APPLICATION OF THE RASCH RATING SCALE MODEL WITH MATHEMATICS ANXIETY RATING SCALE-SHORT VERSION (MARS-SV)

A MASTER'S THESIS

BY

HİLAL KURUM

THE PROGRAM OF CURRICULUM AND INSTRUCTION
BILKENT UNIVERSITY
ANKARA

MAY 2012

APPLICATION OF THE RASCH RATING SCALE MODEL WITH MATHEMATICS ANXIETY RATING SCALE-SHORT VERSION (MARS-SV)

The Graduate School of Education
of
Bilkent University

by

HİLAL KURUM

In Partial Fulfillment of the Requirements for the Degree of
Master of Arts

in

The Program of Curriculum and Instruction
Bilkent University
Ankara

May 2012

BILKENT UNIVERSITY
GRADUATE SCHOOL OF EDUCATION
THESIS TITLE: APPLICATION OF THE RASCH RATING SCALE MODEL WITH MATHEMATICS ANXIETY RATING SCALE-SHORT VERSION (MARS-SV)

Supervisee: Hilal Kurum
May 2012

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum and Instruction.

Supervisor Assistant Prof. Dr. Minkee Kim

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum and Instruction.

Examining Committee Member Title and Name

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum and Instruction.

Examining Committee Member Title and Name
Approval of the Graduate School of Education

Director Title and Name

ABSTRACT

APPLICATION OF THE RASCH RATING SCALE MODEL WITH MATHEMATICS ANXIETY RATING SCALE-SHORT VERSION (MARS-SV)

Hilal Kurum

M.A., Program of Curriculum and Instruction
Supervisor: Asst. Prof. Dr. Minkee Kim

May 2012

This study aimed to explore the relationship between students' mathematics anxiety and their mathematics achievement by applying the Rasch Rating Scale Model to investigate whether mathematics anxiety is debilitative or facilitative for their mathematics achievements. For data analysis, the study employed the Rasch Rating Scale Model on an instrument called Mathematics Anxiety Rating Scale (MARS-SV) and examined the differences between the students' MARS-SV mean scores and the applied Rasch measures. The study was carried out with 79 ninth grade students from different classes in a private high school, Ankara. In the first phase, these students' school exam marks were obtained. MARS-SV was administrated to the 79 students and then descriptive analyses applied to MARS-SV data. The correlation between the students' mean scores on the MARS-SV and school exam marks was computed.

In the second phase, the Rasch Rating Scale Model was applied to the MARS-SV raw scores to give Rasch measures for mathematics anxiety. The correlation between these Rasch measures and the students' mathematics school exam marks was computed. Also a descriptive analysis was applied to the Rasch measures.

It was found that there were moderate negative correlations between students' mathematics exam marks and the two types of anxiety measured by the student mean scores (r = -0.40) and the Rasch measures (r = -0.45).

The finding indicated that the mathematics anxiety was debilitative for students. In conclusion, the Rasch analysis provided the more reliable measure of student anxiety, which approaches more to the normal distribution. In addition, it provides a practical conversion table from a raw score of anxiety to its counterpart Rasch measure.

Key words: Mathematics education, mathematics anxiety, Mathematics Anxiety rating scale model-Short Version (MARS-SV), the Rasch rating scale model, alternative

ÖZET

RASCH DEĞERLENDİRME ÖLÇEĞİ MODELİNİN MATEMATİK KAYGISI ÖLÇEĞİ-KISA VERSİYON (MARS-SV) İLE UYGULANMASI

Hilal Kurum

Yüksek Lisans, Eğitim Programları ve Öğretim
Tez Yöneticisi: Yrd. Doç. Dr. Minkee Kim

Mayıs 2012

Bu araştırma öğrencilerin matematik kaygıları ve okul sınav notları arasındaki ilişkinin Rasch değerlendirme ölçeği modeli ile incelememesini amaçlamıştır ve matematik kaygısının öğrencilerin matematik başarısı üzerinde yararlı mı yoksa zararlı mı olduğunu incelemiştir. Veri analizi için çalışma Rasch değerlendirme ölçeğini Matematik Kaygısı Değerlendirme Ölçeği (MARS-SV) olarak adlandırılan araç üzerinde kullanmıştır ve klasik ortalama değerleri ile elde edilen Rasch değerleri arasındaki farklar incelenmiştir. Bu araştırma da katılımcılar Ankara'daki özel bir lisede dokuzuncu sınıf 79 öğrenciden oluşmuştur. İlk aşamada,öğrencilerin sınav sonuçları elde edilmiştir. MARS-SV ölçeği araştırmanın ilk safhasında bu 79 dokuzuncu sınıf öğrencilerine uygulanmıştır ve klasik analiz yöntemi MARS-SV verilerine uygulanmıştır. Matematik kaygı ham sonuçları ile öğrencilerin matematik başarıları arasındaki ilgi araştırılmıştır.

İkinci safhada, matematik kaygısı için Rasch değerleri elde etmek amacıyla Rasch Değerlendirme Ölçeği Modeli MARS-SV ham sonuçlarına uygulanmıştır. ve

matematik kaygısı için Rasch değerleri ile öğrencilerin matematik sınav sonuçları arasındaki ilgi hesaplanmıştır.Ayrıca klasik analiz yöntemi Rasch değerlerine uygulanmıştır.

Çalışmanın sonunda öğrencilerin matematik sınav sonuçları ile klasik ortalama değerleri($r = -0.40$) ve Rasch değerleri(-0.45) ile elde edilen iki çeşit kaygı arasında negatif orta dereceli bir ilgi olduğu bulunmuştur

Bu bulgular matematik kaygısını öğrencilerin matematik başarısı için zarar verici olduğu sonucuna varılmıştır. Sonuç olarak, Rasch modelin öğrencilerin matematik kaygısı hakkında daha güvenilir bilgi sunduğu görülmüştür. Bu bilgilerin normal dağılıma daha çok yaklaştığı görülmüştür ve Rasch model öğrencilerin matematik kaygılarına ait ham sonuçlarına karşılık gelen Rasch değerlerini içeren bir tablo sunmuştur.

Anahtar kelimeler: Matematik Eğitimi, Matematik Kaygısı, Matematik Değerlendirme Ölçeği-Kısa Versiyon (MARS-SV), Rasch Değerlendirme Ölçeği Modeli

ACKNOWLEDGEMENTS

I would like to express my gratitude to Prof. Dr. Ali Doğramacı, Prof. Dr. M. K. Sands and everyone at Bilkent University Graduate School of Education who supported me throughout my masters program.

I would like to present my most sincere appreciation to Asst. Prof. Dr. Minkee Kim, who has been my official thesis supervisor during these challenging two years. Throughout my masters program, I have learned a lot and gained a lot of valuable experiences with the help of Asst. Prof. Dr Minkee Kim. With his help, I have learned how to be a researcher and how to go further. I would also like to offer my appreciation to Prof. Dr. Cengiz Alacacı and Prof. Dr. Alipaşa Ayas who never neglected to help me when I had some problems or difficulties. They kindly gave their time to me and guided me. I also want to thank Ece Biçer for supporting me while collecting my data.

I would also like to express my special thanks to my friends who were always with me in these years. I have gained a lot of unforgettable beautiful memories and I always feel that I am very lucky. I also especially want to thank Şakire who always opened her home to me.

Finally I would like to express my gratitude to my family. They want the best for me and have given me their full support and love in my long education life. I believe that these valuable people in my life made me stronger so that I could complete my study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Figure Page

LIST OF EQUATIONS

Equation Page

CHAPTER 1: INTRODUCTION

Introduction

Mathematics is an important school subject because the knowledge of mathematics is essential for many parts of everyday life. It is used in many details of our daily routines such as shopping, managing bank accounts, computers and in many other aspects in life. In addition, a mathematical background is required for many careers and potential jobs such as engineering, medical professions, or banking. Mathematics lessons therefore have an important place in education and students are required to take mathematics classes through their educational life. Mathematics is also necessary for developing spatial abilities, logical and critical thinking, creativity and problem solving abilities, which are necessary aspects for our lives. In spite of this importance of mathematics, many students consider mathematics difficult and they avoid learning mathematics in high school and college by restricting their range of careers.

Anxiety towards mathematics is an important factor in students' avoidance from learning mathematics in their education lives and using mathematics in their daily lives. There have been studies on mathematics anxiety with regard to students' cognitive, behavioral, and physiological domains (Hopko, McNeil, Zvolensky, & Eifert, 2001). Over five decades, teachers, parents, and researchers have observed that many students have such mathematics anxiety. Students fear mathematics and avoid learning in mathematics classes (Alkan, 2011; Dreger & Aiken, 1957). As a result, mathematics anxiety can affect their achievement within their educational lives. For this reason, mathematics anxiety should continue to be investigated

In previous studies, various mathematics anxiety scales have been used and the data obtained from these scales have been explored by descriptive analysis such as calculating mean, percentages or total scores. In these studies there is a consensus about mathematics anxiety being a psychological construct and there are different factors which underlie mathematics anxiety. A new method entitled the Rasch model has recently been used among researchers to measure mathematics anxiety. It has been used to measure psychological constructs such as mathematics anxiety, since this model provides more useful numerical information about the student variables and items simultaneously. Furthermore, the Rasch model provides researchers with the chance of comparing individuals independently from items and the opportunity of comparing items differently from traditional analysis.

The current study used the short and the revised version of Mathematics Anxiety Rating Scale (MARS-SV), which is considered to be a reliable scale (Baloğlu, 2010). For gaining more illuminating information related to mathematics anxiety, the Rasch Rating Scale Model was applied to the MARS-SV. How to apply the model was explored and the results from this analysis were obtained. The findings from this analysis were compared with traditional analysis and the differences between the application of the Rasch analysis and the traditional analysis were identified. In the light of these findings, the relation between students' mathematics anxiety and their school midterm achievements were correlated. In the previous studies mathematics anxiety was considered rarely facilitative for students and many studies suggested that mathematics anxiety was debilitative for students. Moreover, in the present study mathematics anxiety being facilitative or debilitative also was investigated. The aim of this study was to measure mathematics anxiety more efficiently and to analyze the

obtained data by using an advanced statistical method. The results of this study provided practical and useful information about students' mathematics anxiety levels so that it will help the practitioners to understand and mediate mathematics anxiety in the classrooms.

Background

Since the 1950s, researchers have been interested in mathematics anxiety, its causes, structure and effects on students' learning. Many different questions arouse regarding mathematics anxiety and researchers investigated many effects of mathematics anxiety. Similarly, in Turkey, mathematics anxiety is an important issue in education. During the developing phase of Turkish education, mathematics education was an important part of the curriculum. Starting in the 1990s, studies investigating mathematics education became widespread and researchers focused on mathematics anxiety as an essential part of this process.

In Turkey, the Turkish National Exams for entering various high schools and universities is a vital factor in Turkish education. Turkish students are required to be successful in these national exams so that they can continue their education in the direction they prefer. Moreover, mathematics is a major tested field in these exams which students are required to pass. Consequently, this centralized exam system may cause mathematics anxiety in Turkish students towards mathematics. Due to the pressure from the university entrance exam at the end of the four-year high school and the entrance exam at the end of elementary education, students may feel that they are unable to achieve high enough scores in these exams. Hence, students develop mathematics anxiety and this affects their further education. Thus, in Turkey

researchers, educators and parents should pay more attention to students' level of anxiety and they should try to understand mathematics anxiety more, including the ways of managing mathematics anxiety.

In the previous studies carried out in Turkey, various mathematics anxiety rating scales were used and the data obtained from these scales generally were traditionally analyzed without considering the weights of every item. In a study related to the fear of mathematics and reasons of failure in mathematics, the data obtained from elementary and secondary students were analyzed by Chi-square and means of the student responses (Başar, Ünal, & Yalçın, 2002). Similarly, in another study related to irrational beliefs of students in early adolescents and test anxiety also used mean scores and investigate the correlation according to mean scores and total scores of students (Boyacioglu & Kucuk, 2011). Researchers in Turkey still use the classic analysis in their studies and the Rasch model is not used frequently. Even though the Rasch model created by George Rasch has become a mainstream in many countries, the model does not receive enough attention from the Turkish researchers. This model has just started to be considered in the field of education in recent years. With the present study, the advantages of the Rasch model may be noticed more and the application of the Rasch model may come to rise.

Problem

The majority of students generally fear learning mathematics and they develop anxiety towards mathematics due to various reasons. As the literature suggests mathematics anxiety has significant negative effects on students. Educators and

parents should be aware of students' mathematics anxiety to make mathematics learning more effective and permanent. For this aim, measuring mathematics anxiety becomes an important issue and more attention should be put on this issue. The relation between mathematics anxiety and students' mathematics achievement can be investigated more.

Since mathematics anxiety is an abstract construct, it is difficult to define students' anxiety with reliability. For this reason, researchers have developed many scales and they have applied different methods to reach qualified results. Generally, the data obtained from these scales were analyzed traditionally based on raw scores and percentages. The results of traditional studies can be deceptive for the researchers and may not represent correct results. Hence, new and more reliable methods are required to measure such abstract constructs. In pursuit of new methods, the Rasch model, which is a mathematical model, come to the forefront and has started to be used frequently. This model is used to measure abstract constructs in the social sciences like education and psychology. By using the Rasch method, the obtained data can provide more meaningful and useful inferences for the researchers.

Purpose

The main purpose of the present study was to explore the relationship between students' mathematics anxiety and their mathematics achievement by using the Rasch Rating Scale Model to obtained data and investigate whether mathematics anxiety is debilitative or facilitative for students regarding their mathematics achievement. Moreover, this study explored how to apply the Rasch Rating Scale

Model to MARS-SV. As a psychological construct, there are difficulties in measuring and analyzing mathematics anxiety. This study aims to analyze obtained data by using Rasch model and to indicate that the data provides more meaningful information with Rasch Rating Scale Model. The Rasch model is used for analyzing data that is obtained from measuring things such as abilities, attitudes, and personality traits. The Rasch model is used particularly in psychometrics, a field that includes theories and techniques of psychological and educational measurement. This study applied Rash Rating Scale Model which is a sub model of the Rasch model in mathematics education.

Research questions

The main questions of the study are:

- How is the Rasch Rating Scale Model applied to MARS-SV?
- Is there a correlation between students' mathematics achievement and mathematics anxiety measured by MARS-SV?

In the light of the main questions, the sub-questions being examined are :

- What are students' levels of mathematics anxiety?
- Is there any relation between their mathematics achievements score and their mathematics anxiety ratings?

Significance

The outcomes of this research will be beneficial to educators, teachers, and parents in order to understand mathematics anxiety more efficiently. In the literature, there are many different scales and many methods to evaluate the results of students'

mathematics anxiety. Until now, researchers mostly have investigated students' raw scores and they have made inferences by using descriptive analyses such as mean, percentages or total scores. However, using the Rasch model to analyze the data obtained from the mathematic anxiety scales may provide more reliable information to researchers, teachers and educators. By using the Mathematics Anxiety Rating Scale and Rasch Rating Scale Model, students' achievement and their anxiety level can be predicted more accurately. In addition, administrators, researchers and teachers may find the Rasch model more useful in psychological and educational measurement of such things as mathematics anxiety.

Definitions of key terms

Cemen (1987) defined mathematics anxiety as a state of discomfort from situations involving challenging and hard tasks which make people feel a lack of confidence (as cited in Trujilo & Hadfield, 1999). In other words, it is a feeling of tension that arises in response to difficult situations.

Mathematics anxiety also defined by Richardson and Suinn (1972a, p. 551) as "Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide, variety of ordinary life and academic situations."

Another description of mathematics anxiety is defined by Adeyemo and Adetona (2005, p. 122), "With reference to mathematics, anxiety is an emotional reaction to mathematics usually based on a past unpleasant experience, which harms future learning and leads to heightened degrees of mathematics avoidance."

Facilitative anxiety defined by Alpert and Haber (1960) is an anxiety which helps students to be more alert and attentive to a task and it affects students positively to accomplish a task positively.

Debilitative anxiety is a negative anxiety where students become very anxious so that the debilitative anxiety hinders students' performing task at an optimum level (Alpert & Haber, 1960).

The Rasch model is a statistical, logistic model which gives a structure to the items in test. It depends on logarithmic probabilistic function and is a sub model of Item Response Theory (Linden & Hambleton, 1997).

Mathematics Anxiety Rating Scale-Short Version (MARS-SV) is the shortest and newest revised version of the Mathematics Anxiety Rating Scale, revised and translated into Turkish by Baloğlu (2010).

CHAPTER 2: REVIEW OF RELATED LITERATURE

Introduction

Over past five decades, mathematics anxiety has become a common issue among studies due to its importance in mathematics learning (Alkan, 2011; Dreger & Aiken, 1957). Mathematics anxiety often hinders students' mathematics learning (Cates & Rhymer, 2003; Hembree, 1990; Ryan & Ryan, 2005; Singh, Granville, & Dika, 2002). Moreover, mathematics anxiety discourages students from studying further subjects in mathematics. Being an essential effecter of mathematics learning, attributes of mathematics anxiety will be considered in detail. This review describes and examines mathematics anxiety in research literature along with its structure, and causes.

Mathematics anxiety

In the literature, various definitions for mathematics anxiety were defined. The general definition of anxiety was defined by Cemen (1987). He described anxiety as being in a state of discomfort because of situations involved with challenging and hard tasks which make people feel a lack of confidence (as cited in Trujilo & Hadfield, 1999). In other words, it is a feeling of tension that arises in response to difficult situations. In the light of this definition, Richardson and Suinn (1972a, p. 551) defined a definition for mathematics anxiety in the light of the definition of anxiety which is "Mathematics anxiety involves feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide, variety of ordinary life and academic situations."

Another description of mathematics anxiety defined by Adeyemo and Adetona (2005, p. 122) is that "With reference to mathematics, anxiety is an emotional reaction to mathematics usually based on a past unpleasant experience, which harms future learning and leads to heightened degrees of mathematics avoidance." Similarly, Dreger and Aiken (1957) defined mathematics anxiety as having intense reactions to mathematics and numerical arithmetic.

In mathematics education, it can be understood that why there is anxiety towards mathematics in the light of these definitions. Mathematics is based on abstract concepts such as theorems, axioms, lemmas, and formulas as a result of its nature. Each concept has complex structures which connect strongly with each other. It is required to make transitions between concepts to understand mathematics. This is a process that some students find difficult to understand. The linking of concepts with each other and visualizing the connections in their minds since they cannot find actual, concrete representations of mathematical concepts in their daily lives. For instance, when people are taught geometrical shapes, graphs of functions or limit concept they can't visualize their shapes, behaviors or properties such as how to evaluate the volume or areas of these shapes or how the graphic changes when x variable changes. They can find concrete represents of functions or x variable in their daily life. As a result, mathematics anxiety gradually arouses in students in some cases.

Taxonomy of anxiety according to its effects

It is suggested that mathematics anxiety is a very complex structure and it is multidimensional, that is, there are different factors in mathematics anxiety (Rounds & Hendel, 1980). These factors are defined by the application of analysis on the instruments which are used to measure mathematics anxiety. Rounds and Hendel (1980) identified two factors related to mathematics anxiety which were 'Numerical anxiety' and 'Mathematics Test Anxiety'. By analyzing Mathematics Anxiety Rating Scale (MARS), Plake and Parker (1982) defined two clear factors for MARS which are called 'Learning Mathematics Anxiety' and 'Mathematics Evaluation Anxiety'. Moreover, the former refers to anxiety towards the process of learning mathematics, while the latter refers to the anxiety that is related testing situations.

In their research, various researchers found different factors which underlie mathematics anxiety. In Bessant's (1995) research it was found that there are different factors in MARS and these factors were named as 'General Evaluation Anxiety', 'Everyday Numerical Anxiety', 'Passive Observation Anxiety', 'Performance Anxiety', 'Mathematics Test Anxiety' and 'Problem Solving Anxiety'. Likewise, another researcher, Baloğlu (2010) indicated that the short version of MARS was compose of five factors which underlined mathematics anxiety. These factors were 'Mathematics Test Anxiety' and 'Course Anxiety', 'Computation Anxiety', 'Application Anxiety', and 'Social Anxiety'.

Kazelskis (1998) also identified another dimension of anxiety such as 'Worry' in addition to numerical anxiety and mathematics test anxiety by analyzing MARS. He also investigated the positive and negative effects of the anxiety which are two

dominant dimensions of mathematics anxiety. In the literature, these two dimensions of mathematics anxiety are defined as facilitative anxiety and debilitative anxiety. Many researchers emphasized these two dimensions of the mathematics anxiety. As it is seen, there are various factors which are associated with students' mathematics anxiety. Even though, the findings of studies differ from each other, they all point out that mathematics anxiety is composed of different factors.

Facilitative anxiety

Some researchers suggested that mathematics anxiety can be facilitative for students. That is, it can help students to be motivated and mathematics anxiety makes them more alert when they learn. Alpert and Haber (1960) identified facilitative anxiety as anxiety which helps students to be more alert and attentive to a task and affects students positively to accomplish a task positively. It is explained that a small degree of anxiety can be useful for mathematics learning and it can motivate students. In addition, it can have positive effects on students' performance and achievement (Newstead, 1998). Skemp (1971) suggested that at some certain point, anxiety has positive effects on performance that requires higher mental activities and conceptual processes. Small amounts of anxiety can keep students motivated and engaged with their lessons. Students can be more alert and aware of what they learn with math anxiety which can also lead students to give more effort in mathematics.

For instance, in Tsui and Mazzocco's research (2007), the effects of mathematics anxiety and perfectionism on mathematics performance under timed testing conditions with mathematically gifted sixth graders were investigated. From this research it was found that mathematics anxiety is related inversely with the

discrepancy in math performance. On-timed versus untimed testing, students' performance accuracy didn't change in the higher anxiety situation of timed testing but the performance accuracy changed in the lower anxiety group. In other means, the lower performance on-timed math test (versus the untimed) was observed in only the lower mathematics-anxiety group (Tsui & Mazzocco, 2007).

Other research used two different instructional approaches to six sections of a developmental arithmetic course at a community college. The findings indicated that high math anxious college students felt themselves more comfortable with the highly structured algorithmic course than with a less structured conceptual course in developmental arithmetic (Norwood, 1994).

Debilitative anxiety

Majority of the researchers focused mathematics anxiety's negative effects on students, on their performance, on spatial abilities or working memory in the literature. These negative effects were referred as debilitative as Alpert and Haber (1960) defined in their research. Debilitative anxiety is a negative anxiety. That is, students become highly anxious and, therefore, debilitative anxiety hinders students' performing task at the optimum level. Previous studies showed that mathematics anxiety has negative effects on students as the amount of anxiety increases. The major finding in this previous studies was that there is a negative correlation between mathematics anxiety and students' mathematics performance (Hembree, 1990; Ma, 1999; Zakaria & Nordin, 2008).

The researchers focused on different grades while investigating the effects of the mathematics anxiety on students' mathematics performances. These studies showed that among these different grades the findings indicated the same results. That is, mathematics anxiety is significantly correlated with poor mathematics performance. In studies which were conducted among college students, the results showed that mathematics test performance was negatively correlated with measures of mathematics anxiety (Betz, 1978; Richardson & Suinn, 1972b). In another study among grade school children, similar results were obtained. Wigfield and Meece (1988) argued that mathematics anxiety caused negative reactions such as students' ability perceptions, performance perceptions, and math performance, which can be debilitating for students.

Mathematics anxiety is also related to the psychological effects on students such as feeling tension and fear, low self-confidence and self-regulation, feeling threatened, and reduction in working memory (Ashcraft & Kirk, 2001; Jain & Dowson, 2009). The anxiety can be an indicator of these effects or these effects can be the consequences of mathematics anxiety. Moreover, the results from these two studies showed that mathematics anxiety prevents students doing calculations and to solve mathematical problems in their lives, in academic situations or in their social environments (Richardson & Suinn, 1972b ; Suinn, Taylor, & Edwards, 1988).

Another study investigated the effects of mathematics anxiety on matriculation students' motivation and achievement being related. The obtained a strong negative correlation between math anxiety and motivation of students (Zakaria & Nordin, 2008). When students' mathematics anxiety is high, it may indicate a lower level of

motivation in the students. In accordance with poor mathematics performance, another major effect of mathematics anxiety on students is a decrease in mathematics achievement. Previous researchers has found that mathematics anxiety affects students negatively regarding their mathematics performance and it causes a decrease in students' mathematics achievement and performance (Ashcraft & Moore, 2009; Buckley & Ribordy, 1982; Karimi & Venkatesan, 2009; Scarpello, 2007). In these studies, researchers found that mathematics anxiety is moderately and negatively correlated with mathematics achievement.

In addition, avoidance from learning mathematics is another aspect of mathematics anxiety. High math anxiety is related students' mathematics performance and achievement in schools and this relation may lead students not to involve with mathematics (Hembree, 1990). Students may choose not to continue with advanced mathematic courses or further elective mathematic courses in their education lives (Ashcraft & Kirk, 2001). That is, they can choose not to be involve in environments and careers that will require mathematics and application of mathematical skills (Ashcraft & Faust, 1994; Hopko, 2003; Silverman, 1992). Metje and colleagues (2007) claimed in their research that the number of students who preferred students continuing with their mathematics education post GCSE had decreased in recent years and students did not apply for engineering degrees as much as in the past as a consequence.

Mathematics anxiety may cause physiological consequences that hinder students' learning mathematics and indirectly impair their life functions (Hopko et al., 2001). Math anxiety may cause blanking out, headaches, cramps, blurred vision, and

sleepiness with students (Dellens, 1979). Mathematics anxiety may be also associated with sweaty palms, feeling nausea, or having difficulties in breathing (Malinsky, Ross, Pannells, & McJunkin, 2006). Physical effects interfere with students' performing well in mathematics and the more the anxiety increases, physical effects also increase and it causes more of a drop in mathematics performance. Moreover nausea, extreme nervousness, inability to hear the teacher, not able to concentrate, stomach-ache, mind going blank, and negative self-talk are considered as symptoms of mathematics anxiety (Kitchens, 1995).

Different causes of anxiety

Causes of mathematics anxiety in classrooms and in student lives became an important issue among researchers. According to different researchers, there is probably not a single reason for mathematics anxiety and there can be various reasons that cause it (Alkan, 2011; Fiore, 1999). Similarly, Norwood (1994) suggested that there is not a single cause for mathematics anxiety. Different factors such as inability to handle frustration, excessive school absences, poor self-concept, parental and teacher attitudes towards mathematics can be causal factors. The causes of math anxiety, components of ambiguity of language of mathematics, the cumulative structure of mathematics, distrusts of intuition, the confinement of exact answers and social prejudices towards mathematics also have a place (Tobias, 1993). These factors of mathematics anxiety can be categorized as environmental factors, intellectual factors and personal factors (Hadfield & McNeil, 1994).

In addition, negative school experiences can be one of reasons for mathematics anxiety (Arem, 2009). The embarrassment related to mathematics anxiety in the

school may lead students to feel anxiety toward mathematics (Miller & Mitchell, 1994). difficulties in learning mathematics because of teaching methods, bad experiences of mathematics exams and tests, and teachers with unkind attitudes towards students can be examples of the negatives that a student encounters in their learning process. It was suggested that having unsuccessful, bad teachers in previous grades can cause students to have mathematics anxiety (Frank, 1990; Widmer & Chavez, 1982). Moreover, traditional, restricted and stereotypical instructional methods may also cause mathematics anxiety in students (Tobias, 1993).

Another cause of mathematics anxiety can be cultural factors and social prejudices (Zaslavsky, 1994). Male students often do better than female students in math and Asians often have potential to do mathematics well are prevalent among many educators. These can be called the common prejudices towards mathematics. In addition to social prejudices, Alkan (2011) suggested in her study that the effects of the teacher, the effects of students' personality, the effects of parents and effects of the peers are the some of the reason which cause mathematics anxiety. When students don't understand what they are doing, they start to feel mathematics anxiety. Their personalities may cause them to develop anxiety toward math. Moreover, Alkan (2011) suggested that these effects can simultaneously cause mathematics anxiety in students. When students fear that their friend will tease them about not able to do mathematics or when students observe their parents' negative attitudes towards mathematics, students may develop mathematics anxiety. Not able to cope with failure, absence from school and lower self-confidence are related to students' personalities and they are also reasons for mathematics anxiety (Norwood, 1994).

The structure of mathematics is also an important reason for students having mathematics anxiety. Many people learn by seeing, hearing and experiencing and since mathematics has an abstract nature, many people find mathematics hard and difficult to understand. Many people become frustrated and feel distanced towards mathematics because of this reason and since they are not able to handle frustration, it causes an increase in mathematics anxiety. Then, with the increase of mathematics anxiety, their frustration also increases. The relationship between mathematics anxiety and frustration is circular. These two factors affect each other and cause the other one to increase. This model can also be applied to other causes of mathematics anxiety. For example, there is a similar relation between mathematics anxiety and failure in mathematics. A student who fails on mathematics exams, tests or even solving some mathematic problems often develops math anxiety. Moreover, the possibility of the students failing in future exams increases producing more anxiety. This circulation can be inferred from Ernest's (2000) model (see Figure 1) that he defined in his research.

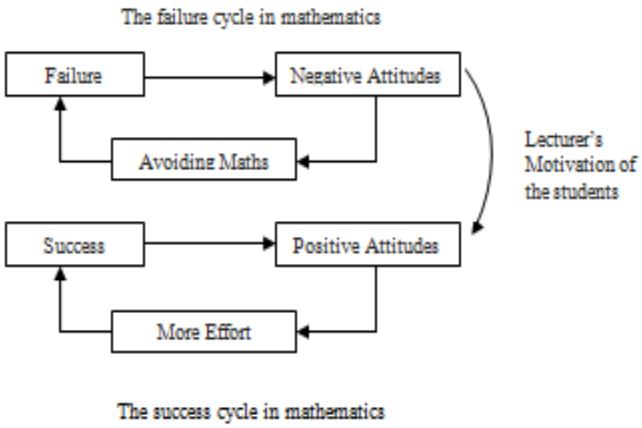


Figure 1. The success/failure cycles in mathematics.

Therefore, with many different causes such as social prejudices or mathematical language, people begin to develop mathematics anxiety. This anxiety facilitates students' mathematics learning to a certain point but after mathematics anxiety goes beyond this certain point, it becomes debilitative for students. This facilitative and debilitative anxiety can influence students' mathematics anxiety.

