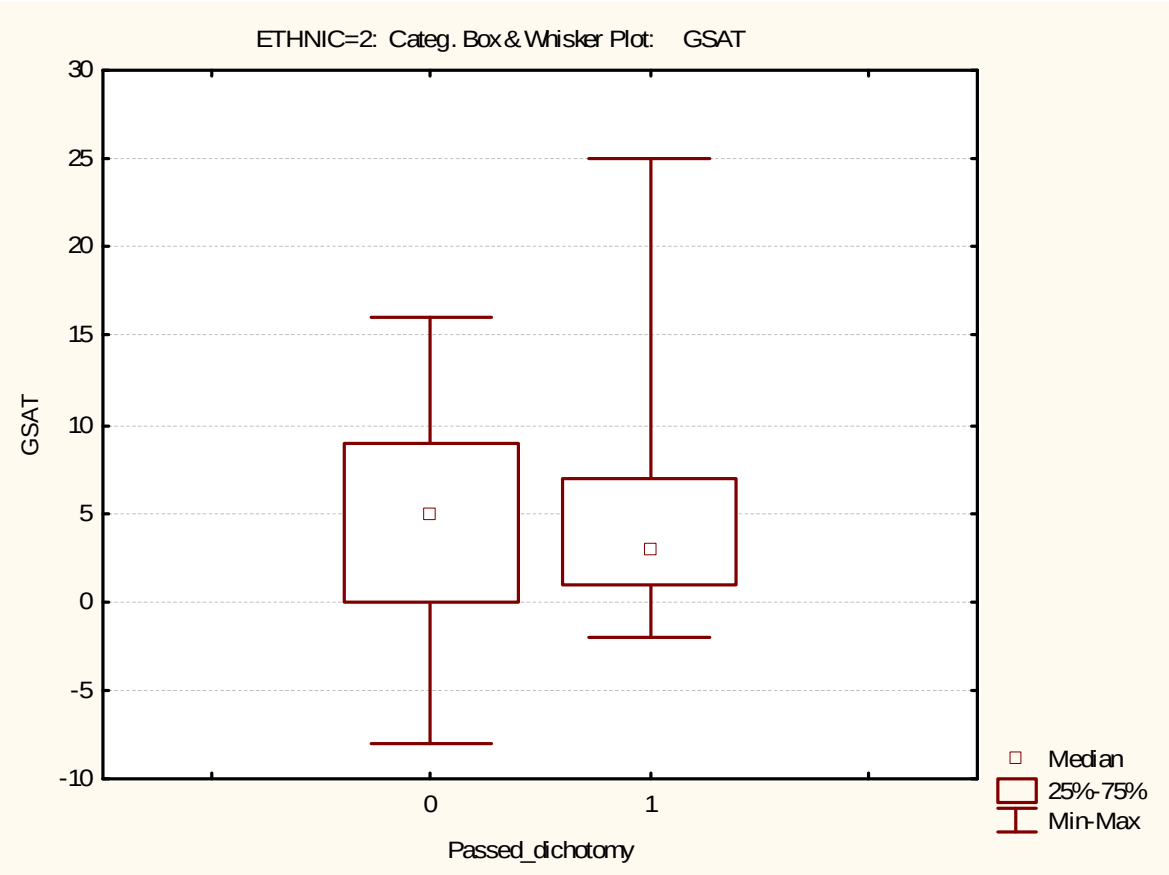
Variable	Analysis of Variance (ETHNIC=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	109.1041	4	27.27603	2380.696	75	31.74261	0.859287	0.492460

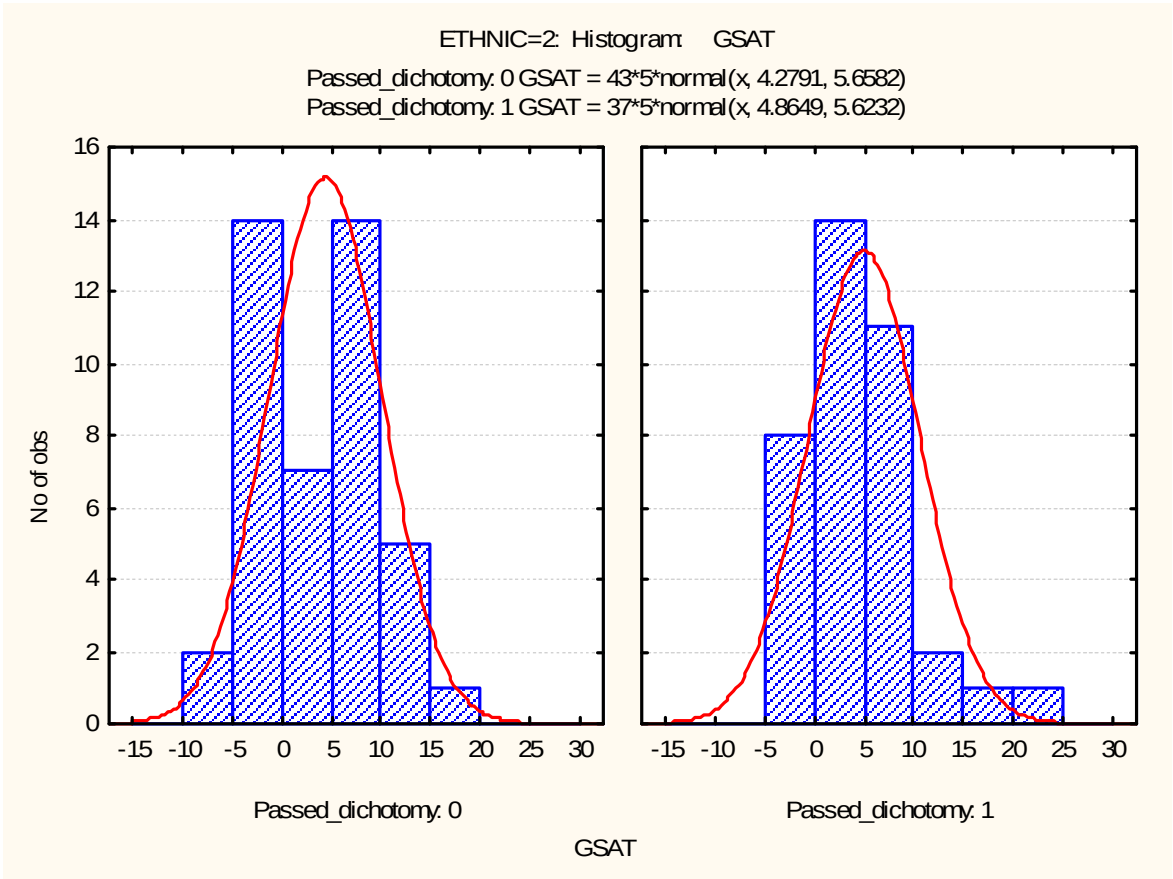
Variable	Levene Test of Homogeneity of Variances (ETHNIC=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	30.85351	4	7.713377	789.8412	75	10.53122	0.732430	0.572677


ETHNIC=2: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
12
10
8
6
4
2
0
-2
0
1
2
3
4
Subj Passed
GSAT

ETHNIC=2: Subjects passed dichotomous

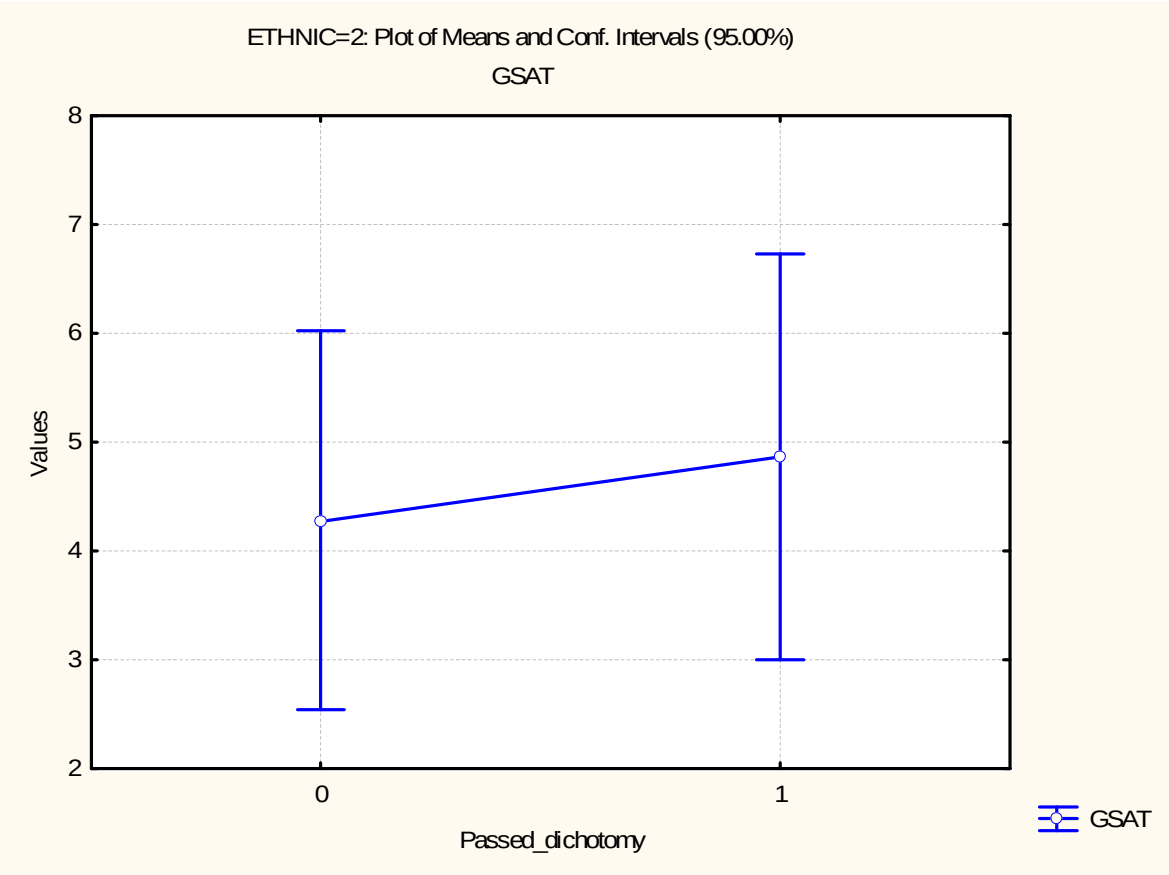
Breakdown Table of Descriptive Statistics (ETHNIC=2) N=80 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	4.279070	43	5.658224
1	4.864865	37	5.623177
All Grps	4.550000	80	5.613952





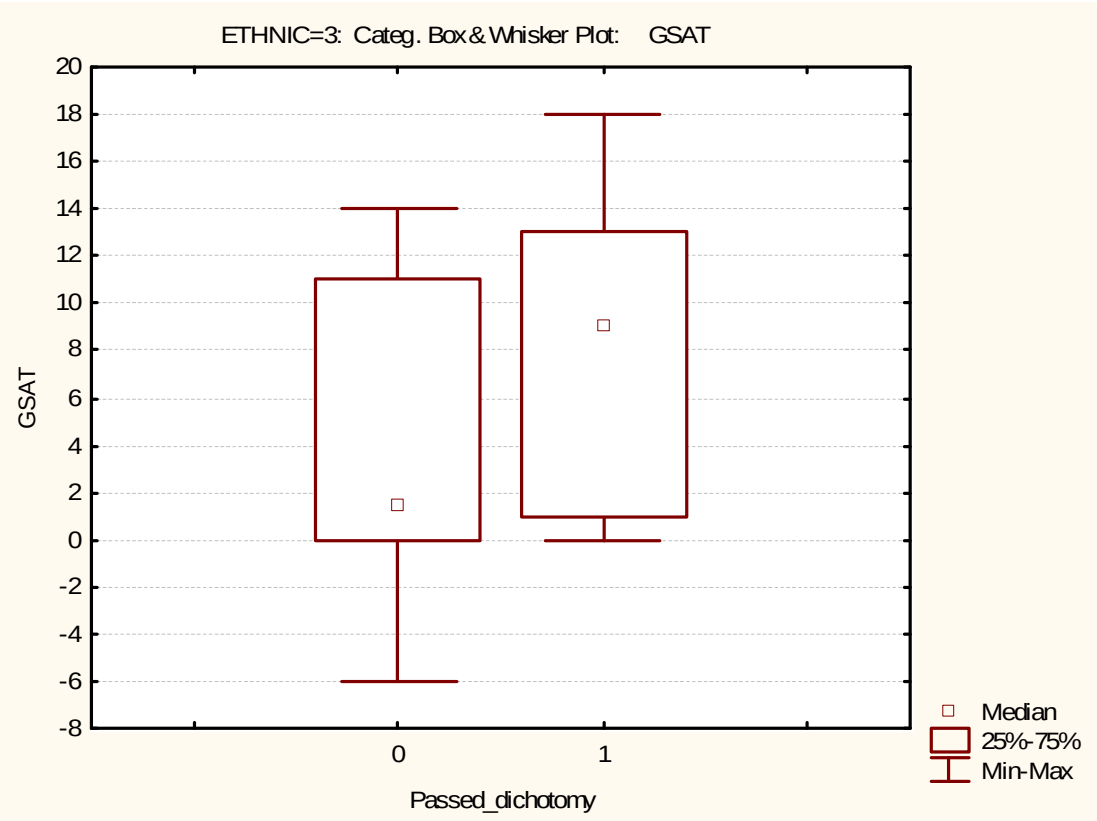
Variable	Analysis of Variance (ETHNIC=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	6.824513	1	6.824513	2482.975	78	31.83302	0.214385	0.644641

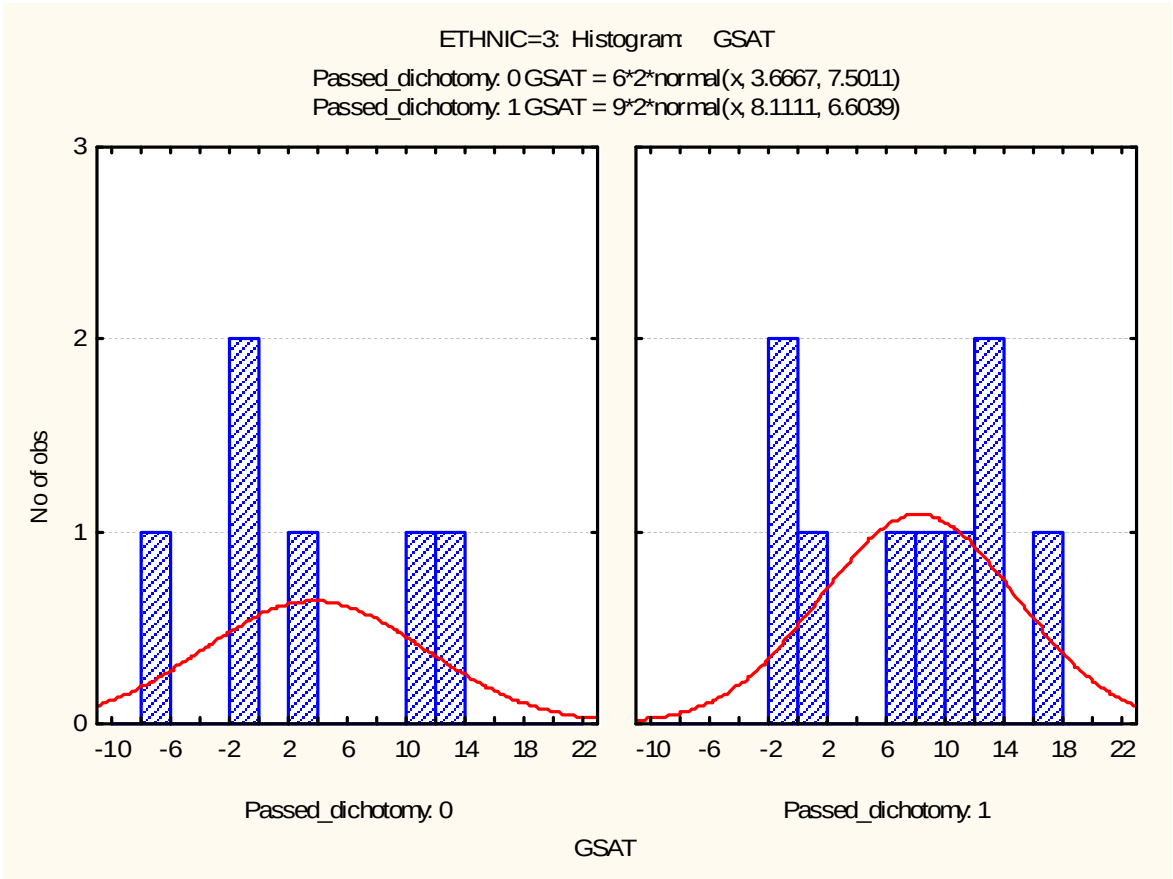
Variable	Levene Test of Homogeneity of Variances (ETHNIC=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	5.227946	1	5.227946	857.3402	78	10.99154	0.475634	0.492454


ETHNIC=2: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
8
7
6
5
4
3
2
0
1
Passed_dichotomy
GSAT

ETHNIC=3: Subjects passed dichotomous

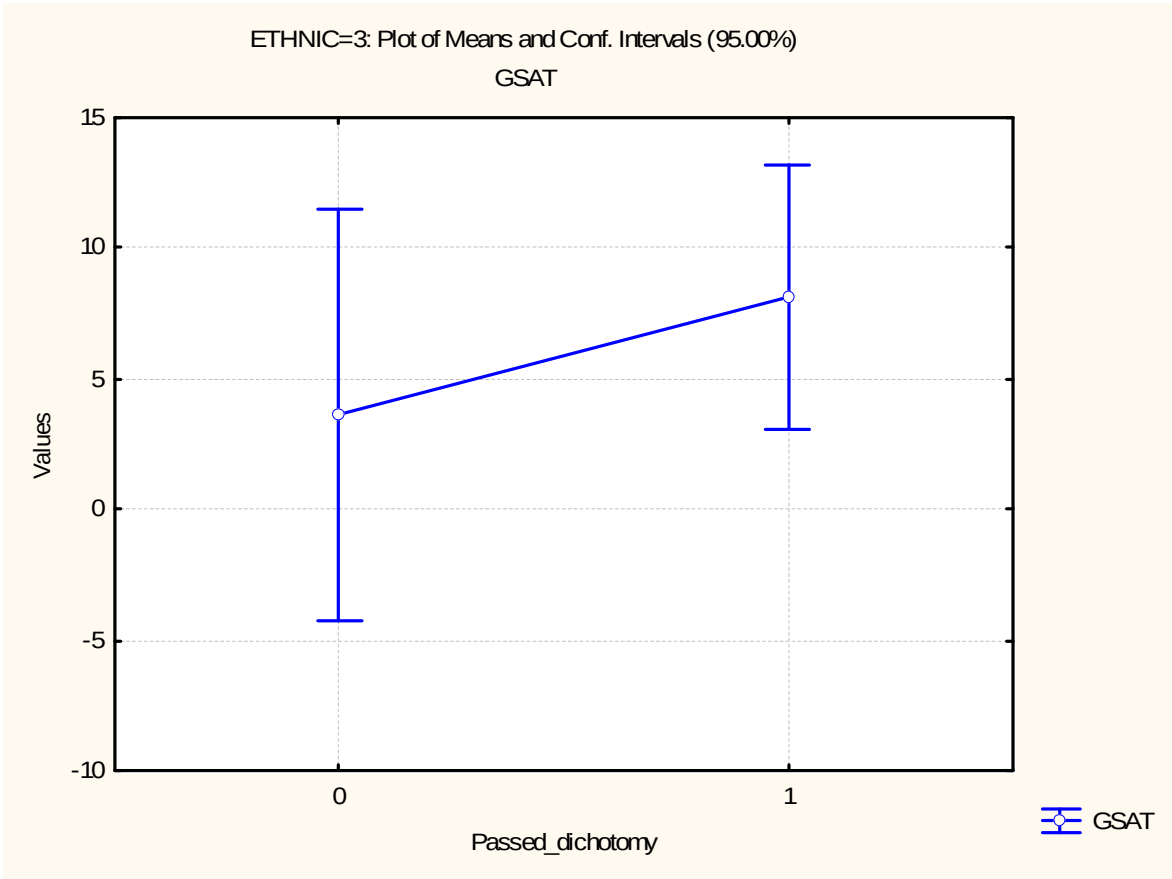
Breakdown Table of Descriptive Statistics (ETHNIC=3) N=15 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.666667	6	7.501111
1	8.111111	9	6.603871
All Grps	6.333333	15	7.077799





Variable	Analysis of Variance (ETHNIC=3) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	71.11111	1	71.11111	630.2222	13	48.47863	1.466855	0.247400

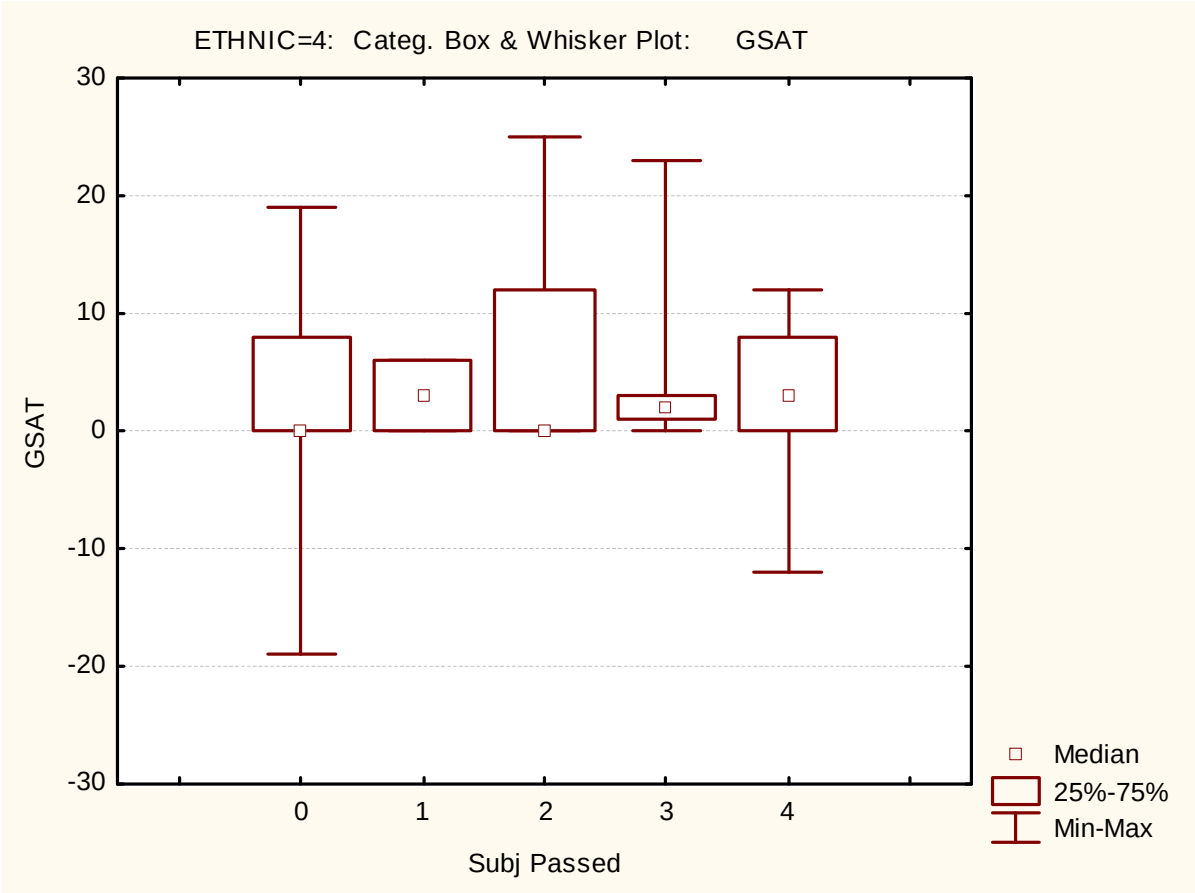
Variable	Levene Test of Homogeneity of Variances (ETHNIC=3) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	0.751166	1	0.751166	156.5789	13	12.04453	0.062366	0.806698