Mathematics anxiety scales

In the literature, different math attitude scales and math anxiety scales have been developed to evaluate math anxiety and abilities, mathematics achievement, and math performances. The first mathematics anxiety scale was called Number Anxiety Scale, developed by Dreger and Aiken (1957). Another scale which has been used by many researchers is the Fennema-Sherman Mathematics Attitudes Scale (Fennema & Sherman, 1976). In addition, the Mathematics Anxiety Scale (MAS) is a 10-item scale that was adapted by Betz (1978) from the Anxiety subscale of the Fennema-Sherman Mathematics Scales. This scale measures 'feelings of anxiety, dread, nervousness', and associated bodily symptoms related to doing mathematics (Fennema & Sherman, 1976). The Mathematics Attitude Inventory (Sandman, 1980) and Mathematics Anxiety Questionnaire (Wigfield and Meece, 1988) are other frequently used scales in research.

Mathematics Anxiety Rating Scale (MARS) is also an prevalent and major mathematics anxiety instrument in the research. This instrument is considered a pioneer instrument to measure mathematics anxiety. Moreover, it has been found that MARS has a high reliability and validity in previous research (Dew & Galassi, 1983)

Richardson and Suinn's (1972a) Mathematics Anxiety Scale (MARS) is a 98-item, five-point, Likert type instrument which is designed to measure the anxiety of individuals' using mathematics in ordinary life and academic situations. Students vote on the level of anxiety according to their feelings in various situations. The application of 98-item MARS was time-consuming and it caused difficulties in the application of the scale. For this reason, many derivatives of this scale were developed and devised in studies over time.

Plake and Parker (1982) developed the Mathematics Anxiety Rating Scale-revised (MARS-RV) by reducing the 98 items of the MARS to 24 items so that the problem of application time was overcome. To make the scale specialized for adolescents, Suinn and Edward (1982) has revised the original MARS scale and constructed the Mathematics Anxiety Rating Scale-Adolescents (MARS-A). Similarly, the original MARS scale has been revised for elementary students and is called the Mathematics Anxiety Rating Scale-Elementary (MARS-E) (Suinn et al., 1988). Moreover, MARS has also been revised and translated into other languages and is frequently used in studies to measure mathematics anxiety. Similarly, Baloglu and Kocak (2006) also have revised the original MARS and have constructed the Revised Mathematics Anxiety Rating Scale (MARS-R).

Rasch analysis in educational studies

Response analysis of the student surveys

The Human sciences such as education and psychology deal with abstract constructs and try to construct reliable instruments for measuring these abstract concepts

objectively. However, their standards for measurement are not closer to the standards of measurement in the experimental sciences.

In case of responses to a Likert-scale, traditionally numbers represent the response categories. As a result, ordinal data is produced. These numbers from responses are summed and the sums are considered as a total score and a measure for students. Then these total scores are used in statistical analyses . The responses to an ordinal scale are considered interval data. These total scores reflect students' value for the construct which can be deceptive for researchers. For example, two students with the same total score for an achievement test with 10 questions can be considered. One of the students might have answered a question incorrectly which was a hard question. Similarly, many other students might also have answered incorrectly. One the other hand, the other student answered one question incorrectly while many other students answered this question correctly. As it can be inferred, one of the questions was difficult while the other one was easy. In this example, it can be inferred that students' abilities were different from each other. However, both students would have received the same score since they answered only one question incorrectly and they both answered 90% of the test correctly. Regarding the traditional analysis of the test results both students are at the same level. As for the test, these questions were considered equals and total scores were given to the students according to this equal consideration. In this case, the researcher cannot make significant inferences from the total scores of these students or they cannot distinguish these students from each other.

Human science researchers, in order to be able to make some reliable inferences from their data and to be able to reach generalizations are required to construct scientific measures with acceptable reliability. They need to construct objective measurements to make inferences from their data rather than merely describing the data.

In 1960, Danish mathematician George Rasch introduced the Rasch Model, which was recognized as a logistic model for measuring constructs objectively in the social sciences (Andrich, 1988). The model is commonly used in education and psychology to measure abstract constructs (Bond & Fox, 2003). The model has been particularly applies to psychometrics, the field concerned with the theory and technique of psychological and educational measurement. The Rasch model is also used for analyzing data from assessments measuring things such as abilities, attitudes, and personality traits as well as measuring conceptual understanding of students (Edwards & Alcock, 2010), and constructing and evaluating item banks (Planinic, Ivanjek, & Susac, 2010).

George Rasch attempted to define the difficulty of an item independent from other items and the ability of an individual independent from the other items he has actually solved (Rasch, 1960). The Rasch model is a statistical, logistic model that is commonly used in recent literature to analyze both test data and Likert survey data. The model includes a family of probabilistic models. These models are specifications of the original model according to response categories of the scales which are used. For example in one specification, when all items have the same response categories across all items such as not at all, a little, much, or very much, the model is for

Likert-type scales and is called ‘Rasch Rating Scale Model’ like Likert-scales. In a second specification, if items do not have the same response categories and response categories are different across items, the model is called ‘Partial Credit Model’.

With the Rasch model, researchers can make estimates about what a construct might be like and they can get useful approximations of measures that help researchers understand the way items and people behave in a particular way (Bond & Fox, 2003). To estimate the probabilities of responding, the Rasch model uses traditional analysis and total scores as a starting point. The model follows the logic that an easy item is more likely to be answered by people rather than a difficult item and a person with high ability is more likely to answer the items correctly rather than a person with low ability (Bond & Fox, 2003).

The Rasch model falls into the Item Response Theory (IRT) models. The main feature of IRT is to develop mathematical functions to relate the probability of an examinee’s response to a test item to an underlying ability (Linden & Hambleton, 1997). In the present day, IRT model is one of the dominating measurement fields with its logistic response functions. The Rasch model is an individual centered with separate parameters for items and examinees. In other words, The Rasch model emphasizes probabilistic modeling of the interaction between an item of the scale and an individual examinee.

By using probabilistic functions and probabilistic relationships between an item’s difficulty and a person’s ability, the Rasch model finds estimates for each item and each person separately. The basic Rasch model is important because it can separate the ability of test takers and the quality of the test. For all persons and items,

estimates are magnitudes with a uniform meaning across the scale. This property helps researchers distinguish items and persons from each other and tells the researcher the relative value of every item and person. With the Rasch model, researchers try to obtain the means that will produce a genuine interval scale and obtain measurements for both persons and items from categorical response data. In the Rasch model, all the items are given an incremental scale of difficulty. People's responses are measured in terms of item difficulty. The more an item is difficult over other items or a person has intensity for the measured variable, the larger Rasch measures they earn.

A well-defined group of people respond to a set of items for assessment. According to students' responses with the Rasch analysis, each item is given a difficulty and weight. By adding across items, each person is given a total score. This total score represents the responses to all the items. When a person gets a higher total score that means the person shows more of the variable assessed.

Identifying weights of each item

Most of the questionnaires and measures have ordinal scales and researchers claim that it can cause some problems while evaluating raw scores (Elhan & Atakurt, 2005). In the Rasch model, the items are measured on a weighing scale. With this method, the problems which occur in evaluating can be solved. In the Rasch model, probabilistic function identifies weights to items. The parameters of probabilistic function are person ability, item difficulty, and observed answers from participants. In the probabilistic function, D represents difficulty of an item and B represents the ability of a person. In other means, $D_1, D_2, D_3, D_4 \ldots Dj$ where D_i is the difficulty

parameter for item i =1, 2, 3, 4… j and B_1, B_2, B_3, B_4 …B_k where B_n is the ability parameter for a person n =1, 2, 3, 4… k. Let X_{ni} =x ∈ $\{0,1, \ldots\ldots, m_i\}$ be an integer where m_i is the maximum score for item i. The variable X_{ni} is a random variable that can take integer values in the interval [0,m_i]. In the present study, response categories coded between the integers 1 to 5 and the maximum value of m_i is 5 for the item *i*. The variable X_{ni} is a random variable that can take integer values in the interval [1, m_i].

The probability of the outcome is presented in Equation 1. Note that, the τ_k is the k_{th} threshold of the rating scale which is common to all items.

$$P\{X_{n,i} = \mathrm{x}\} = \frac{\exp \sum_{k=0}^{x} (B_n - (D_i - \tau_k))}{\sum_{\mathrm{x}=0}^{\mathrm{m}} \exp \sum_{\mathrm{k}=0}^{\mathrm{x}} (\mathrm{B_n} - (\mathrm{D_i} - \tau_\mathrm{k}))}$$

Equation 1. The probabilistic function of the Rasch Rating Scale Model (Andrich, 1978)

Given a particular item *i* and person *t*, the Rasch Rating Scale Model calculates the probability of the person t answering the item *i* in demand response category. For instance, considering the MARS-SV, when exploring the approximation of that person responding item *i* to 4, values are applied in Equation 2:

$$P\{X_{t,i} = 4\} = \frac{\exp \sum_{k=1}^{5} (B_t - (D_i - \tau_k))}{\sum_{\mathrm{x}=0}^{5} \exp \sum_{\mathrm{k}=1}^{5} (\mathrm{B_t} - (\mathrm{D_i} - \tau_\mathrm{k}))}$$

Equation 2. An example of the fourth choice in 5-point Likert scale

Rasch model software like Winsteps and Bigsteps calculates item difficulty and a person ability by using raw scores for the items and people. The Rasch model defines a unit of measurement, the logit scale, to make measurement objective.

The Logit scale of Rasch model

After defining persons' abilities and item calibrations, the Rasch model presents them on a two dimensional 'Logit scale'. The scale is a vertical linear measurement of items and persons. An example of the logit scale is given in Figure 2. On the one hand, item measures are represented while on the other hand person measures are represented.

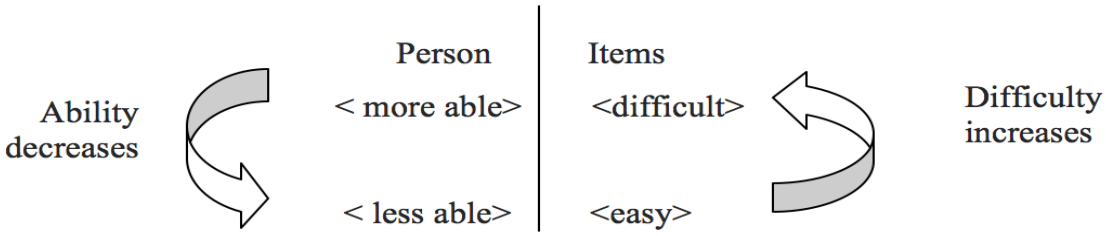


Figure 2. The explanation of the Logit scale

Rasch measures are expressed in two dimensional Logit scales. As a result of this two dimensional Logit scale, persons can be distinguished according to their Logit places which is different from traditional analysis. In traditional analysis, percentages do not provide clear inferences to researchers since they cannot address differences between persons. However, the Rasch model provides a linear measure to researchers with its Logit scale. The model also provides more effective and useful statistical studies since with Rasch measures, arithmetical operations can be performed.

The item measures and people measures are represented on the same scale so the interpretation of items and persons can be made and their relation with each other can be explained from this scale. It is an important property of the Rasch model which is construction of an interval scale from an ordinal scale for both items and persons. Since the Rasch model constructs an interval scale, it allows the researchers compare persons with each other and items with each other.

Furthermore, with the Rasch model, observed students' ratings converted to estimate measures with Rasch probabilistic function and the model provide 'expected score-measure graph'. This graph defines the cumulative normal distribution of the Rasch model. In the graph, y-axis demonstrates the average expected rating while x-axis refers to the latent variable (Linacre, 1999). The expected score ogive graph is a monotonic *S*-shaped function of the cumulative score accounting for high ability and low ability. Moreover, expected score ogive shows the rating measure zones. The ogive figure is divided into zones according to respond categories. The measured ability is represented on the x-axis, while the expected scores are represented on the y-axis. The intersection of measured ability and expected scores falls in a zone. It means that the expected score refers to the zone which it is located (Wu & Adams, 2007).

Fit statistics of Rasch model

Rasch model applies fit statistics for items and persons. Rasch measurement programs use two-chi- square ratios which are called INFIT and OUTFIT mean square for fit statistics. The first ratio, INFIT is an information-weighted fit statistic, which provides information about unexpected behavior affecting responses to items near the person's ability level. INFIT MNSQ is defined as "mean square for INFIT statistic with expectation 1" (Linacre & Wright, 1993, p. 93). A MNSQ value is calculated by dividing the observed variance of data by the expected variance which is estimated by the Rasch model. As it is seen, the ideal ratio of MNSQ being 1 means that observed variance equals the expected value and allows researchers to make correct predictions about student responses to certain items (Bond & Fox, 2003). MNSQ values below 1 indicate dependency in the data set, whereas MNSQ

values above 1 indicate noise. That means that some items or people responses does not fit the model well.

INFIT ZSTD defines “INFIT mean square fit statistic standardized to approximate a theoretical mean 0 and variance 1 distribution”(Linacre & Wright, 1993, p. 94) other means, the calculation of the sum of squared standardized residuals given in the form of Z-scores (Linacre & Wright, 1993). A particular item with a large INFIT value indicates that a person whose ability is closer the item’s difficulty didn’t respond to the item as expected. The second ratio for the fit statistics of the Rasch model is OUTFIT which is based on the average sum of squared residuals and an outlier-sensitive fit statistic. OUTFIT provides information about unexpected behavior of individuals which affects items and is not consistent with the persons’ ability level.

OUTFIT MNSQ is “the mean-square OUTFIT statistic, with expectation 1” (Linacre & Wright, 1993, p. 94) similarly to INFIT MNSQ. MNSQ values less than 1 indicates dependency in your data and MNSQ values greater than 1 indicates that there are unexpected outliers. OUTPUT ZSTD is “the OUTFIT mean-square fit statistic which is also similar to INFIT ZSTD which is a theoretical mean 0 and variance 1 distribution” (Linacre & Wright, 1993, p. 94). A particular item with large OUTFIT values indicates that a person whose ability is on a different level than item difficulty responded unexpectedly. When there is an easy item with a large OUTFIT value, it means that high ability students did not give the expected answer and failed on the item. For example, in the case of solving a mathematics-test, a large OUTFIT value means that high ability students could not solve this particular item. On the other hand, when there is a difficult item with large output values, it means that most

of the low ability students gave unexpected responses to the item and for the same example of mathematics test, it means that the low ability students solved the item even though it is difficult.

Items and persons are considered to a misfit to the Rasch model when their INFIT and OUTFIT MNSQ values are not in the range of 0.6-1.4 for the Likert scale according to Linacre and Wright (2000). The range of 0.5-1.5 is also used for identifying misfit items and persons that have values of INFIT MNSQ and OUTFIT MNSQ which exceed the range (Ariffin et al., 2010) and also recommended by Wright and et al (1994). Moreover, in previous studies items with both INFIT and OUTFIT ZSTD beyond ± 2 were considered misfit Rasch model (Hsueh, Wang, Sheu, Hsieh, & others, 2004). In the present study the range 0.5-1.5 was used to identify the misfit items in the Rasch model.

CHAPTER 3: METHOD

Research design

In this study, the Mathematics Anxiety Rating Scale-Short Version (MARS-SV) was administered to ninth grade students enrolled at a private high school in Ankara, Turkey. The Rasch model was applied to the collected data in the present study. The correlation was used to explore the Rasch measures of mathematics anxiety and midterm scores. It was also used to address the research question: "Is students' mathematics anxiety measured by MARS-SV facilitative for their mathematics achievement?". In this study, the Rasch model identified weights to items and provided the participants to individual ratings based on observed scores. The researcher investigated the relationship between mathematics anxiety and mathematics achievement by using participants' mathematics anxiety ratings from the Rasch model and participants' first midterm scores.

The Rasch model provides more appropriate data for this study in exploring mathematics achievement and mathematics anxiety since this model is used for educational psychological measurement of response such as multidimensional abilities, attitudes or cognitive processes since the 1980s. Mathematics anxiety is considered as a psychological construct. Moreover, the distinctiveness of mathematics anxiety as a psychological construct has received researchers' attention. There is not however a general consensus between researchers on the complexity of mathematics anxiety. Measuring mathematics anxiety could cause validity and reliability problems in research. For these reasons, this study applied the Rasch

model to measure students' mathematics anxiety and give each student's individual ratings for the levels of anxiety.

Context

This study was conducted in a private secondary school in Ankara, Turkey with all students from ninth-grade classes of the school. As a result of economic and social conditions of the researcher and the strong relations of this school represented good conditions for this proposed study. Additionally, the ninth-grade students represented a more appropriate sample for this study since they are unlike eleventh and twelfth grade students. For a few reasons, the ninth-grade students were less stressful about the Turkish National University Exam since they still have three years to take the exam.

Participants

Seventy nine students participated from five ninth-grade in a private high school in this study. The Mathematics Anxiety Rating Scale was administered to all students from ninth-grade in the school. Following that students took their common first midterm exam, which were applied to ninth-grade students in the school.

Instruments

Mathematics Anxiety Rating Scale - Short Version (MARS-SV)

This study used a 30-item Mathematics Anxiety Rating Scale-Short Version (MARS-SV). MARS-SV was derived from the 98-item Mathematics Anxiety Rating Scale

(MARS) which was adopted by Suinn and Winston (2003).The short version of MARS was revised since the original instrument is a long and time consuming instrument with many dimensions. The Mathematics Anxiety Rating Scale-Short Version (MARS-SV) was translated into Turkish by Baloğlu (2010) and this translation of the scale was used in this present study. The short and translated Mathematics Anxiety Rating Scale is a five-point Likert scale (from *1. not at all* to *5. very much*). This instrument assesses students' levels of mathematics anxiety.

Midterm exam for mathematics achievement

In the present study, the mathematics achievements of participants was determined by their midterm exam which was given in October to all ninth-grade students. After the exam results were released, the researcher obtained the students' exam results from classroom teachers.

The midterm was a 10-question open-ended written exam. This exam involved the concepts of logic and sets. The exam questions can be found in Appendix E. Questions 1, 2, 5, 7, 9, and 10 were related to logics, while the questions 3, 4, 6, and 8 were related to sets. Question 10 included both logic and sets, and the tenth question was a fill in blank question.

Method of data collection

In the first step of the study, "Translated Mathematics Anxiety Rating Scale-Short Version" (MARS-SV) was administrated to the ninth-grade students enrolled in five classes at the high school. The researcher coded each student with numbers as ST1-ST78. After the application of the MARS-SV, all ninth-grade students took the

midterm exam. The classroom teachers graded the results of the midterm exam and the results were released by the school mathematic teachers to the researcher. The midterm exam was evaluated out of 100. According to their codes, the researcher matched the students' answers to the MARS-SV and their midterm results. The data obtained from the MARS-SV and the students' responses to the items: not at all, a little, a fair amount, much and very much, were coded from 1 to 5 respectively and the students' responses were screened.

In the second step of the study, the obtained data were screened and analyzed using traditional methods. Descriptive analysis was applied to the raw scores which were investigation of mean, standard deviation, median, and a histogram of raw scores. Following the descriptive analysis, the correlation between raw scores and students' midterm scores was investigated. Data were analyzed by using the Bigsteps package which is a DOS-based Rasch measure program. Rasch Rating Scale Model was applied to the data. Fitness between data and model was analyzed. Thus misfit items were found based on the model's criteria of the Rasch Rating Scale Model. The Logit scale of the Rasch model was rescaled by using the codes USCALE and UMEAN codes in order to make the investigation more effective. USCALE arranges the value of the one Logit of Rasch measures and by using UMEAN code, the mean of items, and persons converted to a specific interval.

After the misfit items had been excluded and the arrangements for rescaling have been done, the data have been analyzed using the Bigsteps program. From this analysis, every participant received a total measurement for their level of mathematics anxiety and item difficulties were found. The obtained data from the Rasch model will be called Rasch measures in this current study. Similar to the

descriptive analysis of raw scores, the mean, standard deviation, median and histogram of Rasch measures were calculated and the correlation was explored between students' Rasch measures and their midterm scores. The steps suggested in the literature and Rasch analysis were compared in the Table 1.

Method of analysis procedures

Table 1
Data analysis procedure with Rasch Rating Scale Model

Steps	In the literature	Procedure in this study
1. Data Screening	Eliminate student responses with extreme Z-scores Eliminate responses of students who missed the last page of the scale.	ST 41's responds were eliminated (Z-score = 5.39) ST2, ST64, ST72, ST75, ST76's responds were eliminated.
2. Descriptive statistics of raw scores	Classical analysis of raw scores Correlation between raw scores and exam results	*M* = 1.84, *SD*= 0.57, *r* = -0.40
3. Constructing a control file (see appendix)	Constructions of the control file for The Bigsteps program and run the Bigsteps.	Calculation Rasch measures with the 73 students (without ST2, 41, 64, 72, 75, and 76) and 30 items into Bigsteps
4. Rescaling the control file	Rescaling the control of Bigsteps by using codes USCALE and UMEAN	USCALE = (wanted range) / (current range) = 4 / (4.41+4.95) = 0.43; UMEAN = (wanted low) - (current low * USCALE) = 1 – (-4.95) * 0.43 = 3.12
5. Application of Rasch model	Application of the constructed control file to Bigsteps	Examination of the output file
6. Fit Statistics for items	Examine TABLE 10.1 in Step 5 output file. Find items with which MNSQ is out of 0.5 – 1.5 and ZSTD is out of -2 – +2. Repeat step3 until misfit for items eliminated	Item deletion according to selection fit statistics criteria. Addition of I 6, I 18, I 23, I 27 in IDFILE (control file of Bigsteps) for deletion and refit data with Bigsteps. Addition of I11 and I22 in IDFILE for deletion and refit the data with Bigsteps.
7. Constructing a control file (see appendix)	Constructions of the control file for The Bigsteps program and run the Bigsteps.	Calculation Rasch measures with the 73 students (without 2, 41, 64, 72, 75, and 76) and 24 items into Bigsteps (without the items I6, I11, I18, I22, I23, and I27).
8. Descriptive Statistics of Rasch measures	Analysis of Rasch measures from Bigsteps; calculation of correlation between raw scores and exam results	*M* = 2.45, *SD*= 0.50, *r* = -0.45
9. Comparison	Comparison of effect size of correlations from Rasch measures and raw scores.	The correlation in the Rasch measures is higher than the one in the raw scores.

CHAPTER 4: RESULTS

Introduction

This chapter includes the results from descriptive statistics for raw scores and Rasch measures, and outcomes of Rasch analysis. Moreover, the correlation between students' raw score to MARS-SV, their school midterm results, and the correlation between students' Rasch measures of anxiety and their school midterm results are given in this chapter.

Descriptive and correlation analysis of raw scores

In the data screening phase of the study, one student response to the categories was found to be extreme. Student 41 responded to all items '5 - very much' and in the result he has got an extreme z-score= 5.39 so his responses were eliminated from the study in the data screening phase. It was found that students ST2, ST64, ST72, ST75, and ST 76 missed the last page of the survey and they did not respond to the items on the last page. Their responses were also deleted from the study in the data screening process because of the missing data. Hence, the final sample of the study consisted of 73 students after the screening phase. The students' responses to MARS-SV were calculated using a mean across all items. The mean and frequencies calculated by using 73 students' responses to the scale. The distribution of scores according to the frequency was presented in Figure 3.

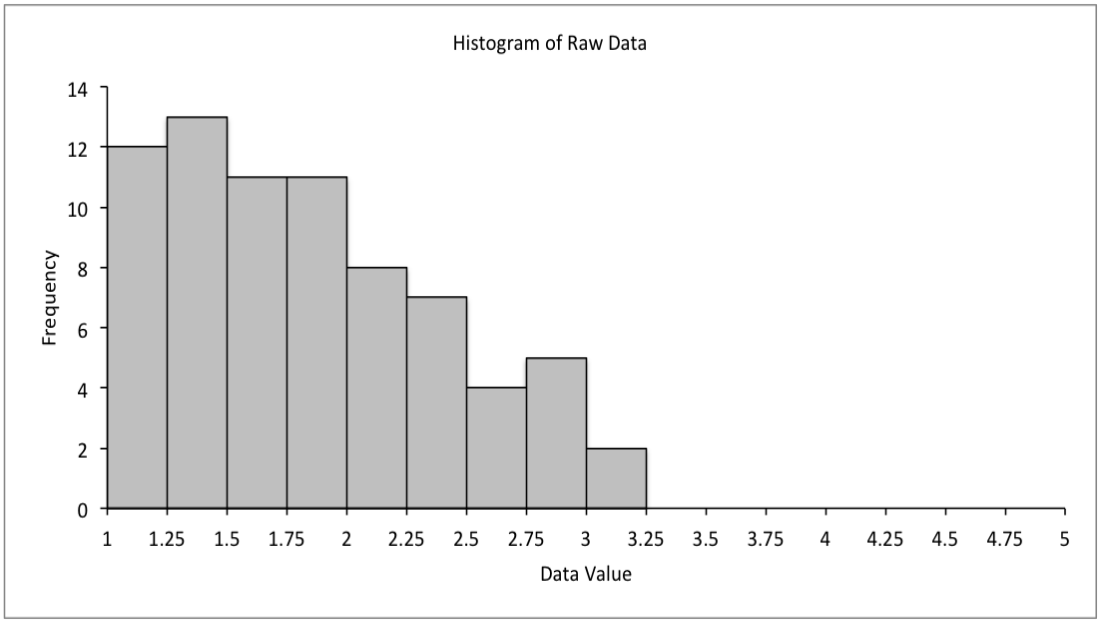


Figure 3. Histogram of the raw scores

Sixty-five percent of the students received measures that were placed between 1 and 2. Sixteen percent of the students have got measures which have been placed between 1-1.25 while 19% of the students received measures that were placed between 1.25 and 1.5. Moreover, 30% of the sample received measures that were placed between 1.5 and 2. In the light of these percentages, it can be concluded that many students were not anxious towards mathematics. The measures between 1 and 2 correspond to response categories “not at all” and “a little” from the Likert-scale. On the other hand, the most anxious students in the class received values between 3 and 3.25 but these students only comprised 3% of all the sample. These two students rate themselves as they had “a fair amount” of mathematics anxiety. Furthermore, the mean of the sample was 1.84 and the standard deviation was 0.57. This also showed that the sample did not show much anxiety towards mathematics. Moreover, the median of the sample was 1.77. The mean and median were different so the data did not show normal a distribution.

After descriptive analysis of raw scores was completed, the correlation between mathematics anxiety raw scores and exam scores was investigated. The correlation between students' raw scores of mathematics anxiety and their mathematics exam scores were analyzed by using EXCEL and the SPSS package program. The scatter plot and the correlation is presented in Figure 4.

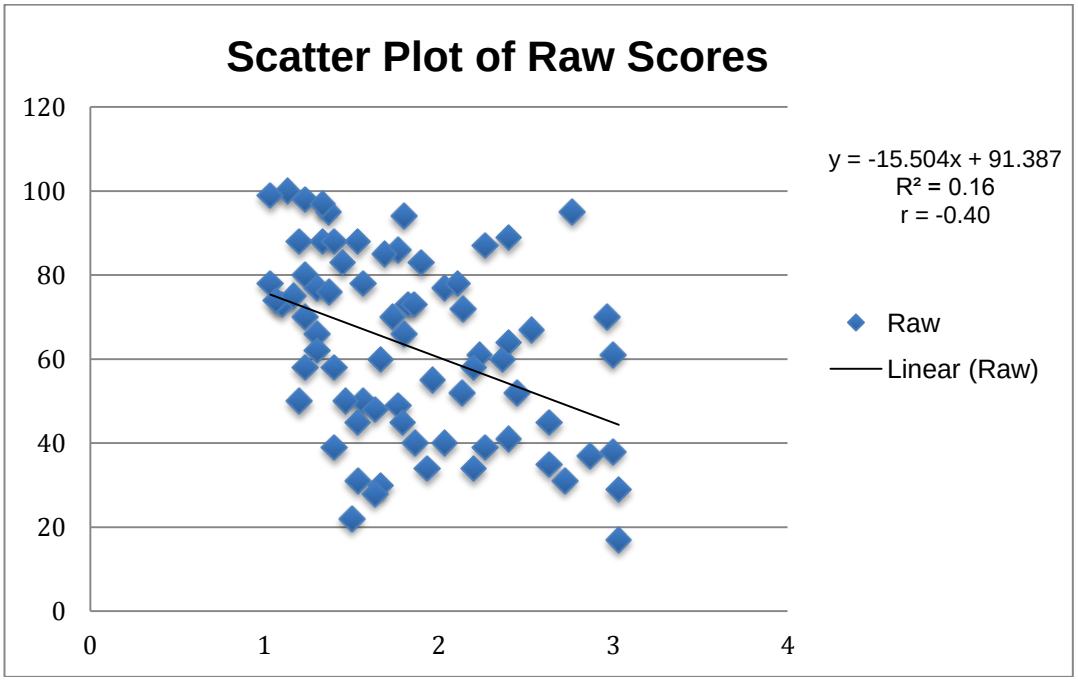


Figure 4. The scatter plot of raw scores of MARS-SV and midterm scores

The findings showed that there was a moderate correlation between students' mathematics anxiety—the raw scores—and their mathematic midterm scores, r = -0.40 (p < .01). This correlation coefficient shows that there was a significant relation between mathematics anxiety and students' mathematics achievement. Moreover, 16% of the variance in the mathematics exam score was related to variances in students' mathematics anxiety ratings.

Findings from Rasch analysis

In the third, fourth, fifth, sixth and seventh steps of the study, the computer package Bigsteps Final Version 2.82 was used to analyze the students' responses to MARS-SV (see Table 1) and to apply Rasch Rating Scale Model to the data. After the data screening phase, responses from the 73 students to 30 items in the scale were analyzed by Bigsteps. It was found that there were some items which did not fit the model well. In the study, the Bigsteps instructions for the INFIT, and OUTFIT criteria for the misfit data (0.5-1.5) were followed. The responses to the items, which their INFIT and OUTFIT MNSQ values exceed the range were eliminated. The data was refitted and analyzed again by Bigsteps until there were no misfit items.

The Rasch analysis program Bigsteps provided a table for the misfit order and it is presented in Table 2. In the current study, these items were considered a misfit to the Rasch model when both their INFIT and OUTFIT MNSQ values are out of the significant range between 0.5 and 1.5. Furthermore, it was accepted that the significant values for the misfit statistics for both INFIT and OUTFIT ZSTD, which are standard residuals as z-statistics, are in the range between -2 and 2. The misfit items were explored according to Bigsteps fit statistics tables and according to guidance of Bigsteps regarding the most fitting items.

In the first run of the Bigsteps program, it was discovered that four items 6, 18, 23, and 27 (see appendix)were misfit to the Rasch model with high values exceeding INFIT range. All four items had high values both for INFIT and OUTFIT MNSQ, and ZSTD. The large OUTFIT values indicated that unexpected responses were given to these items. Item 6: 'waiting to get a math test returned in which you expected well', Item18: 'reading a cash register after your purchase', Item 23:

‘totaling up a dinner that you think they overcharged you’ and Item 27: ‘watching someone work with a calculator’ were given unexpected responses according to Rasch model. That is, the response patterns were unpredictable and erratic for the Rasch model. This implies that the responses to MARS-SV may not provide enough information about the underlying construct, mathematics anxiety compared to other items of the scale. Especially, the outfit ZSTD values of these items were very high which implied that these questions may be not appropriate for the students in this study. The model also implies that there can be different reasons for the unexpected responses and it suggest further investigation on these four items.

In the step for repetition of the Bigsteps, it was found that Item 11 ‘taking the math section of a college entrance exam’ and Item 22 ‘having someone watch you as you total up a column of figures’ were misfits of the Rasch model. These two items also had high INFIT and OUTFIT MNSQ and ZSTD values. This shows that these items did not provide much information about mathematics anxiety of the students.

In Table 2, note that SCORE represents the raw score corresponding to the anxiety while COUNT is the number of valid data points. MEASURE defines the estimated value for mathematics anxiety. ERROR is the standard error of the estimate. INFIT is a standardized information-weighted mean square statistic whereas OUTFIT is a standardized outlier-sensitive mean square fit statistic. MNSQ is the mean-square statistic, with expectation 1 and ZSTD is the mean-square fit statistic standardized to approximate a theoretical mean 0 and variance 1 distribution.

Table 2
The misfit order of the items

Entry Number	Raw Score	Count	Measure	INFIT		OUTFIT		Item
				MNSQ	ZSTD	MNSQ	ZSTD	
20	95	71	3.47	1.49	1.60	0.95	-0.10	I20
9	164	72	2.81	1.10	0.60	1.47	1.90	I9
29	97	72	3.46	1.46	1.50	0.98	0.00	I29
8	176	72	2.73	1.42	2.30	1.46	2.00	I8
26	124	71	3.10	1.42	1.90	1.23	0.80	I26
14	122	68	3.06	1.08	0.40	1.32	1.00	I14
28	101	72	3.39	1.30	1.10	1.26	0.60	I28
10	127	72	3.09	1.27	1.30	1.23	0.80	I10
7	140	72	2.98	0.96	-0.20	1.21	0.80	I7
24	125	72	3.11	1.20	1.00	1.16	0.50	I24
19	93	69	3.47	1.19	0.70	1.12	0.30	I19
17	88	72	3.65	1.17	0.50	0.75	-0.60	I17
21	92	71	3.53	1.14	0.50	0.71	-0.70	I21
25	129	69	3.03	0.80	-1.10	1.10	0.40	I25
16	103	70	3.33	1.09	0.40	0.90	-0.30	I16
30	92	72	3.56	1.07	0.20	0.93	-0.20	I30
13	86	72	3.71	1.01	0.00	0.72	-0.60	I13
5	215	72	2.49	1.00	0.00	0.97	-0.20	I5
4	207	72	2.54	0.90	-0.70	0.91	-0.50	I4
15	120	72	3.16	0.86	-0.70	0.73	-1.00	I15
2	159	72	2.84	0.84	-1.00	0.82	-0.90	I2
12	150	72	2.91	0.81	-1.10	0.77	-1.10	I12
3	193	72	2.62	0.77	-1.60	0.71	-1.70	I3
1	174	71	2.72	0.70	-2.10	0.66	-1.90	I1
MEAN	132	71	3.12	1.08	0.20	1.00	0.00	
S.D	39	1	0.35	0.23	1.10	0.24	1.00	

From Table 2, the item measures for the remaining 24 items of the scale and their misfit values can be seen. These 24 items fit the data well and their INFIT and OUTFIT values were in significant range of the Rasch model. These items provided information about students' mathematics anxiety efficiently. These findings showed that the six items of MARS-SV, which were items 6, 11, 18, 22, 23 and 27, does not fit the model very well. They have high values of INFIT, OUTFIT MNSQ and ZSTD. Even though these items do not influence reliability and validity of the scale, they do not underlie the construct mathematics anxiety effectively. The model suggests that these items should be investigated more in detail to understand why they did not provide effective information regarding mathematics anxiety. From these results, it can be concluded that the application of these 24 items instead of all

30 items can be more effective and can provide more information about the mathematics anxiety of students.

Table 3
The conversion table of Rasch measures on the complete test

SCORE	MEASURE	S.E	SCORE	MEASURE	S.E	SCORE	MEASURE	S.E
24	1.00E	0.60	57	2.87	0.09	90	3.45	0.09
25	1.29	0.42	58	2.89	0.09	91	3.47	0.09
26	1.58	0.30	59	2.91	0.09	92	3.49	0.09
27	1.76	0.24	60	2.93	0.09	93	3.51	0.09
28	1.88	0.21	61	2.95	0.09	94	3.53	0.09
29	1.97	0.19	62	2.96	0.09	95	3.55	0.09
30	2.05	0.17	63	2.98	0.09	96	3.57	0.09
31	2.12	0.16	64	3.00	0.09	97	3.59	0.09
32	2.17	0.15	65	3.02	0.09	98	3.61	0.10
33	2.23	0.14	66	3.03	0.09	99	3.63	0.10
34	2.27	0.14	67	3.05	0.09	100	3.65	0.10
35	2.32	0.13	68	3.07	0.09	101	3.68	0.10
36	2.35	0.13	69	3.09	0.09	102	3.70	0.10
37	2.39	0.12	70	3.10	0.09	103	3.72	0.10
38	2.43	0.12	71	3.12	0.08	104	3.75	0.10
39	2.46	0.12	72	3.14	0.08	105	3.78	0.11
40	2.49	0.11	73	3.15	0.08	106	3.80	0.11
41	2.52	0.11	74	3.17	0.08	107	3.83	0.11
42	2.55	0.11	75	3.19	0.08	108	3.86	0.12
43	2.57	0.11	76	3.20	0.09	109	3.90	0.12
44	2.60	0.10	77	3.22	0.09	110	3.93	0.12
45	2.62	0.10	78	3.24	0.09	111	3.97	0.13
46	2.65	0.10	79	3.26	0.09	112	4.01	0.14
47	2.67	0.10	80	3.27	0.09	113	4.06	0.15
48	2.69	0.10	81	3.29	0.09	114	4.11	0.16
49	2.71	0.10	82	3.31	0.09	115	4.17	0.17
50	2.74	0.10	83	3.32	0.09	116	4.25	0.19
51	2.76	0.09	84	3.34	0.09	117	4.35	0.22
52	2.78	0.09	85	3.36	0.09	118	4.49	0.27
53	2.80	0.09	86	3.38	0.09	119	4.74	0.40
54	2.82	0.09	87	3.40	0.09	120	5.00E	0.58
55	2.84	0.09	88	3.41	0.09			
56	2.86	0.09	89	3.43	0.09			

In Table 3, note that SCORE represents the raw score corresponding to anxiety. MEASURE defines estimated value for the mathematics anxiety. SE is the standard error of measure. The Rasch model also provided a conversion table for the raw scores. In Table 3, the conversion table of the Rasch model was represented. The Score defines the scores which students can get after filling the MARS-SV scale where MEASURE defines students' Rasch measures corresponding to the scores of

the students. By using Table 3, the Rasch measures of a participant can be converted to raw scores easily and inversely, the raw score of a participant can be converted to Rasch measurement. Moreover, from now on, Table 3 can be used to convert the raw scores of 24 item MARS-SV to Rasch measures without applying the Rasch Rating Scale Model again. After applying the 24 items of the MARS-SV (without the 6 misfit items), for example, an educator can convert his samples' scores by using Table 3.

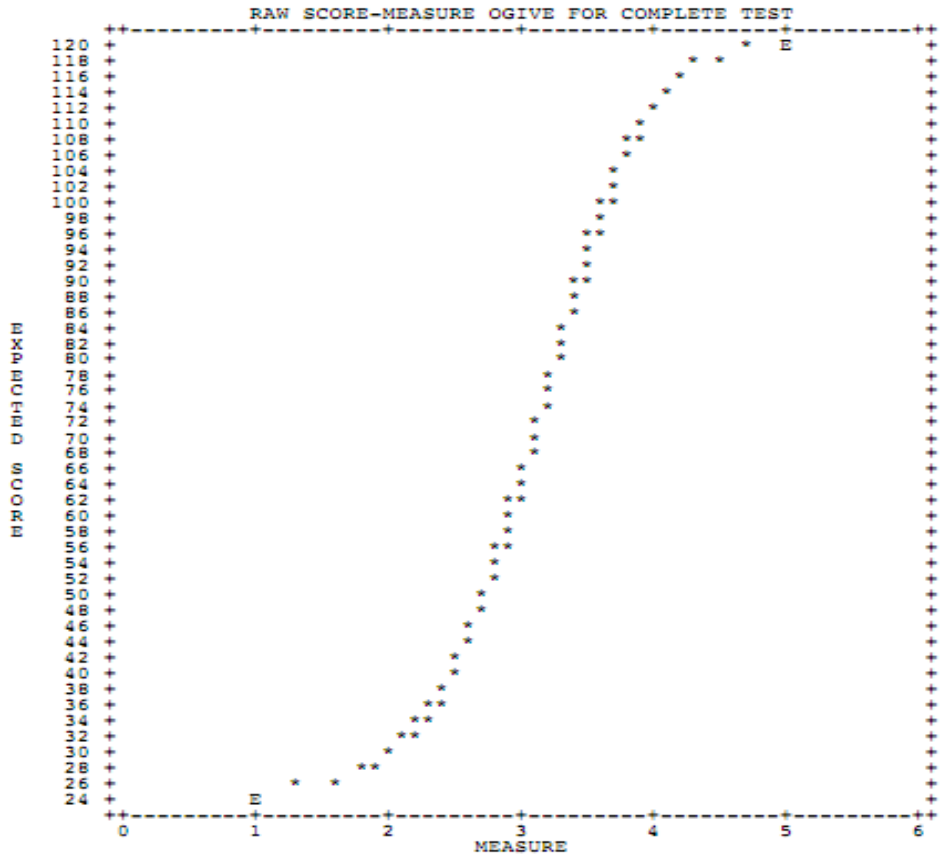


Figure 5. Raw score-measure ogive for complete test

Furthermore, the distribution between the expected raw scores and the Rasch measures are presented in Figure 5. The Rasch measures between 1 and 2 corresponded to the expected scores between 24 and 30 while the Rasch measures

between 2 and 3 corresponded to the expected scores between 30 and 66. Similarly the Rasch measures between 3 and 4 corresponded to the expected scores between 66 and 110 whereas the Rasch measures between 4 and 5 corresponded to the expected scores between 110 and 120. Even though the Rasch model provided linear Logits for the measures, it is obvious from Figure 5 that the distribution of the linear Rasch measures which correspond to the expected scores for raw scores, differ from each other. In Figure 5, it can be seen that the distribution of the expected scores corresponding to the Rash measures interval 3-4 is larger than the distribution of expected scores for other Rasch measures intervals. Similarly, the Rasch measures interval 2-3 includes a larger distribution of the expected scores. It can be concluded from Figure 5 that students receiving the Rasch measures between 3 and 4 are the highest probability according to the Rasch model. Moreover, students receiving the Rasch measures between 2 and 3 had the second highest probability.

The two dimensional Logit scales for the Rasch measures was presented in Figure 6. The left hand side shows the distribution of students' level of anxiety while the right hand side shows the distribution of item calibrations. Items were labeled as I1-I30 and students are coded with numbers. M is the mean value while S labels one standard deviation and Q labels two standard deviations of the item and person distribution.

As it is understood from Figure 6, students did not have a high level of anxiety towards mathematics. The distribution of item calibrations and students' mathematics anxiety levels did not match in the person item map. Since it is an object-measurement of Logit, we can compare the mean of the students' mathematics

anxiety with the items' representing level of anxiety. Students' anxiety level mean was 1.5 Logit below items' mean. This says that students did not have a high level of anxiety towards mathematics. From Figure 6, it is obvious that items 13 and 17 measured students' anxiety more than any other items while items I3, I4 and I5 reflected students' anxiety towards mathematics less than the other items. Some items reflect the same level of anxiety in the scale. For example, the items I19, I20, and I29 measure mathematics anxiety at the same level.

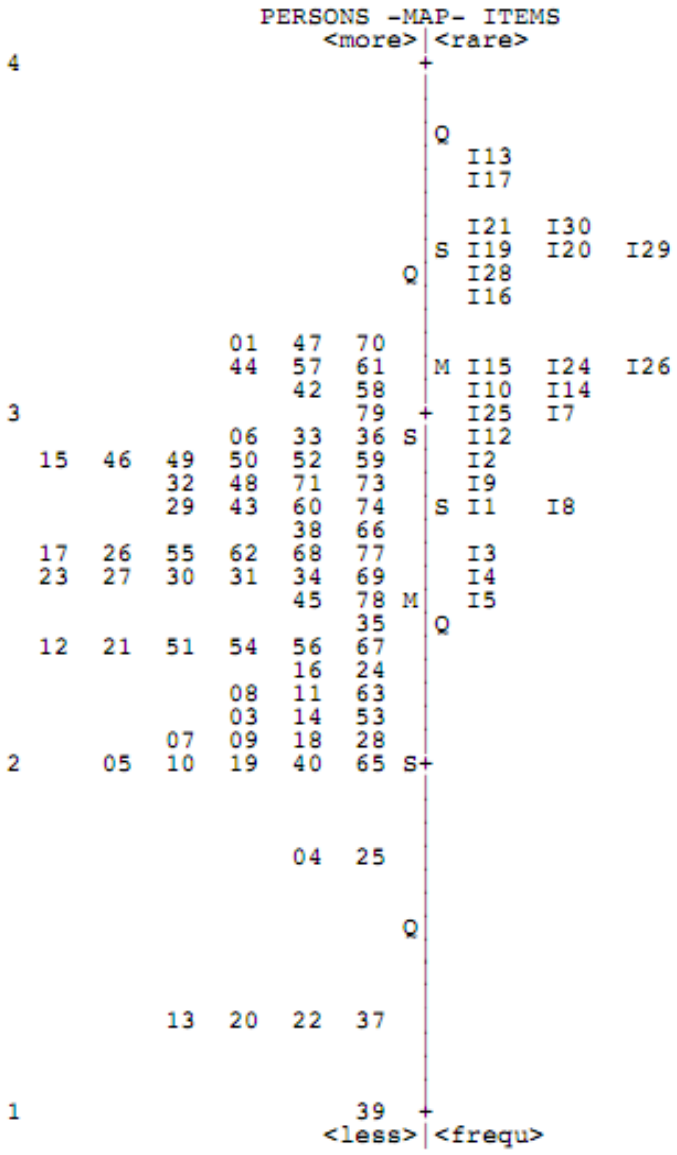


Figure 6. Person-item map for the students

Moreover, ST70 was the most anxious student in the sample with Rasch measure 0.25 while ST39 was the least anxious student in the sample with a Rasch measure -4.96. The width of scale is approximately 4 Logit and most of the items were distributed between the Logit 0 and 2. The width of the students' distribution was approximately 3.5 Logit and most of the students are distributed between the Logit 0 and 2. Again from the investigation of Figure 6, it is seen that many students had the same level of mathematics anxiety.

Descriptive and correlation analysis for Rasch measures

In this current study, the mean of the students' Rasch measures for mathematics anxiety were also calculated. The distribution of the Rasch measures according to the frequency is presented in Figure 7:

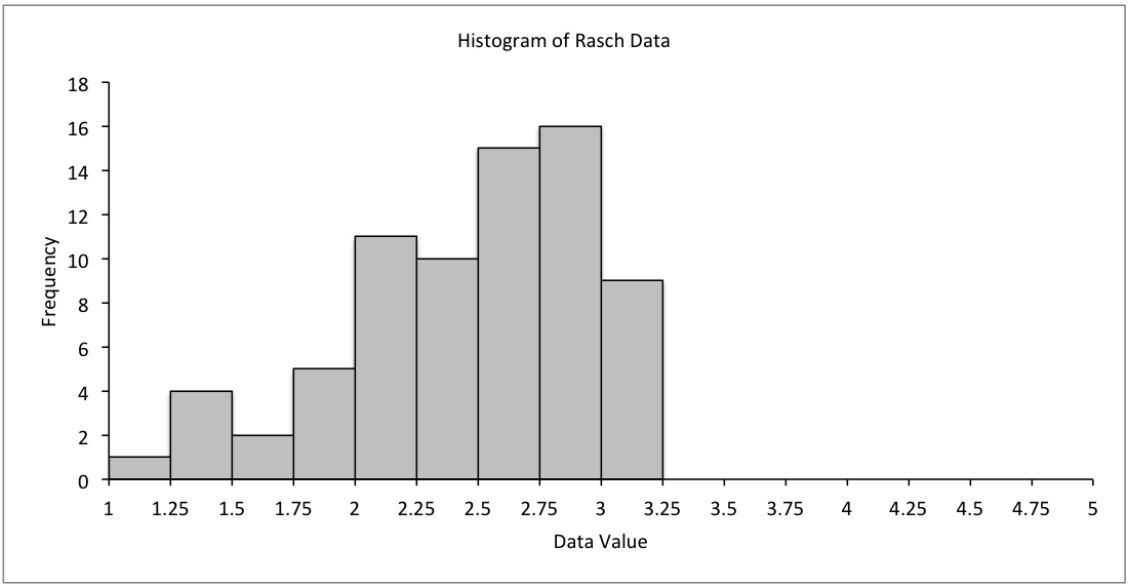


Figure 7. Histogram of Rasch measures

As shown in Figure 7, 22% of the students received values between 2.75 and 3. Additionally, 21% of the students' Rasch measures were between 2.5 and 2.75. It can

be concluded that most of the students had significant and moderate mathematics anxiety according to the Rasch measures. The least anxious students composed 1, 4% of the sample which is very small. This showed that many students in the sample were anxious towards mathematics. The mean of the sample was 2.45 while the standard deviation was 0.5. The median of the sample was 2.54. The student's anxiety measures with the Rasch model were then transferred into the computer environment using SPSS. The correlation between students' mathematics anxiety measurement and their mathematics scores were analyzed. The correlation can be seen in Figure 8.

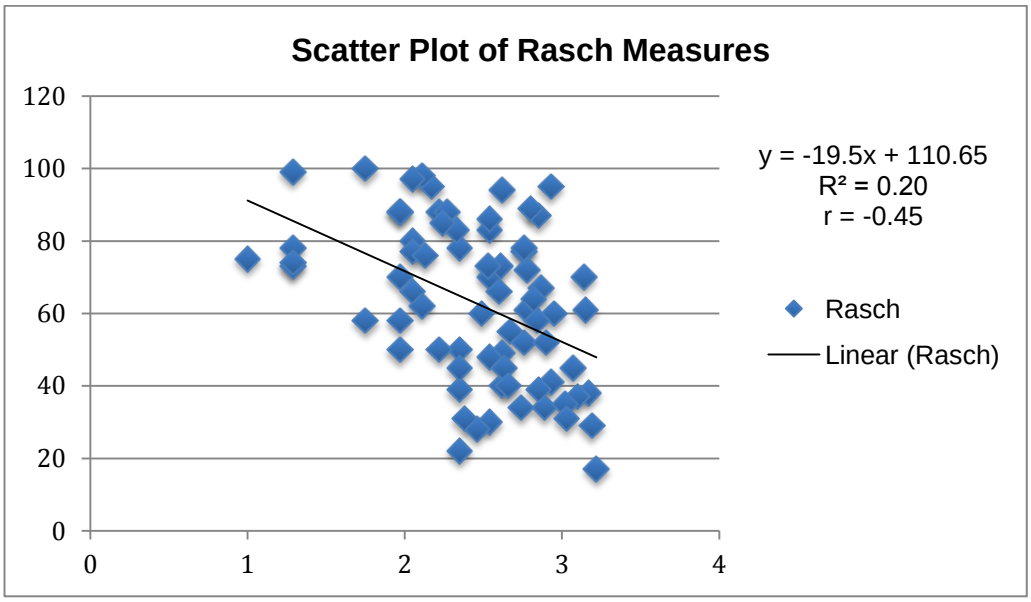


Figure 8. The scatter plot of Rasch measures to MARS-SV and midterm scores

From Figure 8, findings shows that there was a moderate correlation between students' mathematics anxiety—the Rasch measures—and their mathematic midterm scores, r = -0. 45 (p < .01). This shows that 20% of the variance in the mathematics exam score was related to variance in the students' mathematics anxiety ratings.

CHAPTER 5: DISCUSSION

Introduction

This study investigated the correlation between mathematics anxiety and mathematics achievement with the application of MARS-SV. For this aim, the Rasch Rating Scale Model was applied to raw score and procedure of the application of the Rasch model (see Table 1) was explored. Comparing the conventional method of mean calculation, this section discusses the application of the Rasch rating scale model in terms of enhancement correlation. Subsequently, the implications for educators and further research question were discussed.

Discussion of findings

Application of the Rasch rating scale model to MARS-SV

As mentioned in Chapter 4, the present study applied Rasch rating scale model to investigate the correlation between mathematics anxiety and mathematics achievement. The Rasch model based analysis of the MARS-SV provided important insights about raw scores from traditional analysis. That is, significant differences between raw scores and Rasch measures were found in this study. When the histogram of raw scores (see Figure 3) and the histogram of Rasch measures (see Figure 7) were compared, it can be seen that there were significant differences between the two histograms. In the histogram of raw scores (Figure 3), the distribution had a positive skew. That is, the responses of the students tended to be in the lower end of MARS which means that the students had ‘a little’ amount of mathematics anxiety. Consistent with these results, the mean of the raw scores was

1.84 and its median was 1.77. These values also imply that the students did not show too much anxiety towards mathematics.

On the other hand, the histogram of the Rasch measures in Figure 7 provided more detail. It can be seen that the distribution of the Rasch measures was negatively skewed which is different from the distribution of raw scores. After applying the Rasch model to raw scores, the Rasch measures tended to be placed in the higher end of MARS. This finding indicated that according to the Rasch measures, students were more anxious towards mathematics than the raw scores indicated. As a result of application of Rasch model, the mean also increased to 2.45 and the median became 2.54. The findings indicated that, compared to raw scores, Rasch measures indicated more mathematics anxiety. Furthermore, it is obvious from both histograms (see Figure 3 and Figure 7) of the Rasch measures and raw scores were not normally distributed. The mean and the median were not same or close for both histograms. It is known that in a normal distribution, mode, median, and mean are equal to each other, which is an important property of normal distribution. The histograms of this present study did not satisfy this property. Despite of the weakness, it can be inferred that the Rasch measures approached to the normal distribution more than the raw scores. Hence, the Rasch measures provides more efficient and useful information to researchers.

In addition, according to the Rasch model six items were found to be misfit to the Rasch model and it was concluded that 24-item of MARS-SV should be used instead of using the initial enhancement. This reduction gave more effective results for researchers and educators. While constructing the control file for Rasch analysis and

application of Rasch model, these items were investigated in more detail. The Rasch model also provided information about MARS-SV which defined misfit items for this model. The fit statistics of the Rasch model suggested that the items with higher INFIT MNSQ, OUTFIT MNSQ, and ZSTD values did not threaten the dependency in the data. Though these items needed further investigation about why their values were higher and for what reasons these items had higher misfit values. The Rasch model also provides researchers with detailed information about the scale which was applied. The model provided more questions about the items and why some of the items did not fit the model. In the light of these questions, more detailed investigation can be conducted to the used scale.

Another insight from the application of the Rasch model was the difference between correlation results (see Figure 4 and Figure 8). Even though the correlation effect sizes are close to each other, there was still a slight difference between the correlation of Rasch measures and correlation of raw scores. The correlation between raw scores and students' midterm scores was -0.40 in Figure 4 whereas the correlation between Rasch measures and students' midterm results was -0.45 in Figure 8. These findings showed that the Rasch model provided more effective and useful information to researchers. Furthermore, with a larger sample these differences can be wider, so that the difference between classical analysis and Rasch analysis can be more informative.

The correlation between students' mathematics achievement and mathematics anxiety measured by MARS-SV

In the current study, even though there were differences between the correlation of raw scores and Rasch measures, there was a moderate negative correlation between students' mathematics anxiety and students' mathematics achievement for both raw scores and Rasch measures (see Figure 4 and Figure 8). This result is also consistent with previous studies (Brush, 1978; Buckley & Ribordy, 1982; Cooper & Robinson, 1991; Dew, Galassi, & Galassi, 1984; Nicholas & Holcomb, 1986; Wigfield & Meece, 1988) in the vast literature. That is, this finding is significant since it shows students, teachers, and parents that mathematics anxiety is important. It can be inferred that parents and educator should be aware of their students' anxiety towards mathematics and should pay attention to the effects of mathematics anxiety on students' mathematics achievement. Teachers and educators should also try to understand their students' mathematics anxiety so that they can manipulate or mediate students' anxiety levels. Anxiety interferes with students' learning. That is, the mathematics anxiety has negative effects on students and students' mathematics achievement is affected by it. For effective learning and to enhance students' becoming more successful at mathematics it is essential to reduce students' anxiety towards mathematics.

In the present study, the question of whether mathematics anxiety is facilitative or debilitative was also considered. It can be inferred that the mathematics anxiety has debilitative effects on the students' mathematics achievement in the light of the negative correlation which was found (see Figure 4 and Figure 8). According to these findings, mathematic achievement also affects mathematics anxiety inversely. This

inverse relationship between mathematics anxiety and mathematics achievement indicates that the mathematics anxiety is debilitative for achievement of the students.

Implications for practice

In mathematics classrooms, teachers can use the table of the Rasch model in Table 3 to measure their students' anxiety effectively. Traditional analysis may be deceptive for teachers who aim to use scales in their classrooms to measure students' anxiety levels. With traditional analysis, teachers can order students' scores and give them ranks according to students' percentages. However, to measure an abstract construct and for mental testing, the student responses should be evaluated independently from the items. In traditional analysis, this separation is impossible, but Rasch measures provides this property to teachers. By referring to the Logit scale of the Rasch model (see Figure 6), teachers can compare students' anxiety independent from items. Moreover, teachers can also relate with items with students' anxiety so they can make more effective inferences regarding their students.

As it is seen from the results of the current study, mathematics anxiety interferes with students' learning. Hence, teachers are required to focus on their students' mathematics anxiety. It is a fact that measuring students' anxiety is important and teachers should understand and manage their students' mathematics anxiety (Hembree, 1990; Newstead, 1998). For this aim, teachers can use the 24-item MARS-SV in Table 2 to explore their students' anxiety level. Even though the Rasch model is an advantageous statistical model in many aspects, the procedure of application of the Rasch model to MARS-SV can be difficult, complex or tiring for a

teacher. In this case, mathematics teachers can apply the MARS-SV to their students. After the application of the MARS-SV, teachers can use the comparison table (see Table 3) which was obtained from the Rasch model. After calculating the students' raw scores, teachers can determine the corresponding Rasch measures from the conversion table so that they can obtain more linear and useful information about the students' level of mathematics anxiety. In this way, they can reach practical effective results. Thus, they may use the Rasch measurement results to cope with the students' anxiety towards mathematics in their classes and to predict student achievements.

Implications for further research

In the current study, the correlation between mathematics anxiety and mathematics achievement was explored. The findings show that there is an inverse relationship between students' mathematics anxiety and achievement (see Figure 4 and Figure 8). On the one hand, it can be concluded that mathematics anxiety has debilitative effects on students' achievements. In the literature there are suggestions of a certain amount of anxiety that can motivate students and facilitate the students' learning (Alpert & Haber, 1960; Newstead, 1998). That is, the small amount of anxiety can facilitate students and, after reaching a certain amount, anxiety becomes debilitative for learning. To prevent mathematics anxiety becoming debilitative, how to manage students' anxiety should be investigated in more detailed. The findings reassure that anxiety plays an important role in mathematics achievement, so that teachers and educators should manipulate or mediate students' anxiety to facilitate student learning.

In the study, linear models were used to measure and analyze students' level anxiety. For this reason, facilitative anxiety couldn't measured effectively. To measure facilitative anxiety for students' mathematics achievement, different methods and tools can be investigated in future studies. Moreover, further studies should explore students' level of mathematics anxiety in terms of gender differences. How the relation between mathematics achievement and anxiety varies among girls and boys should be investigated by using Rasch Rating Scale Model.

Limitations

This study was conducted in one private school, Ankara to measure students' mathematics anxiety. The student profile of private schools may be different from student profile of public schools. Similar studies should be done in a public school to observe whether there is the same pattern of student responses or not. The shortest and revised version of the MARS was applied in the study. Baloğlu (2010) translated the MARS-SV into Turkish. Even though, there were a few items which were not appropriate for ninth grade students, the original scale was used in the study in order to preserve validity and reliability of the scale. For data analysis in the study, Rasch Rating Scale Model was applied to the data and the relation between students' mathematics anxiety and their mathematics achievement was investigated with the computation of correlation. Since both methods are linear, any possible non-linear relations such as a quadratic curve between two factors could not be observed properly. The methodology of the study could not measure facilitative anxiety of the students even if there might have been a certain degree. Future studies may consider using nonlinear measures of the relationship between mathematics anxiety and mathematics achievement.

REFERENCES

Adeyemo, D. A., & Adetona, M. O. (2005). A path analytic study of the personality factors affecting students' learning outcomes in mathematics. *European Journal of Scientific Research*, *18*(1), 118–133.

Alkan, V. (2011). Etkili matematik öğretiminin gerçekleştirilmesindeki engellerden biri: Kaygı ve nedenleri. *Pamukkale University Journal of Education*, *29*(1), 89–107.

Alpert, R., & Haber, R. N. (1960). Anxiety in academic achievement situations. *Journal of Abnormal and Social Psychology*, *61*(2), 207–215. doi:10.1037/h0045464

Andrich, D. (1978). A rating formulation for ordered response categories. *Psychometrika*, *43*(4), 561–573.

Andrich, D. (1988). *Rasch models for measurement*. California: Sage Publications, Inc.

Arem, C. A. (2009). *Conquering math anxiety*. Brooks/Cole One Unit Series in Precalculus Mathematics. Belmont: Brooks/Cole.

Ariffin, S. R., Asari, S. M., Mohamed, S., Shahar, S. N., Ishak, N. M., Din, R., Ahmad, A. G.,Yamat, H., Majid, R., Yasin, S. F. (2010). Validity of UKM1 Intelligence Test using Rasch Analysis. *Procedia - Social and Behavioral Sciences*, *7*(0), 205–209. doi:10.1016/j.sbspro.2010.10.029

Ashcraft, M. H., & Faust, M. W. (1994). Mathematics anxiety and mental arithmetic performance: An exploratory investigation. *Cognition & Emotion*, *8*(2), 97–125. doi:10.1080/02699939408408931

Ashcraft, M. H., & Kirk, E. P. (2001). The relationships among working memory, math anxiety, and performance. *Journal of Experimental Psychology: General*, *130*(2), 224.

Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment, 27*(3), 197 –205. doi:10.1177/0734282908330580

Baloğlu, M. (2010). An investigation of the validity and reliability of the adapted Mathematics Anxiety Rating Scale-Short Version (MARS-SV) among Turkish Students. *European Journal of Psychology of Education, 25*(4), 507–518.

Baloğlu, M., & Koçak, R. (2006). A multivariate investigation of the differences in mathematics anxiety. *Personality & Individual Differences*, *40*(7), 1325–1335. doi:10.1016/j.paid.2005.10.009

Başar, M., Ünal, M., & Yalçın, M. (2002). İlköğretim kademesiyle başlayan matematik korkusunun nedenleri (pp. 16–18). Presented at the V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, ODTÜ Kültür ve Kongre Merkezi.

Bessant, K. C. (1995). Factors associated with types of mathematics anxiety in college students. *Journal for Research in Mathematics Education*, 327–345.

Betz, N. E. (1978). Prevalence, distribution, and correlates of math anxiety in college students. *Journal of Counseling Psychology*, *25*(5), 441–448. doi:10.1037/0022-0167.25.5.441

Bond, T. G., & Fox, C. M. (2003). Applying the Rasch model: Fundamental measurement in the human sciences. *Journal of Educational Measurement, 40*(2), 185–187. doi:10.1111/j.1745-3984.2003.tb01103.x

Boyacioglu, N., & Kucuk, L. (2011). Irrational beliefs and test anxiety in Turkish school adolescents. *Journal of School Nursing*, *27*(6), 447–454. doi:10.1177/1059840511417631

Brush, L. R. (1978). A validation study of the Mathematics Anxiety Rating Scale (MARS). *Educational and Psychological Measurement*, *38*(2), 485–499.

Buckley, P. A., & Ribordy, S. C. (1982). *Mathematics anxiety and the effects of evaluative instructions on math performance.*Paper presented at the Midwestern Psychological Association, Minneapolis, MN.

Cates, G. L., & Rhymer, K. N. (2003). Examining the relationship between mathematics anxiety and mathematics performance: An instructional hierarchy perspective. *Journal of Behavioral Education*, *12*(1), 23–34.

Cemen, P. B. (1987). *The nature of mathematics anxiety.* Stillwater, OK: Oklahoma State University.

Cooper, S. E., & Robinson, D. A. (1991). The relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. *Measurement and Evaluation in Counseling and Development*, *24*(1), 4–11.

Dellens, M. (1979). Math anxiety: What can a learning center do about it? Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED176963

Dew, K. H., & Galassi, J. P. (1983). Mathematics anxiety: Some basic issues. *Journal of Counseling Psychology*, *30*(3), 443.

Dew, K. H., Galassi, J. P., & Galassi, M. D. (1984). Math anxiety: Relation with situational test anxiety, performance, physiological arousal, and math avoidance behavior. *Journal of Counseling Psychology*, *31*(4), 580–583. doi:10.1037/0022-0167.31.4.580

Dreger, R. M., & Aiken, L. R. J. (1957). The identification of number anxiety in a college population. *Journal of Educational Psychology*, *48*(6), 344–351. doi:10.1037/h0045894

Edwards, A., & Alcock, L. (2010). Using Rasch analysis to identify uncharacteristic responses to undergraduate assessments. *Teaching Mathematics and its Applications*, *29*(4), 165–175. doi:10.1093/teamat/hrq008

Elhan, A. H., & Atakurt, Y. (2005). Ölçeklerin değerlendirilmesinde niçin Rasch analizi kullanılmalıdır? *Ankara Üniversitesi Tıp Fakültesi Mecmuası*, *58*, 47–50.

Ernest, P. (2000). The mathematical attitudes, beliefs and ability of students. *Maths for Engineering and Science*, (LTSN Maths Team), 4–5.

Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman mathematics attitudes scales: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *Journal for Research in Mathematics Education*, *7*(5), 324–326. doi:10.2307/748467

Fiore, G. (1999). Math-abused students: Are we prepared to teach Them? *Mathematics Teacher*, *92*(5), 403–06.

Frank, M. L. (1990). What myths about mathematics are held and conveyed by teachers? *Arithmetic Teacher*, *37*(5), 10–12.

Hadfield, O. D., & McNeil, K. (1994). The relationship between Myers-Briggs personality type and mathematics anxiety among preservice elementary teachers. *Journal of Instructional Psychology*, *21*(4), 375–384.

Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. *Journal for research in mathematics education*, *21*(1), 33–46.

Hopko, D. R. (2003). Confirmatory factor analysis of the Math Anxiety Rating Scale–Revised. *Educational and Psychological Measurement*, *63*(2), 336–351. doi:10.1177/0013164402251041

Hopko, D. R., McNeil, D. W., Zvolensky, M. J., & Eifert, G. H. (2001). The relation between anxiety and skill in performance-based anxiety disorders: A behavioral formulation of social phobia. *Behavior Therapy*, *32*(1), 185–207. doi:10.1016/S0005-7894(01)80052-6

Hsueh, I. P., Wang, W. C., Sheu, C. F., Hsieh, C. L., & others. (2004). Rasch analysis of combining two indices to assess comprehensive ADL function in stroke patients. *Stroke*, *35*(3), 721–726.

Jain, S., & Dowson, M. (2009). Mathematics anxiety as a function of multidimensional self-regulation and self-efficacy. *Contemporary Educational Psychology*, *34*(3), 240–249. doi:10.1016/j.cedpsych.2009.05.004

Karimi, A., & Venkatesan, S. (2009). Mathematics anxiety, mathematics performance and academic hardiness in high school students. *International Journal of Education Science*, *1*(1), 33–37.

Kazelskis, R. (1998). Some dimensions of mathematics anxiety: A factor analysis across instruments. *Educational and Psychological Measurement*, *58*(4), 623–633. doi:10.1177/0013164498058004006

Kitchens, A. N. (1995). *Defeating math anxiety*. Chicago: Irwin Career Education Division.

Linacre, J. M. (1999). Investigating rating scale category utility. *Journal of Outcome Measurement*, *3*(2), 103.

Linacre, J. M., & Wright, B. D. (1993). *A user's guide to BIGSTEPS: Rasch-model computer program*. Chicago: Mesa Press.

Linacre, J. M., & Wright, B. D. (2000). *Winsteps: Computer software.* Chicago: MESA Press.

Linden, W. J. van der, & Hambleton, R. K. (1997). *Handbook of modern item response theory*. New York: Springer.

Ma, X. (1999). A meta-analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal for research in mathematics education*, 30(5),520–540.

Malinsky, M., Ross, A., Pannells, T., & McJunkin, M. (2006). Math anxiety in pre-service slementary school teachers. *Education, 127*(2), 274–279.

Metje, N., Frank, H. L., & Croft, P. (2007). Can't do maths-understanding students' maths anxiety. *Teaching Mathematics and its Applications, 26*(2), 79 –88. doi:10.1093/teamat/hrl023

Miller, L. D., & Mitchell, C. E. (1994). Mathematics anxiety and alternative methods of evaluation. *Journal of Instructional Psychology*, *21*(4), 353-358.

Newstead, K. (1998). Aspects of children's mathematics anxiety. *Educational Studies in Mathematics, 36*(1), 53–71.

Nicholas, A. A., & Holcomb, W. R. (1986). Analysis of the relationship between anxiety about mathematics and performance. *Psychological Reports, 59*(2), 943–948. doi:10.2466/pr0.1986.59.2.943

Norwood, K. S. (1994). The effect of instructional approach on mathematics anxiety and achievement. *School Science and Mathematics, 94*(5), 248–254. doi:10.1111/j.1949-8594.1994.tb15665.x

Plake, B. S., & Parker, C. S. (1982). The development and validation of a revised version of the Mathematics Anxiety Rating Scale. *Educational and*

Psychological Measurement, *42*(2), 551–557. doi:10.1177/001316448204200218

Planinic, M., Ivanjek, L., & Susac, A. (2010). Rasch model based analysis of the Force Concept Inventory. *Physical Review Special Topics-Physics Education Research*, *6*(1), 010103(11 pages).

Rasch, G. (1960). *Studies in mathematical psychology: I. Probabilistic models for some intelligence and attainment tests*. Oxford: Nielsen & Lydiche

Richardson, F. C., & Suinn, R. M. (1972a). The mathematics anxiety rating Scale: Psychometric data. *Journal of Counseling Psychology*, *19*(6), 551–554. doi:10.1037/h0033456

Rounds, J. B., & Hendel, D. D. (1980). Measurement and dimensionality of mathematics anxiety. *Journal of Counseling Psychology*, *27*(2), 138–149. doi:10.1037/0022-0167.27.2.138

Ryan, K. E., & Ryan, A. M. (2005). Psychological processes underlying stereotype threat and standardized math test performance. *Educational Psychologist*, *40*(1), 53–63.

Scarpello, G. (2007). Helping students get past math anxiety. *Techniques: Connecting Education and Careers*, *82*(6), 34–35.

Silverman, F. L. (1992). Student-generated story problems. *Arithmetic Teacher*, *39*(8), 6–12.

Singh, K., Granville, M., & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *The Journal of Educational Research*, *95*(6), 323–332.

Skemp, R. R. (1971). The psychology of learning mathematics. Penguin Books, Inc. Retrieved from http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED068336

Suinn, R. M., & Edwards, R. (1982). The measurement of mathematics anxiety: The Mathematics Anxiety Rating Scale for Adolescents—MARS-A. *Journal of Clinical Psychology*, *38*(3), 576–580.

Suinn, R. M., Taylor, S., & Edwards, R. W. (1988). Suinn mathematics anxiety rating scale for elementary school students (MARS-E): Psychometric and normative data. *Educational and Psychological Measurement*, *48*(4), 979–986.

Tobias, S. (1993). *Overcoming math anxiety*. New York: W.W. Norton.

Trujillo, K. M., & Hadfield, O. D. (1999). Tracing the roots of mathematics anxiety through in-depth interviews with preservice elementary teachers. *College Student Journal*, *33*(2), 219.

Tsui, J. M., & Mazzocco, M. M. M. (2007). Effects of math anxiety and perfectionism on timed versus untimed math testing in mathematically gifted sixth graders. *Roeper Review*, *29*(2), 132–139.

Widmer, C. C., & Chavez, A. (1982). Math anxiety and elementary school teachers. *Education*, *102*(3), 272–276.

Wigfield, A., & Meece, J. L. (1988). Math anxiety in elementary and secondary school students. *Journal of Educational Psychology*, *80*(2), 210–216.

Wright, B. D., Linacre, J. M., Gustafson, J. E., & Martin-Lof, P. (1994). Reasonable mean-square fit values. *Rasch Measurement Transactions*, *8*(3), 370.

Wu, M., & Adams, R. (2007). *Applying the Rasch model to psycho-social measurement: A practical approach*. Melbourne: Educational Measurement Solutions.

Zakaria, E., & Nordin, N. M. (2008). The effects of mathematics anxiety on matriculation students as related to motivation and achievement. *Eurasia Journal of Mathematics, Science & Technology Education*, *4*(1), 27–30.

Zaslavsky, C. (1994). *Fear of math: How to get over it and get on with your life*. New Brunswick: Rutgers University Press.

APPENDICES

Appendix A: The permission for use of the instrument

AGREEMENT FOR TRANSLATION
OF THE MATHEMATICS ANXIETY RATING SCALES-SHORT VERSION

The signatory below, Mustafa Baloglu, Ph.D. agrees to the following:

1) the Mathematics Anxiety Rating Scale-Short Version will be translated into the Turkish language,
2) the following will be printed at the bottom of the first page for each scale: "The Mathematics Anxiety Rating Scales are copyrighted (c) by Richard M. Suinn, Ph.D., 808 Cheyenne Drive, Ft. Collins, Colorado, 80525, USA" This copyright statement will be printed in both English and Turkish.
3) one copy of the translated scale will be sent to Richard M. Suinn, 808 Cheyenne Drive, Ft. Collins, CO 80525.
4) copies of any requests of the MARS-Short Version to Dr. Baloglu by other persons or agencies shall be forwarded to Richard M. Suinn for his information
5) any use by Dr. Baloglu of the Turkish or English MARS-Short Version for research or any purpose requiring duplication of either scale must obtain written permissions from Richard M. Suinn
6) copyright of the translated Turkish language version of the MARS-Short Version scale remains under the name of Richard M. Suinn, with all rights reserved by Richard M. Suinn.

_____ _____

Signed Date

Address

From: "B a l o g l u" <baloglu@hotmail.com> Subject: RE: Yükseklisans Tezi
Date: Tue, August 2, 2011 10:48 am To: kurum@bilkent.edu.tr
Olcegi ve ilgili makaleyi ekte gonderiyorum...

Mustafa Baloglu, Ph.D.
Dean & Professor
Department of Educational Sciences
Gaziosmanpasa University
Tokat-Turkey
Phone: +90 356 252 1514
Phone: +90 356 252 1616 ext. 3415
Fax: +90 356 252 1546
baloglu@hotmail.com or baloglu@gop.edu.tr
- Date: Thu, 28 Jul 2011 14:11:36 +0300
> Subject: RE: Yükseklisans Tezi
> From: kurum@bilkent.edu.tr
> To: baloglu@hotmail.com
> Mustafa Bey,
> Formu size kargo ile yollamış bulunuyorum.Yarın elinizde olucağını
> düşünüyorum. Yardımlarınız için çok teşekkür ederim.
> Saygılarla,
> Hilal Kurum
Permission from translator
From: "B a l o g l u" <baloglu@hotmail.com> Subject: RE: Yükseklisans Tezi
Date: Tue, July 19, 2011 3:26 pm To: kurum@bilkent.edu.tr

Hilal hanim,
size ekte bir form gonderiyorum, bu formu bana ulastirdiktan sonra size olgeci gonderebilecegim.
Mustafa

Mustafa Baloglu, Ph.D.
Dean & Professor
Department of Educational Sciences
Gaziosmanpasa University
Tokat-Turkey
Phone: +90 356 252 1514
Phone: +90 356 252 1616 ext. 3415
Fax: +90 356 252 1546
baloglu@hotmail.com or baloglu@gop.edu.tr
> Date: Fri, 15 Jul 2011 14:22:08 +0300
> Subject: Yükseklisans Tezi
> From: kurum@bilkent.edu.tr
> To: baloglu@hotmail.com
> > Sayın Prof.Dr. Baloğlu,
> Ben Bilkent Üniversitesi Eğitim Bilimleri Enstitüsünde yükseklisans
> öğrencisiyim ve şu an tezim üzerinde çalışıyorum. Tezimin konusu
> matematik endişesi ile matematik başarısı arasındaki ilişkiyi Rasch
> Değerlendirme Ölçeği modeli kullanılarak incelenmesidir.

> Tezimde öğrencilerin matematik endişe seviyesini ölçmek için
> "Mathematics Anxiety Rating Scale" kullanmak istiyorum.Yazmış olduğunuz
> makaleyi, "Adaptation of the Mathematics Anxiety Rating Scale to
> Turkish, Language Validity and Preliminary Psychometric Properties"
> okumuş bulunmaktayım. Bu adapte ettiğiniz bu değerlendirme ölçeğinden
> Türkçe çevirimi, güvenirliliği ve geçerliliği açısından yararlanmak
> istiyorum.
> Yapmış olduğunuz bu sıkı çalışmanın sonucunda elde ettiğiniz çevrilmiş
> bu değerlemdirme ölçeğini benimle paylaşmanızı umut ediyorum.
> Haberlerinizi bekliyorum.
> En derin saygılarımla,
> Hilal Kurum.

Appendix B: The survey questions (English)

MATHEMATICS ANXIETY RATING SCALE: SHORT FORM (MKDÖ-KF)*

Explanation: In this scale, questions refer to things and experiences that may cause fear or apprehension. Please describe how much fear is associated with each item by choosing 1-"Not at all," 2-"A little" , 3-"A fair amount," 4-"Much" and 5-"Very much". Please work quickly but to consider each item carefully.

	Reason for fear and apprehension...	Not at all	A little	A fair Amount	Much	Very Much.
1.	Taking an examination (final) in a math course	1	2	3	4	5
2.	Thinking about an upcoming math test 1 week before	1	2	3	4	5
3.	Thinking about an upcoming math test 1 day before	1	2	3	4	5
4.	Thinking about an upcoming math test 1 hour before	1	2	3	4	5
5.	Thinking about an upcoming math test 5 minutes before	1	2	3	4	5
6.	Waiting to get a math test returned in which you expected to do well.	1	2	3	4	5
7.	Receiving your final math grade in the mail (report)	1	2	3	4	5
8.	Realizing that you have to take a certain number of math classes to fulfil the requirements for graduations.	1	2	3	4	5

* Matematik Kaygısını Derecelendirme Ölçeği Türkçe formu Prof. Dr. Richard Suinn'in 'Mathematics Anxiety Rating Scale: Short Version (MARS-SV) adlı ölçeğinin orijinal formundan geliştirilmiştir. Orijinal form hakkında Prof. Dr. Richard Suinn 808 Cheyenne Drive, Ft. Collins, CO 80525 USA adresinden bilgi alınabilir.

	Reason for fear and apprehension...	Not at all	A little	A fair Amount	Much	Very Much.
9.	Being given a “pop” quiz in a math class.	1	2	3	4	5
10.	Studying for a math test	1	2	3	4	5
11.	Taking the math section of a college entrance exam like LGS-LYS	1	2	3	4	5
12.	Taking an examination (midterm) in a math course	1	2	3	4	5
13.	Picking up a math textbook to begin working on a homework assignment.	1	2	3	4	5
14.	Being given a homework assignment of many difficult problems which is due to next class meeting.	1	2	3	4	5
15.	Getting ready to study for a math test.	1	2	3	4	5
16.	Dividing a five digit number by a two digit number in private with pencil and paper	1	2	3	4	5
17.	Adding up 976+777 on paper	1	2	3	4	5
18.	Reading a cash register receipt after you purchase.	1	2	3	4	5
19.	Figuring the sales tax (KDV) on a purchase that costs more than 1 Turkish Lira	1	2	3	4	5
20.	Figuring out your monthly budget	1	2	3	4	5
	Reason for fear and apprehension...	Not at all	A little	A fair Amount	Much	Very Much.
21.	Being given a set of numerical problems involving addition to solve on paper	1	2	3	4	5
22.	Having someone watch you as you total up a column of figures	1	2	3	4	5
23.	Totalling up a dinner that you think overcharged you.	1	2	3	4	5
24.	Being responsible for collecting dues for an organization and keeping track of the amount	1	2	3	4	5
25.	Studying for a driver’s licence test and memorizing the figures involved	1	2	3	4	5

	such as the distances it takes to stop a car going at different speeds					
26.	Totalling up the dues received and the expenses of a club you belong to	1	2	3	4	5
27.	Watching someone work with a calculator	1	2	3	4	5
28.	Being given a set of division problems to solve on paper	1	2	3	4	5
29.	Being given a set of subtraction problems to solve on paper	1	2	3	4	5
30.	Being given a set of multiplication problems to solve on paper	1	2	3	4	5

Appendix C: The survey questions (Turkish)

Adı Soyadı_____

MATEMATİK KAYGISINI DERECELENDİRME ÖLÇEĞİ: KISA FORM (MKDÖ-KF)*

Açıklama: Bu ölçekte, gerilim veya endişeye neden olabilecek deneyim ve durumlarla ilgili ifadeler bulunmaktadır. 1-"Hiç kaygılanmam," 2-"Çok az kaygılanırım," 3-"Kaygılanırım," 4-"Epeyce kaygılanırım" ve 5-"Aşırı derecede kaygılanırım" aralığında, belirtilen maddedeki durumun bugünlerde sizi ne kadar kaygılandıracağına karar veriniz. Maddelerin karşısındaki satırda belirtilen rakamlardan birini seçiniz. Her cümleyi ayrı olarak düşününüz ve mümkün olduğunca hızlı cevaplamaya çalışınız.

	KAYGI NEDENİ...	Hiç Kaygılanmam.	Çok Az Kaygılanırım.	Kaygılanırım.	Epeyce Kaygılanırım.	Aşırı derecede Kaygılanırım.
1.	Bir matematik dersinin dönem sonu sınavına girmekten	1	2	3	4	5
2.	Bir hafta öncesinden bir matematik sınavını düşündüğümde	1	2	3	4	5
3.	Bir gün öncesinden bir matematik sınavını düşündüğümde	1	2	3	4	5
4.	Bir saat öncesinden bir matematik sınavını düşündüğümde	1	2	3	4	5
5.	Beş dakika öncesinden bir matematik sınavını düşündüğümde	1	2	3	4	5
6.	İyi geçtiğini düşündüğüm bir matematik sınavının sonucunun ilan edilmesini beklerken	1	2	3	4	5
7.	Karnemde yıl sonu matematik notumu gördüğümde	1	2	3	4	5
8.	Mezun olabilmek için belli sayıda matematik dersini tamamlamak	1	2	3	4	5

* Matematik Kaygısını Derecelendirme Ölçeği Türkçe formu Prof. Dr. Richard Suinn'in 'Mathematics Anxiety Rating Scale: Short Version (MARS-SV) adlı ölçeğinin orijinal formundan geliştirilmiştir. Orijinal form hakkında Prof. Dr. Richard Suinn 808 Cheyenne Drive, Ft. Collins, CO 80525 USA adresinden bilgi alınabilir.

	zorunda olduğumu fark ettiğimde					
9.	Matematik dersinde daha önceden haber verilmemiş quiz tipi bir sınava girdiğimde	1	2	3	4	5
10.	Matematik sınavına çalışırken	1	2	3	4	5
11.	Ö.S.S. gibi bir standart testin matematik bölümünü cevaplandırırken	1	2	3	4	5
12.	Bir matematik dersinin ara sınavına girmekten	1	2	3	4	5
13.	Ödevimi yapmak için matematik kitabımı elime aldığımda	1	2	3	4	5
14.	Bir sonraki derse getirilmek üzere, içerisinde birçok zor matematik problemi bulunan bir ev ödevi verildiğinde	1	2	3	4	5
15.	Bir matematik sınavı için çalışmaya hazırlanırken	1	2	3	4	5
16.	Beş basamaklı bir sayıyı iki basamaklı bir sayıya bölme işlemini, kağıt-kalemle, tek başıma yaparken	1	2	3	4	5
17.	Kağıt üzerinde 976+777 toplamasını yaparken	1	2	3	4	5
18.	Alışverişten sonra kasa fişini okurken	1	2	3	4	5
19.	1 Türk Lirası'ndan daha pahalı bir malın KDV'sini hesaplarken	1	2	3	4	5
20.	Aylık gelir ve giderlerimi hesaplarken	1	2	3	4	5
21.	Benden kağıt üzerinde bir dizi toplama işlemi yapmam istendiğinde	1	2	3	4	5
22.	Alt alta bir dizi sayıyı toplarken birinin beni izlemesinden	1	2	3	4	5
23.	Bir yemek sonrasında, fazla ödeme yaptığımı düşündüğümde, hesabı yeniden toplarken	1	2	3	4	5
24.	Bir dernekte aidatları toplayarak, toplanan miktarı takip etmekten sorumlu kişi olmaktan	1	2	3	4	5
25.	Ehliyet sınavına çalışırken, gerekli rakamları ezberlerken (Örneğin: Farklı hızlarda giden araçların durmaları için gerekli minimum mesafeler gibi.)	1	2	3	4	5
26.	Üyesi olduğum derneğe gelen aidatların ve dernek harcamalarının hesabını yapmaktan	1	2	3	4	5
27.	Hesap makinesi ile işlem yapan birini izlerken	1	2	3	4	5
28.	Benden kağıt üzerinde bir dizi bölme işlemi yapmam istendiğinde	1	2	3	4	5

29.	Benden kağıt üzerinde bir dizi çıkarma işlemi yapmam istendiğinde	1	2	3	4	5
30.	Benden kağıt üzerinde bir dizi çarpma işlemi yapmam istendiğinde	1	2	3	4	5

Appendix D: Parent permission letter for student participation (English)

Dear parent,

Hi! My name is Hilal Kurum. I am a master student in Master at Curriculum and Instruction with Teaching Certificate program in Bilkent University. In addition, I am a student-teacher in the field of mathematics. I am in my second year and I am working on my thesis currently. With your permission and contribution, I will conduct my study. The one of the main goal of the program which I attend is improve education, teachers and their teaching styles by locating problems in education and producing solutions to these problems.

The aim of this study is to observe the attitude of the ninth-grade students and investigate the relationship between their attitudes and their mathematic achievement. This study will help teachers to understand their students and their attitudes towards mathematics more. By this way, the study will contribute to teachers to be more effective in their class. Because of these reasons students participants and your contribution is very important for this study.

In this study, with the given scale students' attitudes towards mathematics will be investigated. Afterward in the light of obtained results, the relation between students' attitudes and their achievement will be investigated.

In the study the names of students will be kept confidential. Moreover, every type of data will be kept confidential and the scale results won't be shared with other students, participants and parents of students. At the end of the study, the relationship between attitudes towards mathematics and students' mathematics achievement will be explained and the analysis part, there will be no information about participants' personal information and scale results.

I hope that you will contribute to this study. For further information, you can contact with me by the mail address below. Thank you for your support in advance.

Sincerely,
Hilal Kurum
kurum@bilkent.edu.tr

Name-Surname:
Signature:

Appendix E: Parent permission letter for student participation (Turkish)

Veli Bilgilendirme ve İzin Yazısı

Sayın veli,

Merhaba! Ben Hilal Kurum. Bilkent Üniversitesi Eğitim Bilimleri Enstitüsünde tezli yüksek lisans programında eğitimimi sürdürmekle birlikte matematik alanında stajyer öğretmenlik yapmaktayım. Yüksek lisansta son senem olması itibariyle bitirme tezimin araştırmasını sizin de izin ve katkılarınızla yürüteceğim. Devam etmekte bulunduğum yüksek lisans programının temel hedeflerinden biri öğretmenlerin öğretim becerilerini geliştirmek ve eğitimde karşılaşılan zorlukları tespit edip çözüm yolları önermektir.

Yapacağım tez çalışmasının amacı 9. sınıf öğrencilerinin matematiğe karşı tutumlarını incelemek ve öğrencilerin başarısı ile tutumları arasındaki ilişkiyi araştırmaktır. Bu çalışma öğrencilerimizin matematik dersine karşı tutumlarını anlamaya ve öğretmenlerin daha etkin eğitim ve öğretim yapabilmelerine yardımcı olacaktır. Bu araştırmaya öğrencilerimizin katılımı ve sizlerin desteği çalışma için önemlidir.

Çalışmada vereceğim anketle, öğrencilerin matematik dersine yönelik genel tutumlarını öğreneceğim. Çalışmanın devamında ise bu anket sonuçları göz önünde tutularak öğrencilerin tutumları ile matematik dersindeki başarıları arasındaki ilişkiyi ortaya çıkarmayı planlıyorum.

Toplanan hiçbir veride öğrencilerin ismi kullanılmayacaktır. Her türlü verinin gizli kalacağını, öğrencilerin anket sonuçlarının diğer öğrenciler, çalışanlar ve velilerle paylaşılmayacağını vurgulamak isterim. Çalışmalar sonunda matematiğe yönelik tutum ile matematik başarısının ilişkisi açıklanıp yorumlanacak, sonuçlarda bireysel katılımcıların kişisel bilgileri ve anket verilerinden bahsedilmeyecektir.

Bu çalışmada bana destek vereceğinizi umuyorum. Çalışma ile ilgili daha fazla bilgi almak isterseniz aşağıdaki e-posta adresimden bana ulaşabilirsiniz. Desteğiniz için şimdiden teşekkür ederim.

Saygılarımla,
Hilal Kurum

kurum@bilkent.edu.tr

Name-Surname:

Signature:

Appendix F: The midterm exam for mathematics achievement (Turkish)

Ninth Grade- First Midterm Exam

Açıklamalar: Sınav 10 sorudan oluşmaktadır ve her bir sorunun değeri 10 puandır. Soruları çözerken işlemlerinizi gösteriniz ve cevaplarınızı en sade halinde yazınız. Sadece sonuçları yazmak size puan getirmeyecektir. Sınav süresi 40 dakikadır. Başarılar dileriz. ☺

Ad-Soyad: No:										
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Toplam

1. Doğruluk tablosu kullanarak $[p \wedge (p \Rightarrow q)] \Rightarrow (p' \vee q)$ önermesinin doğruluk değerini bulunuz. (Aşağıdaki tablodaki satır ve sütunları ihtiyacınız kadar kullanınız.)

2.

Aşağıda verilen önermelerin doğruluk değerlerini bulunuz.

$(p \wedge 0)$	
$(p \vee 0) \Rightarrow 1$	
$(0 \Leftrightarrow 1) \Rightarrow r$	
$1 \Leftrightarrow r$	
$r \Leftrightarrow r$	
$0 \wedge q$	
$q \vee (1 \vee r)$	
$(r \vee 1) \vee (0 \Leftrightarrow 0)$	
$1 \Rightarrow (0 \Rightarrow 1)$	
$q \Rightarrow 0$	

3.

A= {a,b,c,d,e,1,2,3} kümesinin

a) 4 elemanlı alt kümelerinin kaç tanesinde, sesli harfler bulunurken 2 bulunmaz?

b) Alt kümelerinin kaç tanesinde e bulunur, sayı bulunmaz?

c) 3 elemanlı alt kümelerinin kaçtanesinde c ve 1 bulunur, a ve 3 bulunmaz?

4.

7 elemanlı bir kümenin en az dört elemanlı alt kümelerinin sayısı, A kümesinin alt kümelerinin sayısına eşittir. Buna göre A kümesinin 4 elemanlı alt küme sayısı kaçtır?

5.

$(p' \wedge q) \wedge [p \wedge (q \Rightarrow r)]$ bileşik önermesini, önerme özellikleri yardımıyla en sade biçimde yazınız.

6.

A={e,s,c,d }, B={{6}, p, 5, e, m, c, 6, s, d } kümeleri veriliyor. Buna göre ve $A \subset C \subset B$ ve $s(A)+s(C)=s(B)$ koşullarını sağlayan kaç tane C kümesi vardır?

7.