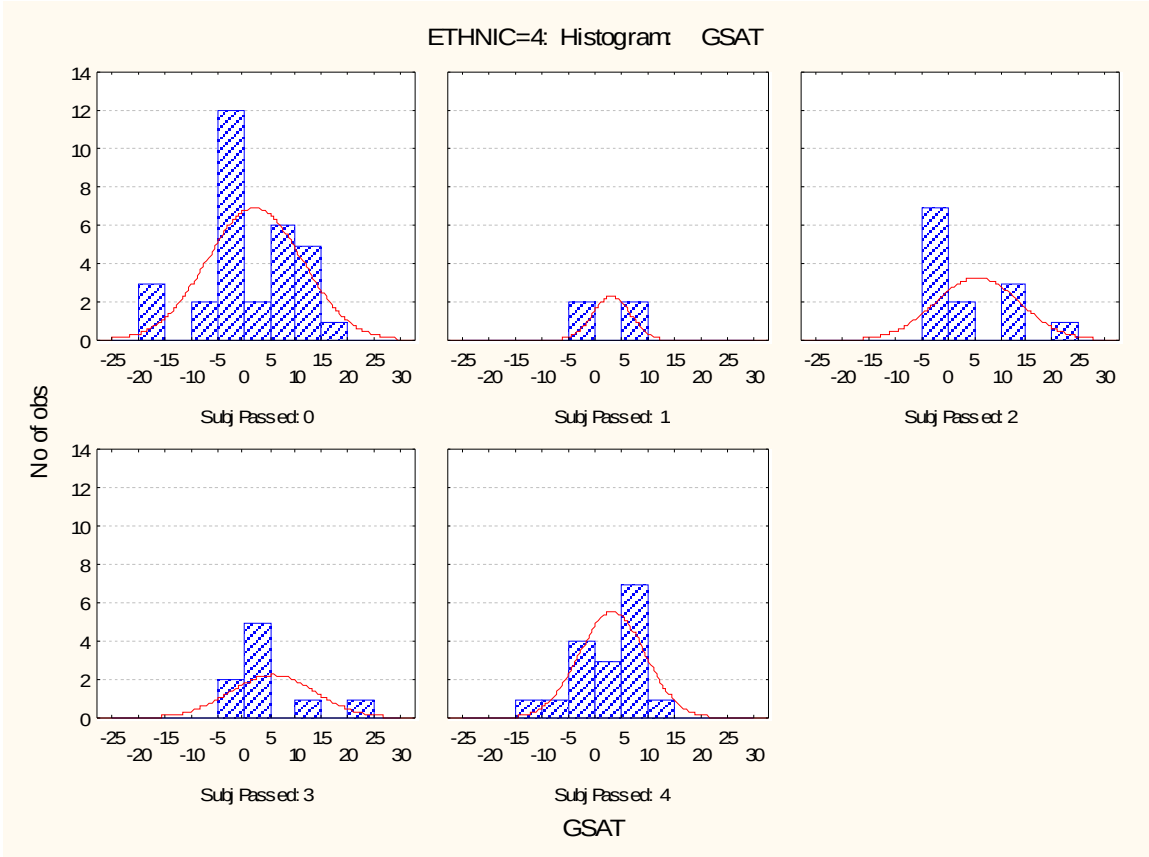

ETHNIC=3: Plot of Means and Conf. Intervals (95.00%)
GSAT
15
10
5
0
-5
-10
Values
0
1
Passed_dichotomy
GSAT

ETHNIC=4: Subjects passed raw

Breakdown Table of Descriptive Statistics (ETHNIC=4)
N=74 (No missing data in dep. var. list)

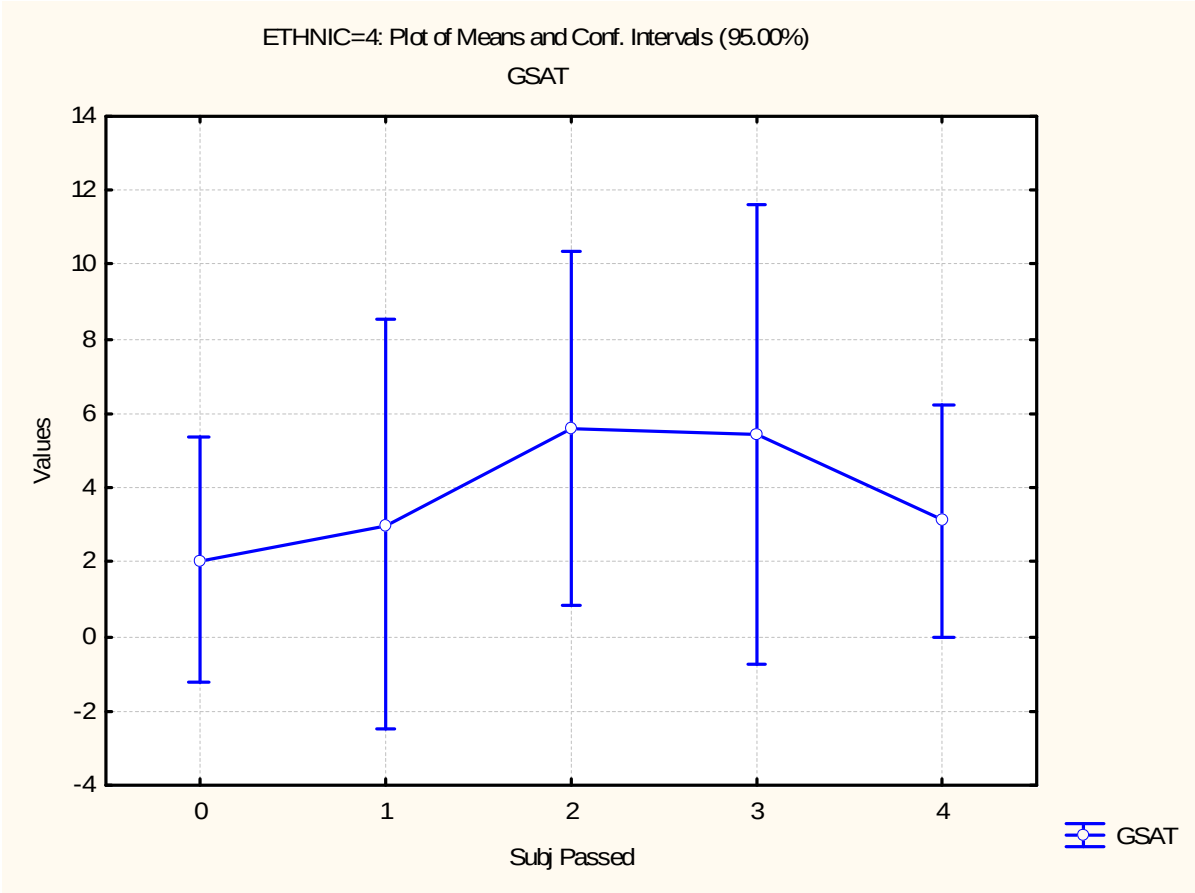
Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	2.064516	31	8.932844
1	3.000000	4	3.464102
2	5.615385	13	7.900828
3	5.444444	9	8.017342
4	3.117647	17	6.091822
All Grps	3.391892	74	7.803788





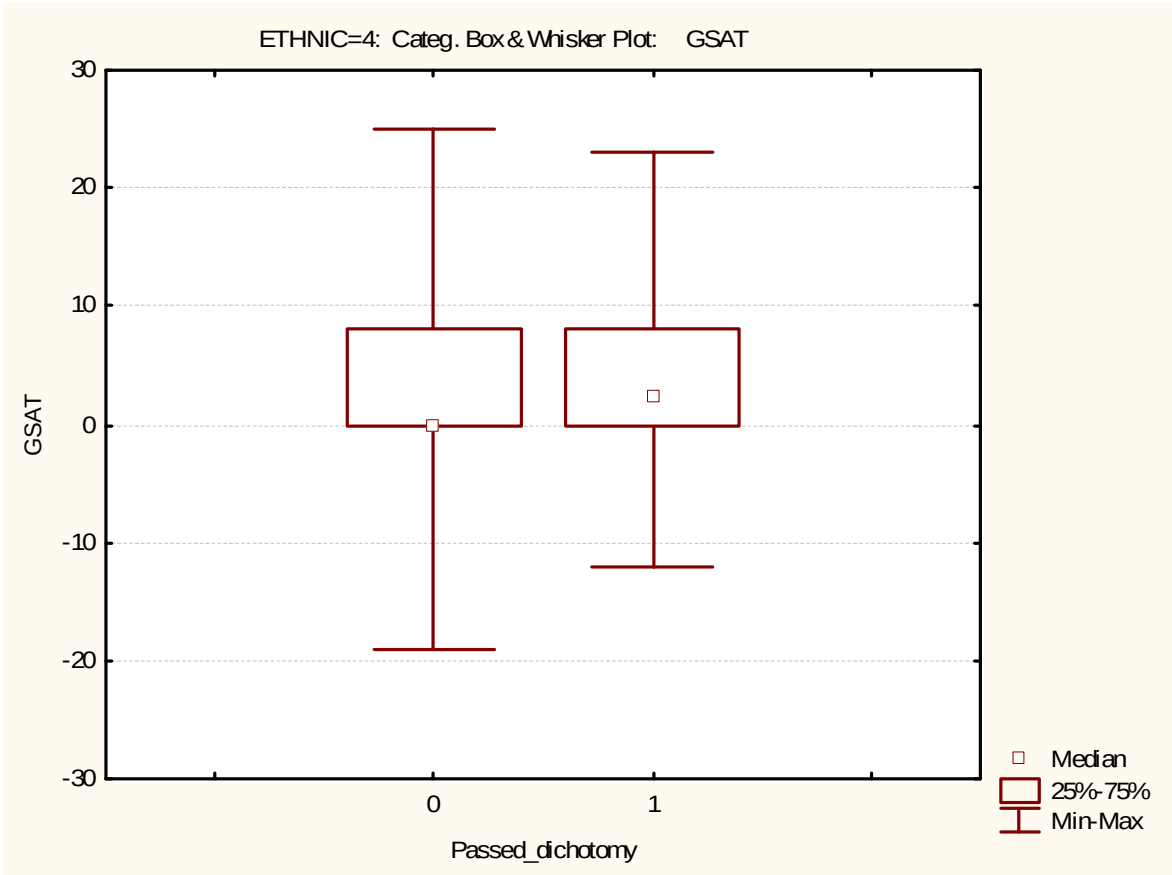
Variable	Analysis of Variance (ETHNIC=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	158.7003	4	39.67508	4286.935	69	62.12949	0.638587	0.636742

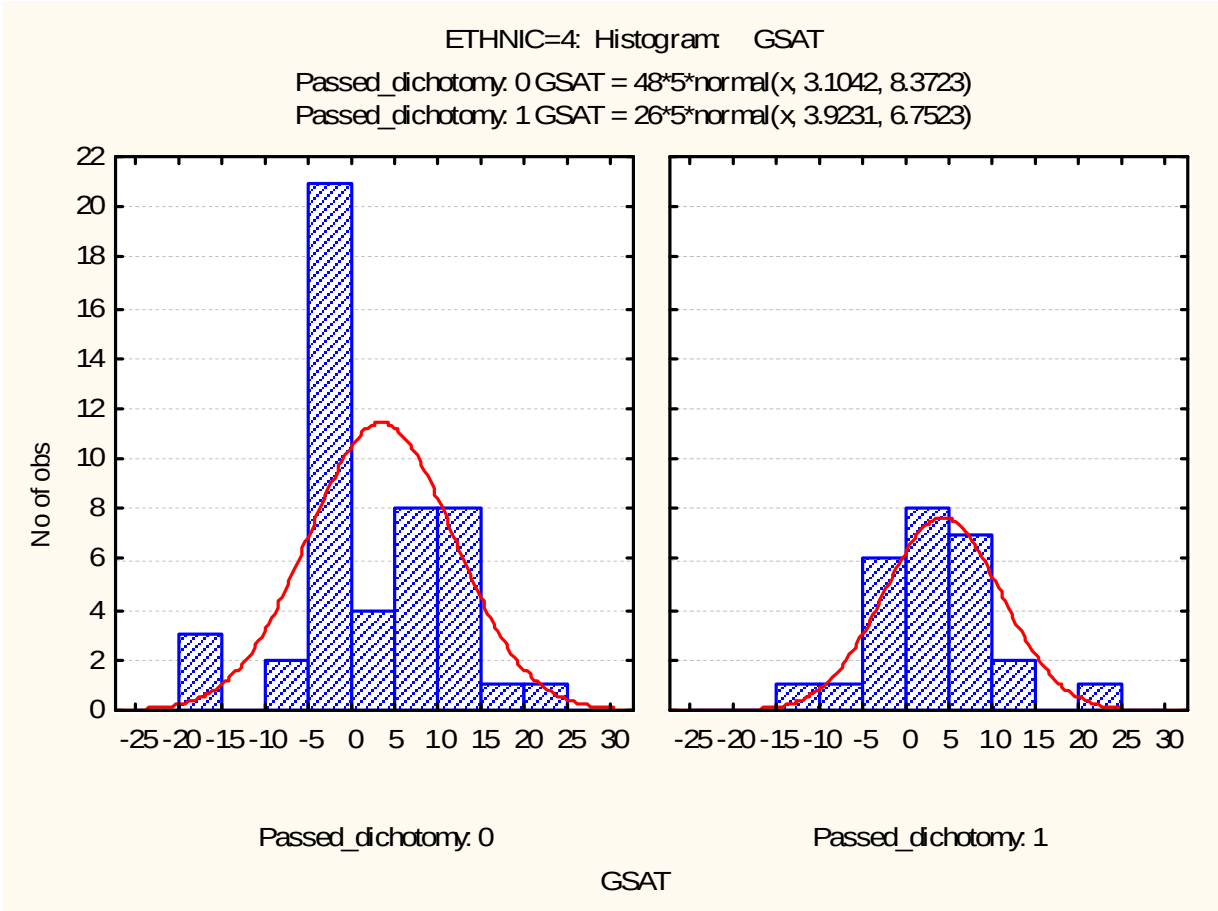
Variable	Levene Test of Homogeneity of Variances (ETHNIC=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	69.58266	4	17.39566	1673.544	69	24.25426	0.717221	0.583035


ETHNIC=4: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
14
12
10
8
6
4
2
0
-2
-4
0
1
2
3
4
Subj Passed
GSAT

ETHNIC=4: Subjects passed dichotomous

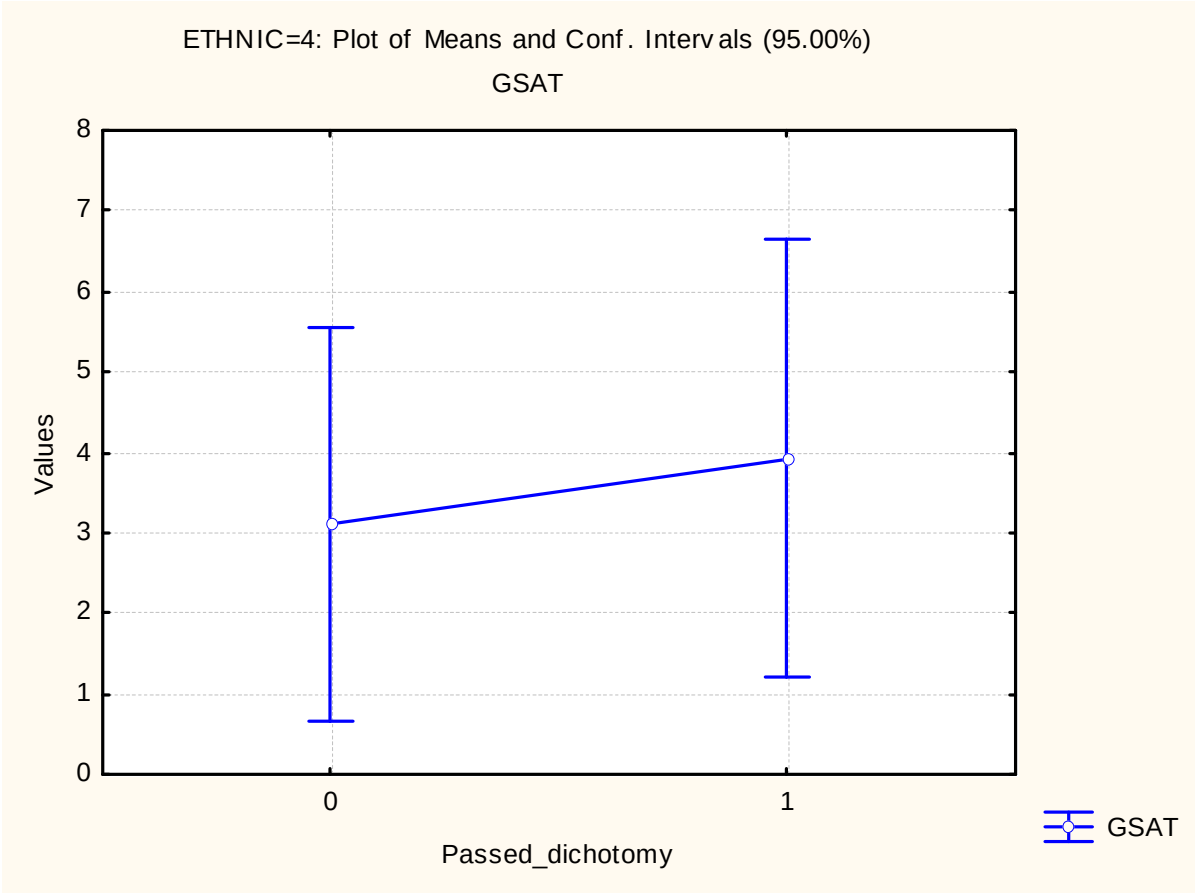
Breakdown Table of Descriptive Statistics (ETHNIC=4) N=74 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	3.104167	48	8.372294
1	3.923077	26	6.752322
All Grps	3.391892	74	7.803788





Variable	Analysis of Variance (ETHNIC=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	11.30981	1	11.30981	4434.325	72	61.58785	0.183637	0.669545

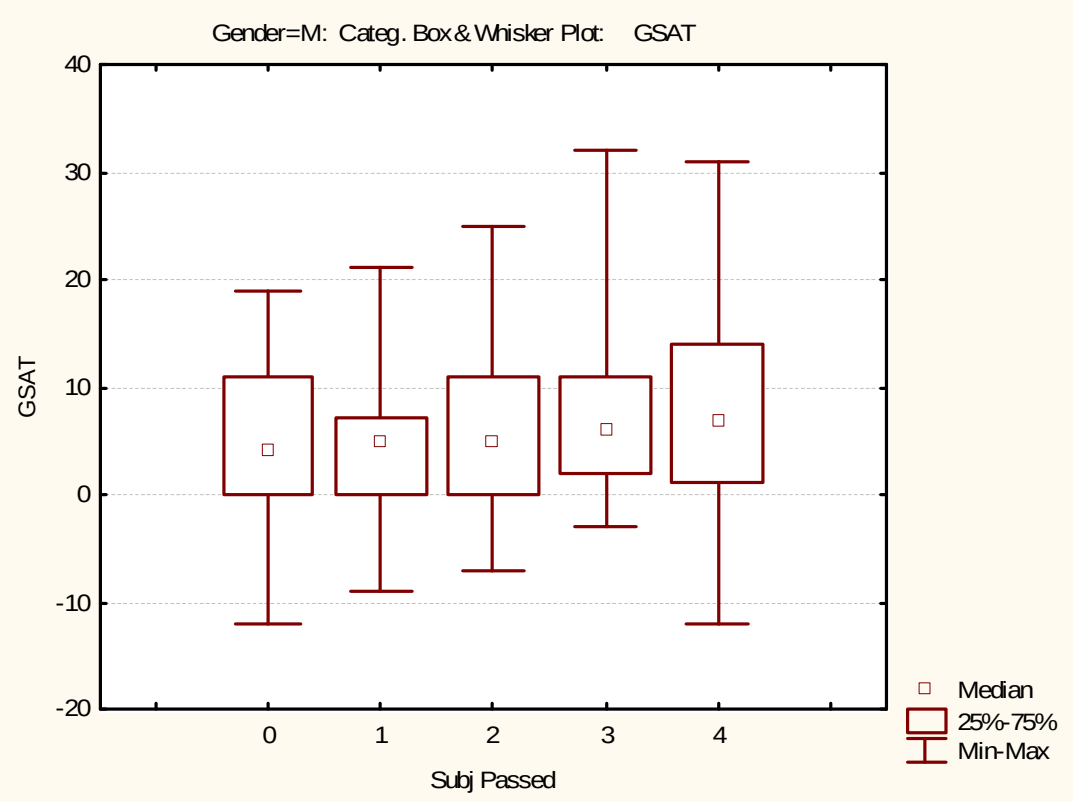
Variable	Levene Test of Homogeneity of Variances (ETHNIC=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	26.95683	1	26.95683	1916.015	72	26.61132	1.012984	0.317560

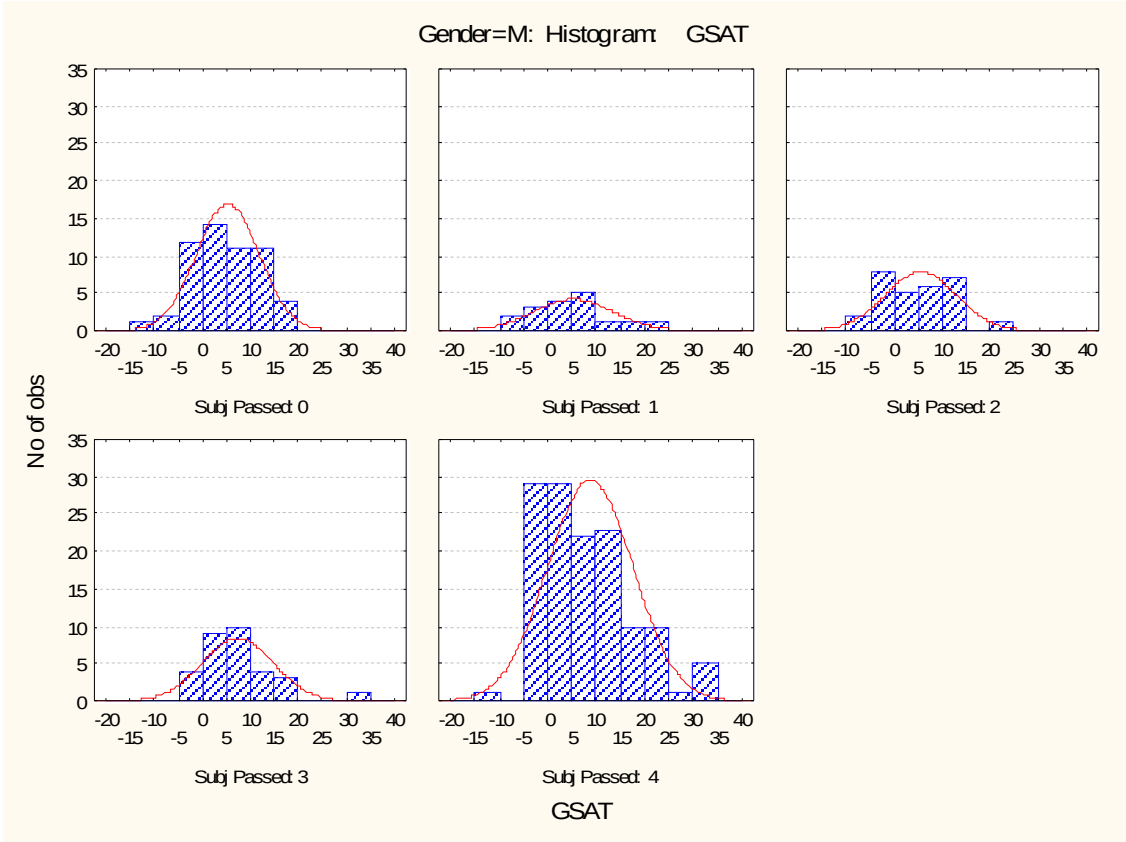

ETHNIC=4: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
8
7
6
5
4
3
2
1
0
0
1
Passed_dichotomy
GSAT

Gender=M: Subjects passed raw

Breakdown Table of Descriptive Statistics (Gender=M)
Smallest N for any variable: 262

Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	5.181818	55	6.481000
1	5.117647	17	8.053589
2	5.379310	29	7.355337
3	7.258065	31	7.316501
4	8.615385	130	8.768676
All Grps	7.148855	262	8.070379

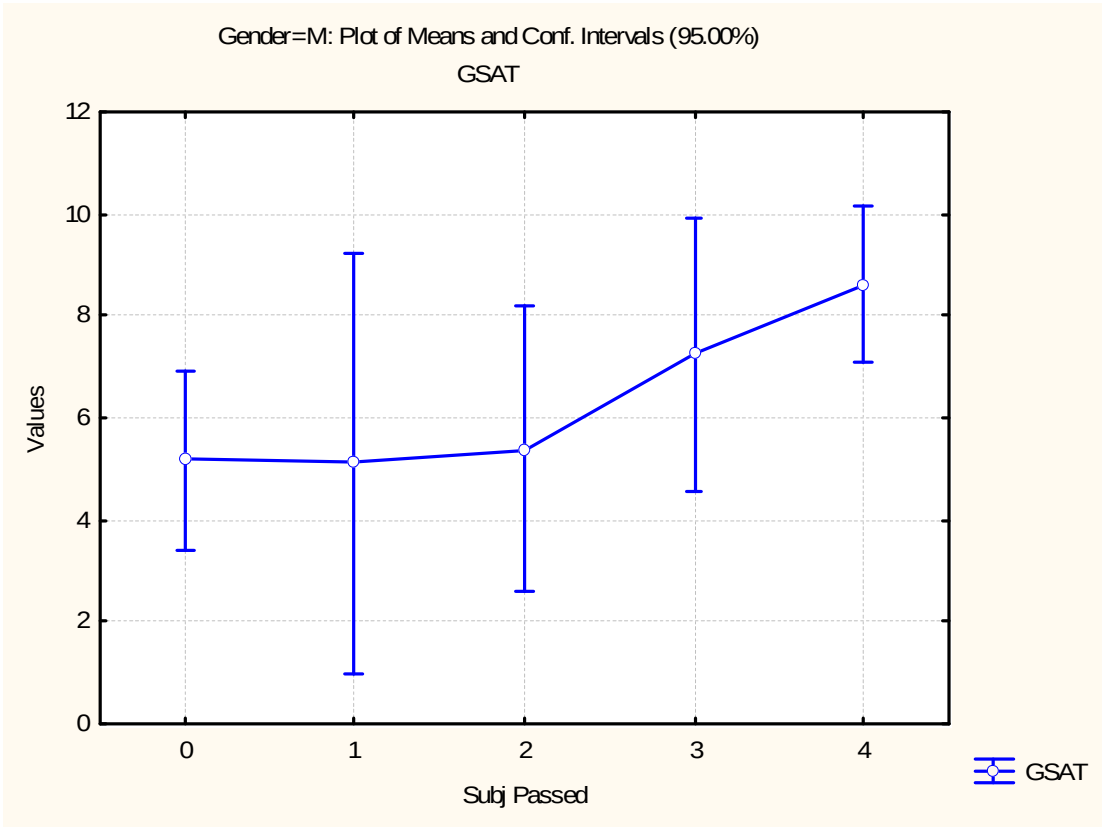




Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	653.7158	4	163.4290	16345.48	257	63.60108	2.569594	0.038500