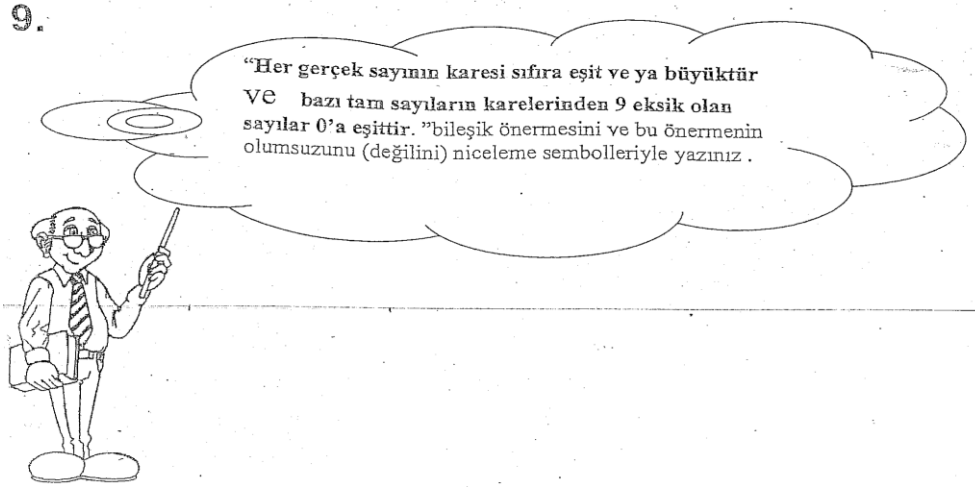
$p \rightarrow (r \vee q')$ bileşik önermesinin karşıt tersi çelişki olduğuna göre $[(p \Rightarrow r) \wedge (r' \Rightarrow p)] \vee (p \Leftrightarrow q)$ bileşik önermesinin doğruluk değeri nedir?

8.

S ={1, 2, {4,5}, x, y, {z}, t} kümesi ile ilgili tabloda verilen ifadelerin doğru veya yanlış olup olmadığını tespit ediniz. Yanlış olduğunu düşündüğünüz ifadelerin doğru şekillerini açıklama bölümünde belirtiniz.

	Doğru	Yanlış	Açıklama
{1,{4,5}}∈ S			
{2,y,z} ⊂ S			
y,z,{4,5} ∈ S			
{x, y, z, t }⊂ S			
1, 2∈ S			
{4,5}⊂S			
{{z}}⊂S			
{1, 2, {4,5}, x, y, {z}, t}⊂ S			
Ø ⊂S			
{4,5}, {z} ∈ S			

9.



10.

Aşağıdaki cümlelerde boş olan yerleri uygun ifadelerle doldurunuz.

a. Elemanları sayılarak belirtilemeyen kümelere.....küme denir.
b. A herhangi bir küme olmak üzere, A kümesinin bütün alt kümelerinin kümesine.....kümesi denir.
c. Bir kümenin kendisinden farklı her alt kümesine, bu kümenin ..... kümesi denir.
d. Eleman sayıları eşit olan kümelere .....kümeler denir.
e. Hiç elemanı olmayan kümeye .....küme, denir.
f. Doğru ve sistemli düşünme kuralları bilgisine.....denir.
g. Doğruluk değerleri aynı olan önermelere .....önerme denir.
h. Bir bileşik önerme, doğruluk değerlerinin tümü için doğru oluyorsa bu önermeye .....denir.
i. Her ile ifade edilen niceleyiciye.....niceleyici denir.
j. İki ya da daha çok önermenin bağlanmasıyla elde edilen önermelere .....önermeler, denir.

English summary of exam

1) Find the truth value of $[p \wedge (p \Rightarrow q)] \Rightarrow (p' \vee q)$ by using the truth table.
2) Find the truth values of the statements below:
3) a) The set A is given. How many subsets with four members of A contain vowels and not include 2?

   b) How many subsets of A include e, and don't include a number?

   c) How many subsets with three members of A contain c and 1 and don't include a and 3?
4) The number of subsets of A with at least four members, is equal to the number of all subsets of A. How many subsets of A with 4 members are there?
5) Please write $(p' \wedge q) \wedge [p \wedge (q \Rightarrow r)]$ in the simplest way.
6) The set A= {e,s,c,d} and B={{6},p,5,e,m,c,6,s,d} is given. A$\subset$ C$\subset$ B and s(A) + S(B). How many different set C exists?
7) $[(p \Rightarrow r) \wedge (r' \Rightarrow p)] \vee (p \Leftrightarrow q)$ has contra positive. Find the truth value of the compound statement $[(p \Rightarrow r) \wedge (r' \Rightarrow p)] \vee (p \Leftrightarrow q)$.
8) S= {1,2,{4,5},x, y,{z},t}. Decide whether statements in the given table are true or false . Explain why.
9) Write the given statement in symbolic logic.
10) Fill in the blanks.
    a) The sets which are not countable are……
    b) A is any set. All subsets of A are called ……..
    c) The subset of A which is different from A is called ……
    d) The sets which have the same number of members are called…..
    e) The set which has any member is called…..

    …….

Appendix G: Bigsteps control file

```
&INST
 TITLE='MATHEMATICS ANXIETY'
 XWIDE=1
 CODES=12345
 ITEM1=3
 NI=30
 NAME1=1
TABLES=111111111111111111111111111111
 CURVES=111
 LINLEN = 0
 MAXPAG = 0
 USCALE = 0.427350427
 UMEAN = 3.115384615
 PDFILE =*
 76
 72
 64
 75
 2
 41
 *
 IDFILE =*
 23
 18
 27
 6
 11
 22
 *

 &END
I1
I2
I3
I4
I5
I6
I7
I8
I9
I10
I11
I12
I13
I14
I15
I16
I17
I18
I19
I20
I21
I22
I23
I24
I25
I26
I27
I28
I29
I30
END NAMES
0154455433523512242121152354122 2
0234444233313333
0312111 112132121 11 11122221111
0421112211111111111111111211111
0522212211121111111111211111111
0641545222535313312 5112512255111
0721212211211212111111111111111
0821123211211113111111112211111
```

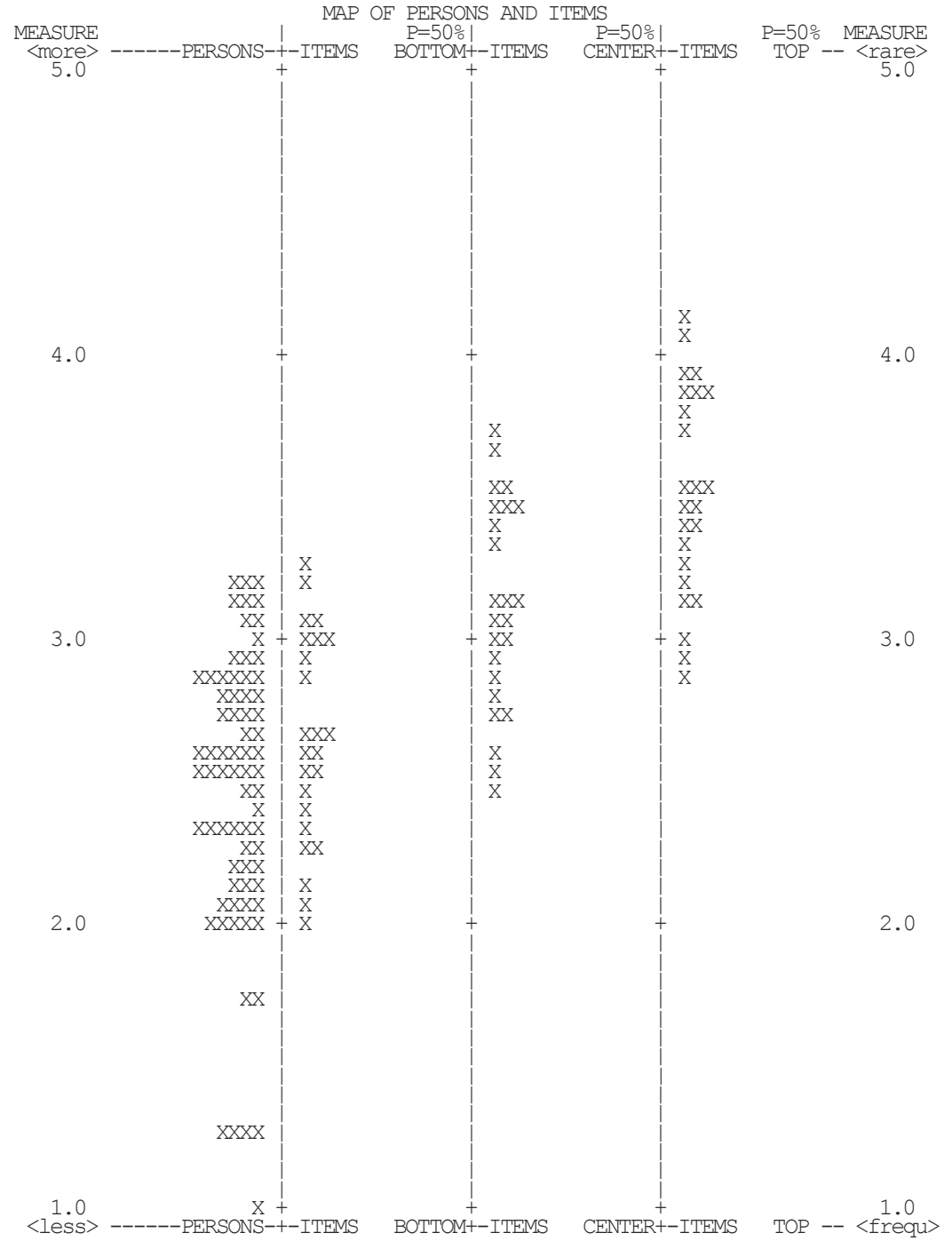
091212131131211211111111112111111
101221121112211221151112111151111
112211231122111121113111211111111
122134431131311211111121111111111
131111121121211111111111111111111
142122211131121111111111111111111
152224342231231221113322223313333
162222211122221121111111211211111
172233311143421311112211122211111
182122221121321111111111211111111
192112221121121111111111111111111
201111111121111111111111111111111
213223322112221 1111111111111111
221111111211111111111111111111111
233333222222222211111111111221111
241211351211511111111111113 24221
251111153121111111111111111111111
263234422222321221111121211 1111
272213441211411233111111422411111
282321111121211211111111121112111
293223113132111231311124241512222
301111111111111111111 1455151534
311333342211331113111111113221111
324355532134531 1111111111311111
333455423334543131111112122211112
342122221432221221122211221122111
352122222211121121221 12212 21211
365155411533411222112331252211111
371111121111111111111111111211111
383334432442321121 1112112111111
391111111111211111111111151111111
401213151221111111111111411111111
415555555555555555555555555555555
423342223523531112313343242 3243
43 243553322321 3511111211211111
442335535321121413333333333333333
453111332541311211111111111131111
464245543432421 2211111322321312
475555555531551143111111115553111
485555511511511111111111521511111
492354312442231133111211222212232
502233432551321212123311233311121
513231312121121311111111111111111
523245544531531121112114434211111
532132111312311111111111111111111
542122231323221221111111111111111
553333413242331121111 111111111
562123233221421211111111111211111
575555533535553451111113414111111
585555535531441312111111122313322
594444422512421531112112111112 12
603345542323531321111111111211111
614555343553552342211125134112 12
623255353322521121111112211111111
632224132221411111111111111111111
6444544424441 43411132231
651122221111111311111111111111111
66224453322122222 11111112121111
671121411521512111111111112111211
683334413312331131111111111111111
693333421223121122111111111111111
703333534134133333324332323334 53
712333342512411222123322322333 21
721244522421531121111121 1
733325551521522212311125222212 11
744444411211322212112431111111111
75111222 112112123351321
765233314131321111112212 1
772312121232132222121122312131
781111515115551111111111111111111
792232232332342323323432234232 32

Appendix H: Bigsteps output file

```
TABLE 1.0 MATHEMATICS ANXIETY                          step8.txt Mar 30  0:17 2012
INPUT: 79 PERSONS, 30 ITEMS  ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS        v2.82
-------------------------------------------------------------------------------

                  PERSONS -MAP- ITEMS
                      <more>|<rare>
    4                       +
                            |
                            |
                            |Q
                            |  I13
                            |  I17
                            |
                            |  I21  I30
                            |S I19  I20  I29
                          Q |  I28
                            |  I16
                            |
                 01  47  70 |
                 44  57  61 |M I15  I24  I26
                     42  58 |  I10  I14
    3                       79  +  I25  I7
                 06  33  36 S|  I12
      15  46  49  50  52  59 |  I2
              32  48  71  73 |  I9
              29  43  60  74 |S I1   I8
                      38  66 |
      17  26  55  62  68  77 |  I3
      23  27  30  31  34  69 |  I4
                      45  78 M|  I5
                          35 |Q
      12  21  51  54  56  67 |
                      16  24 |
                  08  11  63 |
                  03  14  53 |
              07  09  18  28 |
    2     05  10  19  40  65 S+
                            |
                            |
                            |
                      04  25|
                            |
                            |
                          Q |
                            |
                            |
                            |
              13  20  22  37|
                            |
                            |
                            |
    1                   39  +
                      <less>|<frequ>
```

TABLE 1.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

MAP OF PERSONS AND ITEMS



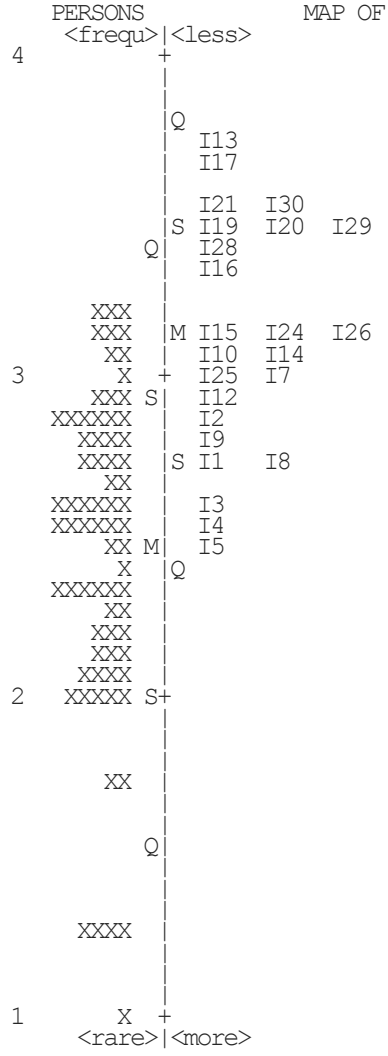
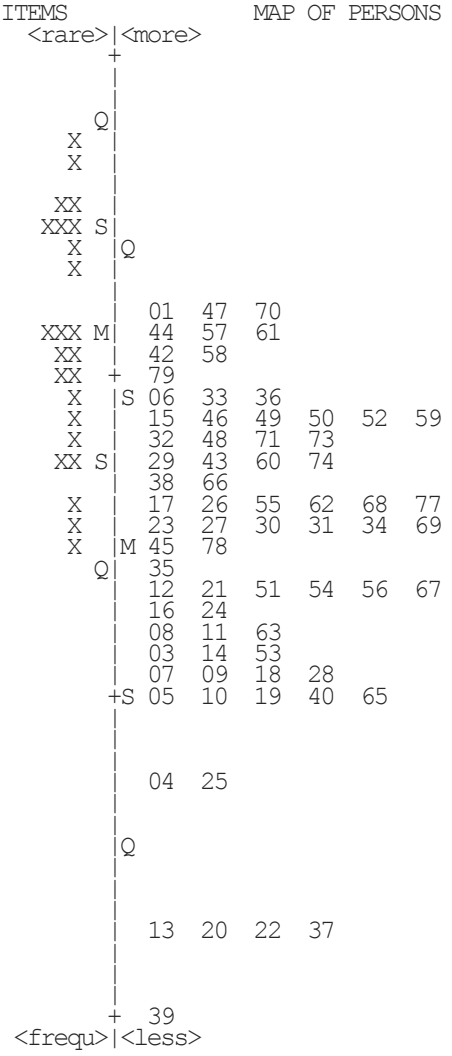
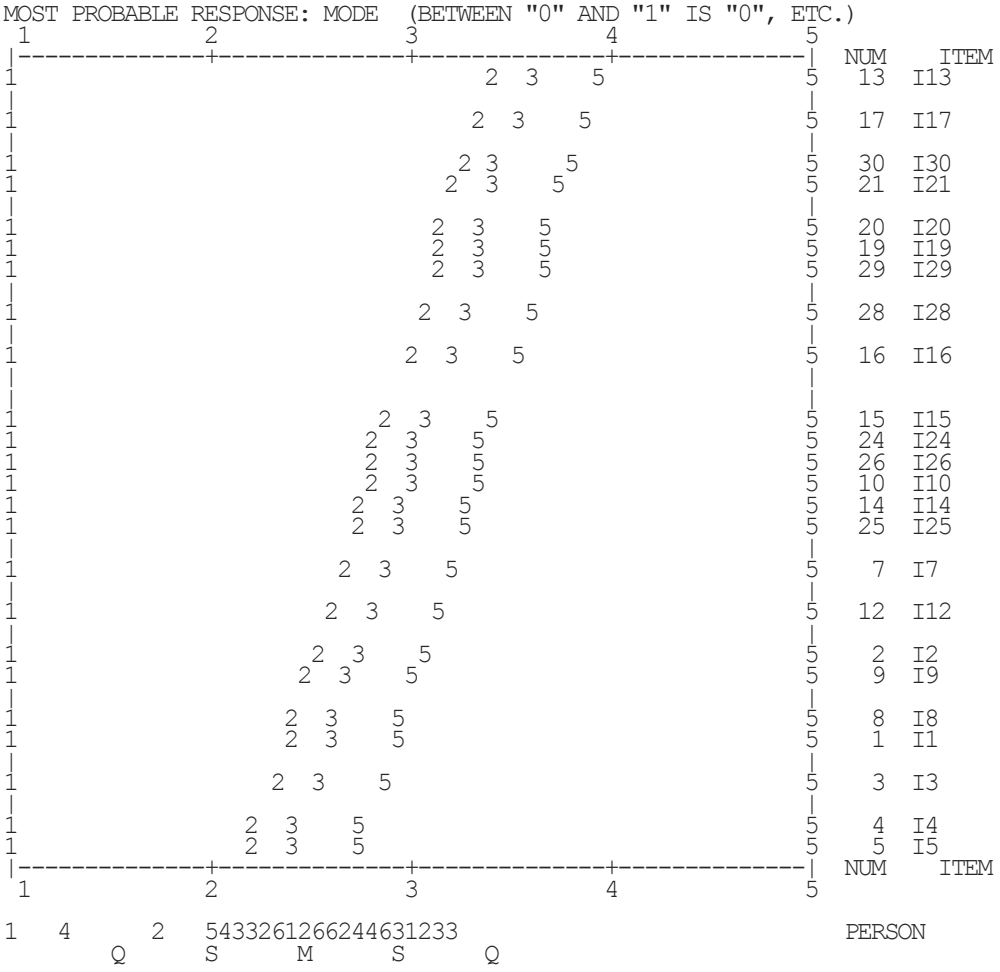

PERSONS MAP OF ITEMS
<frequ>|<less>
4 +
|
|
|Q
| I13
| I17
|
| I21 I30
|S I19 I20 I29
Q| I28
| I16
|
XXX |
XXX |M I15 I24 I26
XX | I10 I14
3 X + I25 I7
XXX S| I12
XXXXXX | I2
XXXX | I9
XXXX |S I1 I8
XX |
XXXXXX | I3
XXXXXX | I4
XX M| I5
X |Q
XXXXXX |
XX |
XXX |
XXX |
XXXX |
2 XXXXX S+
|
|
|
XX |
|
|
Q|
|
|
|
XXXX |
|
|
|
1 X +
<rare>|<more>

TABLE 1.3 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

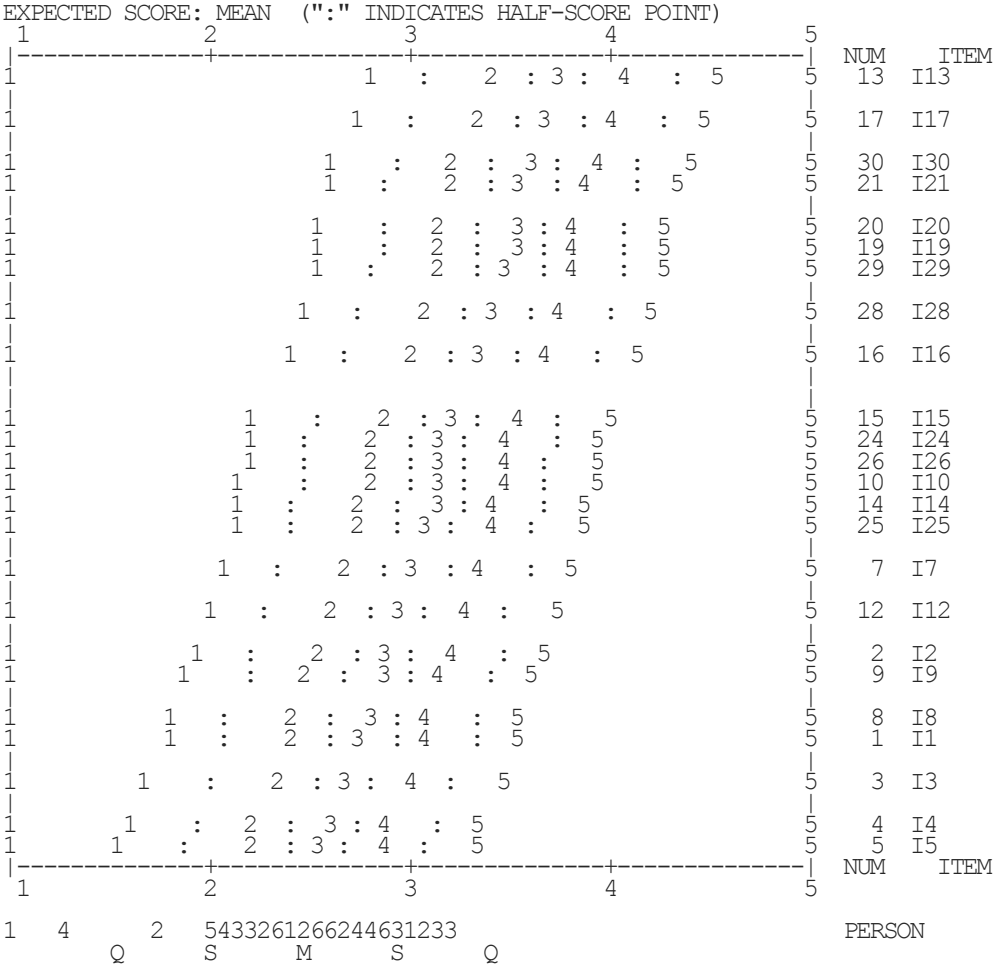


MOST PROBABLE RESPONSE: MODE (BETWEEN "0" AND "1" IS "0", ETC.)

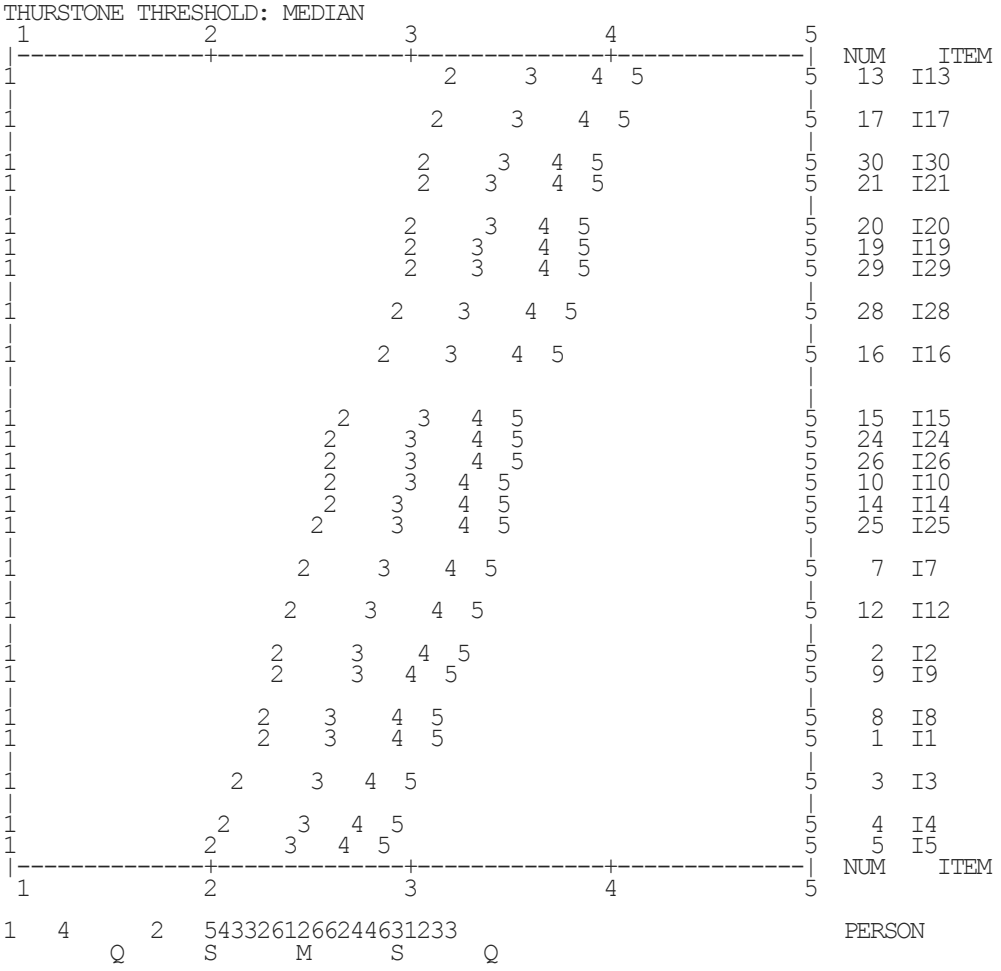


1 4 2 5433261266244631233 PERSON
Q S M S Q

EXPECTED SCORE: MEAN (":" INDICATES HALF-SCORE POINT)



THURSTONE THRESHOLD: MEDIAN



1 4 2 5433261266244631233 PERSON
Q S M S Q

TABLE 3.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

SUMMARY OF 72 MEASURED (NON-EXTREME) PERSONS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	44.1	23.8	2.47	.14	.99	-.2	1.01	-.2
S.D.	14.3	.6	.47	.08	.64	1.5	.89	1.5
MAX.	77.0	24.0	3.22	.43	4.51	5.5	7.15	6.8
MIN.	25.0	22.0	1.29	.08	.25	-3.3	.28	-2.5

REAL RMSE .17 ADJ.SD .44 SEPARATION 2.61 PERSON RELIABILITY .87
MODEL RMSE .16 ADJ.SD .44 SEPARATION 2.75 PERSON RELIABILITY .88
S.E. OF PERSON MEAN .06
WITH 1 EXTREME PERSONS = 73 PERSONS MEAN 2.45 S.D. .50
REAL RMSE .18 ADJ.SD .46 SEPARATION 2.55 PERSON RELIABILITY .87
MODEL RMSE .17 ADJ.SD .46 SEPARATION 2.67 PERSON RELIABILITY .88

MINIMUM EXTREME SCORE: 1 PERSONS
DELETED: 6 PERSONS
VALID RESPONSES: 99.1%

SUMMARY OF 24 MEASURED ITEMS

	RAW SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	132.2	71.3	3.12	.07	1.08	.2	1.00	.0
S.D.	38.5	1.1	.35	.02	.23	1.1	.24	1.0
MAX.	215.0	72.0	3.71	.11	1.49	2.3	1.47	2.0
MIN.	86.0	68.0	2.49	.05	.70	-2.1	.66	-1.9

REAL RMSE .08 ADJ.SD .35 SEPARATION 4.38 ITEM RELIABILITY .95
MODEL RMSE .07 ADJ.SD .35 SEPARATION 4.74 ITEM RELIABILITY .96
S.E. OF ITEM MEAN .07

DELETED: 6 ITEMS

SUMMARY OF MEASURED STEPS

CATEGORY LABEL	OBSERVED COUNT	AVERAGE MEASURE	EXP. MEASURE	COHERENCE EXP%	COHERENCE OBS%	INFIT MNSQ	OUTFIT MNSQ	STEP CALIBRATN
1	932	-.97	-.96	84%	74%	1.02	1.01	NONE
2	374	-.45	-.50	37%	56%	.95	.70	-.32
3	229	-.19	-.19	33%	31%	1.06	1.07	-.12
4	80	.03	.04	17%	23%	.96	1.08	.39
5	97	.19	.22	75%	9%	1.14	1.51	.06*

AVERAGE MEASURE is mean of (Bn-Di), EXP. is expected value.
EXP% = (expected & observed)/(all expected) [MEASURE->RATING?]
OBS% = (expected & observed)/(all observed) [RATING->MEASURE?]

CATEGORY LABEL	STEP CALIBRATN	STEP S.E.	SCORE-TO-MEASURE AT CAT.	----ZONE----		THURSTONE THRESHOLD
1	NONE		(-.93)	-INF	-.63	
2	-.32	.03	-.32	-.63	-.12	-.49
3	-.12	.03	.04	-.12	.19	-.10
4	.39	.04	.35	.19	.59	.21
5	.06	.05	(.82)	.59	+INF	.41

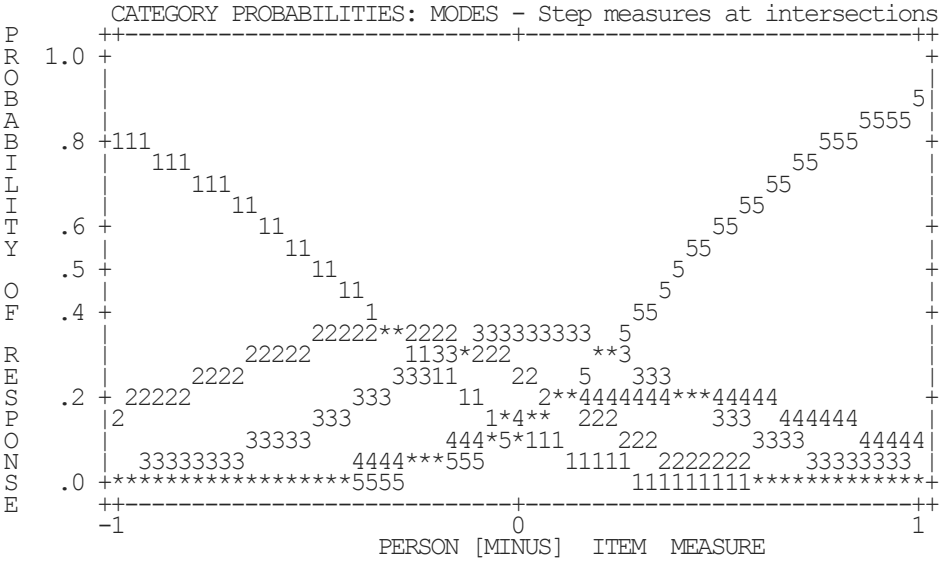


TABLE 4.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

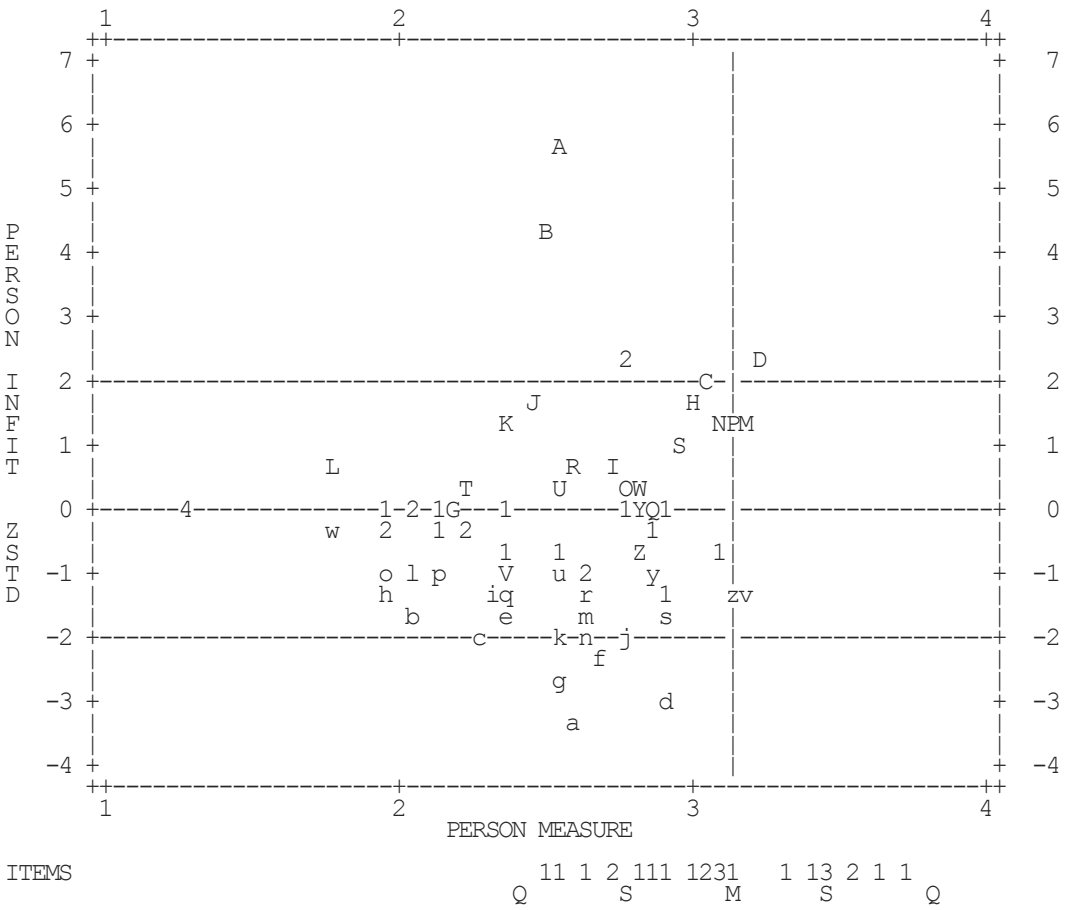


TABLE 5.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

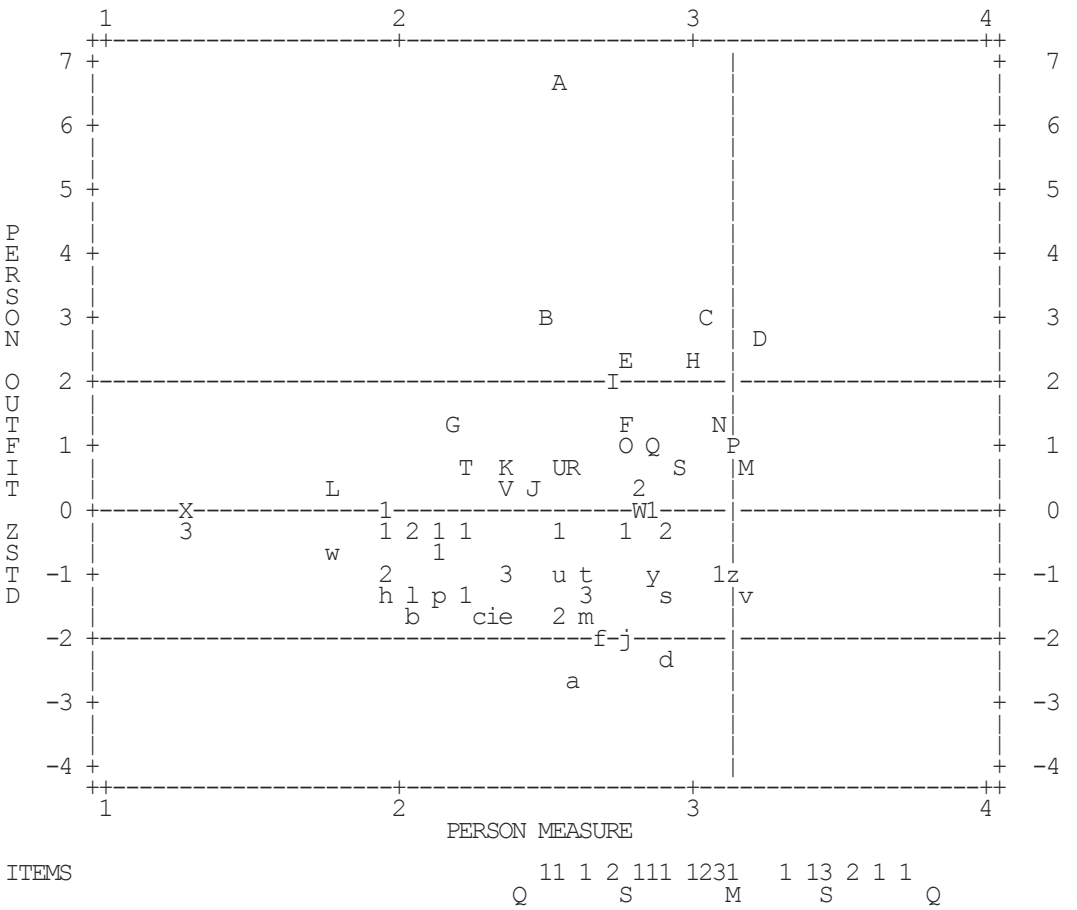
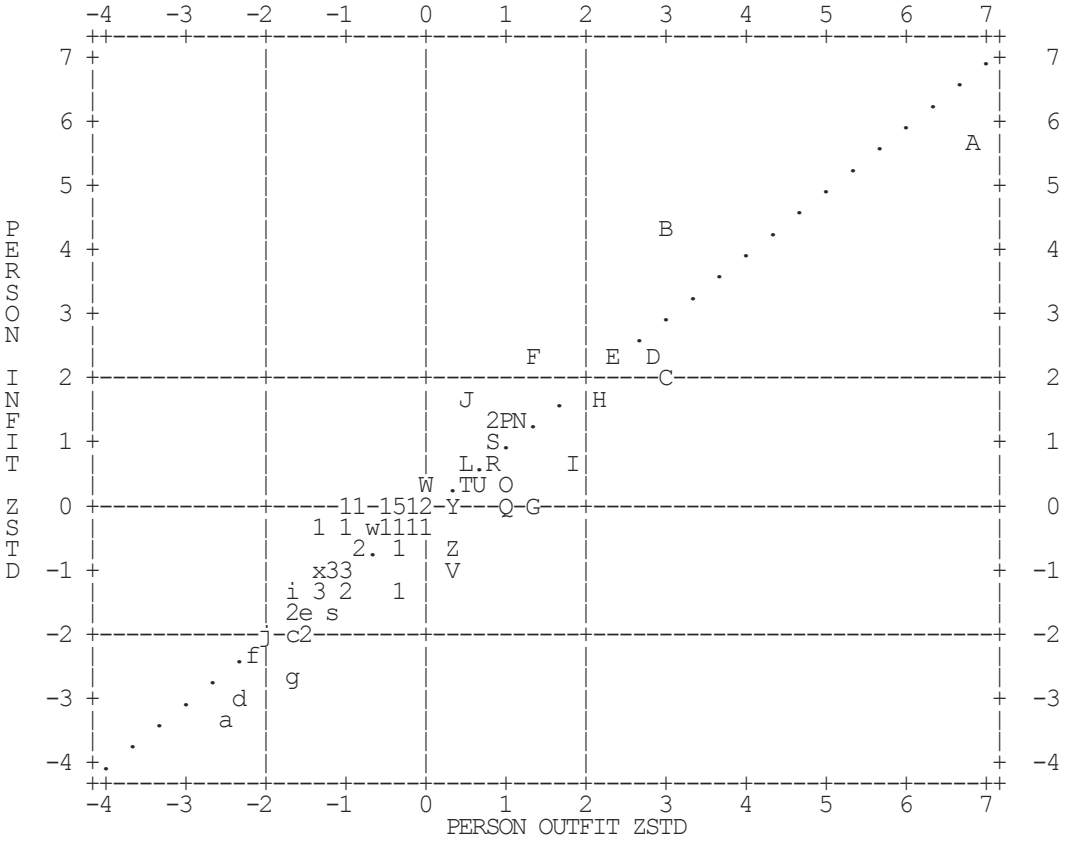


TABLE 5.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82



PERSON STATISTICS: MISFIT ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.		PE
30	39	22	2.53	.11	4.51	5.5	7.15	6.8	A	-.39	30
78	40	24	2.49	.11	3.45	4.3	2.88	3.0	B	.25	78
42	66	24	3.03	.09	1.69	2.1	2.11	3.0	C	.04	42
70	77	24	3.22	.09	1.73	2.2	2.06	2.8	D	-.09	70
29	51	24	2.76	.09	1.83	2.3	1.98	2.3	E	.04	29
48	52	24	2.78	.09	1.93	2.5	1.52	1.4	F	.77	48
11	32	24	2.17	.15	1.01	.0	1.89	1.3	G	.16	11
79	65	24	3.02	.09	1.46	1.5	1.79	2.2	H	-.19	79
74	50	24	2.74	.10	1.23	.7	1.78	1.9	I	.52	74
45	39	24	2.46	.12	1.72	1.6	1.19	.4	J	.47	45
67	36	24	2.35	.13	1.66	1.4	1.44	.8	K	.44	67
25	27	24	1.75	.25	1.57	.7	1.44	.5	L	.10	25
47	75	24	3.19	.08	1.43	1.4	1.25	.8	M	.74	47
44	70	24	3.10	.09	1.37	1.2	1.40	1.2	N	.34	44
43	46	22	2.76	.10	1.09	.3	1.39	1.0	O	.65	43
57	72	24	3.14	.08	1.35	1.2	1.29	.9	P	.75	57
15	56	24	2.85	.09	1.01	.1	1.34	1.0	Q	.27	15
77	44	24	2.60	.10	1.18	.5	1.34	.8	R	.11	77
36	61	24	2.95	.09	1.33	1.1	1.25	.8	S	.63	36
24	32	23	2.24	.15	1.09	.2	1.29	.5	T	.23	24
27	42	24	2.54	.11	1.18	.5	1.28	.7	U	.42	27
35	34	22	2.38	.13	.66	-1.0	1.16	.3	V	.18	35
59	55	24	2.84	.09	1.12	.4	.99	.0	W	.67	59
37	25	24	1.29	.43	.99	.0	1.11	.1	X	.00	37
71	54	24	2.82	.09	.99	.0	1.10	.3	Y	.38	71
73	53	24	2.80	.09	.86	-.5	1.08	.3	Z	.68	73
BETTER FITTING OMITTED											
61	73	24	3.15	.08	.70	-1.3	.75	-.9	z	.75	61
52	57	24	2.87	.09	.74	-1.0	.69	-1.1	y	.85	52
62	45	24	2.62	.10	.74	-.9	.57	-1.4	x	.84	62
4	27	24	1.75	.25	.72	-.5	.54	-.6	w	.41	04
1	74	24	3.17	.08	.70	-1.3	.65	-1.4	v	.76	01
34	42	24	2.54	.11	.69	-1.0	.68	-.9	u	.48	34
17	45	24	2.62	.10	.68	-1.1	.68	-1.0	t	.60	17
49	58	24	2.89	.09	.61	-1.6	.67	-1.2	s	.69	49
68	45	24	2.62	.10	.62	-1.3	.60	-1.3	r	.81	68
54	36	24	2.35	.13	.59	-1.2	.61	-1.0	q	.60	54
14	31	24	2.11	.16	.60	-.9	.45	-1.2	p	.67	14
5	29	24	1.97	.19	.57	-.9	.46	-1.0	o	.54	05
66	45	23	2.66	.10	.52	-1.9	.55	-1.5	n	.82	66
55	44	23	2.63	.10	.54	-1.7	.50	-1.6	m	.83	55
7	30	24	2.05	.18	.53	-1.1	.43	-1.2	l	.57	07
69	42	24	2.54	.11	.49	-1.8	.51	-1.5	k	.80	69
60	51	24	2.76	.09	.50	-2.1	.48	-1.9	j	.91	60
21	34	23	2.33	.13	.50	-1.5	.39	-1.6	i	.77	21
19	29	24	1.97	.19	.48	-1.2	.34	-1.3	h	.65	19
23	42	24	2.54	.11	.33	-2.7	.48	-1.6	g	.78	23
38	47	24	2.67	.10	.45	-2.2	.41	-2.1	f	.91	38
56	36	24	2.35	.13	.45	-1.7	.43	-1.5	e	.72	56
46	56	23	2.90	.09	.39	-2.9	.44	-2.3	d	.89	46
16	34	24	2.27	.14	.34	-2.1	.37	-1.7	c	.69	16
18	30	24	2.05	.18	.37	-1.7	.28	-1.6	b	.77	18
26	41	22	2.61	.11	.25	-3.3	.30	-2.5	a	.90	26
MEAN	44.	24.	2.47	.14	.99	-.2	1.01	-.2			
S.D.	14.	1.	.47	.08	.64	1.5	.89	1.5			

PERSON FIT GRAPH: MISFIT ORDER

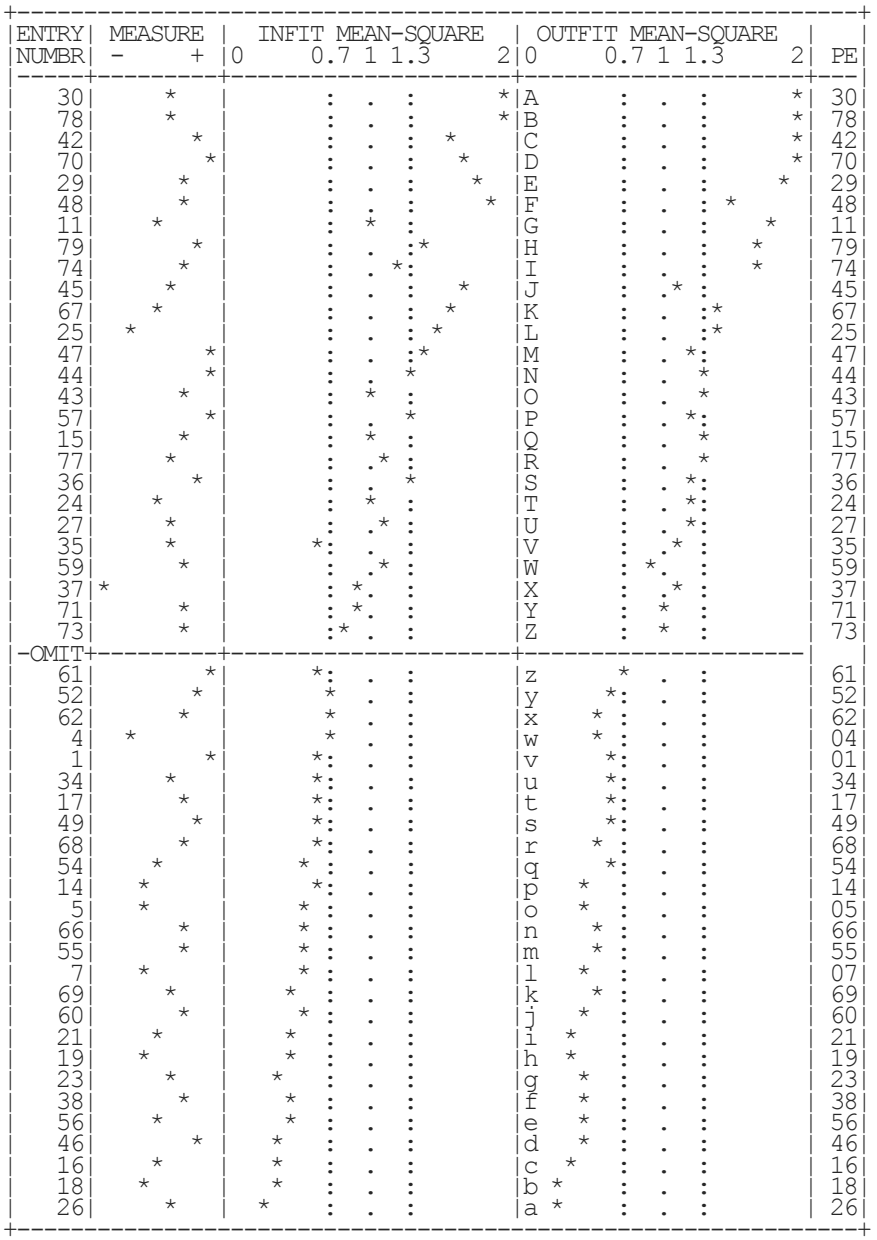


TABLE 6.4 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

MOST MISFITTING RESPONSE STRINGS

PERSON		OUTMNSQ		ITEM
				1 211221122212311
				548922754064568909107 3
			high	
30	30	7.15	A	.....55..53 .4..
78	78	2.88	B	.....55..5.....
42	42	2.11	C	22.....4..4.3.
70	70	2.06	D	.31.....5.....
29	29	1.98	E	1.....54.....3.
48	48	1.52	F	....5..5.....
11	11	1.89	G	.....3....
79	79	1.79	H	22.....4...3.
74	74	1.78	I	.....4.3...
45	45	1.19	J	..54.....3.....
67	67	1.44	K	..5.....2
25	25	1.44	L	.....3.....
43	43	1.39	O	....5.....
15	15	1.34	Q	.....333.3..
77	77	1.34	R	.....3.....2
36	36	1.25	S	.....5.....
24	24	1.29	T	....3..22.....
27	27	1.28	U	.....4.33.....
35	35	1.16	V	.... 2.2.
59	59	.99	W	.....5.....
37	37	1.11	X	.....2.....
71	71	1.10	Y	.....33....
73	73	1.08	Z	.....3.
				low
				548921721122112221231 1
				2 540645689091073

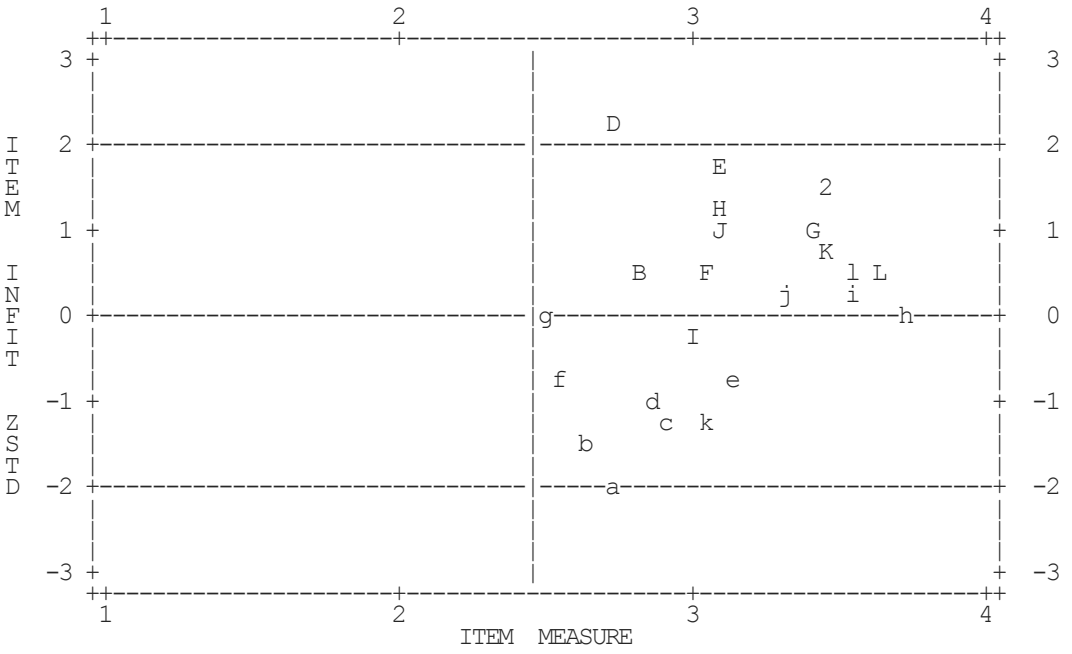
MOST UNEXPECTED RESPONSES

PERSON		MEASURE		ITEM
				1 211221122212311
				548922754064568909107 3
			high	
70	70	3.22	D	.31.....5.....
61	61	3.15	z	3.....
42	42	3.03	C	22.....4..4.3.
79	79	3.02	H	22.....4...3.
36	36	2.95	S	.....5.....
6	06	2.93		.....5.....
33	33	2.93		3
15	15	2.85	Q	.....333.3..
50	50	2.85		.....33....
59	59	2.84	W	.....5.....
71	71	2.82	Y	.....33....
73	73	2.80	Z	.....3.
32	32	2.78		..... 4.....
48	48	2.78	F	....5..5.....
29	29	2.76	E	1.....54.....3.
43	43	2.76	O	....5.....
74	74	2.74	I	.....4.3...
77	77	2.60	R	.....3.....2
23	23	2.54	g	2
27	27	2.54	U	.....4.33.....
31	31	2.54		.....3.....
30	30	2.53	A	.....55..53 .4..
78	78	2.49	B	.....55..5.....
45	45	2.46	J	..54.....3.....
35	35	2.38	V	.... 2.2.
51	51	2.35		.....3.....
54	54	2.35	q	.....3.....
56	56	2.35	e	.....3.....
67	67	2.35	K	..5.....2
24	24	2.24	T	....3..22.....
8	08	2.22		.....3.....
63	63	2.22		.4.....
11	11	2.17	G	.....3....
14	14	2.11	p	...3.....
53	53	2.11		..3.....
9	09	2.05		...3.....
28	28	2.05		....3.....
5	05	1.97	o	.....2.....
10	10	1.97		.....22..2.....
65	65	1.97		.....3.....
4	04	1.75	w	.....2.....
25	25	1.75	L	.....3.....
13	13	1.29		...2.....
20	20	1.29		...2.....
22	22	1.29		..2.....
37	37	1.29	X	.....2.....
				low
				548921721122112221231 1
				2 540645689091073

TABLE OF POORLY FITTING PERSONS (ITEMS IN ENTRY ORDER)
NUMBER - NAME -- POSITION ------ MEASURE - INFIT (ZSTD) OUTFIT

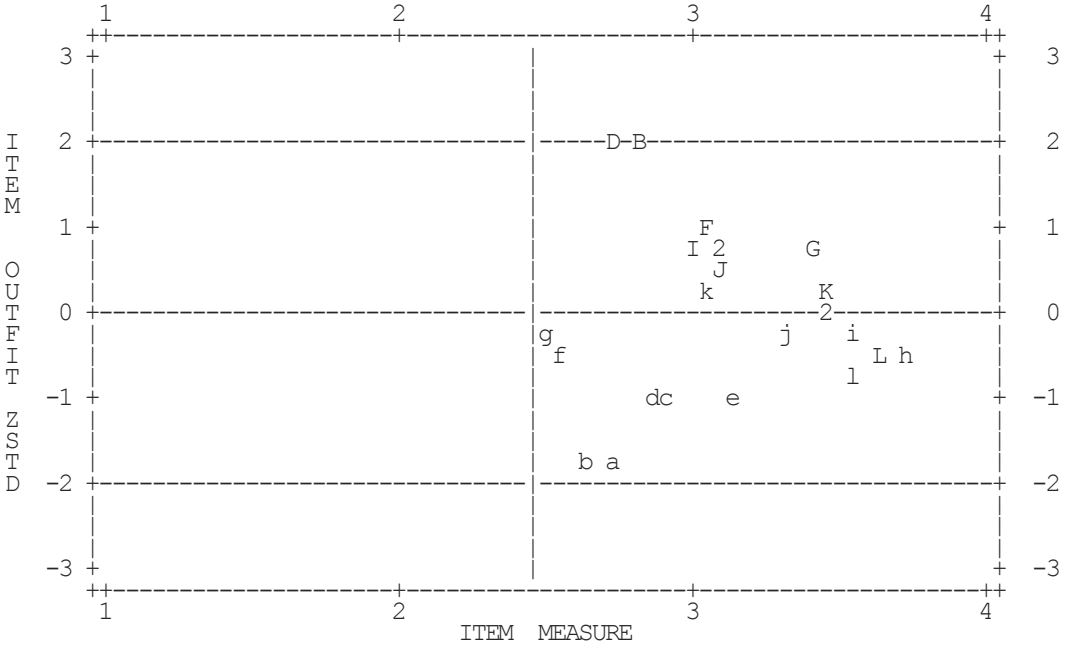
```
   30 30                          2.53     5.5   A    6.8
      RESPONSE:    1:  1 1 1 1 1  1 1 1 1 1   1 1 1 1 1  1 1 1 M M  1 4 5 5 1  5
1 5 3 4
     Z-RESIDUAL:                  X          X            X        X X 4    4
X 6 3 6

   78 78                          2.49     4.3   B    3.0
      RESPONSE:    1:  1 1 1 1 5  1 5 1 1 5   5 5 1 1 1  1 1 1 1 1  1 1 1 1 1  1
1 1 1 1
     Z-RESIDUAL:                  X 4    4   X 3          X        X X
X

   42 42                          3.03     2.1   C    3.0
      RESPONSE:    1:  3 3 4 2 2  2 3 5 2 3   5 3 1 1 1  2 3 1 3 3  4 3 2 4 2  3
M 2 4 3
     Z-RESIDUAL:             -2-2 X          X          2 X      2 X X
2

   70 70                          3.22     2.2   D    2.8
      RESPONSE:    1:  3 3 3 3 5  3 4 1 3 4   1 3 3 3 3  3 3 2 4 3  3 2 3 2 3  3
3 4 5 3
     Z-RESIDUAL:             -2   X  -3      X            X        X X
X   2

   29 29                          2.76     2.3   E    2.3
      RESPONSE:    1:  3 2 2 3 1  1 3 1 3 2   1 1 1 2 3  1 3 1 1 1  2 4 2 4 1  5
1 2 2 2
     Z-RESIDUAL:               -2 X          X          3 X      X X 2    3
X

   48 48                          2.78     2.5   F    1.4
      RESPONSE:    1:  5 5 5 5 5  1 1 5 1 1   5 1 1 1 1  1 1 1 1 1  1 5 2 1 5  1
1 1 1 1
     Z-RESIDUAL:           2      X          X            X        X X   2
X

   79 79                          3.02     1.5   H    2.2
      RESPONSE:    1:  2 2 3 2 2  3 2 3 3 2   3 4 2 3 2  3 3 2 3 4  3 2 2 3 4  3
2 2 3 2
     Z-RESIDUAL:             -2-2 X          X          2 X   2    X X
X
```

TABLE 8.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82



PERSON 1 4 2 5 4 313116 116251153341112221
Q S M S Q

TABLE 9.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82



PERSON 1 4 2 5 4 313116 116251153341112221
Q S M S Q

TABLE 9.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

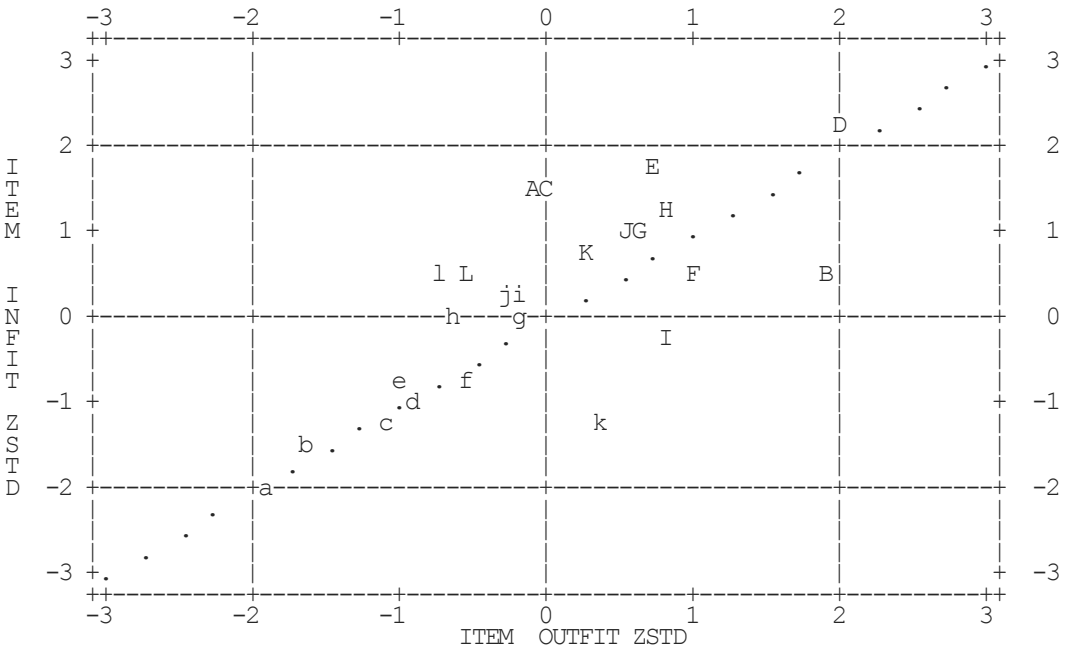
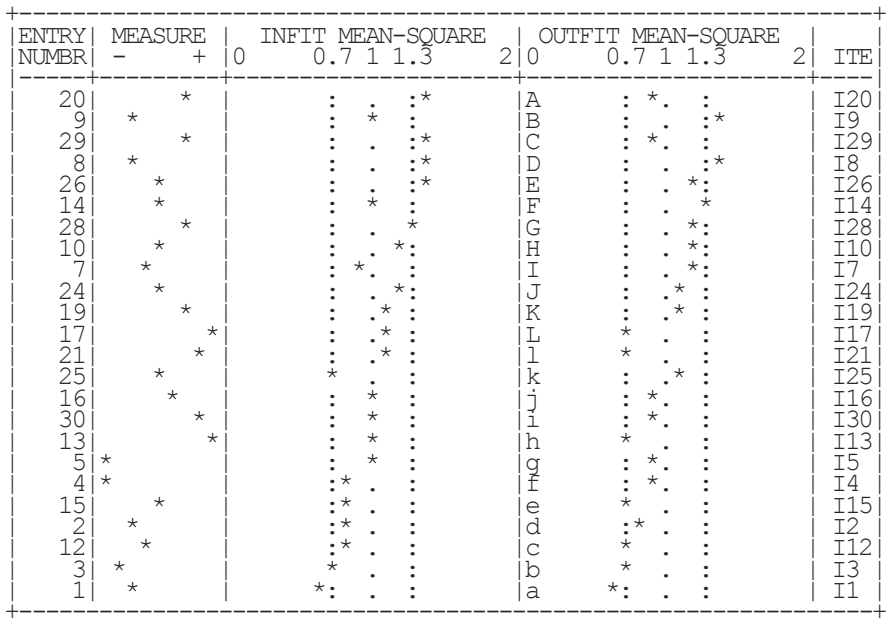