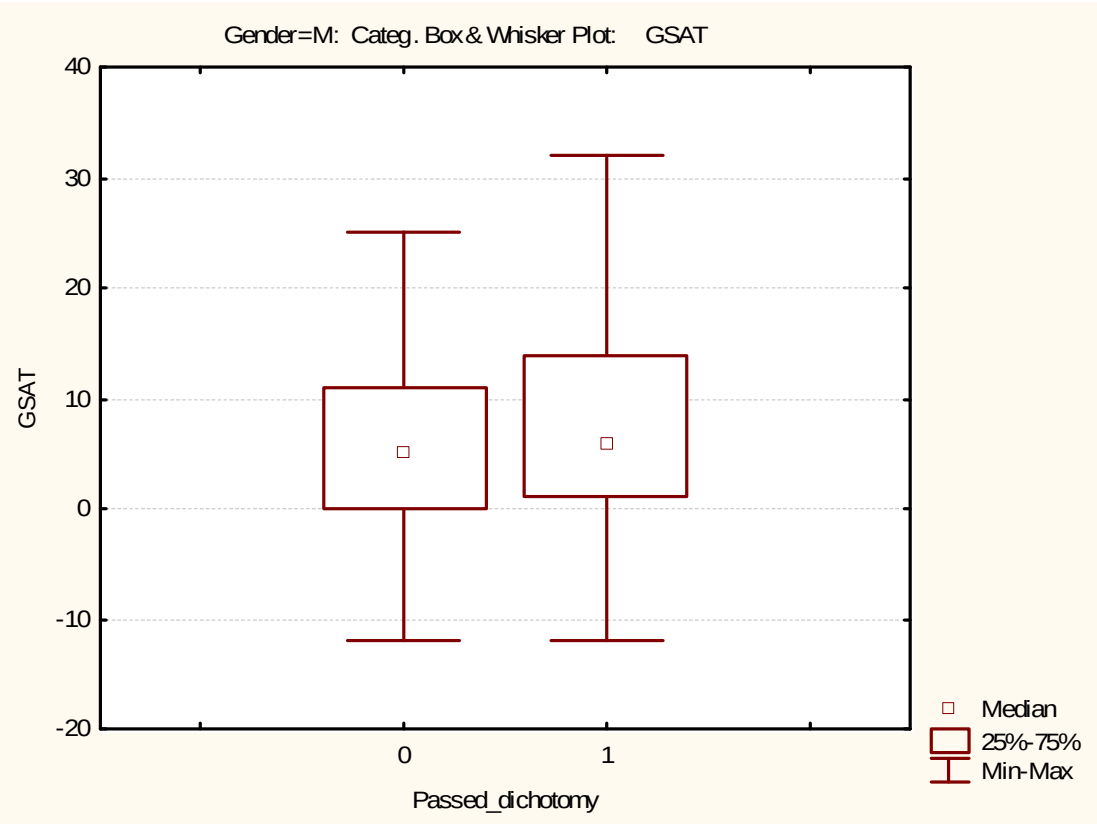
Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	194.2544	4	48.56361	5395.148	257	20.99279	2.313346	0.058029

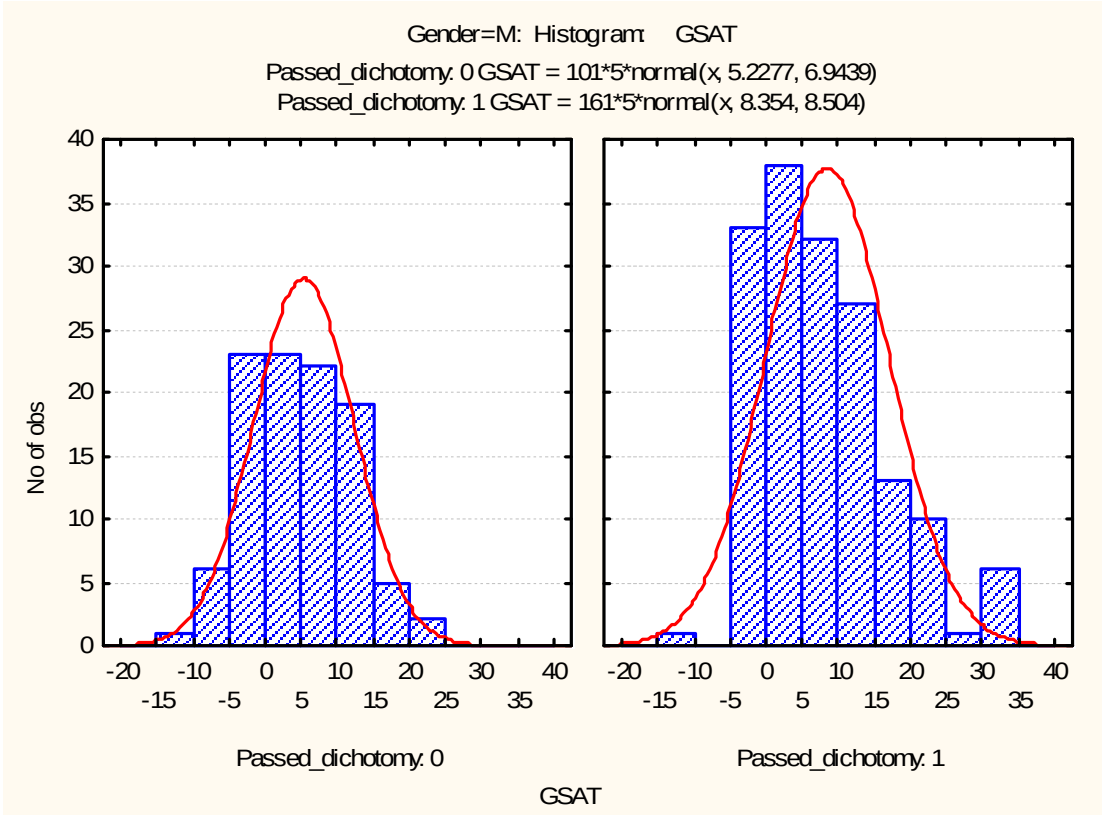
Subj Passed		LSD Test; Variable: GSAT (Gender=M) Marked differences are significant at p < .05000				
		{1} M=5.1818	{2} M=5.1176	{3} M=5.3793	{4} M=7.2581	{5} M=8.6154
0	{1}		0.976890	0.914152	0.247449	0.007916
1	{2}	0.976890		0.914545	0.374671	0.090235
2	{3}	0.914152	0.914545		0.362682	0.049239
3	{4}	0.247449	0.374671	0.362682		0.395279
4	{5}	0.007916	0.090235	0.049239	0.395279	


Gender=M: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
Subj Passed
GSAT
0
1
2
3
4
0
2
4
6
8
10
12

Gender=M: Subjects passed dichotomous

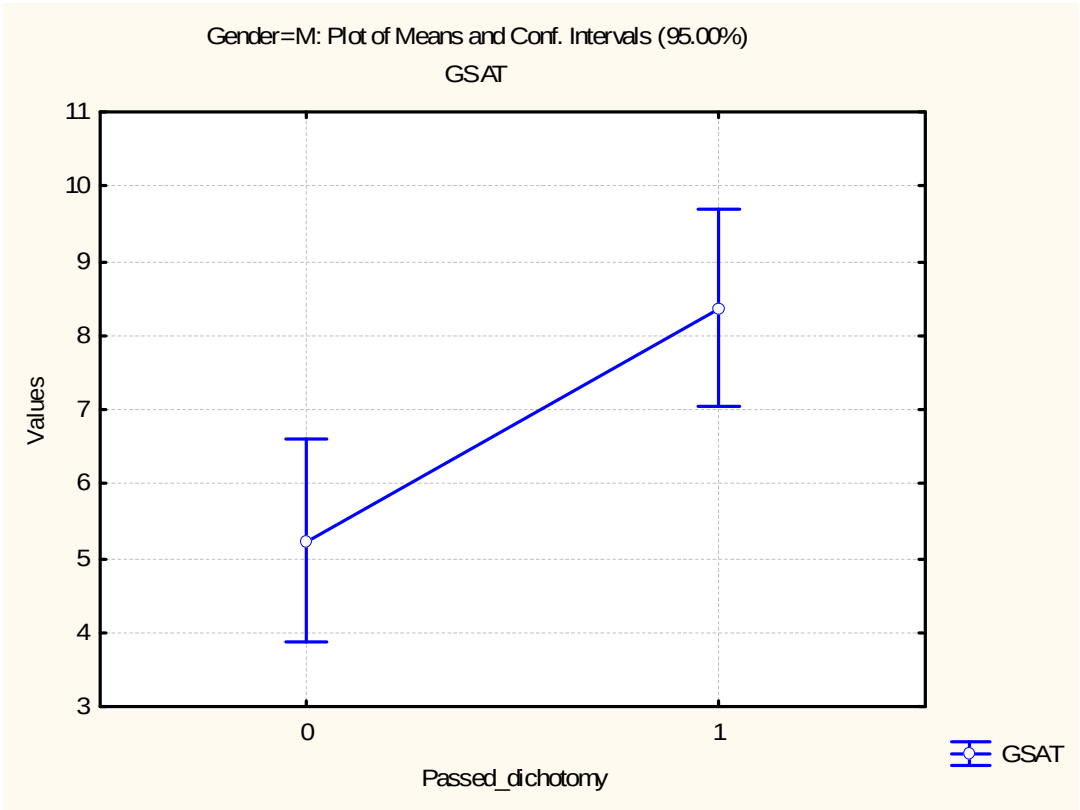
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Gender=M) Smallest N for any variable: 262		
	GSAT Means	GSAT N	GSAT Std.Dev.
0	5.227723	101	6.943891
1	8.354037	161	8.503977
All Grps	7.148855	262	8.070379





Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	606.6124	1	606.6124	16392.58	260	63.04839	9.621378	0.002135

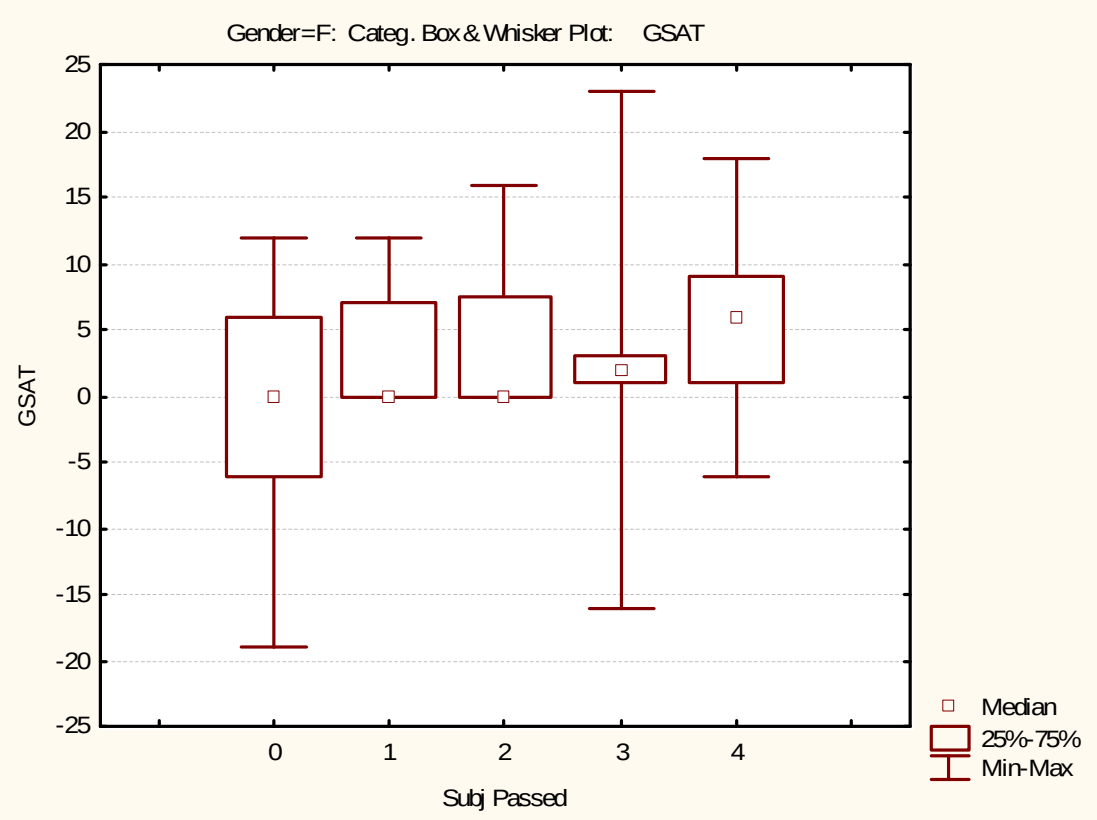
Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	103.6704	1	103.6704	5492.458	260	21.12484	4.907514	0.027607

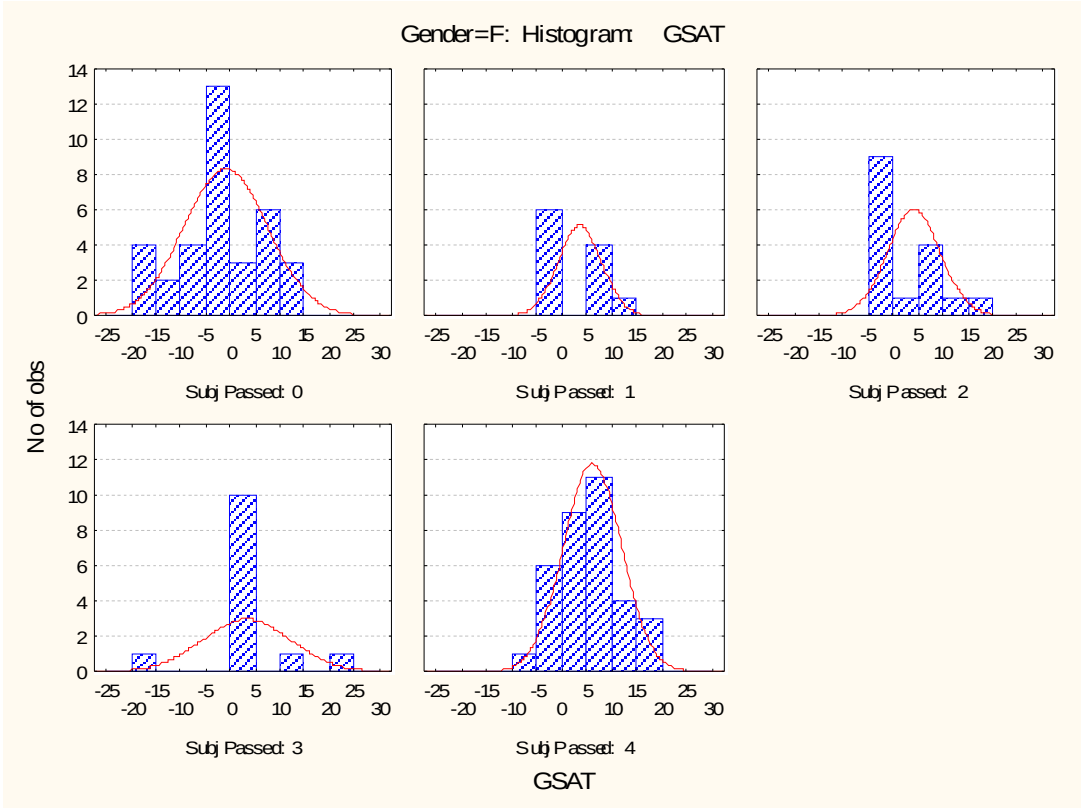

Gender=M: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
11
10
9
8
7
6
5
4
3
0
1
Passed_dichotomy
GSAT

Gender=F: Subjects passed raw

Subj Passed	GSAT Means	GSAT N	GSAT Std.Dev.
0	-1.00000	35	8.391172
1	3.45455	11	4.274661
2	4.00000	16	5.304086
3	3.15385	13	8.764000
4	5.97059	34	5.760289
All Grps	2.85321	109	7.385955

2-Way Tables of Descriptive Statistics (Gender=F)
N=109 (No missing data in dep. var. list)

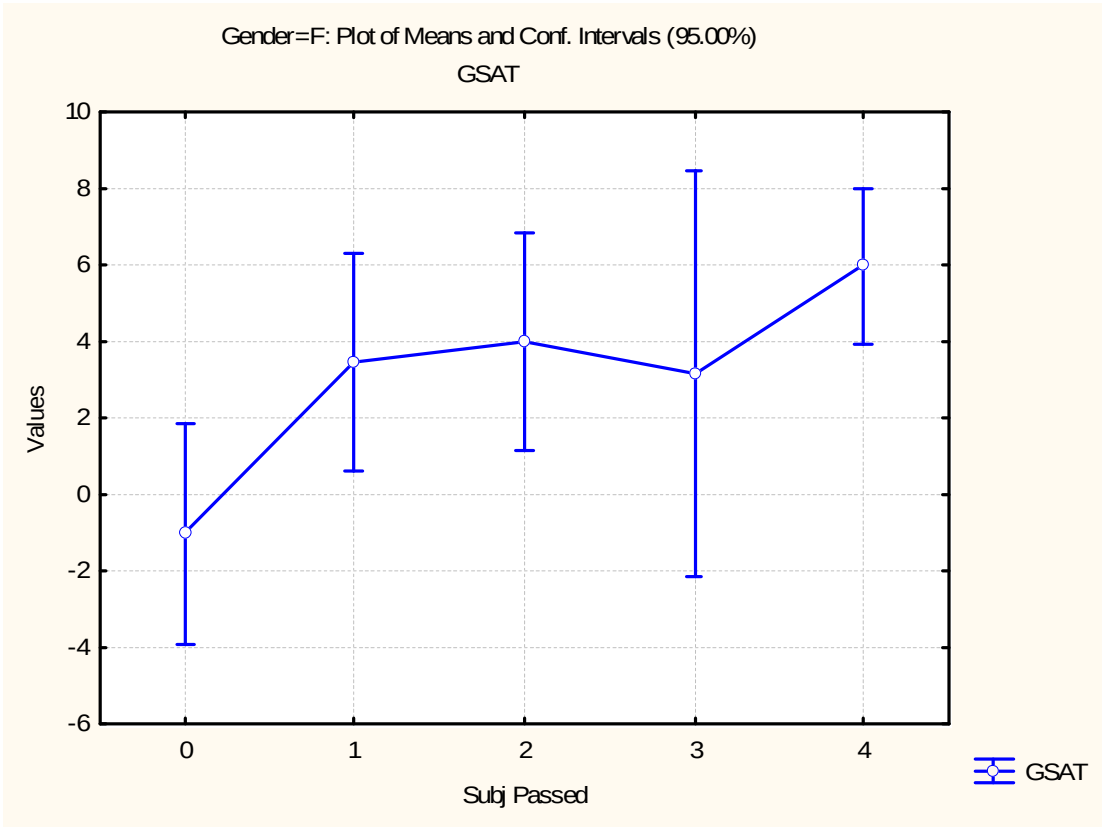




Variable	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	876.2612	4	219.0653	5015.390	104	48.22491	4.542576	0.002017

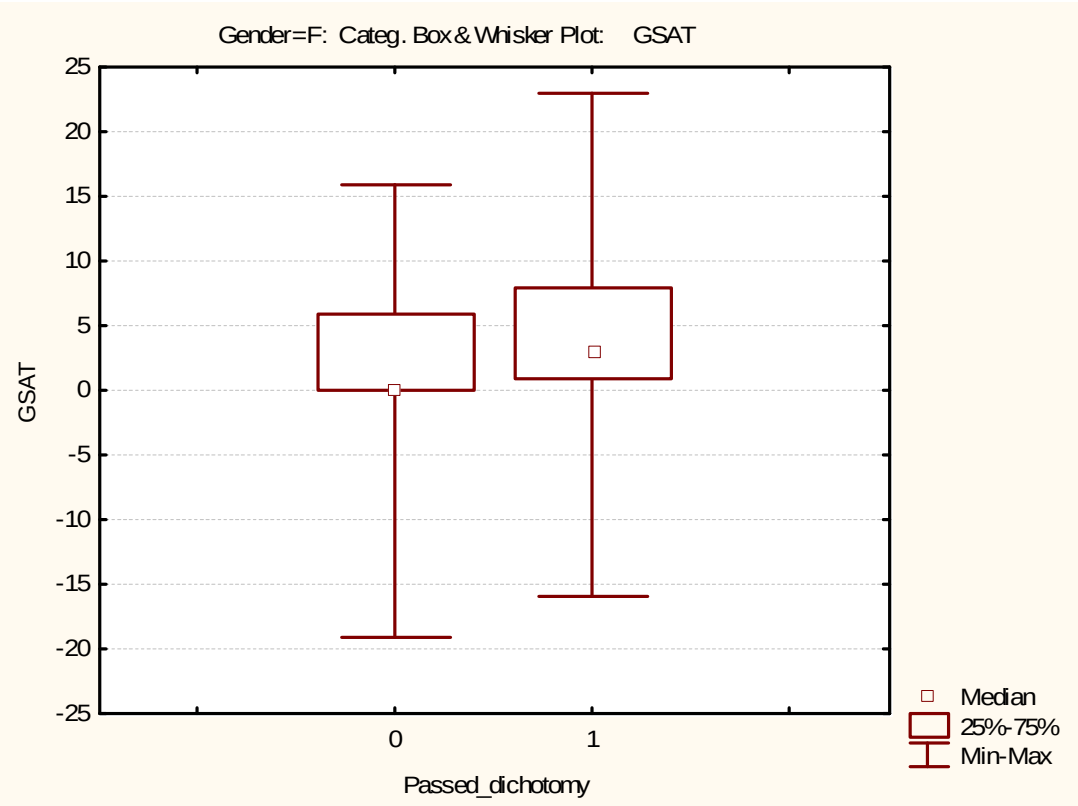
Variable	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	94.32686	4	23.58172	2146.863	104	20.64292	1.142364	0.340825

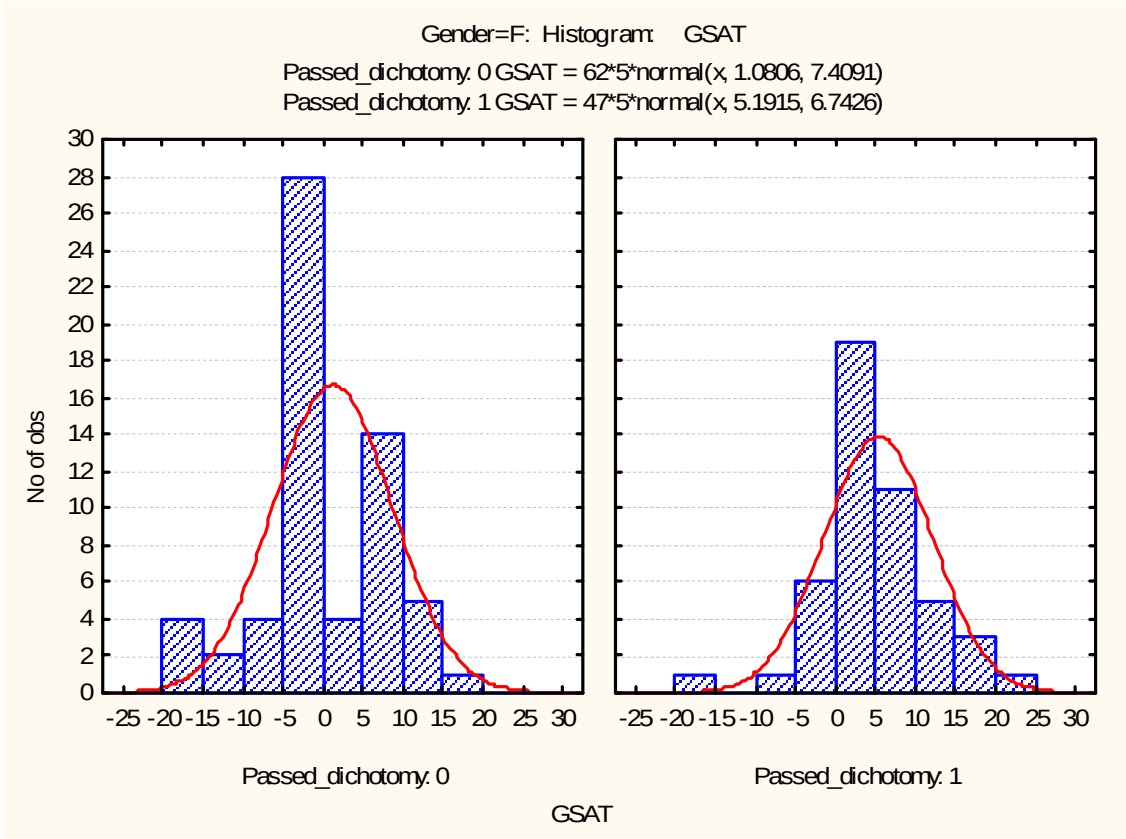
Subj Passed		LSD Test; Variable: GSAT (Gender=F) Marked differences are significant at p < .05000				
		{1} M=-1.000	{2} M=3.4545	{3} M=4.0000	{4} M=3.1538	{5} M=5.9706
0	{1}		0.066321	0.018849	0.068381	0.000064
1	{2}	0.066321		0.841451	0.916027	0.298672
2	{3}	0.018849	0.841451		0.744837	0.351443
3	{4}	0.068381	0.916027	0.744837		0.216345
4	{5}	0.000064	0.298672	0.351443	0.216345	


Gender=F: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
10
8
6
4
2
0
-2
-4
-6
0
1
2
3
4
Subj Passed
GSAT

Gender=F: Subjects passed dichotomous

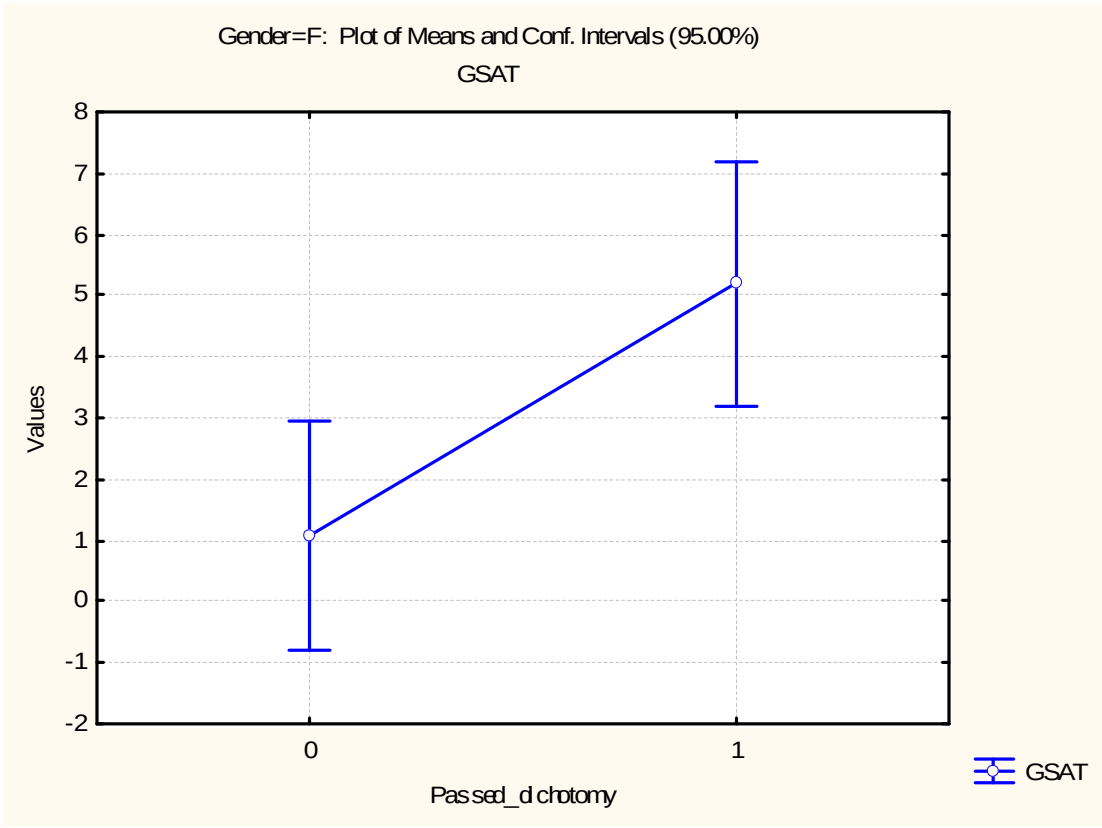
Breakdown Table of Descriptive Statistics (Gender=F) N=109 (No missing data in dep. var. list)			
Passed_dichotomy	GSAT Means	GSAT N	GSAT Std.Dev.
0	1.080645	62	7.409118
1	5.191489	47	6.742591
All Grps	2.853211	109	7.385955





Variable	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	451.7780	1	451.7780	5439.873	107	50.83994	8.886282	0.003557

Variable	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
GSAT	3.114063	1	3.114063	2511.916	107	23.47585	0.132650	0.716419

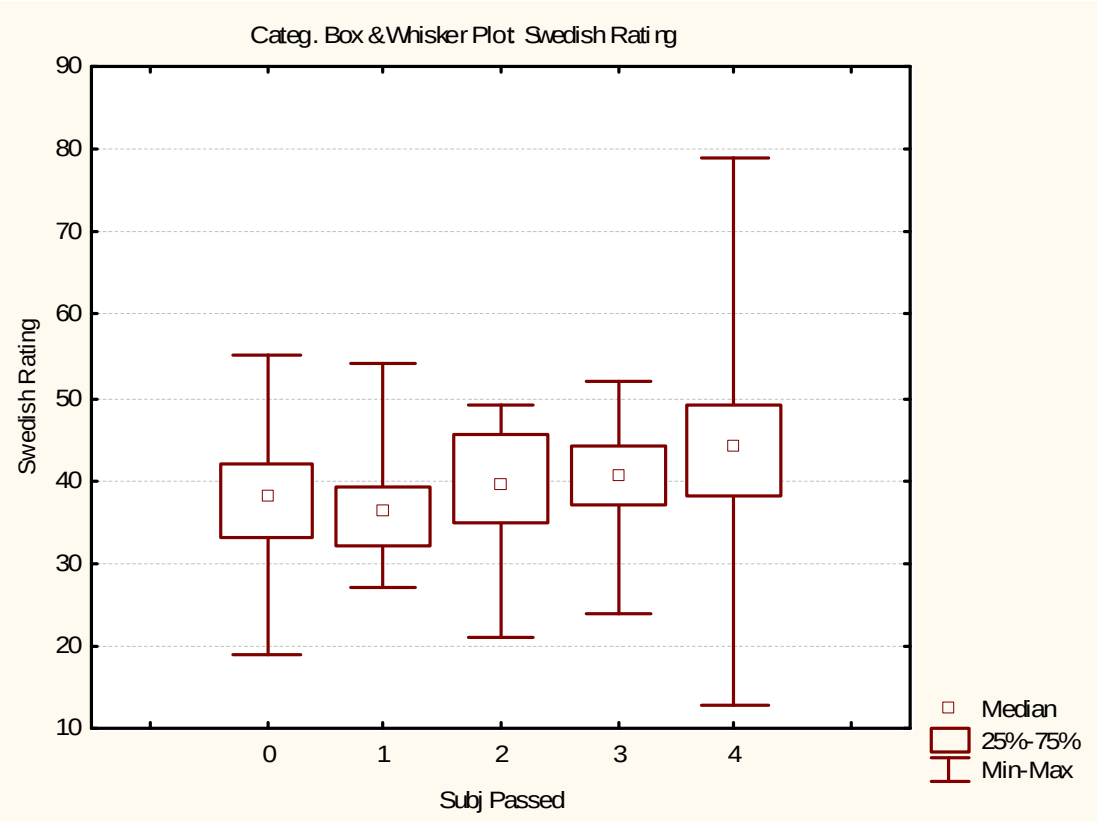

Gender=F: Plot of Means and Conf. Intervals (95.00%)
GSAT
Values
8
7
6
5
4
3
2
1
0
-1
-2
0
1
Passed_dichotomy
GSAT

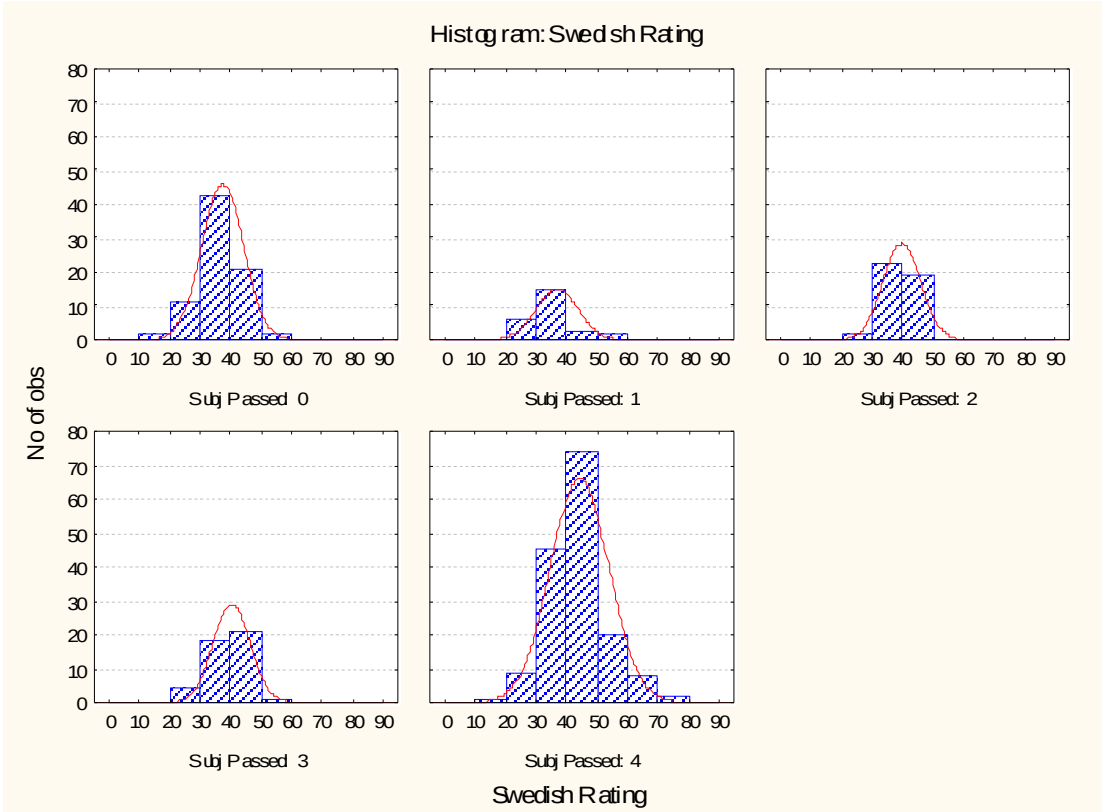
ANNEXURE 2

Analysis of Swedish Rating data

The relationship between Swedish Rating and the number of subjects passed (original variable).

Subj Passed	2-Way Tables of Descriptive Statistics Smallest N for any variable: 352 Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.11392	79	6.885487
1	36.65385	26	6.939408
2	39.56818	44	6.196014
3	40.11364	44	6.047163
4	44.05031	159	9.562452
All Grps	40.89489	352	8.582947

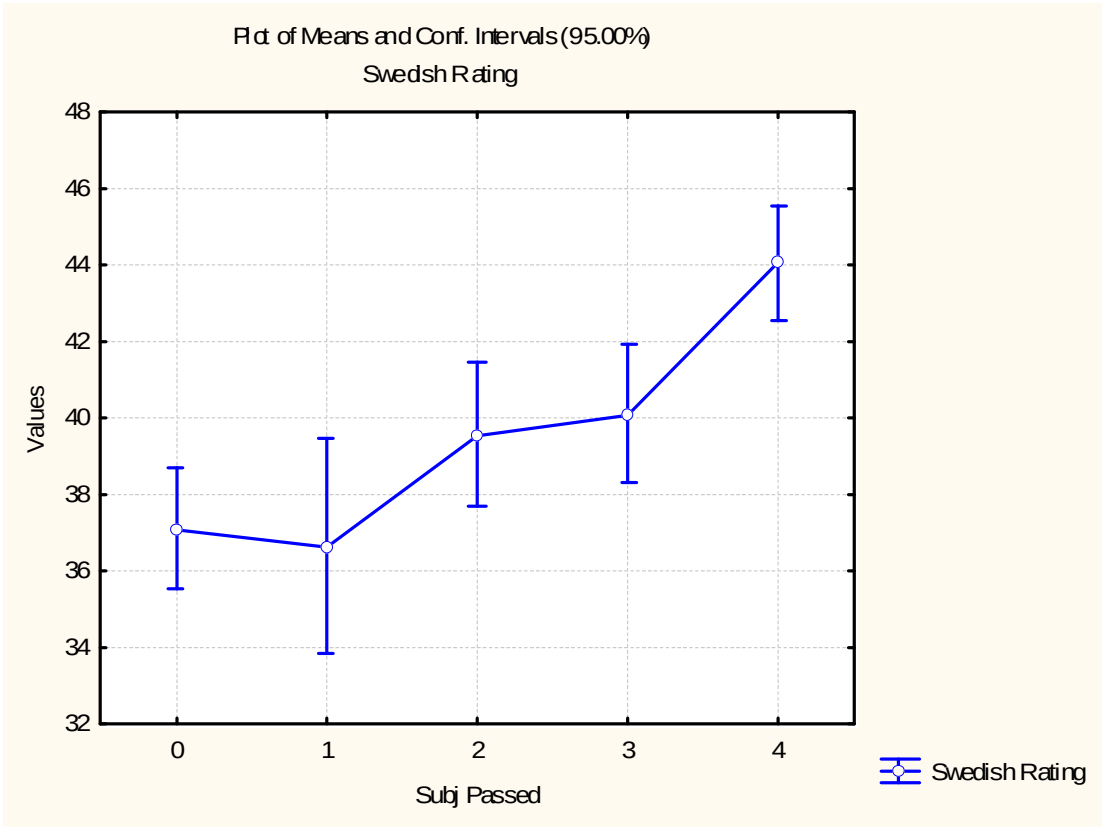




Variable	Analysis of Variance Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	3284.427	4	821.1067	22572.68	347	65.05096	12.62251	0.000000

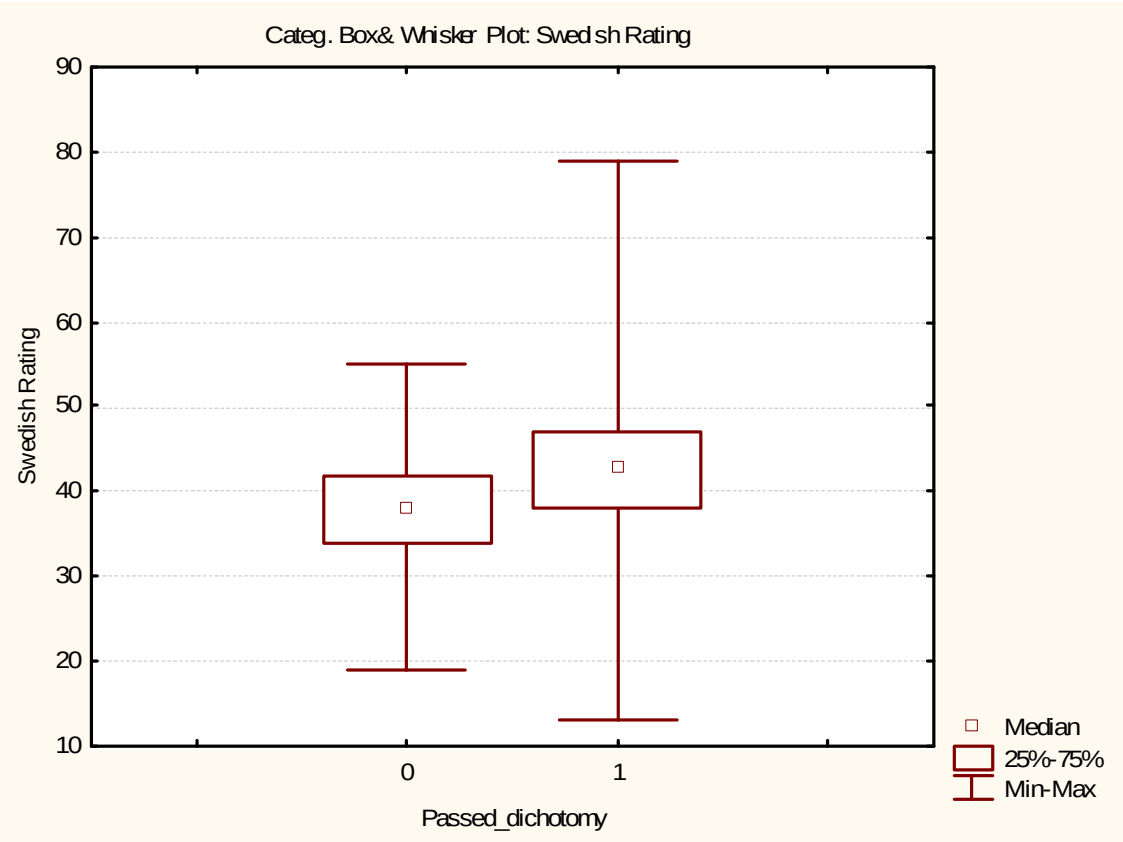
Variable	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	331.4939	4	82.87348	9929.834	347	28.61624	2.896030	0.022156

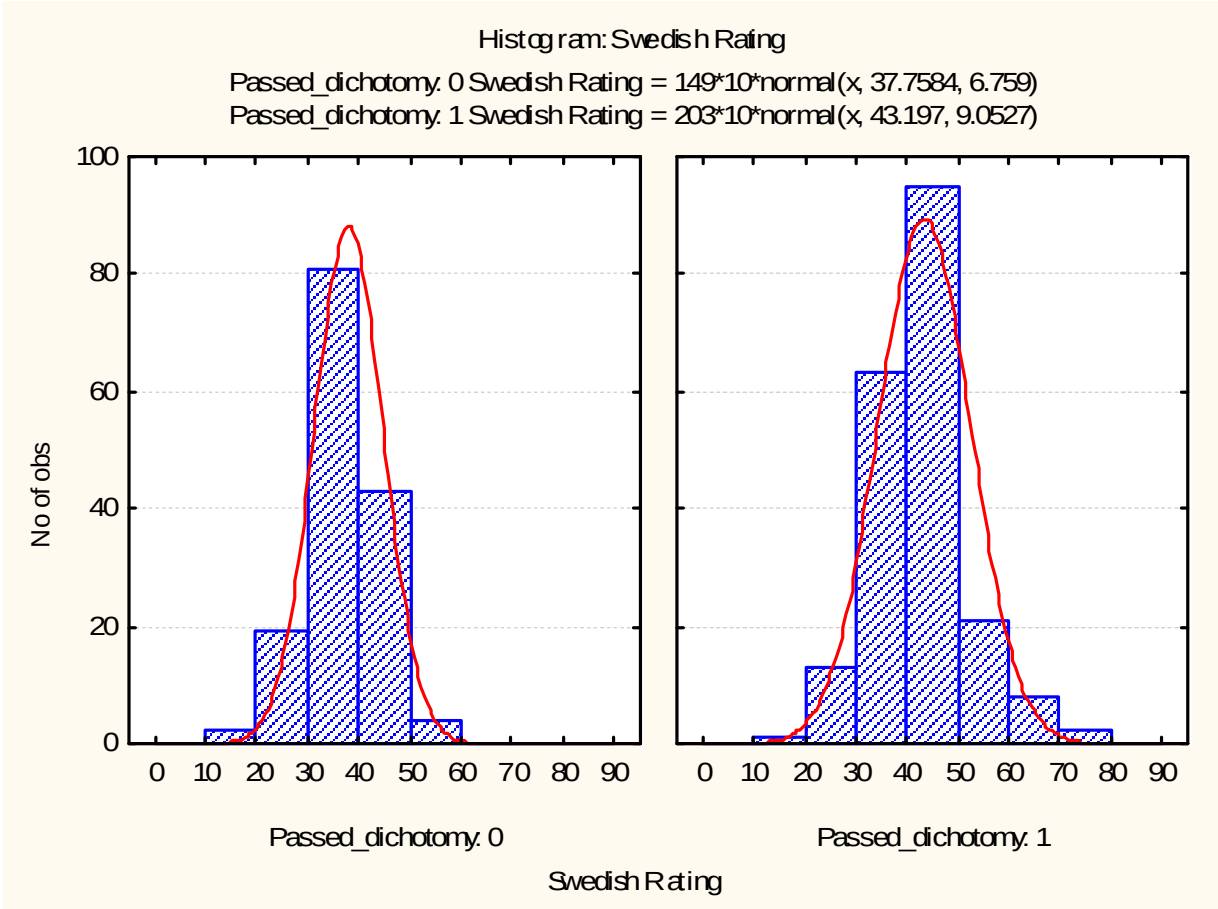
Subj Passed		LSD Test; Variable: Swedish Rating Marked differences are significant at p < .05000				
		{1} M=37.114	{2} M=36.654	{3} M=39.568	{4} M=40.114	{5} M=44.050
0	{1}		0.800962	0.106650	0.048816	0.000000
1	{2}	0.800962		0.144988	0.083779	0.000019
2	{3}	0.106650	0.144988		0.751277	0.001215
3	{4}	0.048816	0.083779	0.751277		0.004419
4	{5}	0.000000	0.000019	0.001215	0.004419	


Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
Values
48
46
44
42
40
38
36
34
32
0
1
2
3
4
Subj Passed
Swedish Rating

Subjects passed dichotomous

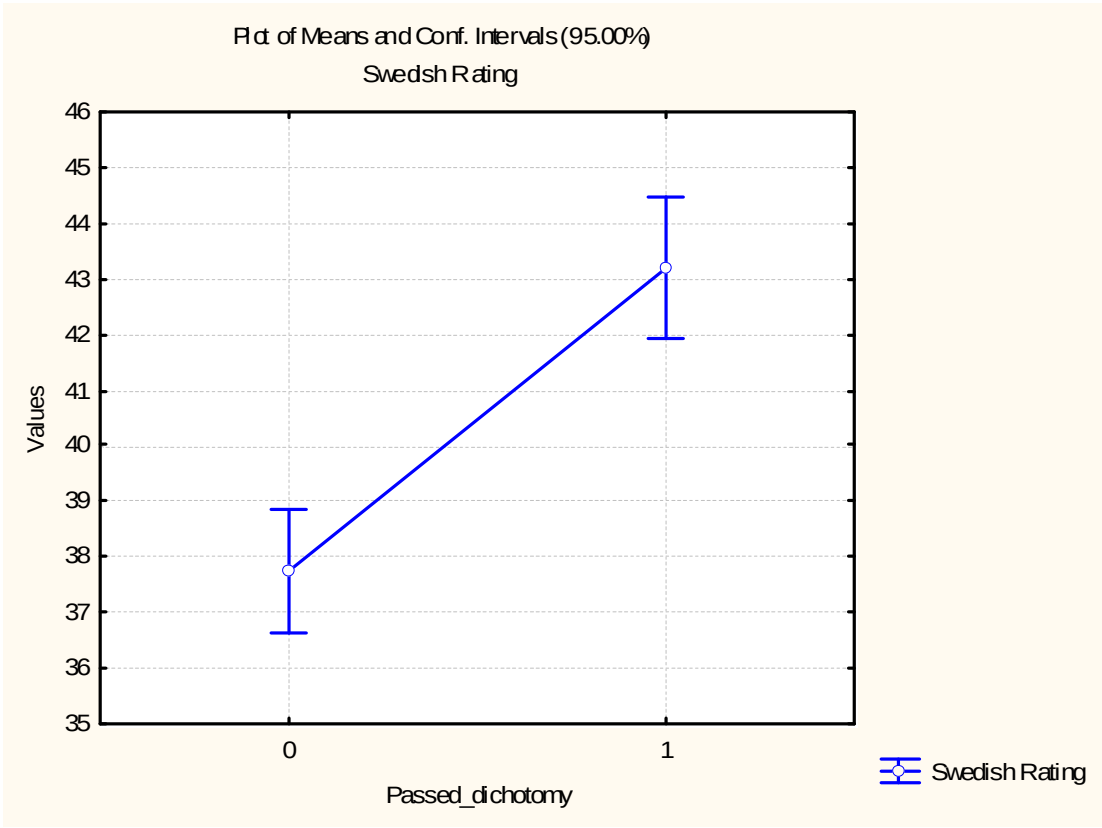
Passed_dichotomy	2-Way Tables of Descriptive Statistics Smallest N for any variable: 352 Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.75839	149	6.759029
1	43.19704	203	9.052684
All Grps	40.89489	352	8.582947