TABLE 10.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS STATISTICS: MISFIT ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.		ITE
20	95	71	3.47	.09	1.49	1.6	.95	-.1	A	.40	I20
9	164	72	2.81	.05	1.10	.6	1.47	1.9	B	.46	I9
29	97	72	3.46	.09	1.46	1.5	.98	.0	C	.44	I29
8	176	72	2.73	.05	1.42	2.3	1.46	2.0	D	.57	I8
26	124	71	3.10	.06	1.42	1.9	1.23	.8	E	.49	I26
14	122	68	3.06	.06	1.08	.4	1.32	1.0	F	.38	I14
28	101	72	3.39	.08	1.30	1.1	1.26	.6	G	.41	I28
10	127	72	3.09	.06	1.27	1.3	1.23	.8	H	.38	I10
7	140	72	2.98	.06	.96	-.2	1.21	.8	I	.60	I7
24	125	72	3.11	.06	1.20	1.0	1.16	.5	J	.49	I24
19	93	69	3.47	.09	1.19	.7	1.12	.3	K	.43	I19
17	88	72	3.65	.11	1.17	.5	.75	-.6	L	.47	I17
21	92	71	3.53	.09	1.14	.5	.71	-.7	l	.47	I21
25	129	69	3.03	.06	.80	-1.1	1.10	.4	k	.68	I25
16	103	70	3.33	.08	1.09	.4	.90	-.3	j	.52	I16
30	92	72	3.56	.10	1.07	.2	.93	-.2	i	.49	I30
13	86	72	3.71	.11	1.01	.0	.72	-.6	h	.38	I13
5	215	72	2.49	.05	1.00	.0	.97	-.2	g	.63	I5
4	207	72	2.54	.05	.90	-.7	.91	-.5	f	.69	I4
15	120	72	3.16	.07	.86	-.7	.73	-1.0	e	.57	I15
2	159	72	2.84	.05	.84	-1.0	.82	-.9	d	.64	I2
12	150	72	2.91	.06	.81	-1.1	.77	-1.1	c	.66	I12
3	193	72	2.62	.05	.77	-1.6	.71	-1.7	b	.71	I3
1	174	71	2.72	.05	.70	-2.1	.66	-1.9	a	.68	I1
MEAN	132.	71.	3.12	.07	1.08	.2	1.00	.0			
S.D.	39.	1.	.35	.02	.23	1.1	.24	1.0			

ITEMS FIT GRAPH: MISFIT ORDER



ITEMS OPTION/DISTRACTOR FREQUENCIES: MISFIT ORDER

NUM	NONMISS	MISSING	R%	SCR		1	%	SCR		2	%	SCR		3	%	SCR		4	%	SCR
20A	72	1	1	**		59	81	1		4	5	2		7	9	3		2	2	4
9B	73	0	0	**		20	27	1		27	36	2		17	23	3		5	6	4
29C	73	0	0	**		59	80	1		6	8	2		6	8	3		1	1	4
8D	73	0	0	**		29	39	1		16	21	2		10	13	3		4	5	4
26E	72	1	1	**		44	61	1		13	18	2		9	12	3		2	2	4
14F	69	4	5	**		32	46	1		24	34	2		10	14	3		2	2	4
28G	73	0	0	**		54	73	1		12	16	2		5	6	3		1	1	4
10H	73	0	0	**		38	52	1		22	30	2		8	10	3		3	4	4
7I	73	0	0	**		35	47	1		18	24	2		14	19	3		2	2	4
24J	73	0	0	**		41	56	1		19	26	2		8	10	3		2	2	4
19K	70	3	4	**		55	78	1		7	10	2		7	10	3		1	1	4
17L	73	0	0	**		63	86	1		4	5	2		6	8	3		0	0	4
21M	72	1	1	**		58	80	1		8	11	2		5	6	3		1	1	4
25N	70	3	4	**		34	48	1		22	31	2		7	10	3		4	5	4
16O	71	2	2	**		50	70	1		12	16	2		7	9	3		1	1	4
30P	73	0	0	**		59	80	1		9	12	2		4	5	3		1	1	4
13Q	73	0	0	**		62	84	1		8	10	2		3	4	3		0	0	4
5R	73	0	0	**		16	21	1		16	21	2		12	16	3		13	17	4
4S	73	0	0	**		19	26	1		14	19	2		14	19	3		11	15	4
15T	73	0	0	**		41	56	1		20	27	2		9	12	3		2	2	4
2U	73	0	0	**		25	34	1		23	31	2		16	21	3		4	5	4
12V	73	0	0	**		28	38	1		25	34	2		12	16	3		3	4	4
3W	73	0	0	**		19	26	1		18	24	2		16	21	3		9	12	4
1X	72	1	1	**		16	22	1		27	37	2		17	23	3		6	8	4

TABLE 10.4 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

MOST MISFITTING RESPONSE STRINGS

```
 ITEM     OUTMNSQ  |PERSON
                   |764733 5157743427732237436555268151296152432 21
                   |012963605913823947173085576414381348950554720 3
                 high-----------------------------------------------
   20 I20      .95 A|...4...33.3.....4.... ........................
    9 I9      1.47 B|.......................4..........3.3.......22
   29 I29      .98 C|5.4.....3........3...3.......2................
    8 I8      1.46 D|1.......................5.5.......3.........2..
   26 I26     1.23 E|......5.........5...4.5.3.....................
   14 I14     1.32 F|.........5...  ..............3..3.....32.......
   28 I28     1.26 G|.......................5.......2...............
   10 I10     1.23 H|..............4........5....3..........22......
    7 I7      1.21 I|.......................5...3.............3.....
   24 I24     1.16 J|....5..........4.....5.......3................
   19 I19     1.12 K|.......33.3.......... ..........3.............
   17 I17      .75 L|..33.......3...3........2......................
   21 I21      .71 l|..4..............3.......2......................
   25 I25     1.10 k|............5........... .... ............22...
   16 I16      .90 j|...............5...33.........................
   30 I30      .93 i|........3.............4.......................
   13 I13      .72 h|.....3...........2..2....2....................
    5 I5       .97 g|.322............1..............................
    4 I4       .91 f|3.22.............................4.............
   15 I15      .73 e|...................3..................2.......
    2 I2       .82 d|.............5.....................3...........
   12 I12      .77 c|.......................5........................
                   |-----------------------------------------------low
                   |764733651577434277322374365552681512961524322 1
                   |012963 059138239471730855764143 1348 50 5 7203
```

TABLE 10.5 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

MOST UNEXPECTED RESPONSES

```
 ITEM     MEASURE  |PERSON
                   |764733 5157743427732237436555268151296152432 21
                   |012963605913823947173085576414381348950554720 3
                 high-----------------------------------------------
    5 I5     2.49 g|.322............1..............................
    4 I4     2.54 f|3.22.............................4.............
    8 I8     2.73 D|1.......................5.5.......3.........2..
    9 I9     2.81 B|.......................4..........3.3.......22
    2 I2     2.84 d|.............5.....................3...........
   12 I12    2.91 c|.......................5........................
    7 I7     2.98 I|.......................5...3.............3.....
   25 I25    3.03 k|............5........... ..... ............22...
   14 I14    3.06 F|.........5...  ..............3..3.....32.......
   10 I10    3.09 H|..............4........5....3..........22......
   24 I24    3.11 J|....5..........4.....5.......3................
   26 I26    3.10 E|......5.........5...4.5.3.....................
   15 I15    3.16 e|...................3..................2.......
   16 I16    3.33 j|..............5...33.........................
   28 I28    3.39 G|.......................5.......2...............
   19 I19    3.47 K|.......33.3.......... .. .......3.............
   29 I29    3.46 C|5.4.....3........3...3.......2................
   20 I20    3.47 A|...4...33.3.....4.... ........................
   21 I21    3.53 l|..4..............3.......2......................
   30 I30    3.56 i|........3.............4.......................
   17 I17    3.65 L|..33.......3...3........2......................
   13 I13    3.71 h|.....3...........2..2....2....................
                   |-----------------------------------------------low
                   |764733651577434277322374365552681512961524322 1
                   |012963 059138239471730855764143 1348 50 5 7203
```

TABLE OF POORLY FITTING ITEMS (PERSONS IN ENTRY ORDER)
NUMBER - NAME -- POSITION ------ MEASURE - INFIT (ZSTD) OUTFIT

```
    8 I8                              2.73     2.3   D    2.0
      RESPONSE:    1:  3 3 1 1 1  2 1 1 1 1   1 1 1 1 2  1 1 1 1 1   1 2 2 2 1  2
2 1 1 1   2 1 3 4 1  5 1 4 1 2   5 5 3 3 5  4 5 5 4 5   1 5 3 3 2  2 5 5 5 3   5 3
2 4 1  2 5 3 2 1   5 4 5 2 M  1 2 1 3
     Z-RESIDUAL:          X                                          3
X     X       2               2                      X      3    -3     X
X
```

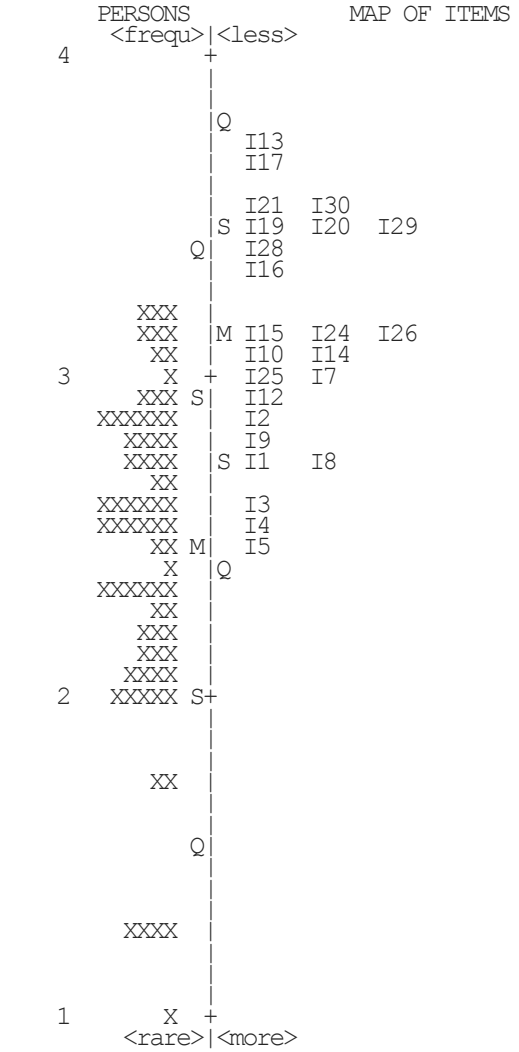



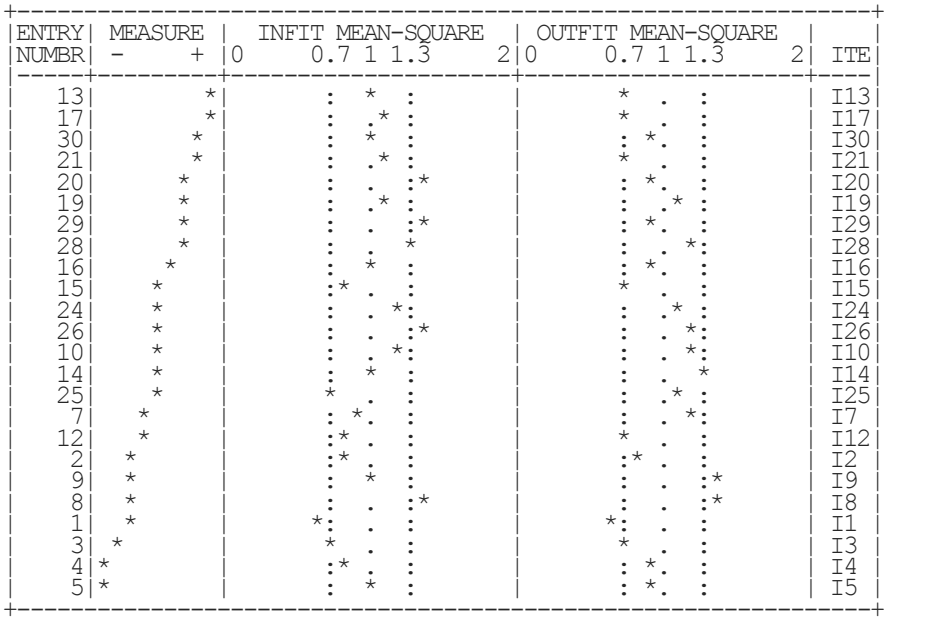
TABLE 13.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS STATISTICS: MEASURE ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	ITE
13	86	72	3.71	.11	1.01	.0	.72	-.6	.38	I13
17	88	72	3.65	.11	1.17	.5	.75	-.6	.47	I17
30	92	72	3.56	.10	1.07	.2	.93	-.2	.49	I30
21	92	71	3.53	.09	1.14	.5	.71	-.7	.47	I21
20	95	71	3.47	.09	1.49	1.6	.95	-.1	.40	I20
19	93	69	3.47	.09	1.19	.7	1.12	.3	.43	I19
29	97	72	3.46	.09	1.46	1.5	.98	.0	.44	I29
28	101	72	3.39	.08	1.30	1.1	1.26	.6	.41	I28
16	103	70	3.33	.08	1.09	.4	.90	-.3	.52	I16
15	120	72	3.16	.07	.86	-.7	.73	-1.0	.57	I15
24	125	72	3.11	.06	1.20	1.0	1.16	.5	.49	I24
26	124	71	3.10	.06	1.42	1.9	1.23	.8	.49	I26
10	127	72	3.09	.06	1.27	1.3	1.23	.8	.38	I10
14	122	68	3.06	.06	1.08	.4	1.32	1.0	.38	I14
25	129	69	3.03	.06	.80	-1.1	1.10	.4	.68	I25
7	140	72	2.98	.06	.96	-.2	1.21	.8	.60	I7
12	150	72	2.91	.06	.81	-1.1	.77	-1.1	.66	I12
2	159	72	2.84	.05	.84	-1.0	.82	-.9	.64	I2
9	164	72	2.81	.05	1.10	.6	1.47	1.9	.46	I9
8	176	72	2.73	.05	1.42	2.3	1.46	2.0	.57	I8
1	174	71	2.72	.05	.70	-2.1	.66	-1.9	.68	I1
3	193	72	2.62	.05	.77	-1.6	.71	-1.7	.71	I3
4	207	72	2.54	.05	.90	-.7	.91	-.5	.69	I4
5	215	72	2.49	.05	1.00	.0	.97	-.2	.63	I5
MEAN	132.	71.	3.12	.07	1.08	.2	1.00	.0		
S.D.	39.	1.	.35	.02	.23	1.1	.24	1.0		

TABLE 13.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS FIT GRAPH: MEASURE ORDER



ITEMS OPTION/DISTRACTOR FREQUENCIES: MEASURE ORDER

NUM	NONMISS	MISSING	R%	SCR	1	%	SCR	2	%	SCR	3	%	SCR	4	%	SCR	5	%	SCR
13	73	0	0	**	62	84	1	8	10	2	3	4	3	0	0	4	0	0	5
17	73	0	0	**	63	86	1	4	5	2	6	8	3	0	0	4	0	0	5
30	73	0	0	**	59	80	1	9	12	2	4	5	3	1	1	4	0	0	5
21	72	1	1	**	58	80	1	8	11	2	5	6	3	1	1	4	0	0	5
20	72	1	1	**	59	81	1	4	5	2	7	9	3	2	2	4	0	0	5
19	70	3	4	**	55	78	1	7	10	2	7	10	3	1	1	4	0	0	5
29	73	0	0	**	59	80	1	6	8	2	6	8	3	1	1	4	1	1	5
28	73	0	0	**	54	73	1	12	16	2	5	6	3	1	1	4	1	1	5
16	71	2	2	**	50	70	1	12	16	2	7	9	3	1	1	4	1	1	5
15	73	0	0	**	41	56	1	20	27	2	9	12	3	2	2	4	1	1	5
24	73	0	0	**	41	56	1	19	26	2	8	10	3	2	2	4	3	4	5
26	72	1	1	**	44	61	1	13	18	2	9	12	3	2	2	4	4	5	5
10	73	0	0	**	38	52	1	22	30	2	8	10	3	3	4	4	2	2	5
14	69	4	5	**	32	46	1	24	34	2	10	14	3	2	2	4	1	1	5
25	70	3	4	**	34	48	1	22	31	2	7	10	3	4	5	4	3	4	5
7	73	0	0	**	35	47	1	18	24	2	14	19	3	2	2	4	4	5	5
12	73	0	0	**	28	38	1	25	34	2	12	16	3	3	4	4	5	6	5
2	73	0	0	**	25	34	1	23	31	2	16	21	3	4	5	4	5	6	5
9	73	0	0	**	20	27	1	27	36	2	17	23	3	5	6	4	4	5	5
8	73	0	0	**	29	39	1	16	21	2	10	13	3	4	5	4	14	19	5
1	72	1	1	**	16	22	1	27	37	2	17	23	3	6	8	4	6	8	5
3	73	0	0	**	19	26	1	18	24	2	16	21	3	9	12	4	11	15	5
4	73	0	0	**	19	26	1	14	19	2	14	19	3	11	15	4	15	20	5
5	73	0	0	**	16	21	1	16	21	2	12	16	3	13	17	4	16	21	5

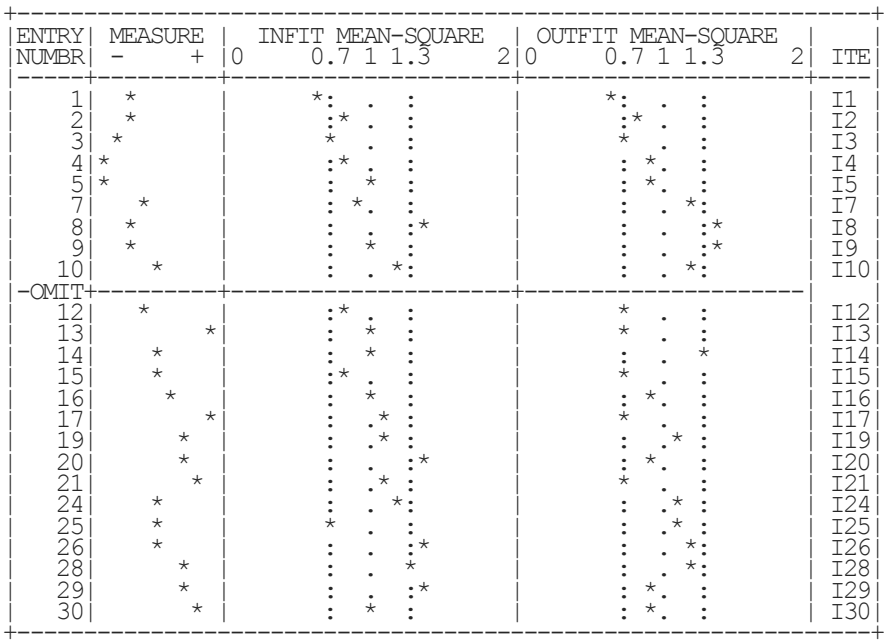
TABLE 14.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS STATISTICS: ENTRY ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	ITE
1	174	71	2.72	.05	.70	-2.1	.66	-1.9	.68	I1
2	159	72	2.84	.05	.84	-1.0	.82	-.9	.64	I2
3	193	72	2.62	.05	.77	-1.6	.71	-1.7	.71	I3
4	207	72	2.54	.05	.90	-.7	.91	-.5	.69	I4
5	215	72	2.49	.05	1.00	.0	.97	-.2	.63	I5
6			DELETED							I6
7	140	72	2.98	.06	.96	-.2	1.21	.8	.60	I7
8	176	72	2.73	.05	1.42	2.3	1.46	2.0	.57	I8
9	164	72	2.81	.05	1.10	.6	1.47	1.9	.46	I9
10	127	72	3.09	.06	1.27	1.3	1.23	.8	.38	I10
11			DELETED							I11
12	150	72	2.91	.06	.81	-1.1	.77	-1.1	.66	I12
13	86	72	3.71	.11	1.01	.0	.72	-.6	.38	I13
14	122	68	3.06	.06	1.08	.4	1.32	1.0	.38	I14
15	120	72	3.16	.07	.86	-.7	.73	-1.0	.57	I15
16	103	70	3.33	.08	1.09	.4	.90	-.3	.52	I16
17	88	72	3.65	.11	1.17	.5	.75	-.6	.47	I17
18			DELETED							I18
19	93	69	3.47	.09	1.19	.7	1.12	.3	.43	I19
20	95	71	3.47	.09	1.49	1.6	.95	-.1	.40	I20
21	92	71	3.53	.09	1.14	.5	.71	-.7	.47	I21
22			DELETED							I22
23			DELETED							I23
24	125	72	3.11	.06	1.20	1.0	1.16	.5	.49	I24
25	129	69	3.03	.06	.80	-1.1	1.10	.4	.68	I25
26	124	71	3.10	.06	1.42	1.9	1.23	.8	.49	I26
27			DELETED							I27
28	101	72	3.39	.08	1.30	1.1	1.26	.6	.41	I28
29	97	72	3.46	.09	1.46	1.5	.98	.0	.44	I29
30	92	72	3.56	.10	1.07	.2	.93	-.2	.49	I30
MEAN	132.	71.	3.12	.07	1.08	.2	1.00	.0		
S.D.	39.	1.	.35	.02	.23	1.1	.24	1.0		

TABLE 14.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS FIT GRAPH: ENTRY ORDER



ITEMS OPTION/DISTRACTOR FREQUENCIES: ENTRY ORDER

NUM	NONMISS	MISSING	R%	SCR	1	% SCR	2	% SCR	3	% SCR	4	% SCR	5	% SCR
1	72	1	1	**	16	22	1	27	37	2	17	23	3	6	8	4	6	8	5
2	73	0	0	**	25	34	1	23	31	2	16	21	3	4	5	4	5	6	5
3	73	0	0	**	19	26	1	18	24	2	16	21	3	9	12	4	11	15	5
4	73	0	0	**	19	26	1	14	19	2	14	19	3	11	15	4	15	20	5
5	73	0	0	**	16	21	1	16	21	2	12	16	3	13	17	4	16	21	5
7	73	0	0	**	35	47	1	18	24	2	14	19	3	2	2	4	4	5	5
8	73	0	0	**	29	39	1	16	21	2	10	13	3	4	5	4	14	19	5
9	73	0	0	**	20	27	1	27	36	2	17	23	3	5	6	4	4	5	5
10	73	0	0	**	38	52	1	22	30	2	8	10	3	3	4	4	2	2	5
12	73	0	0	**	28	38	1	25	34	2	12	16	3	3	4	4	5	6	5
13	73	0	0	**	62	84	1	8	10	2	3	4	3	0	0	4	0	0	5
14	69	4	5	**	32	46	1	24	34	2	10	14	3	2	2	4	1	1	5
15	73	0	0	**	41	56	1	20	27	2	9	12	3	2	2	4	1	1	5
16	71	2	2	**	50	70	1	12	16	2	7	9	3	1	1	4	1	1	5
17	73	0	0	**	63	86	1	4	5	2	6	8	3	0	0	4	0	0	5
19	70	3	4	**	55	78	1	7	10	2	7	10	3	1	1	4	0	0	5
20	72	1	1	**	59	81	1	4	5	2	7	9	3	2	2	4	0	0	5
21	72	1	1	**	58	80	1	8	11	2	5	6	3	1	1	4	0	0	5
24	73	0	0	**	41	56	1	19	26	2	8	10	3	2	2	4	3	4	5
25	70	3	4	**	34	48	1	22	31	2	7	10	3	4	5	4	3	4	5
26	72	1	1	**	44	61	1	13	18	2	9	12	3	2	2	4	4	5	5
28	73	0	0	**	54	73	1	12	16	2	5	6	3	1	1	4	1	1	5
29	73	0	0	**	59	80	1	6	8	2	6	8	3	1	1	4	1	1	5
30	73	0	0	**	59	80	1	9	12	2	4	5	3	1	1	4	0	0	5

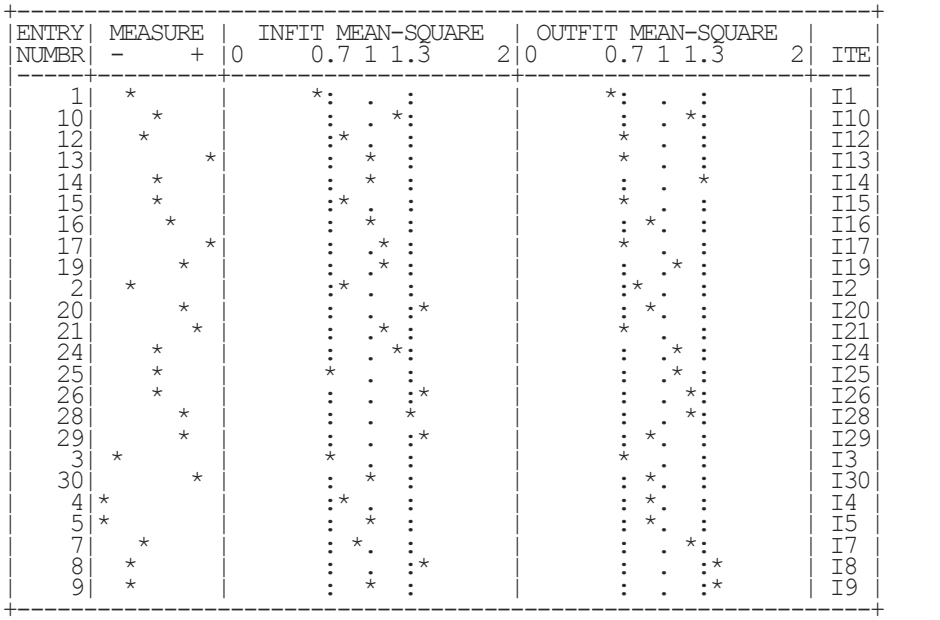
TABLE 15.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS STATISTICS: ALPHA ORDER ON COLUMN: 1.

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	ITE
1	174	71	2.72	.05	.70	-2.1	.66	-1.9	.68	I1
10	127	72	3.09	.06	1.27	1.3	1.23	.8	.38	I10
12	150	72	2.91	.06	.81	-1.1	.77	-1.1	.66	I12
13	86	72	3.71	.11	1.01	.0	.72	-.6	.38	I13
14	122	68	3.06	.06	1.08	.4	1.32	1.0	.38	I14
15	120	72	3.16	.07	.86	-.7	.73	-1.0	.57	I15
16	103	70	3.33	.08	1.09	.4	.90	-.3	.52	I16
17	88	72	3.65	.11	1.17	.5	.75	-.6	.47	I17
19	93	69	3.47	.09	1.19	.7	1.12	.3	.43	I19
2	159	72	2.84	.05	.84	-1.0	.82	-.9	.64	I2
20	95	71	3.47	.09	1.49	1.6	.95	-.1	.40	I20
21	92	71	3.53	.09	1.14	.5	.71	-.7	.47	I21
24	125	72	3.11	.06	1.20	1.0	1.16	.5	.49	I24
25	129	69	3.03	.06	.80	-1.1	1.10	.4	.68	I25
26	124	71	3.10	.06	1.42	1.9	1.23	.8	.49	I26
28	101	72	3.39	.08	1.30	1.1	1.26	.6	.41	I28
29	97	72	3.46	.09	1.46	1.5	.98	.0	.44	I29
3	193	72	2.62	.05	.77	-1.6	.71	-1.7	.71	I3
30	92	72	3.56	.10	1.07	.2	.93	-.2	.49	I30
4	207	72	2.54	.05	.90	-.7	.91	-.5	.69	I4
5	215	72	2.49	.05	1.00	.0	.97	-.2	.63	I5
7	140	72	2.98	.06	.96	-.2	1.21	.8	.60	I7
8	176	72	2.73	.05	1.42	2.3	1.46	2.0	.57	I8
9	164	72	2.81	.05	1.10	.6	1.47	1.9	.46	I9
MEAN	132.	71.	3.12	.07	1.08	.2	1.00	.0		
S.D.	39.	1.	.35	.02	.23	1.1	.24	1.0		

TABLE 15.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

ITEMS FIT GRAPH: ALPHA ORDER ON COLUMN: 1.



ITEMS OPTION/DISTRACTOR FREQUENCIES: ALPHA ORDER ON COLUMN: 1.