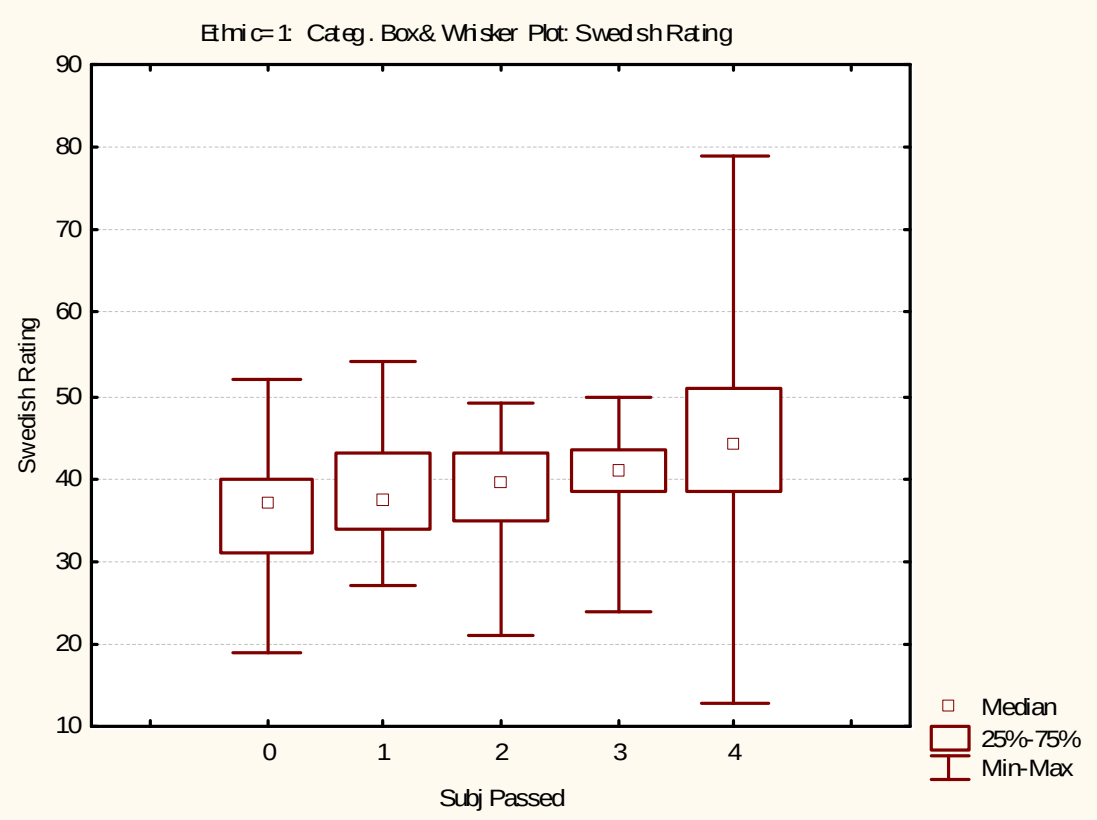
Variable	Analysis of Variance Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2541.691	1	2541.691	23315.42	350	66.61549	38.15465	0.000000

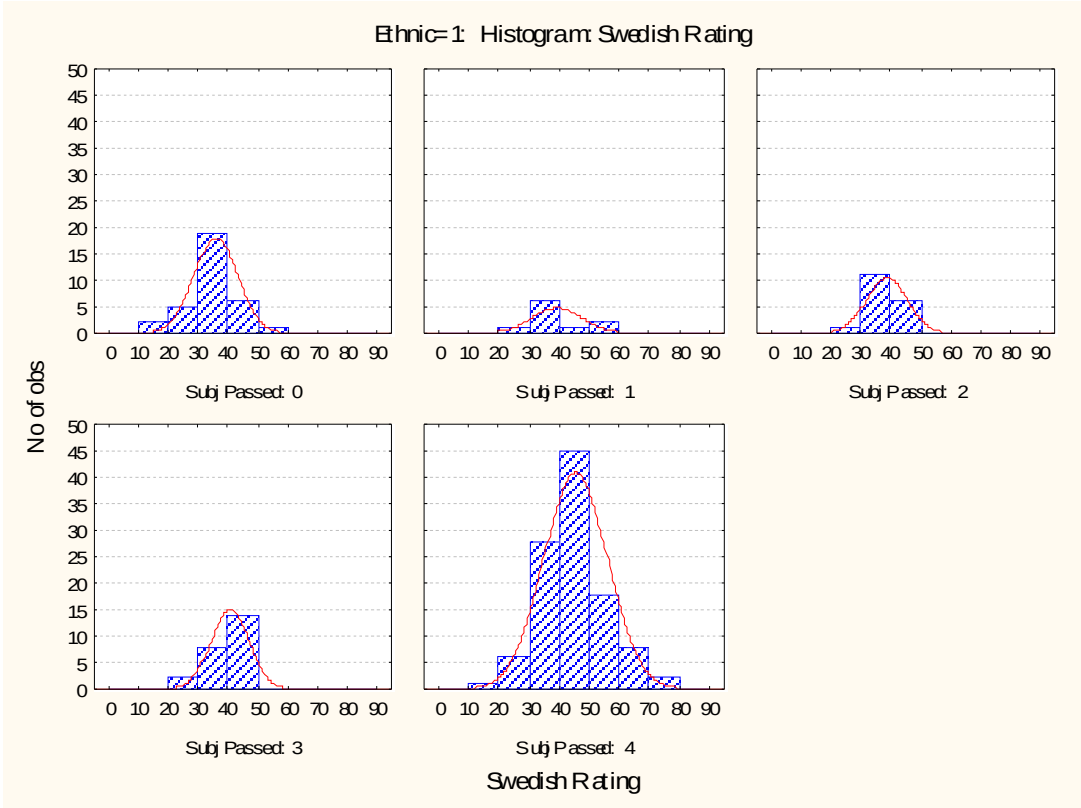
Variable	Levene Test of Homogeneity of Variances Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	165.7571	1	165.7571	10477.57	350	29.93592	5.537062	0.019171


Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
Values
46
45
44
43
42
41
40
39
38
37
36
35
0
1
Passed_dichotomy
Swedish Rating

Ethnic=1: Subjects passed raw

Subj Passed	2-Way Tables of Descriptive Statistics (Ethnic=1) Smallest N for any variable: 193		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	35.78788	33	7.28336
1	39.10000	10	8.33267
2	38.50000	18	6.84492
3	40.54167	24	6.37917
4	45.25000	108	10.52822
All Grps	42.09845	193	9.86448

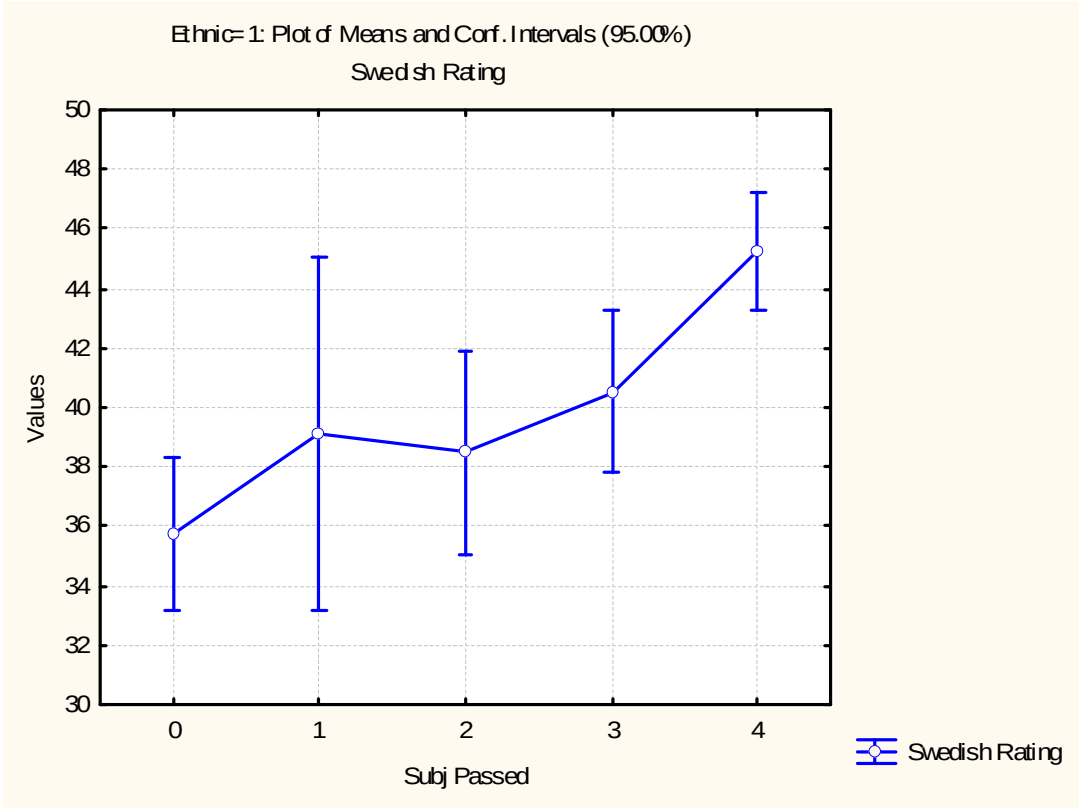




Variable	Analysis of Variance (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2768.006	4	692.0015	15915.12	188	84.65491	8.174381	0.000004

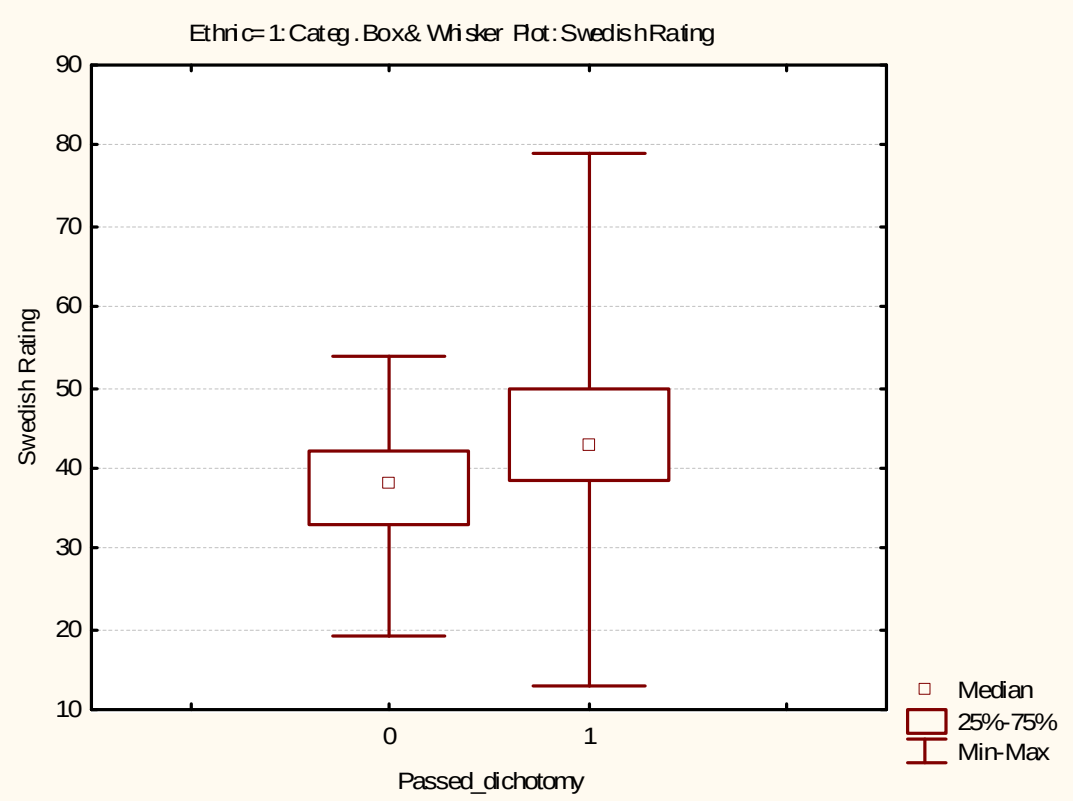
Variable	Levene Test of Homogeneity of Variances (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	361.9752	4	90.49379	6815.603	188	36.25321	2.496159	0.044303

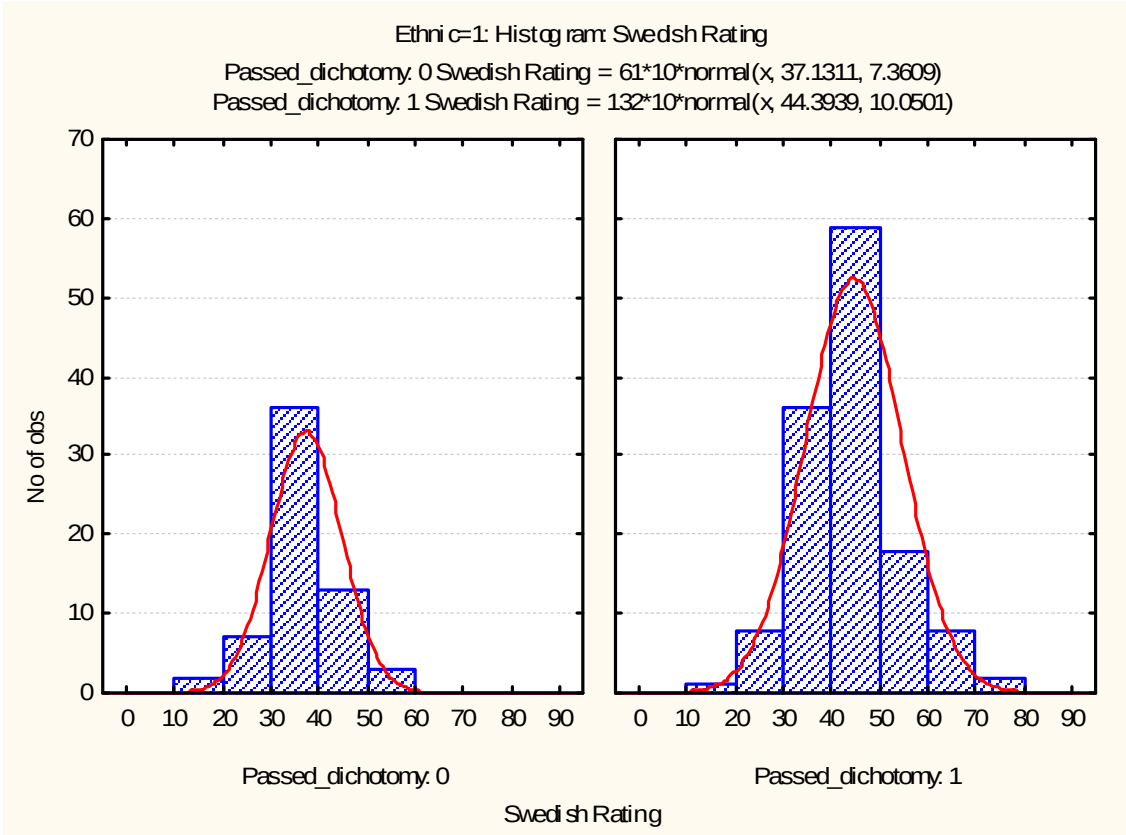
Subj Passed		LSD Test; Variable: Swedish Rating (Ethnic=1) Marked differences are significant at p < .05000				
		{1} M=35.788	{2} M=39.100	{3} M=38.500	{4} M=40.542	{5} M=45.250
0	{1}		0.319926	0.315716	0.055623	0.000001
1	{2}	0.319926		0.868853	0.677666	0.044575
2	{3}	0.315716	0.868853		0.477554	0.004416
3	{4}	0.055623	0.677666	0.477554		0.024490
4	{5}	0.000001	0.044575	0.004416	0.024490	


Ethnic=1: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
50
48
46
44
42
40
38
36
34
32
30
Values
0
1
2
3
4
Subj Passed
Swedish Rating

Ethnic=1: Subjects passed dichotomous

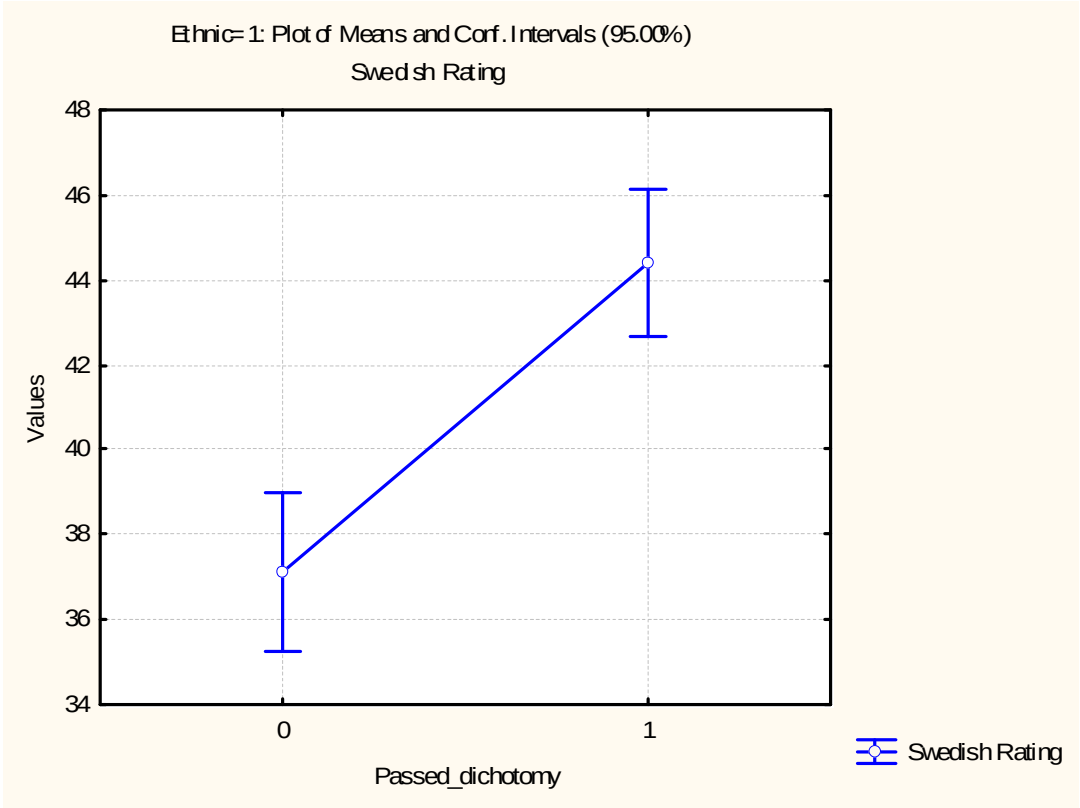
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Ethnic=1) Smallest N for any variable: 193		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.13115	61	7.36088
1	44.39394	132	10.05007
All Grps	42.09845	193	9.86448





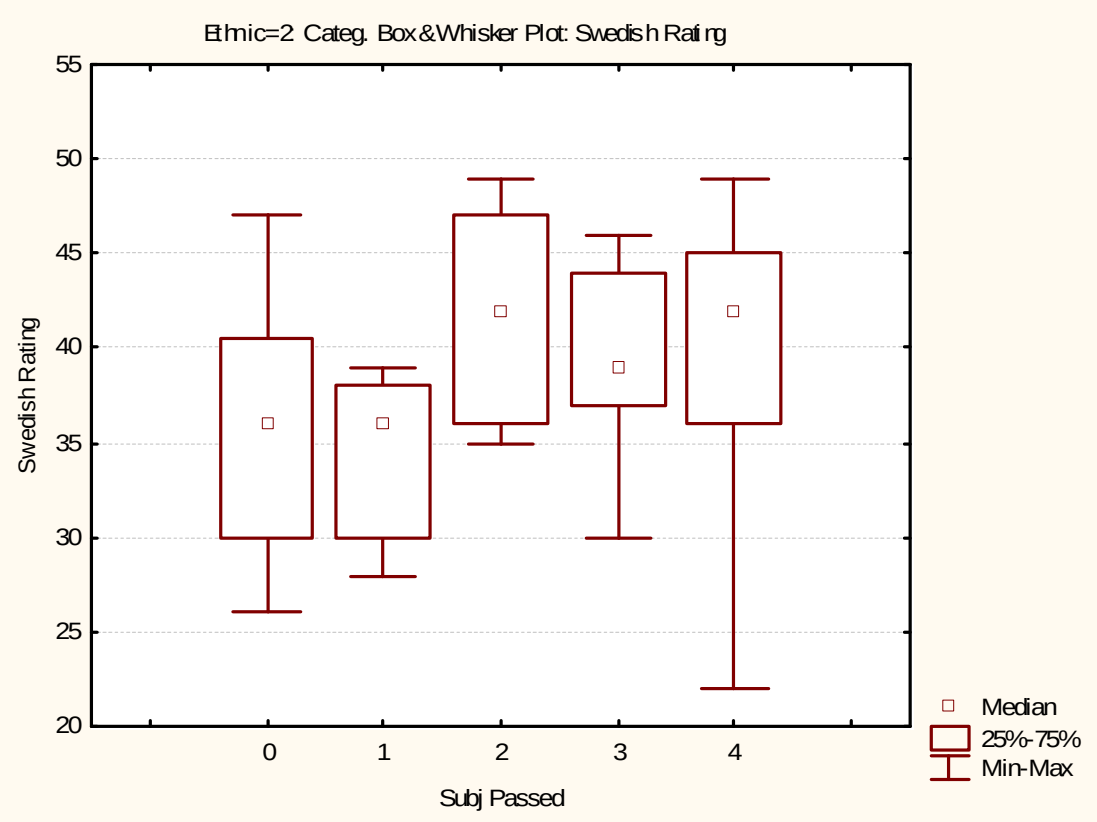
Variable	Analysis of Variance (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2200.664	1	2200.664	16482.47	191	86.29563	25.50145	0.000001

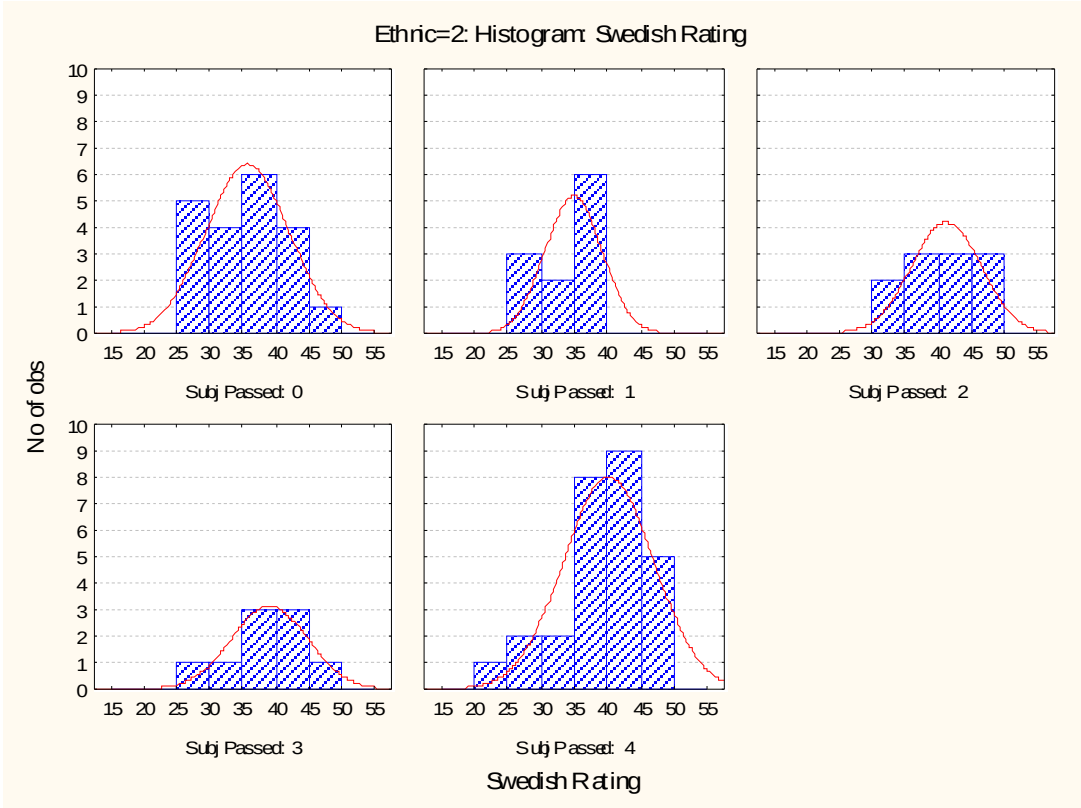
Variable	Levene Test of Homogeneity of Variances (Ethnic=1) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	154.8341	1	154.8341	7341.191	191	38.43556	4.028407	0.046150


Ethnic=1: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
48
46
44
42
40
38
36
34
Values
0
1
Passed_dichotomy
Swedish Rating

Ethnic=2: Subjects passed raw

Subj Passed	2-Way Tables of Descriptive Statistics (Ethnic=2) Smallest N for any variable: 78		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	35.60000	20	6.235721
1	34.81818	11	4.214693
2	41.00000	11	5.234501
3	38.88889	9	5.710614
4	40.03704	27	6.728135
All Grps	38.16667	78	6.315137

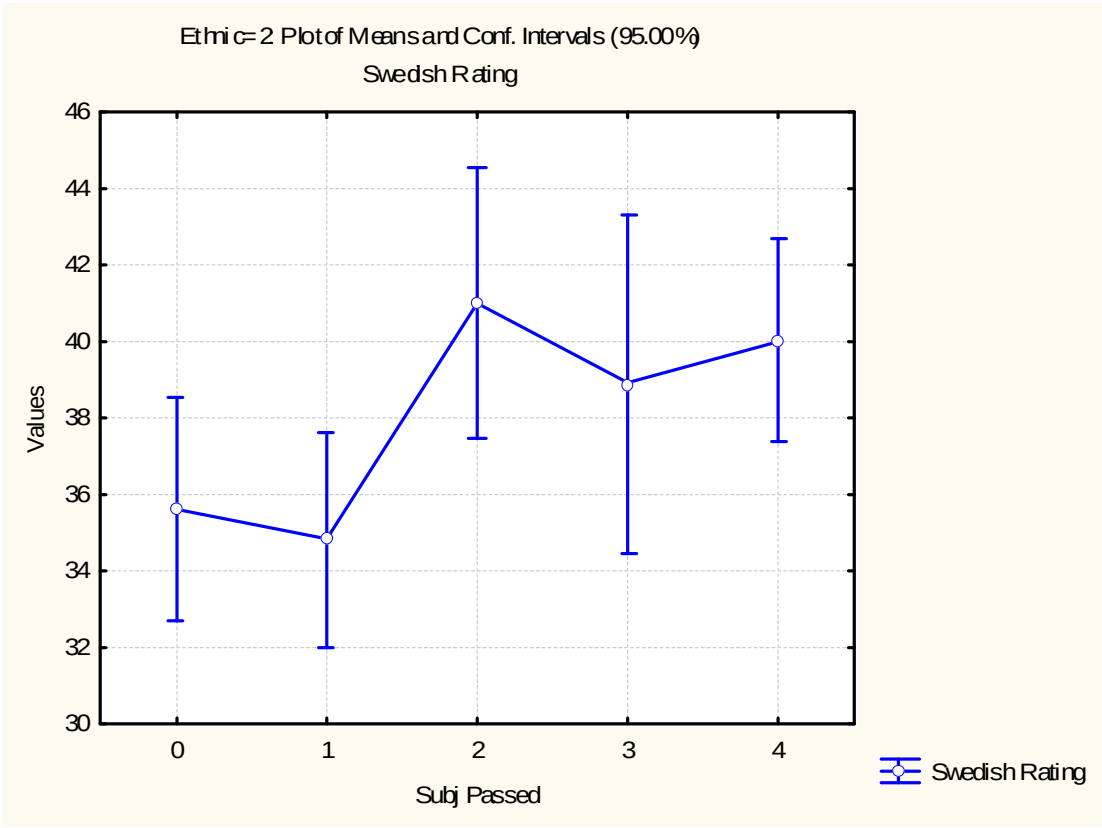




Variable	Analysis of Variance (Ethnic=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	442.5451	4	110.6363	2628.288	73	36.00395	3.072893	0.021369

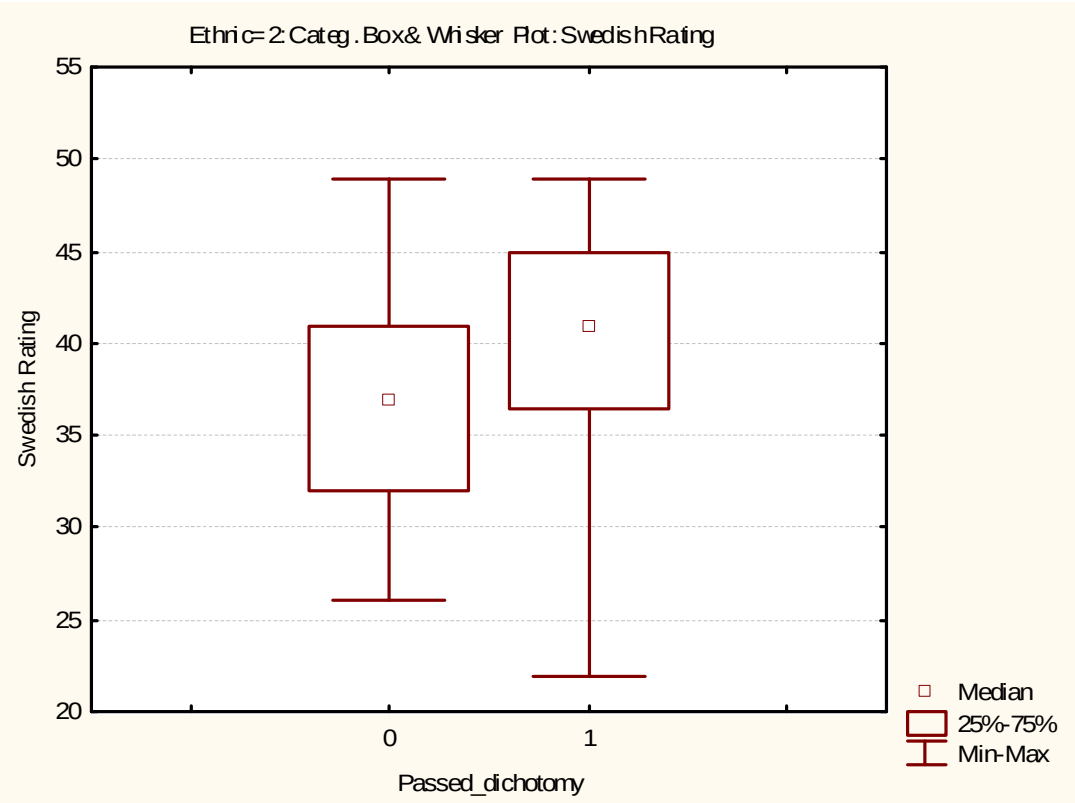
Variable	Levene Test of Homogeneity of Variances (Ethnic=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	42.16196	4	10.54049	736.9564	73	10.09529	1.044099	0.390495

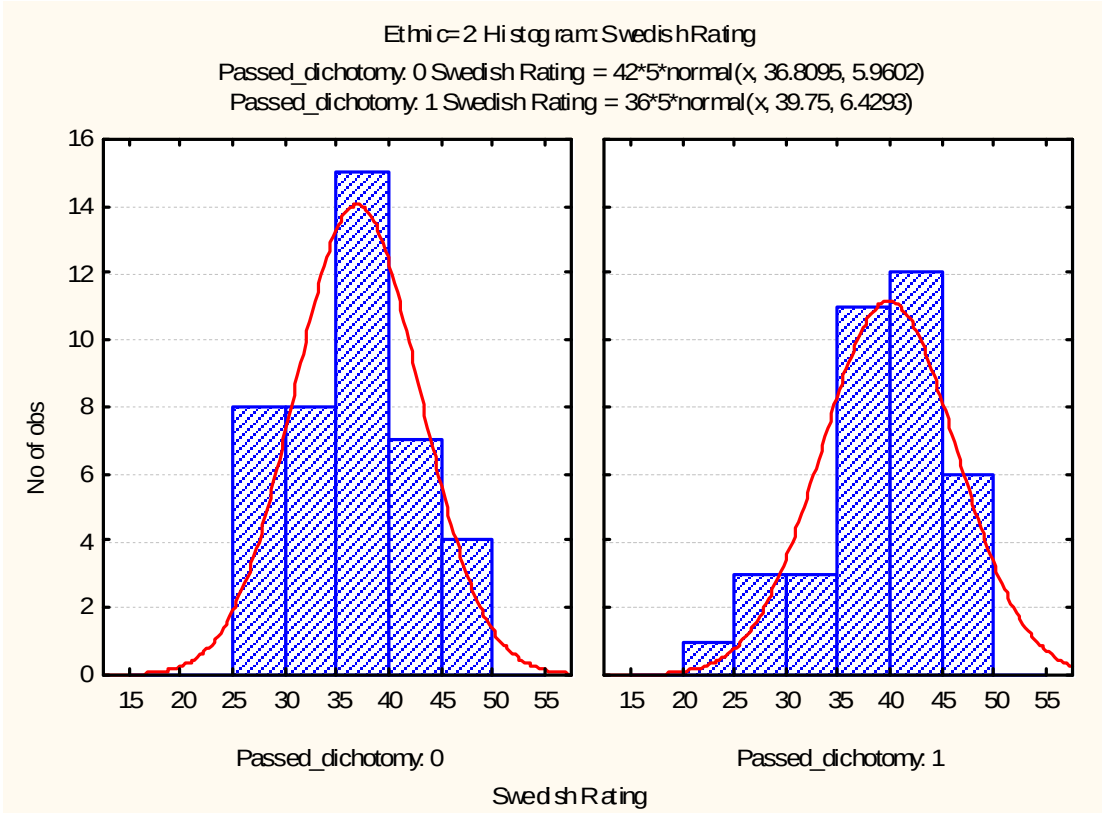
Subj Passed		LSD Test; Variable: Swedish Rating (Ethnic=2) Marked differences are significant at p < .05000				
		{1} M=35.600	{2} M=34.818	{3} M=41.000	{4} M=38.889	{5} M=40.037
0	{1}		0.729511	0.019069	0.176270	0.014421
1	{2}	0.729511		0.018188	0.135519	0.017488
2	{3}	0.019069	0.018188		0.436290	0.655003
3	{4}	0.176270	0.135519	0.436290		0.620588
4	{5}	0.014421	0.017488	0.655003	0.620588	


Ethnic=2 Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
Values
46
44
42
40
38
36
34
32
30
0
1
2
3
4
Subj Passed
Swedish Rating

Ethnic=2: Subjects passed dichotomous

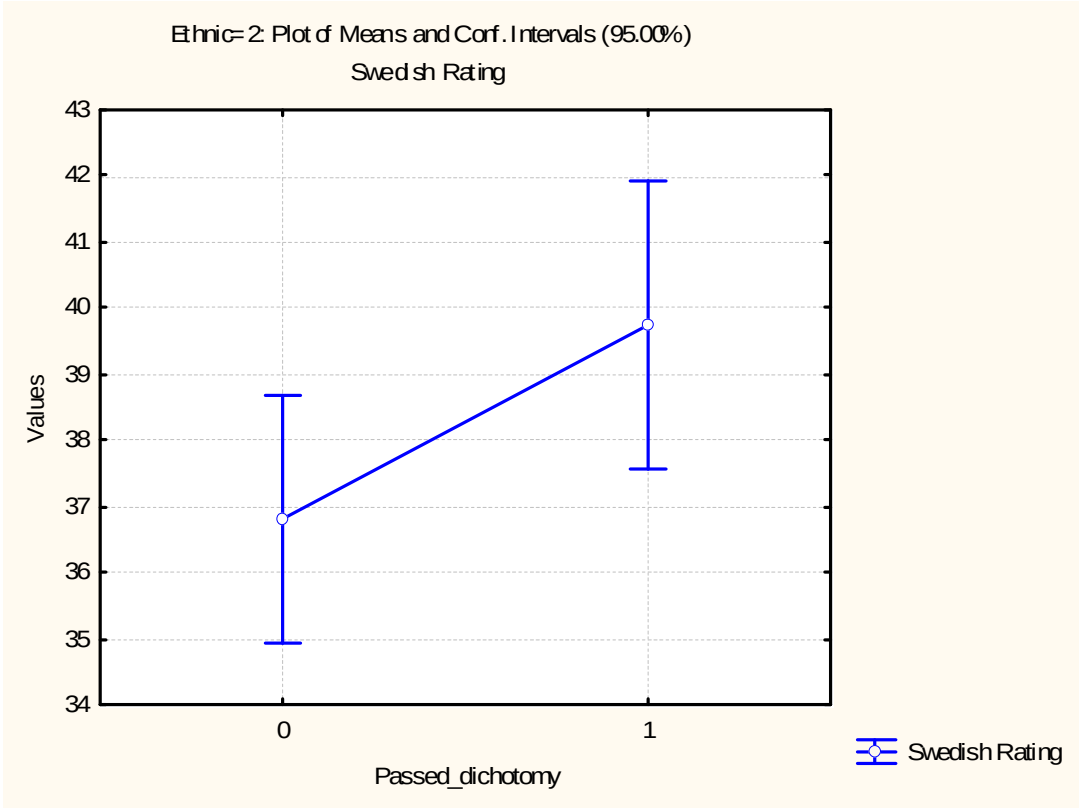
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Ethnic=2) Smallest N for any variable: 78		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	36.80952	42	5.960185
1	39.75000	36	6.429286
All Grps	38.16667	78	6.315137





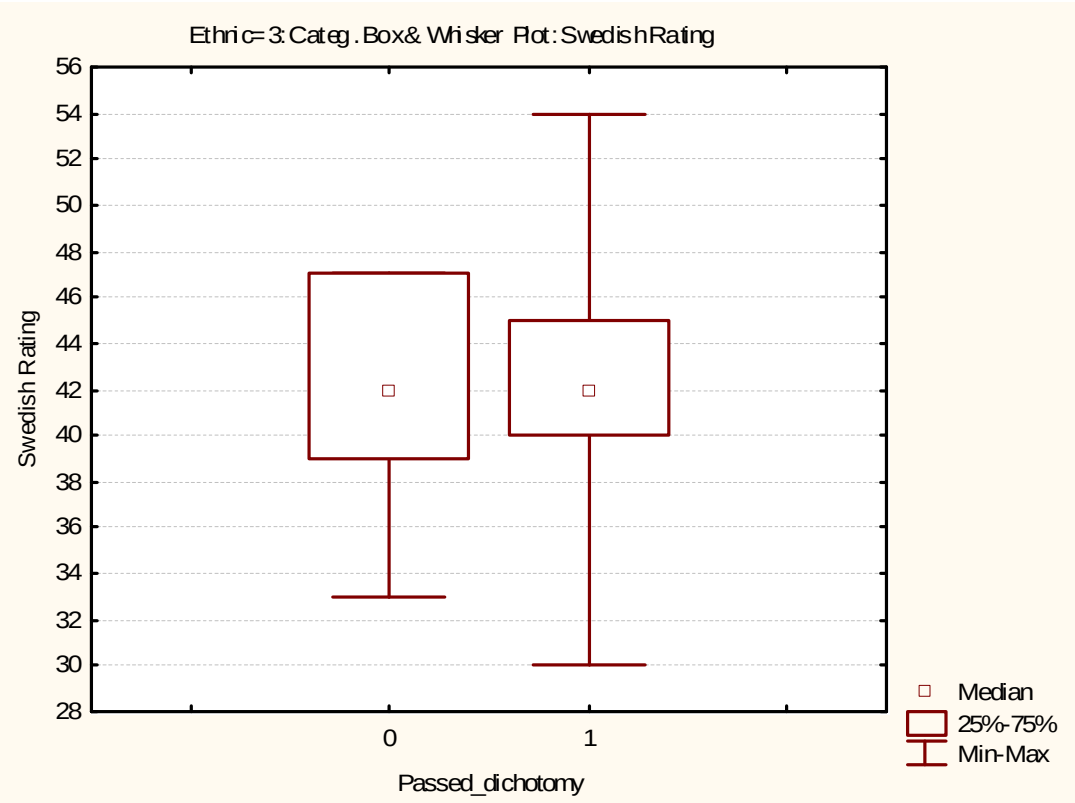
Variable	Analysis of Variance (Ethnic=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	167.6071	1	167.6071	2903.226	76	38.20034	4.387582	0.039534

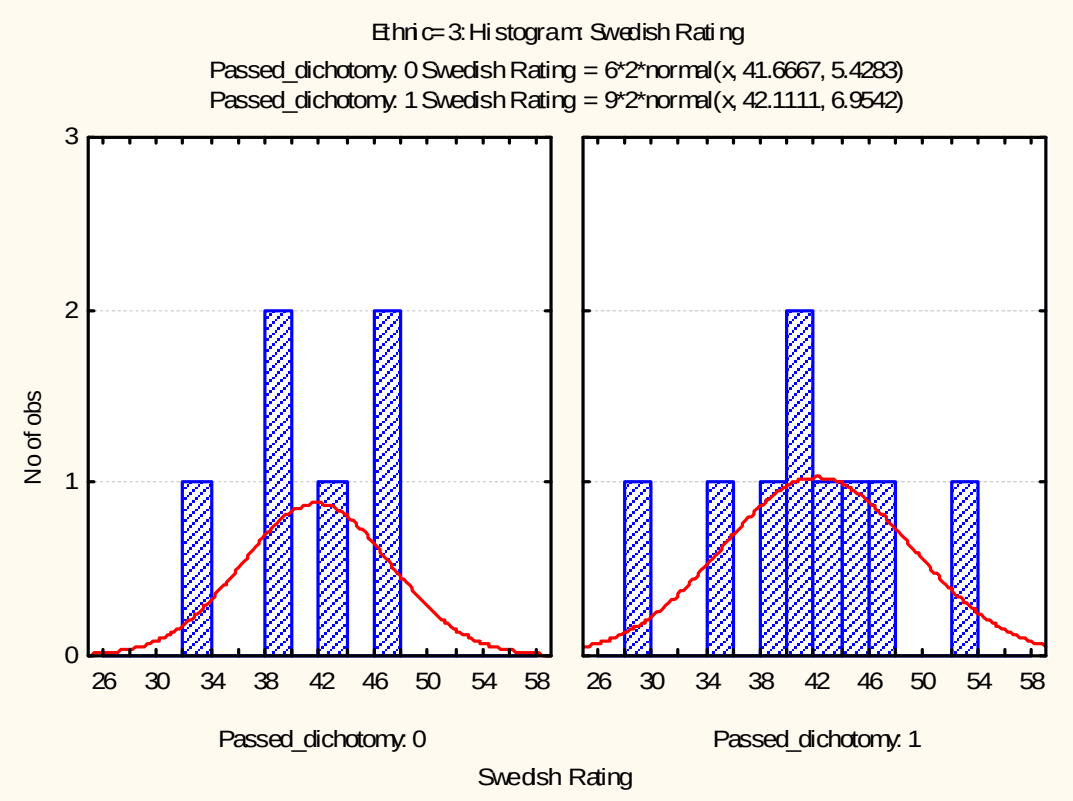
Variable	Levene Test of Homogeneity of Variances (Ethnic=2) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	5.663715	1	5.663715	968.6954	76	12.74599	0.444353	0.507048


Ethnic=2: Plot of Means and Corf. Intervals (95.00%)
Swedish Rating
43
42
41
40
39
38
37
36
35
34
Values
0
1
Passed_dichotomy
Swedish Rating

Ethnic=3: Subjects passed dichotomous

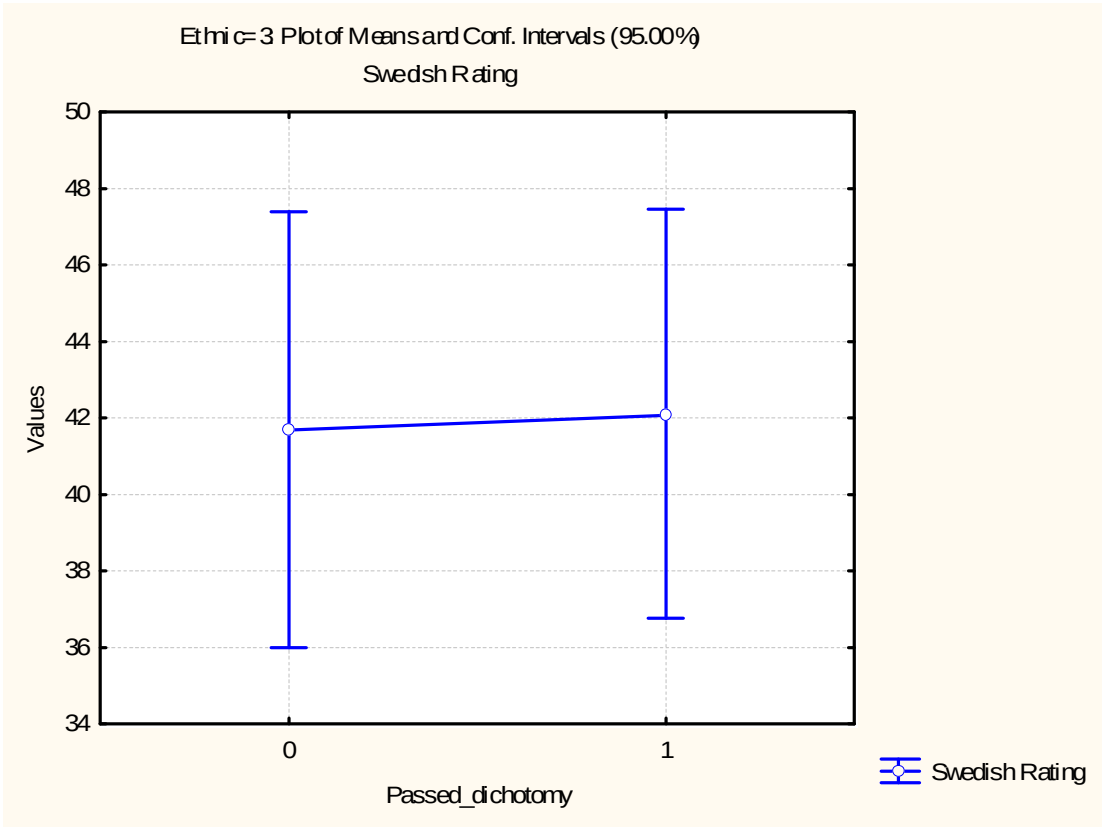
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Ethnic=3) N=15 (No missing data in dep. var. list) Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	41.66667	6	5.428321
1	42.11111	9	6.954215
All Grps	41.93333	15	6.181385





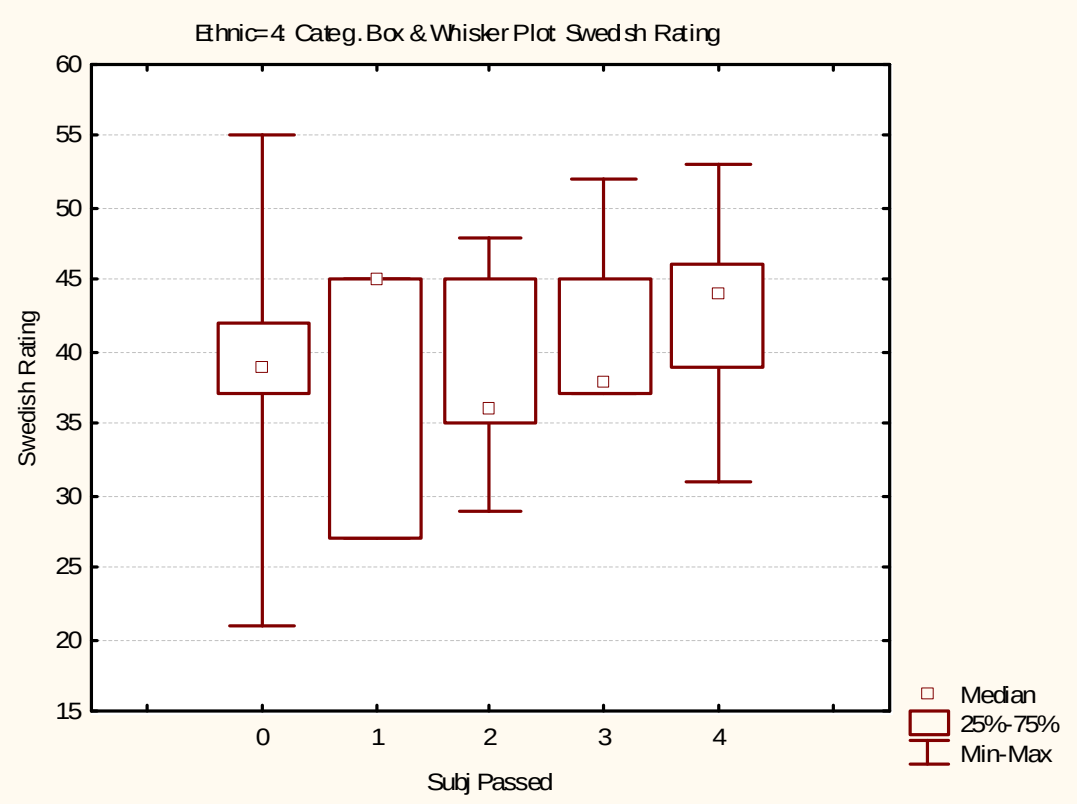
Variable	Analysis of Variance (Ethnic=3) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	0.711111	1	0.711111	534.2222	13	41.09402	0.017304	0.897357

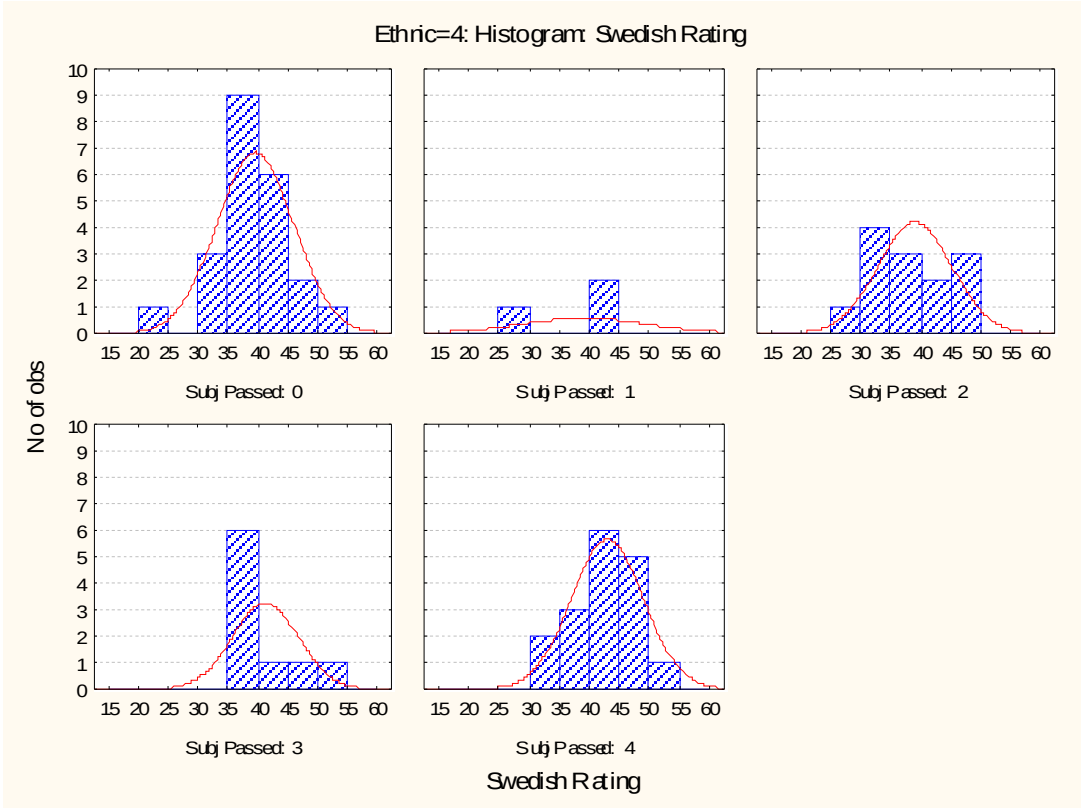
Variable	Levene Test of Homogeneity of Variances (Ethnic=3) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	0.751166	1	0.751166	215.0480	13	16.54215	0.045409	0.834559


Ethnic=3 Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
50
48
46
44
42
40
38
36
34
Values
0
1
Passed_dichotomy
Swedish Rating

Ethnic=4: Subjects passed raw

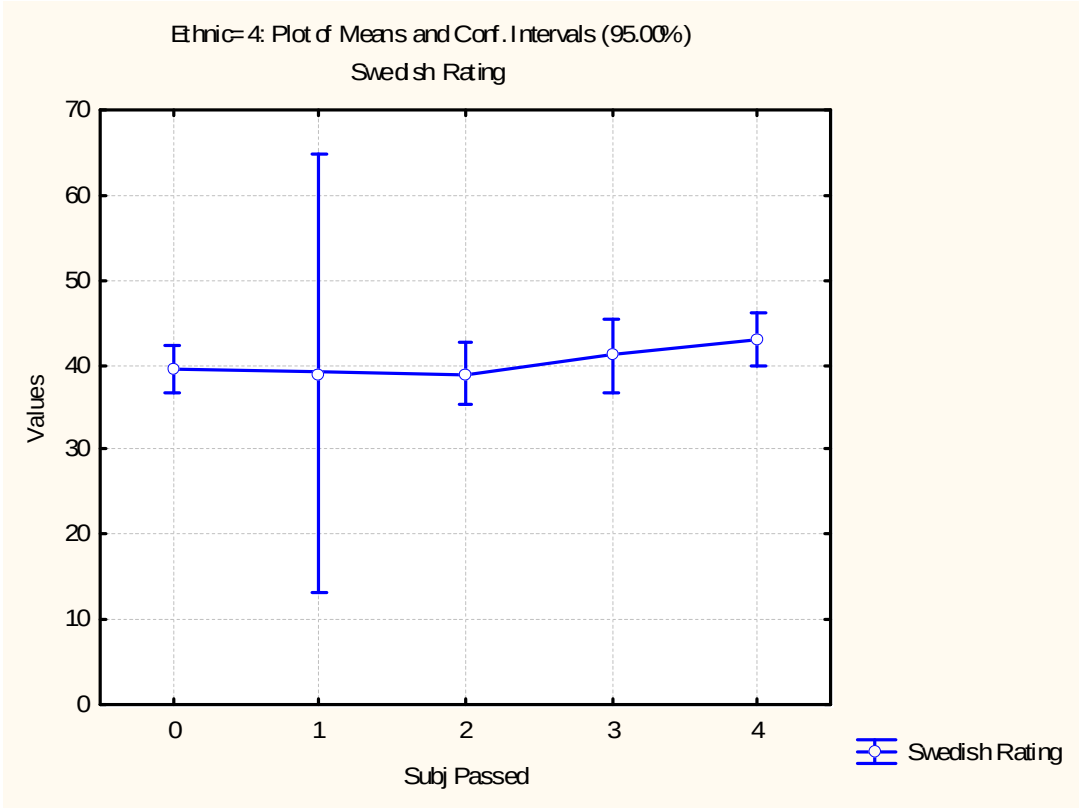
Subj Passed	2-Way Tables of Descriptive Statistics (Ethnic=4) Smallest N for any variable: 64		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	39.45455	22	6.41967
1	39.00000	3	10.39230
2	38.92308	13	6.17065
3	41.11111	9	5.51009
4	42.88235	17	6.00918
All Grps	40.46875	64	6.32699





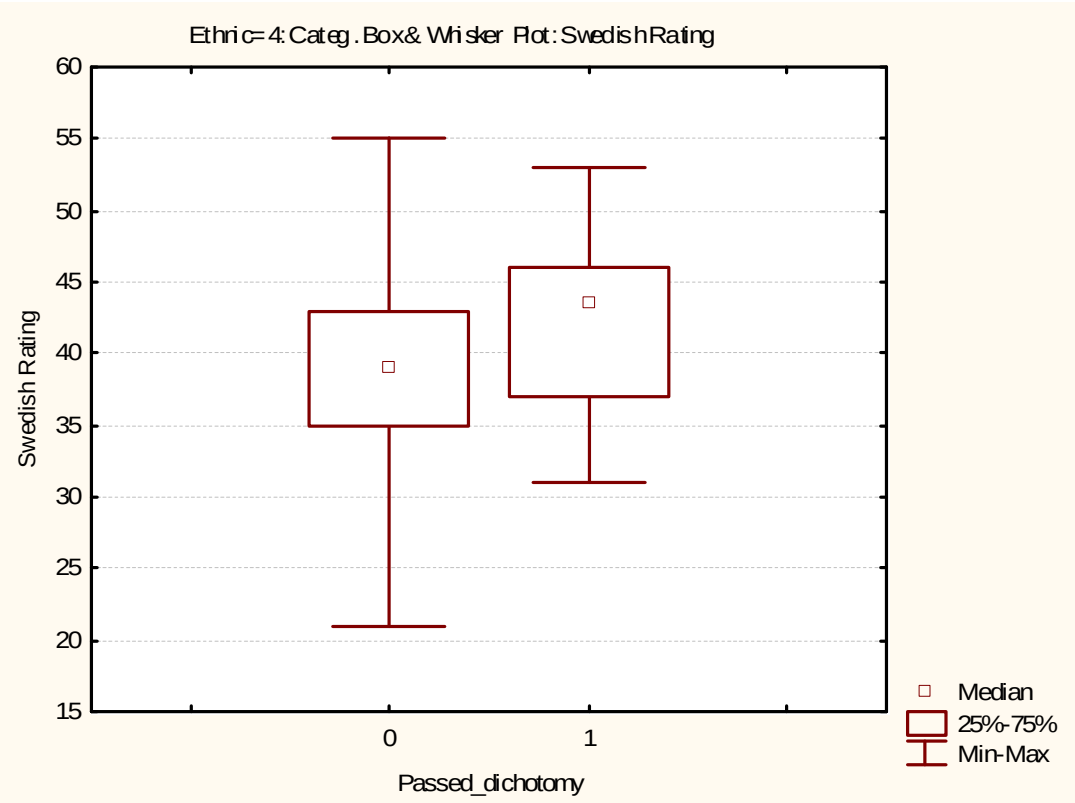
Variable	Analysis of Variance (Ethnic=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	162.9063	4	40.72657	2359.031	59	39.98358	1.018582	0.405241

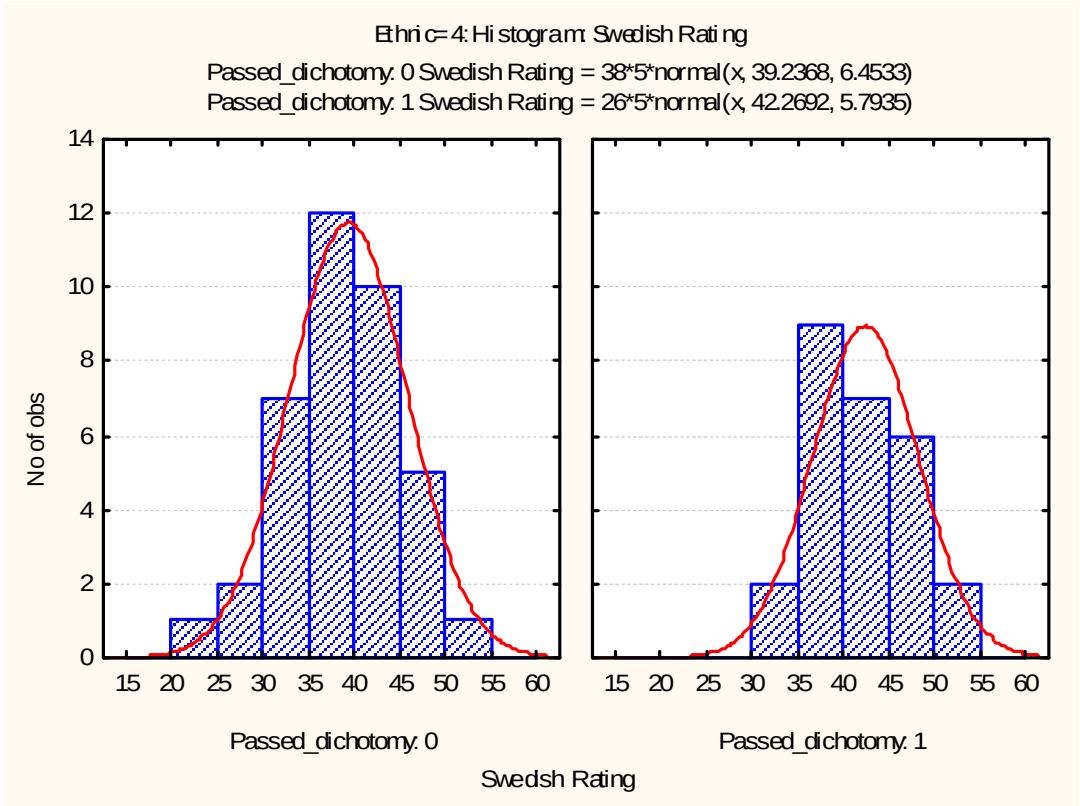
Variable	Levene Test of Homogeneity of Variances (Ethnic=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	39.39318	4	9.848296	821.9491	59	13.93134	0.706917	0.590412


Ethnic=4: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
70
60
50
40
30
20
10
0
Values
0
1
2
3
4
Subj Passed
Swedish Rating

Ethnic=4: Subjects passed dichotomous

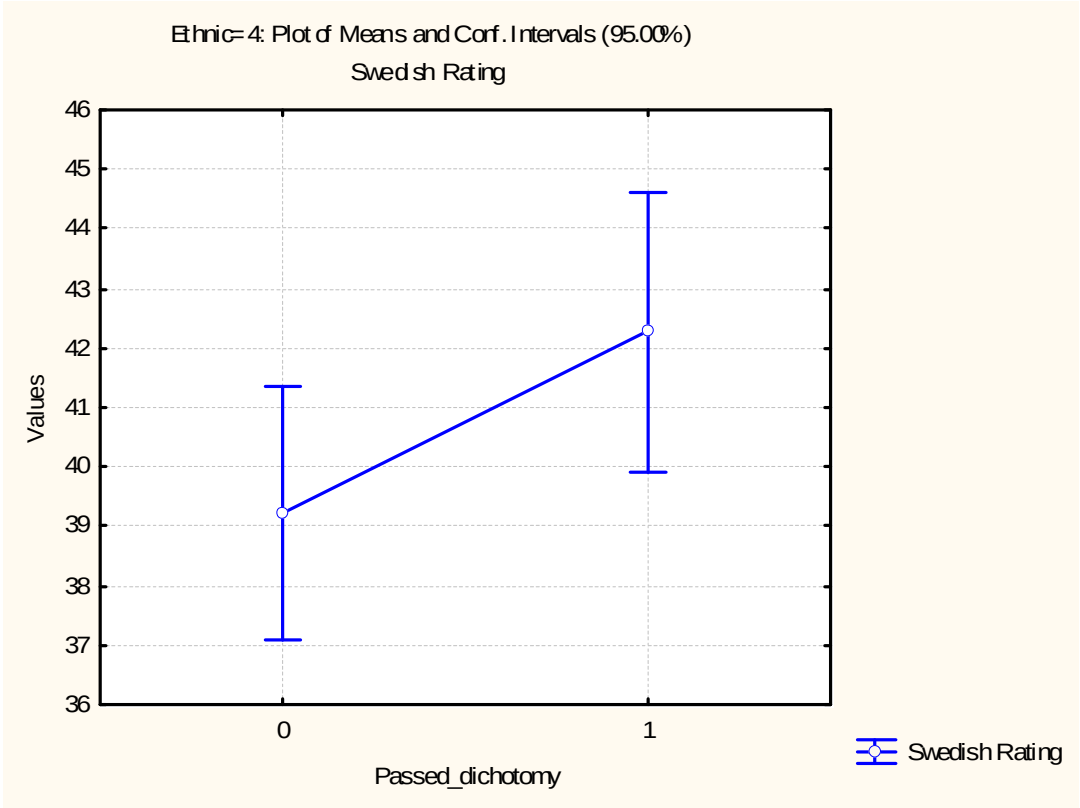
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Ethnic=4) Smallest N for any variable: 64		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	39.23684	38	6.453301
1	42.26923	26	5.793498
All Grps	40.46875	64	6.326986





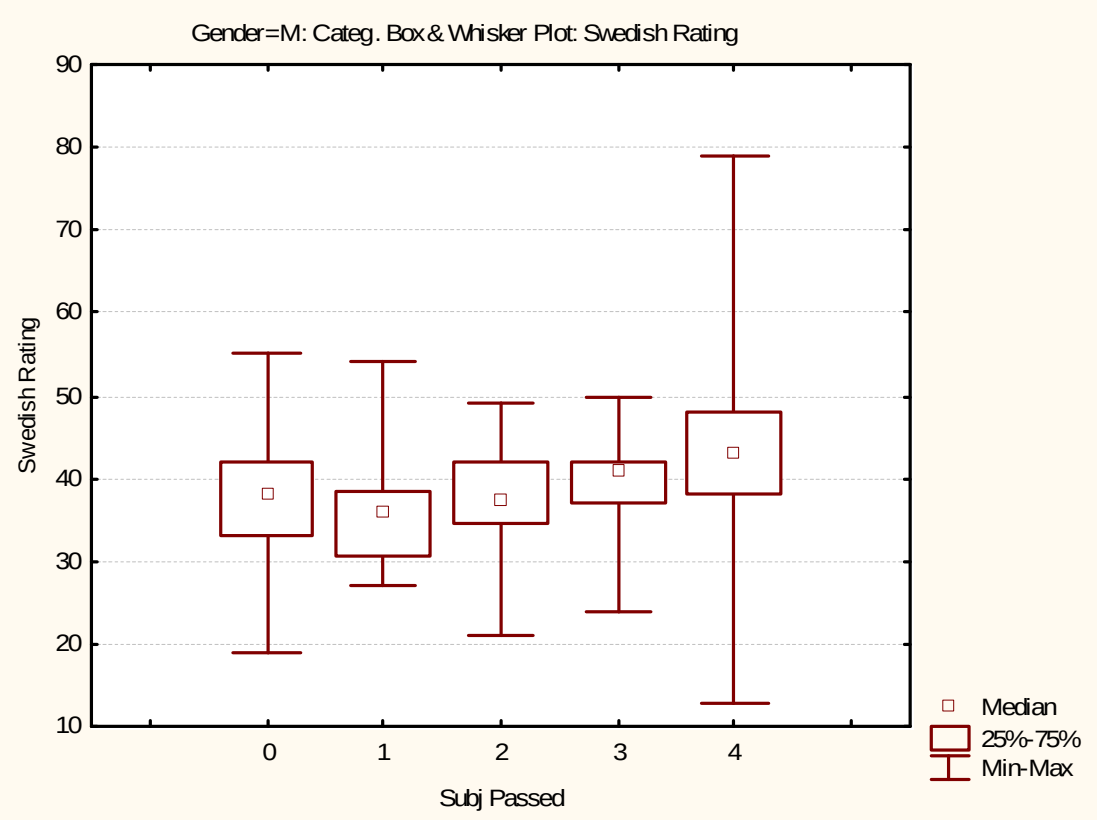
Variable	Analysis of Variance (Ethnic=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	141.9537	1	141.9537	2379.984	62	38.38684	3.697979	0.059074

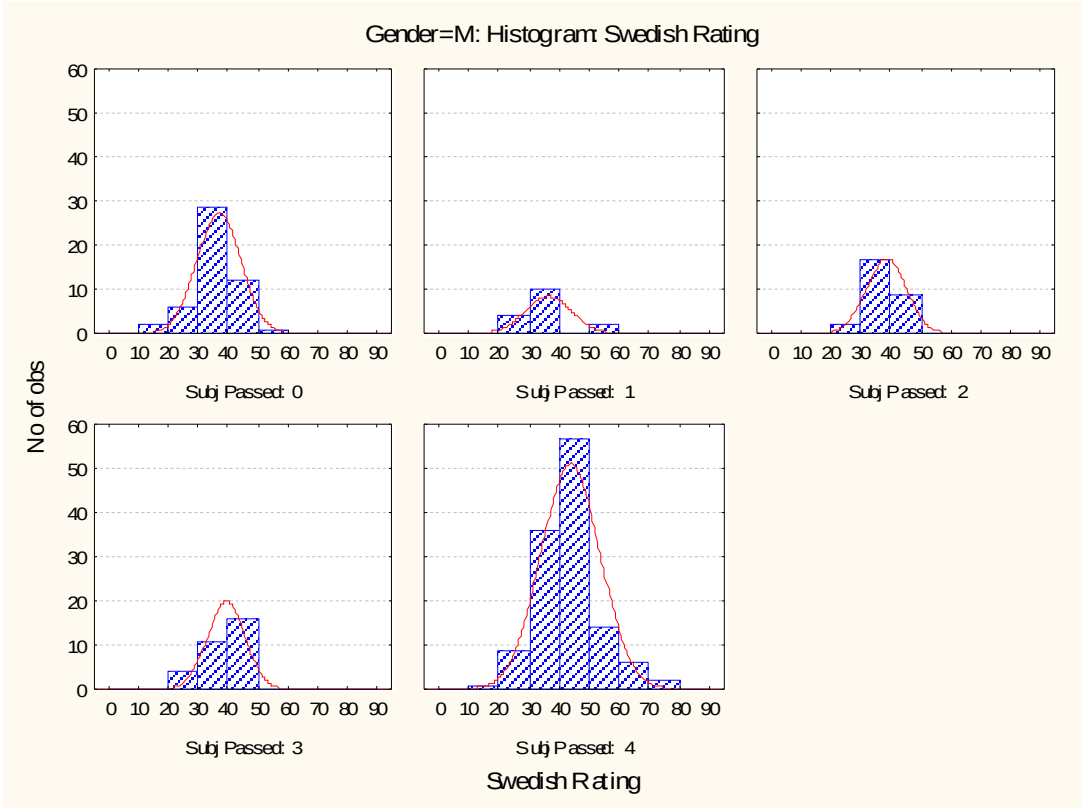
Variable	Levene Test of Homogeneity of Variances (Ethnic=4) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	0.000410	1	0.000410	815.6928	62	13.15634	0.000031	0.995563


Ethnic=4: Plot of Means and Corf. Intervals (95.00%)
Swedish Rating
Values
46
45
44
43
42
41
40
39
38
37
36
0
1
Passed_dichotomy
Swedish Rating

Gender=M: Subjects passed raw

Subj Passed	2-Way Tables of Descriptive Statistics (Gender=M) Smallest N for any variable: 250		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	36.84000	50	7.321648
1	36.25000	16	7.602631
2	38.32143	28	6.566207
3	39.25806	31	6.185832
4	43.55200	125	9.758748
All Grps	40.62400	250	8.943072

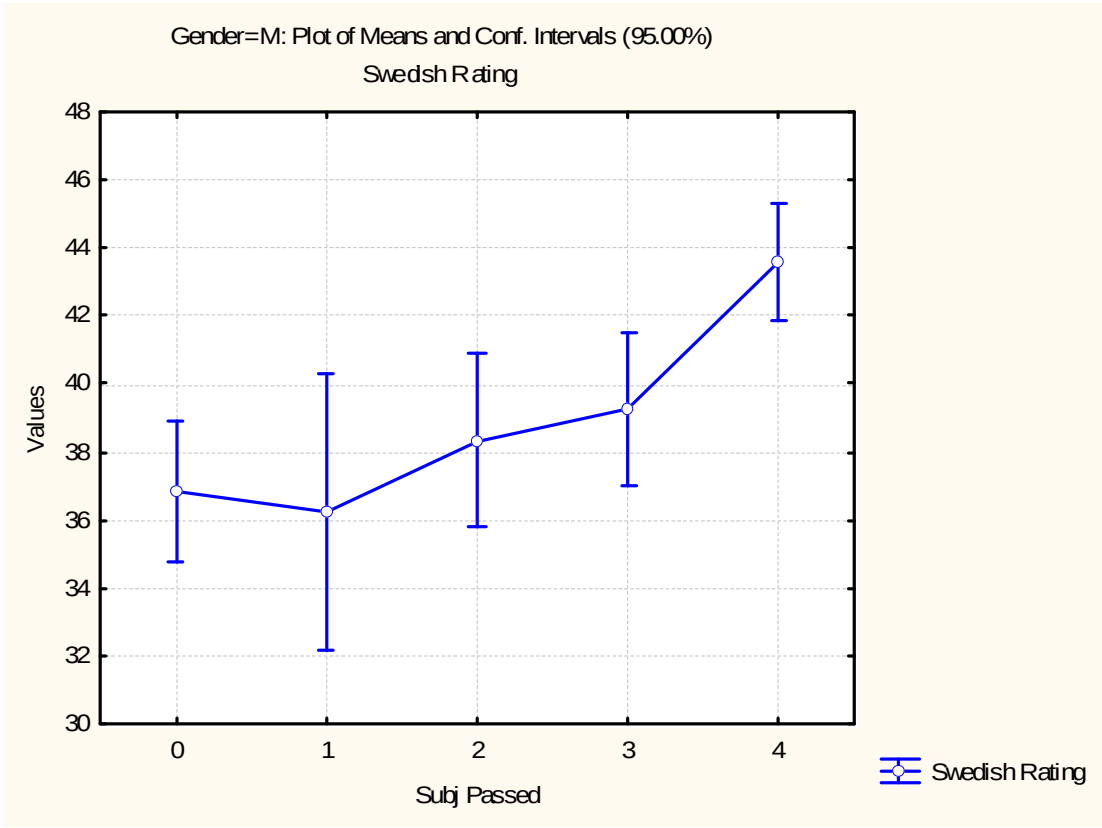




Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	2299.981	4	574.9953	17614.67	245	71.89663	7.997528	0.000004

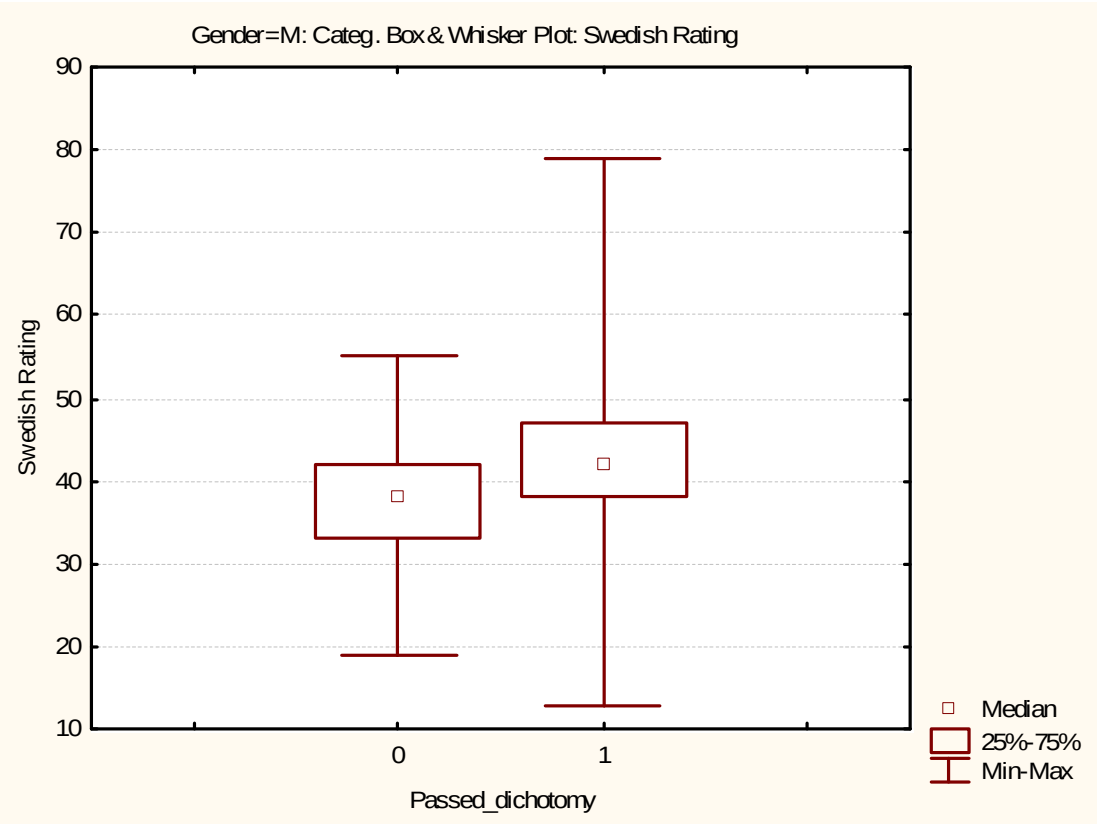
Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	249.0780	4	62.26949	8045.917	245	32.84048	1.896120	0.111718

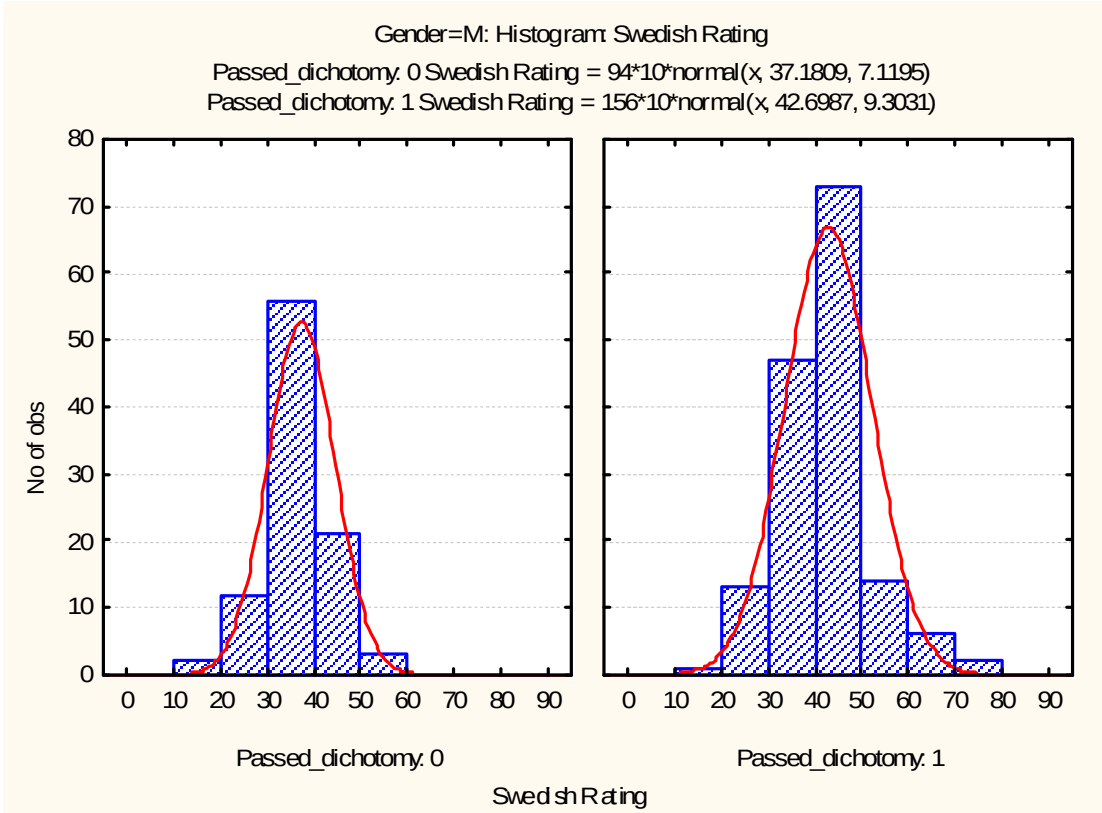
Subj Passed		LSD Test; Variable: Swedish Rating (Gender=M) Marked differences are significant at p < .05000				
		{1} M=36.840	{2} M=36.250	{3} M=38.321	{4} M=39.258	{5} M=43.552
0	{1}		0.808786	0.459893	0.213409	0.000004
1	{2}	0.808786		0.436425	0.250257	0.001346
2	{3}	0.459893	0.436425		0.672162	0.003481
3	{4}	0.213409	0.250257	0.672162		0.012239
4	{5}	0.000004	0.001346	0.003481	0.012239	


Gender=M: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
Values
48
46
44
42
40
38
36
34
32
30
0
1
2
3
4
Subj Passed
Swedish Rating

Gender=M: Subjects passed dichotomous

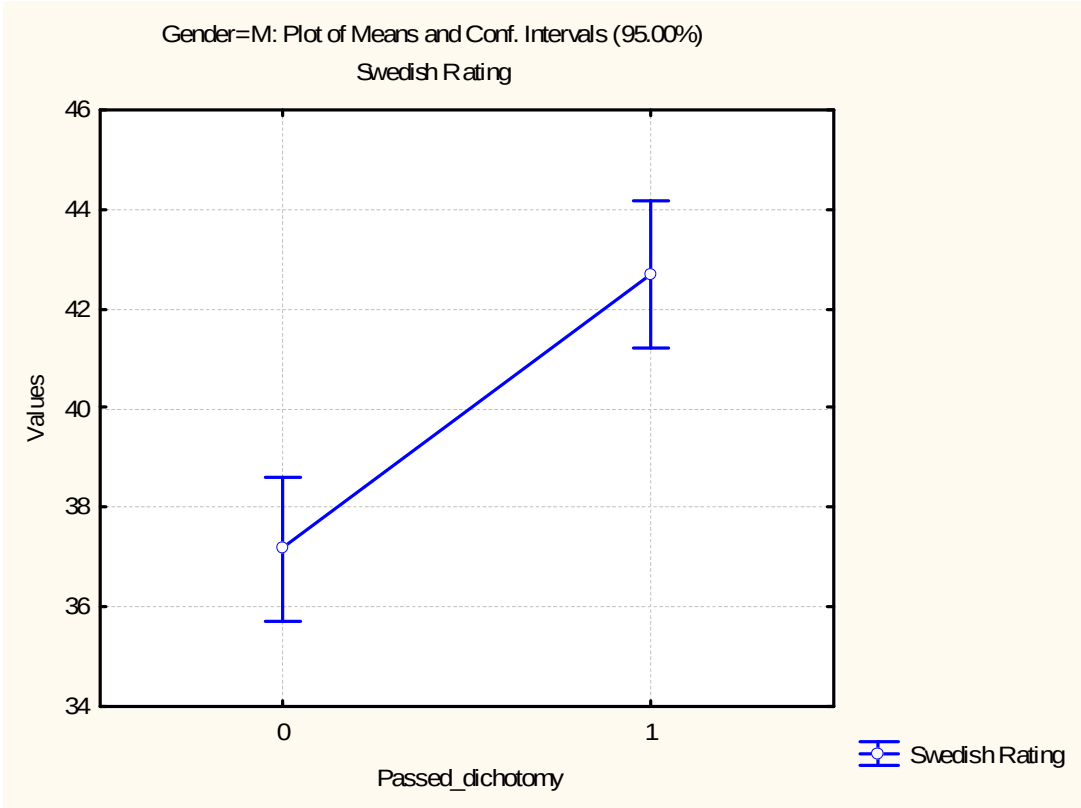
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Gender=M) Smallest N for any variable: 250		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.18085	94	7.119506
1	42.69872	156	9.303083
All Grps	40.62400	250	8.943072





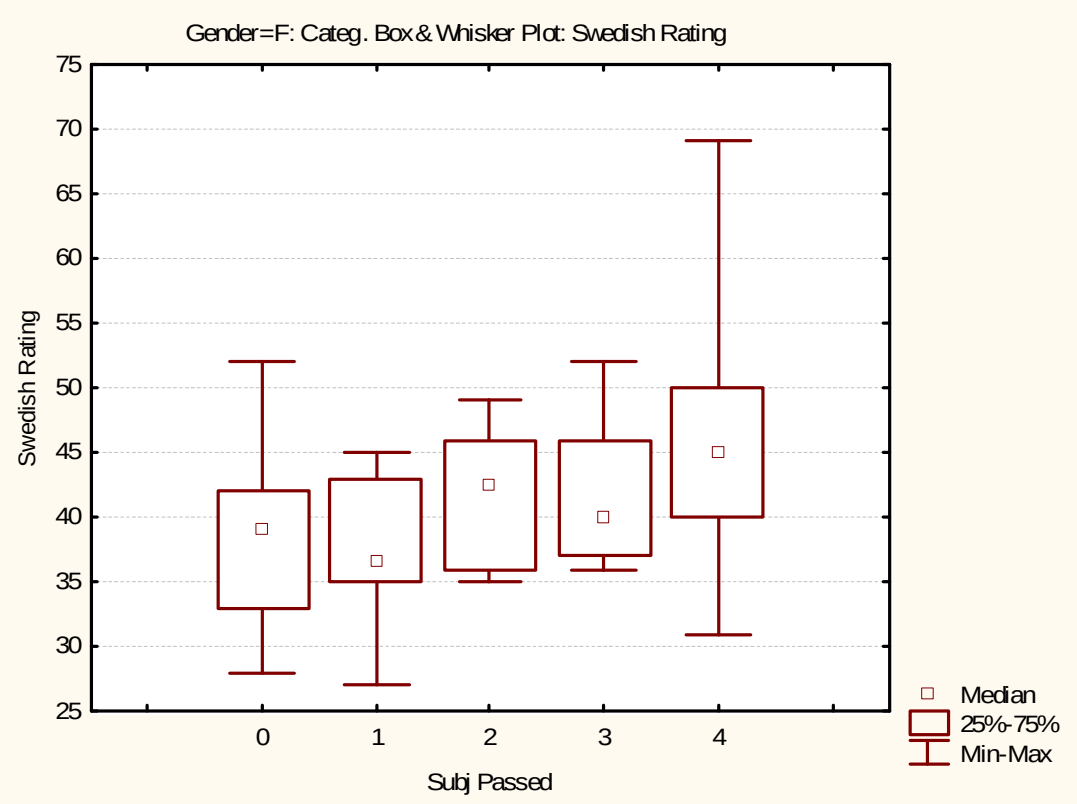
Variable	Analysis of Variance (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	1785.891	1	1785.891	18128.77	248	73.09986	24.43084	0.000001

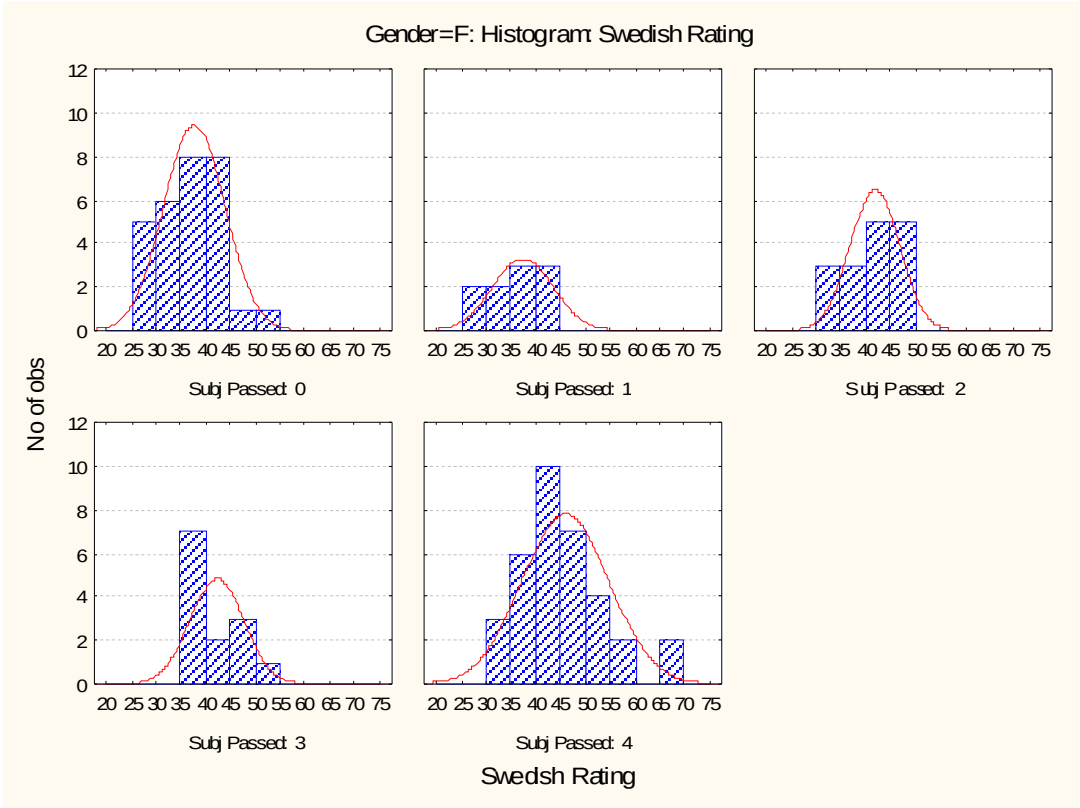
Variable	Levene Test of Homogeneity of Variances (Gender=M) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	117.8214	1	117.8214	8577.922	248	34.58840	3.406385	0.066136


Gender=M: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
46
44
42
40
38
36
34
Values
0
1
Passed_dichotomy
Swedish Rating

Gender=F: Subjects passed raw

Subj Passed	2-Way Tables of Descriptive Statistics (Gender=F) Smallest N for any variable: 102		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	37.58621	29	6.155817
1	37.30000	10	6.056218
2	41.75000	16	4.946379
3	42.15385	13	5.382784
4	45.88235	34	8.692612
All Grps	41.55882	102	7.629507

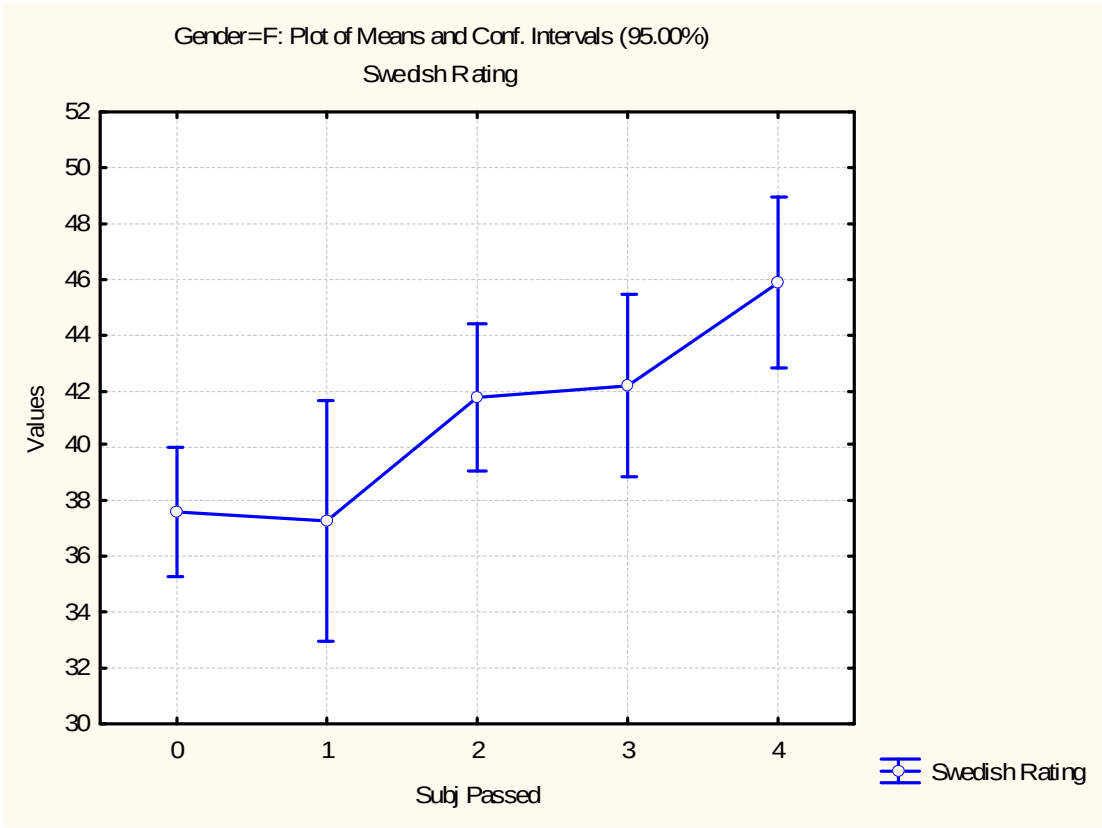




Variable	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	1279.791	4	319.9477	4599.356	97	47.41604	6.747668	0.000078

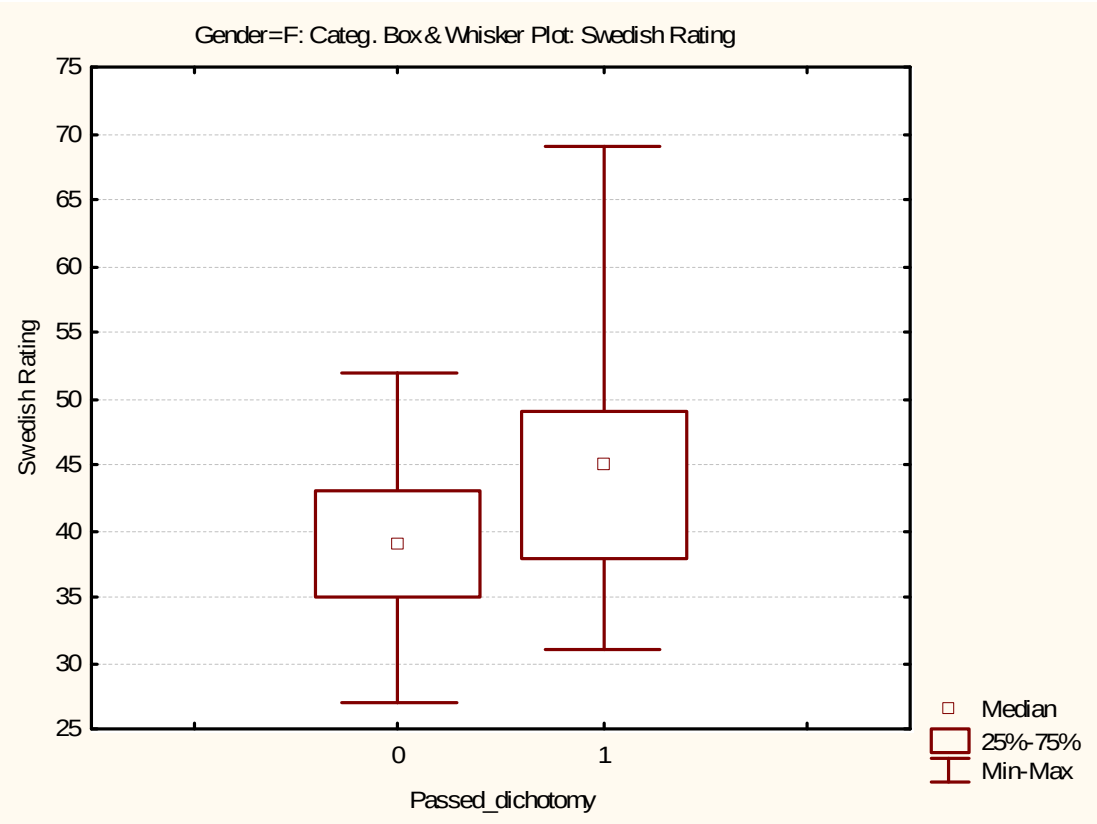
Variable	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	77.65879	4	19.41470	1604.078	97	16.53689	1.174023	0.327089

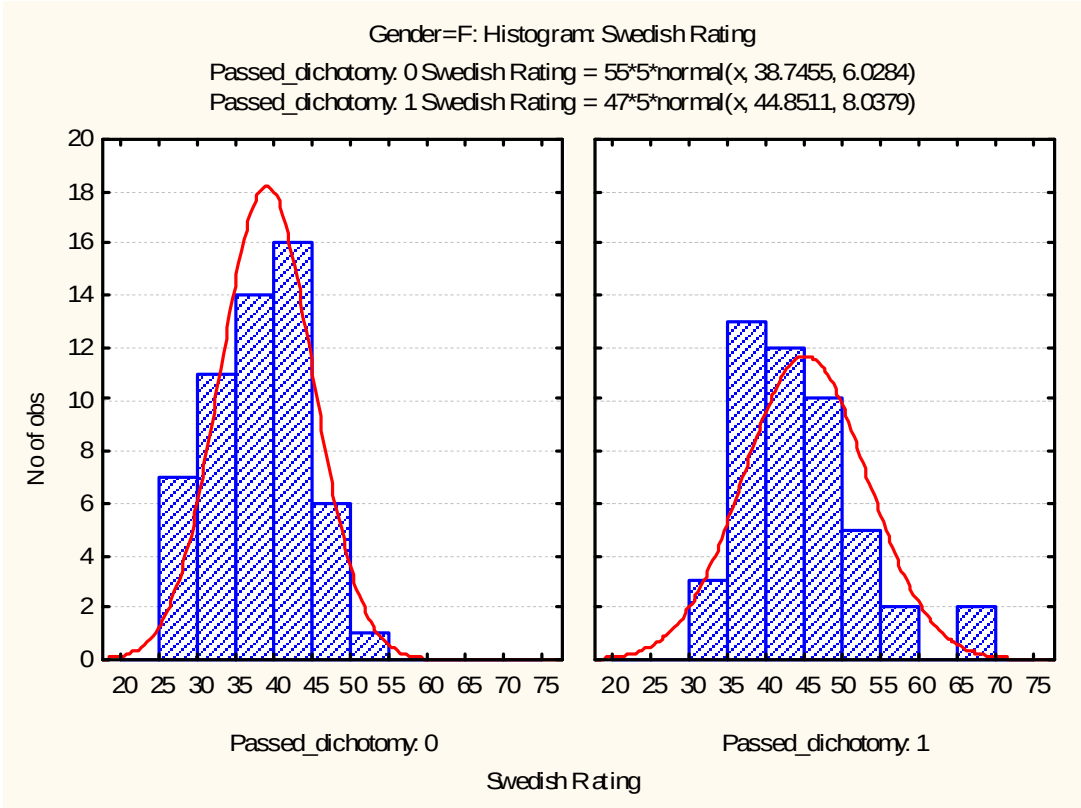
Subj Passed		LSD Test; Variable: Swedish Rating (Gender=F) Marked differences are significant at p < .05000				
		{1} M=37.586	{2} M=37.300	{3} M=41.750	{4} M=42.154	{5} M=45.882
0	{1}		0.909995	0.055076	0.049703	0.000007
1	{2}	0.909995		0.112156	0.096991	0.000792
2	{3}	0.055076	0.112156		0.875518	0.050597
3	{4}	0.049703	0.096991	0.875518		0.100047
4	{5}	0.000007	0.000792	0.050597	0.100047	


Gender=F: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
Values
52
50
48
46
44
42
40
38
36
34
32
30
0
1
2
3
4
Subj Passed
Swedish Rating

Gender=F: Subjects passed dichotomous

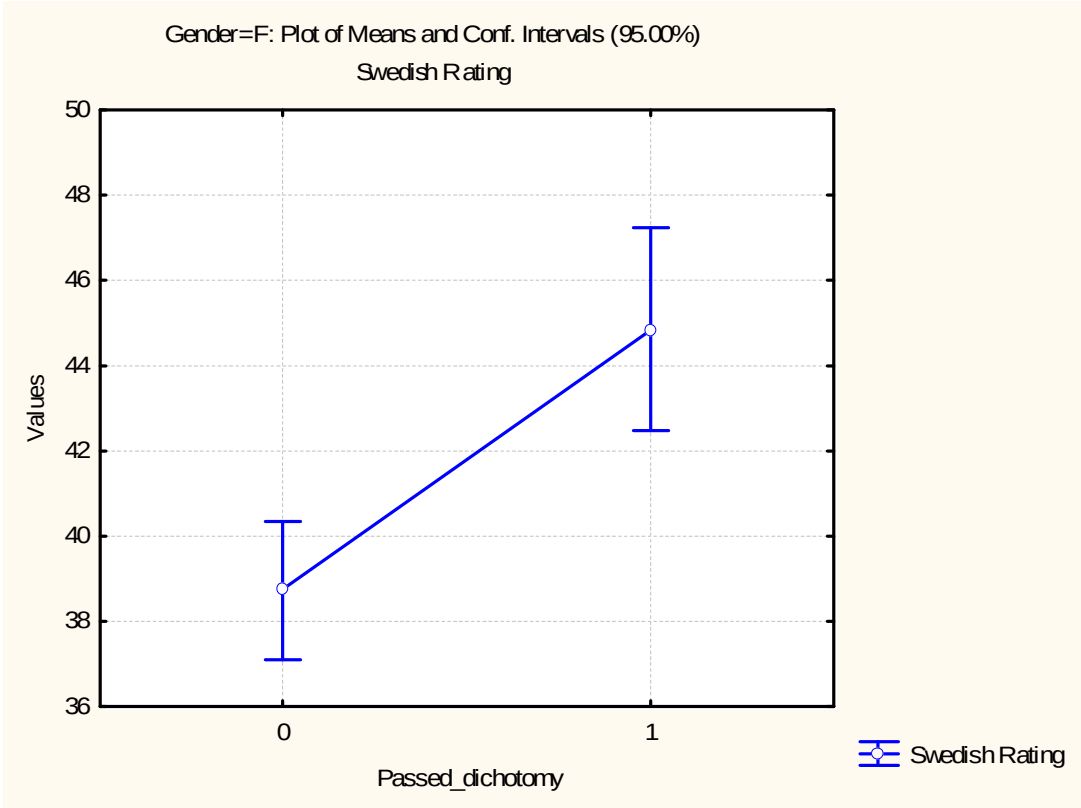
Passed_dichotomy	2-Way Tables of Descriptive Statistics (Gender=F) Smallest N for any variable: 102		
	Swedish Rating Means	Swedish Rating N	Swedish Rating Std.Dev.
0	38.74545	55	6.028384
1	44.85106	47	8.037896
All Grps	41.55882	102	7.629507





Variable	Analysis of Variance (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	944.7532	1	944.7532	4934.394	100	49.34394	19.14629	0.000030

Variable	Levene Test of Homogeneity of Variances (Gender=F) Marked effects are significant at p < .05000							
	SS Effect	df Effect	MS Effect	SS Error	df Error	MS Error	F	p
Swedish Rating	24.49493	1	24.49493	1830.757	100	18.30757	1.337967	0.250149


Gender=F: Plot of Means and Conf. Intervals (95.00%)
Swedish Rating
50
48
46
44
42
40
38
36
Values
0
1
Passed_dichotomy
Swedish Rating