NUM	NONMISS	MISSING	R	% SCR	1	% SCR	2	% SCR	3	% SCR	4	% SCR	5	% SCR
1	72	1	1	**	16	22	1	27	37	2	17	23	3	6	8	4	6	8	5
10	73	0	0	**	38	52	1	22	30	2	8	10	3	3	4	4	2	2	5
12	73	0	0	**	28	38	1	25	34	2	12	16	3	3	4	4	5	6	5
13	73	0	0	**	62	84	1	8	10	2	3	4	3	0	0	4	0	0	5
14	69	4	5	**	32	46	1	24	34	2	10	14	3	2	2	4	1	1	5
15	73	0	0	**	41	56	1	20	27	2	9	12	3	2	2	4	1	1	5
16	71	2	2	**	50	70	1	12	16	2	7	9	3	1	1	4	1	1	5
17	73	0	0	**	63	86	1	4	5	2	6	8	3	0	0	4	0	0	5
19	70	3	4	**	55	78	1	7	10	2	7	10	3	1	1	4	0	0	5
2	73	0	0	**	25	34	1	23	31	2	16	21	3	4	5	4	5	6	5
20	72	1	1	**	59	81	1	4	5	2	7	9	3	2	2	4	0	0	5
21	72	1	1	**	58	80	1	8	11	2	5	6	3	1	1	4	0	0	5
24	73	0	0	**	41	56	1	19	26	2	8	10	3	2	2	4	3	4	5
25	70	3	4	**	34	48	1	22	31	2	7	10	3	4	5	4	3	4	5
26	72	1	1	**	44	61	1	13	18	2	9	12	3	2	2	4	4	5	5
28	73	0	0	**	54	73	1	12	16	2	5	6	3	1	1	4	1	1	5
29	73	0	0	**	59	80	1	6	8	2	6	8	3	1	1	4	1	1	5
3	73	0	0	**	19	26	1	18	24	2	16	21	3	9	12	4	11	15	5
30	73	0	0	**	59	80	1	9	12	2	4	5	3	1	1	4	0	0	5
4	73	0	0	**	19	26	1	14	19	2	14	19	3	11	15	4	15	20	5
5	73	0	0	**	16	21	1	16	21	2	12	16	3	13	17	4	16	21	5
7	73	0	0	**	35	47	1	18	24	2	14	19	3	2	2	4	4	5	5
8	73	0	0	**	29	39	1	16	21	2	10	13	3	4	5	4	14	19	5
9	73	0	0	**	20	27	1	27	36	2	17	23	3	5	6	4	4	5	5

TABLE 16.3 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

```
   ITEMS              MAP OF PERSONS
     <rare>|<more>
4          +
           |
           |
           |
         Q |
       X   |
       X   |
           |
      XX   |
     XXX S |
       X   |Q
       X   |
           |
           |  01  47  70
     XXX M |  44  57  61
      XX   |  42  58
3     XX  + |  79
       X   |S 06  33  36
       X   |  15  46  49  50  52  59
       X   |  32  48  71  73
      XX S |  29  43  60  74
           |  38  66
       X   |  17  26  55  62  68  77
       X   |  23  27  30  31  34  69
       X   |M 45  78
         Q |  35
           |  12  21  51  54  56  67
           |  16  24
           |  08  11  63
           |  03  14  53
           |  07  09  18  28
2          +S 05  10  19  40  65
           |
           |
           |
           |  04  25
           |
           |
           |Q
           |
           |
           |
           |  13  20  22  37
           |
           |
           |
1          +  39
    <frequ>|<less>
```

PERSON STATISTICS: MEASURE ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	PE
70	77	24	3.22	.09	1.73	2.2	2.06	2.8	-.09	70
47	75	24	3.19	.08	1.43	1.4	1.25	.8	.74	47
1	74	24	3.17	.08	.70	-1.3	.65	-1.4	.76	01
61	73	24	3.15	.08	.70	-1.3	.75	-.9	.75	61
57	72	24	3.14	.08	1.35	1.2	1.29	.9	.75	57
44	70	24	3.10	.09	1.37	1.2	1.40	1.2	.34	44
58	68	24	3.07	.09	.82	-.7	.76	-.9	.84	58
42	66	24	3.03	.09	1.69	2.1	2.11	3.0	.04	42
79	65	24	3.02	.09	1.46	1.5	1.79	2.2	-.19	79
36	61	24	2.95	.09	1.33	1.1	1.25	.8	.63	36
6	60	24	2.93	.09	1.04	.2	.94	-.2	.70	06
33	60	24	2.93	.09	.69	-1.2	.89	-.4	.78	33
46	56	23	2.90	.09	.39	-2.9	.44	-2.3	.89	46
49	58	24	2.89	.09	.61	-1.6	.67	-1.2	.69	49
52	57	24	2.87	.09	.74	-1.0	.69	-1.1	.85	52
15	56	24	2.85	.09	1.01	.1	1.34	1.0	.27	15
50	56	24	2.85	.09	.95	-.2	.98	.0	.59	50
59	55	24	2.84	.09	1.12	.4	.99	.0	.67	59
71	54	24	2.82	.09	.99	.0	1.10	.3	.38	71
73	53	24	2.80	.09	.86	-.5	1.08	.3	.68	73
32	50	23	2.78	.10	1.01	.0	.87	-.4	.83	32
48	52	24	2.78	.09	1.93	2.5	1.52	1.4	.77	48
43	46	22	2.76	.10	1.09	.3	1.39	1.0	.65	43
29	51	24	2.76	.09	1.83	2.3	1.98	2.3	.04	29
60	51	24	2.76	.09	.50	-2.1	.48	-1.9	.91	60
74	50	24	2.74	.10	1.23	.7	1.78	1.9	.52	74
38	47	24	2.67	.10	.45	-2.2	.41	-2.1	.91	38
66	45	23	2.66	.10	.52	-1.9	.55	-1.5	.82	66
55	44	23	2.63	.10	.54	-1.7	.50	-1.6	.83	55
17	45	24	2.62	.10	.68	-1.1	.68	-1.0	.60	17
62	45	24	2.62	.10	.74	-.9	.57	-1.4	.84	62
68	45	24	2.62	.10	.62	-1.3	.60	-1.3	.81	68
26	41	22	2.61	.11	.25	-3.3	.30	-2.5	.90	26
77	44	24	2.60	.10	1.18	.5	1.34	.8	.11	77
23	42	24	2.54	.11	.33	-2.7	.48	-1.6	.78	23
27	42	24	2.54	.11	1.18	.5	1.28	.7	.42	27
31	42	24	2.54	.11	.76	-.8	.86	-.4	.59	31
34	42	24	2.54	.11	.69	-1.0	.68	-.9	.48	34
69	42	24	2.54	.11	.49	-1.8	.51	-1.5	.80	69
30	39	22	2.53	.11	4.51	5.5	7.15	6.8	-.39	30
78	40	24	2.49	.11	3.45	4.3	2.88	3.0	.25	78
45	39	24	2.46	.12	1.72	1.6	1.19	.4	.47	45
35	34	22	2.38	.13	.66	-1.0	1.16	.3	.18	35
12	36	24	2.35	.13	.96	-.1	.60	-1.0	.77	12
51	36	24	2.35	.13	.79	-.6	.63	-.9	.62	51
54	36	24	2.35	.13	.59	-1.2	.61	-1.0	.60	54
56	36	24	2.35	.13	.45	-1.7	.43	-1.5	.72	56
67	36	24	2.35	.13	1.66	1.4	1.44	.8	.44	67
21	34	23	2.33	.13	.50	-1.5	.39	-1.6	.77	21
16	34	24	2.27	.14	.34	-2.1	.37	-1.7	.69	16
24	32	23	2.24	.15	1.09	.2	1.29	.5	.23	24
8	33	24	2.22	.15	.81	-.5	.77	-.5	.50	08
63	33	24	2.22	.15	.82	-.4	.45	-1.3	.66	63
11	32	24	2.17	.15	1.01	.0	1.89	1.3	.16	11
3	29	22	2.13	.16	.90	-.2	.79	-.4	.07	03
14	31	24	2.11	.16	.60	-.9	.45	-1.2	.67	14
53	31	24	2.11	.16	.95	-.1	.60	-.8	.55	53
7	30	24	2.05	.18	.53	-1.1	.43	-1.2	.57	07
9	30	24	2.05	.18	1.04	.1	.81	-.3	.30	09
18	30	24	2.05	.18	.37	-1.7	.28	-1.6	.77	18
28	30	24	2.05	.18	.99	.0	.72	-.5	.37	28
5	29	24	1.97	.19	.57	-.9	.46	-1.0	.54	05
10	29	24	1.97	.19	.86	-.3	.84	-.2	.16	10
19	29	24	1.97	.19	.48	-1.2	.34	-1.3	.65	19
40	29	24	1.97	.19	.90	-.2	.47	-1.0	.53	40
65	29	24	1.97	.19	.93	-.1	.99	.0	.44	65
4	27	24	1.75	.25	.72	-.5	.54	-.6	.41	04
25	27	24	1.75	.25	1.57	.7	1.44	.5	.10	25
13	25	24	1.29	.43	.94	-.1	.63	-.3	.16	13
20	25	24	1.29	.43	.94	-.1	.63	-.3	.16	20
22	25	24	1.29	.43	.92	-.1	.52	-.4	.23	22
37	25	24	1.29	.43	.99	.0	1.11	.1	.00	37
39	24	24	1.00	.60	MINIMUM ESTIMATED MEASURE					39
MEAN	44.	24.	2.47	.14	.99	-.2	1.01	-.2		

| S.D. 14. 1. .47 .08| .64 1.5| .89 1.5| | |

TABLE 17.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

PERSON FIT GRAPH: MEASURE ORDER

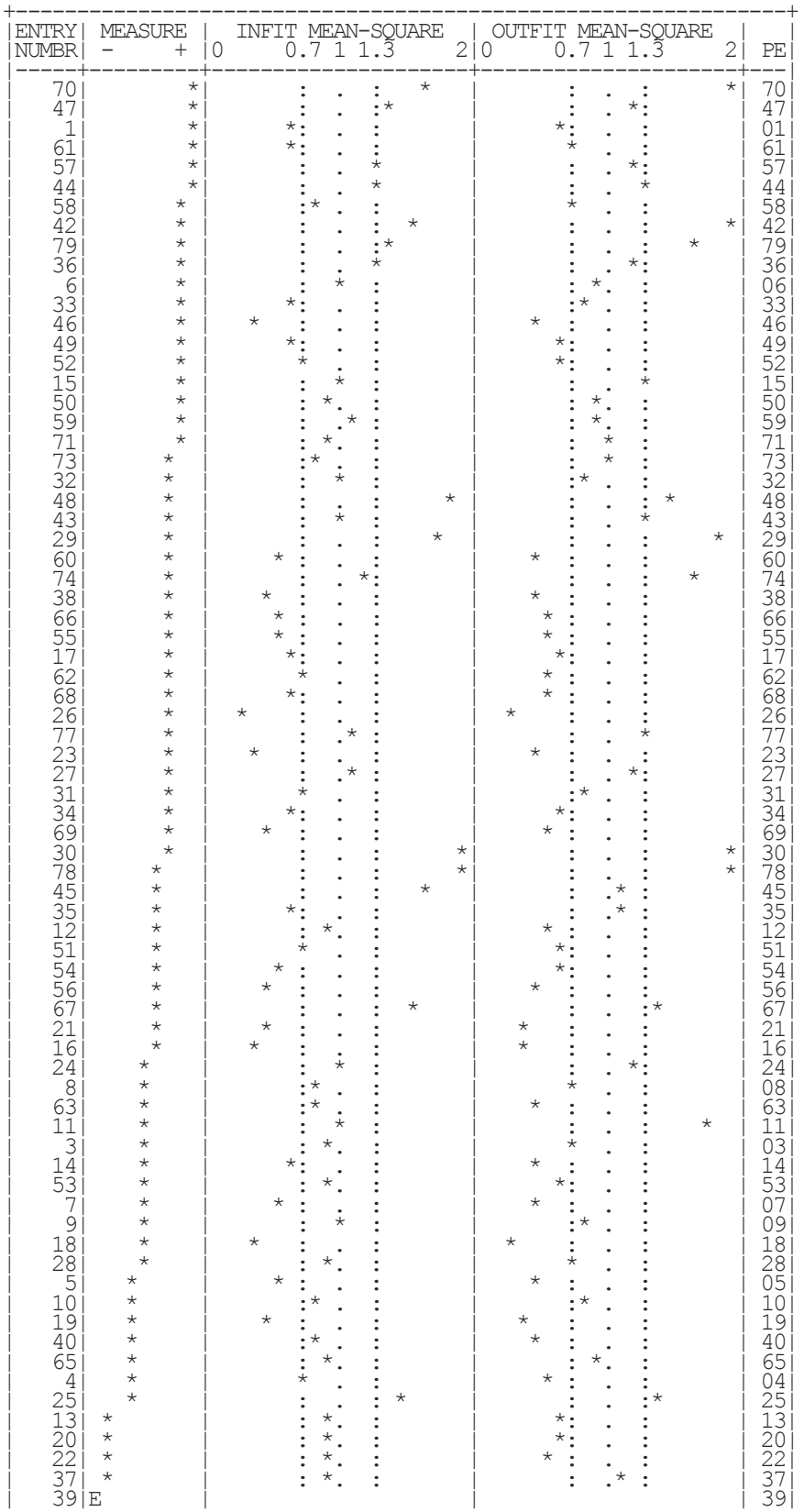


TABLE 18.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

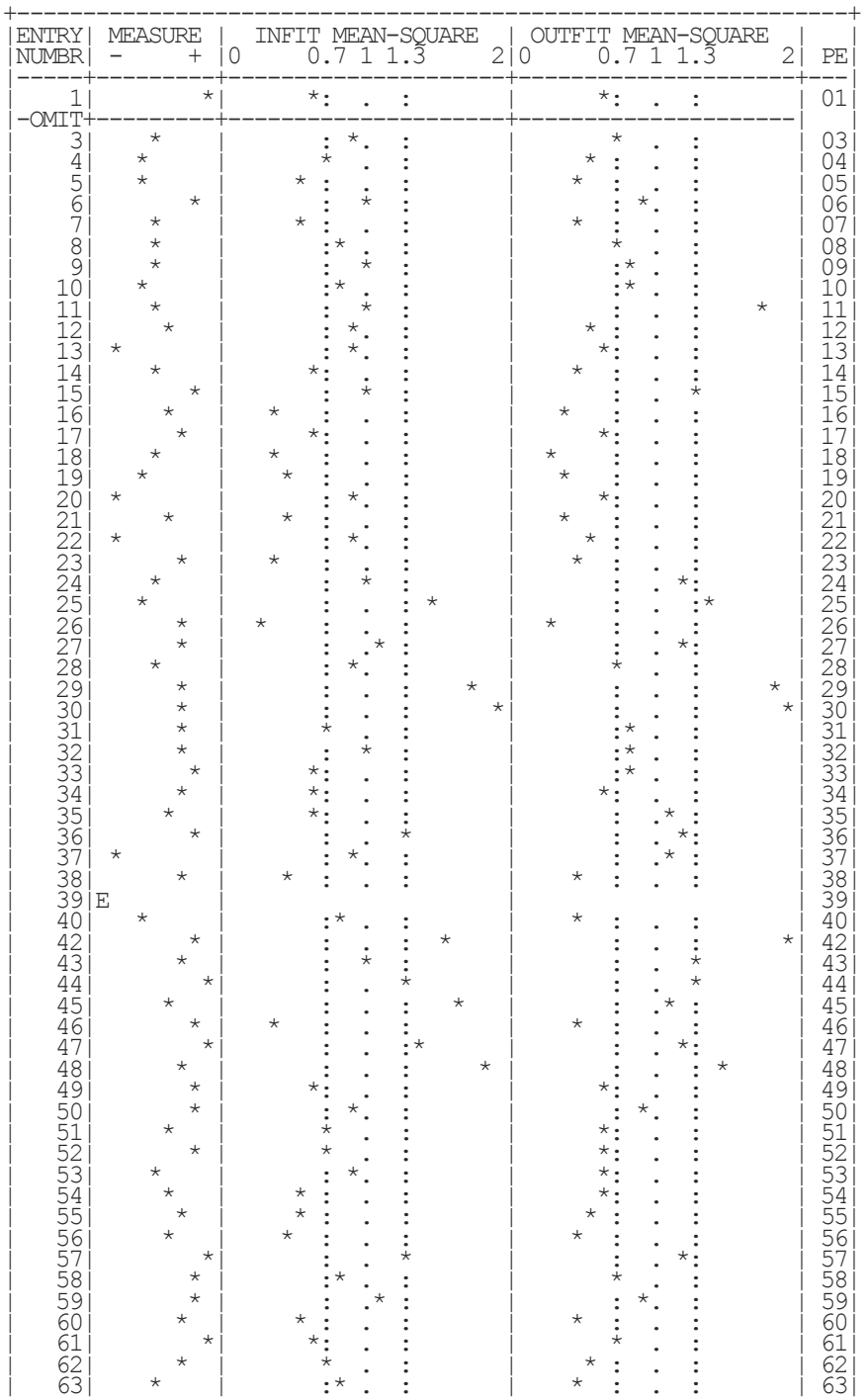
PERSON STATISTICS: ENTRY ORDER

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	PE
1	74	24	3.17	.08	.70	-1.3	.65	-1.4	.76	01
2			DELETED							02
3	29	22	2.13	.16	.90	-.2	.79	-.4	.07	03
4	27	24	1.75	.25	.72	-.5	.54	-.6	.41	04
5	29	24	1.97	.19	.57	-.9	.46	-1.0	.54	05
6	60	24	2.93	.09	1.04	.2	.94	-.2	.70	06
7	30	24	2.05	.18	.53	-1.1	.43	-1.2	.57	07
8	33	24	2.22	.15	.81	-.5	.77	-.5	.50	08
9	30	24	2.05	.18	1.04	.1	.81	-.3	.30	09
10	29	24	1.97	.19	.86	-.3	.84	-.2	.16	10
11	32	24	2.17	.15	1.01	.0	1.89	1.3	.16	11
12	36	24	2.35	.13	.96	-.1	.60	-1.0	.77	12
13	25	24	1.29	.43	.94	-.1	.63	-.3	.16	13
14	31	24	2.11	.16	.60	-.9	.45	-1.2	.67	14
15	56	24	2.85	.09	1.01	.1	1.34	1.0	.27	15
16	34	24	2.27	.14	.34	-2.1	.37	-1.7	.69	16
17	45	24	2.62	.10	.68	-1.1	.68	-1.0	.60	17
18	30	24	2.05	.18	.37	-1.7	.28	-1.6	.77	18
19	29	24	1.97	.19	.48	-1.2	.34	-1.3	.65	19
20	25	24	1.29	.43	.94	-.1	.63	-.3	.16	20
21	34	23	2.33	.13	.50	-1.5	.39	-1.6	.77	21
22	25	24	1.29	.43	.92	-.1	.52	-.4	.23	22
23	42	24	2.54	.11	.33	-2.7	.48	-1.6	.78	23
24	32	23	2.24	.15	1.09	.2	1.29	.5	.23	24
25	27	24	1.75	.25	1.57	.7	1.44	.5	.10	25
26	41	22	2.61	.11	.25	-3.3	.30	-2.5	.90	26
27	42	24	2.54	.11	1.18	.5	1.28	.7	.42	27
28	30	24	2.05	.18	.99	.0	.72	-.5	.37	28
29	51	24	2.76	.09	1.83	2.3	1.98	2.3	.04	29
30	39	22	2.53	.11	4.51	5.5	7.15	6.8	-.39	30
31	42	24	2.54	.11	.76	-.8	.86	-.4	.59	31
32	50	23	2.78	.10	1.01	.0	.87	-.4	.83	32
33	60	24	2.93	.09	.69	-1.2	.89	-.4	.78	33
34	42	24	2.54	.11	.69	-1.0	.68	-.9	.48	34
35	34	22	2.38	.13	.66	-1.0	1.16	.3	.18	35
36	61	24	2.95	.09	1.33	1.1	1.25	.8	.63	36
37	25	24	1.29	.43	.99	.0	1.11	.1	.00	37
38	47	24	2.67	.10	.45	-2.2	.41	-2.1	.91	38
39	24	24	1.00	.60	MINIMUM ESTIMATED MEASURE					39
40	29	24	1.97	.19	.90	-.2	.47	-1.0	.53	40
41			DELETED							41
42	66	24	3.03	.09	1.69	2.1	2.11	3.0	.04	42
43	46	22	2.76	.10	1.09	.3	1.39	1.0	.65	43
44	70	24	3.10	.09	1.37	1.2	1.40	1.2	.34	44
45	39	24	2.46	.12	1.72	1.6	1.19	.4	.47	45
46	56	23	2.90	.09	.39	-2.9	.44	-2.3	.89	46
47	75	24	3.19	.08	1.43	1.4	1.25	.8	.74	47
48	52	24	2.78	.09	1.93	2.5	1.52	1.4	.77	48
49	58	24	2.89	.09	.61	-1.6	.67	-1.2	.69	49
50	56	24	2.85	.09	.95	-.2	.98	.0	.59	50
51	36	24	2.35	.13	.79	-.6	.63	-.9	.62	51
52	57	24	2.87	.09	.74	-1.0	.69	-1.1	.85	52
53	31	24	2.11	.16	.95	-.1	.60	-.8	.55	53
54	36	24	2.35	.13	.59	-1.2	.61	-1.0	.60	54
55	44	23	2.63	.10	.54	-1.7	.50	-1.6	.83	55
56	36	24	2.35	.13	.45	-1.7	.43	-1.5	.72	56
57	72	24	3.14	.08	1.35	1.2	1.29	.9	.75	57
58	68	24	3.07	.09	.82	-.7	.76	-.9	.84	58
59	55	24	2.84	.09	1.12	.4	.99	.0	.67	59
60	51	24	2.76	.09	.50	-2.1	.48	-1.9	.91	60
61	73	24	3.15	.08	.70	-1.3	.75	-.9	.75	61
62	45	24	2.62	.10	.74	-.9	.57	-1.4	.84	62
63	33	24	2.22	.15	.82	-.4	.45	-1.3	.66	63
64			DELETED							64
65	29	24	1.97	.19	.93	-.1	.99	.0	.44	65
66	45	23	2.66	.10	.52	-1.9	.55	-1.5	.82	66
67	36	24	2.35	.13	1.66	1.4	1.44	.8	.44	67
68	45	24	2.62	.10	.62	-1.3	.60	-1.3	.81	68
69	42	24	2.54	.11	.49	-1.8	.51	-1.5	.80	69
70	77	24	3.22	.09	1.73	2.2	2.06	2.8	-.09	70
71	54	24	2.82	.09	.99	.0	1.10	.3	.38	71

72			DELETED						72
73	53	24	2.80	.09	.86	-.5	1.08	.3	.68	73
74	50	24	2.74	.10	1.23	.7	1.78	1.9	.52	74
75			DELETED							75
76			DELETED							76
77	44	24	2.60	.10	1.18	.5	1.34	.8	.11	77
78	40	24	2.49	.11	3.45	4.3	2.88	3.0	.25	78
79	65	24	3.02	.09	1.46	1.5	1.79	2.2	-.19	79
MEAN	44.	24.	2.47	.14	.99	-.2	1.01	-.2		
S.D.	14.	1.	.47	.08	.64	1.5	.89	1.5		

TABLE 18.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

PERSON FIT GRAPH: ENTRY ORDER



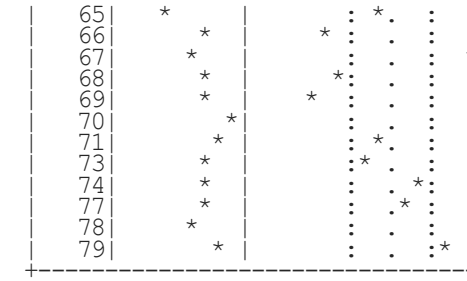


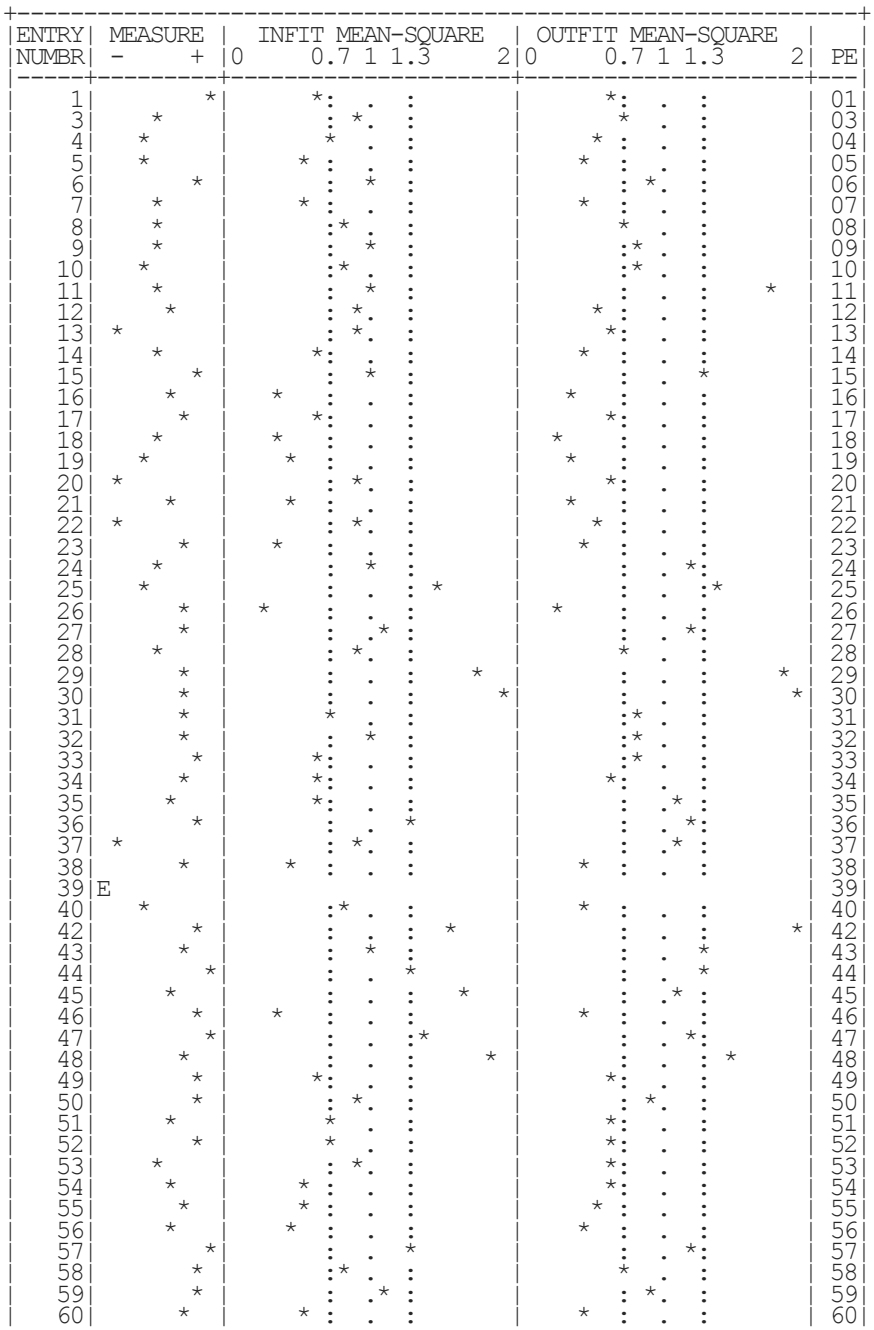
TABLE 19.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

PERSON STATISTICS: ALPHA ORDER ON COLUMN: 1.

ENTRY NUMBR	RAW SCORE	COUNT	MEASURE	ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PTBIS CORR.	PE
1	74	24	3.17	.08	.70	-1.3	.65	-1.4	.76	01
3	29	22	2.13	.16	.90	-.2	.79	-.4	.07	03
4	27	24	1.75	.25	.72	-.5	.54	-.6	.41	04
5	29	24	1.97	.19	.57	-.9	.46	-1.0	.54	05
6	60	24	2.93	.09	1.04	.2	.94	-.2	.70	06
7	30	24	2.05	.18	.53	-1.1	.43	-1.2	.57	07
8	33	24	2.22	.15	.81	-.5	.77	-.5	.50	08
9	30	24	2.05	.18	1.04	.1	.81	-.3	.30	09
10	29	24	1.97	.19	.86	-.3	.84	-.2	.16	10
11	32	24	2.17	.15	1.01	.0	1.89	1.3	.16	11
12	36	24	2.35	.13	.96	-.1	.60	-1.0	.77	12
13	25	24	1.29	.43	.94	-.1	.63	-.3	.16	13
14	31	24	2.11	.16	.60	-.9	.45	-1.2	.67	14
15	56	24	2.85	.09	1.01	.1	1.34	1.0	.27	15
16	34	24	2.27	.14	.34	-2.1	.37	-1.7	.69	16
17	45	24	2.62	.10	.68	-1.1	.68	-1.0	.60	17
18	30	24	2.05	.18	.37	-1.7	.28	-1.6	.77	18
19	29	24	1.97	.19	.48	-1.2	.34	-1.3	.65	19
20	25	24	1.29	.43	.94	-.1	.63	-.3	.16	20
21	34	23	2.33	.13	.50	-1.5	.39	-1.6	.77	21
22	25	24	1.29	.43	.92	-.1	.52	-.4	.23	22
23	42	24	2.54	.11	.33	-2.7	.48	-1.6	.78	23
24	32	23	2.24	.15	1.09	.2	1.29	.5	.23	24
25	27	24	1.75	.25	1.57	.7	1.44	.5	.10	25
26	41	22	2.61	.11	.25	-3.3	.30	-2.5	.90	26
27	42	24	2.54	.11	1.18	.5	1.28	.7	.42	27
28	30	24	2.05	.18	.99	.0	.72	-.5	.37	28
29	51	24	2.76	.09	1.83	2.3	1.98	2.3	.04	29
30	39	22	2.53	.11	4.51	5.5	7.15	6.8	-.39	30
31	42	24	2.54	.11	.76	-.8	.86	-.4	.59	31
32	50	23	2.78	.10	1.01	.0	.87	-.4	.83	32
33	60	24	2.93	.09	.69	-1.2	.89	-.4	.78	33
34	42	24	2.54	.11	.69	-1.0	.68	-.9	.48	34
35	34	22	2.38	.13	.66	-1.0	1.16	.3	.18	35
36	61	24	2.95	.09	1.33	1.1	1.25	.8	.63	36
37	25	24	1.29	.43	.99	.0	1.11	.1	.00	37
38	47	24	2.67	.10	.45	-2.2	.41	-2.1	.91	38
39	24	24	1.00	.60	MINIMUM ESTIMATED MEASURE					39
40	29	24	1.97	.19	.90	-.2	.47	-1.0	.53	40
42	66	24	3.03	.09	1.69	2.1	2.11	3.0	.04	42
43	46	22	2.76	.10	1.09	.3	1.39	1.0	.65	43
44	70	24	3.10	.09	1.37	1.2	1.40	1.2	.34	44
45	39	24	2.46	.12	1.72	1.6	1.19	.4	.47	45
46	56	23	2.90	.09	.39	-2.9	.44	-2.3	.89	46
47	75	24	3.19	.08	1.43	1.4	1.25	.8	.74	47
48	52	24	2.78	.09	1.93	2.5	1.52	1.4	.77	48
49	58	24	2.89	.09	.61	-1.6	.67	-1.2	.69	49
50	56	24	2.85	.09	.95	-.2	.98	.0	.59	50
51	36	24	2.35	.13	.79	-.6	.63	-.9	.62	51
52	57	24	2.87	.09	.74	-1.0	.69	-1.1	.85	52
53	31	24	2.11	.16	.95	-.1	.60	-.8	.55	53
54	36	24	2.35	.13	.59	-1.2	.61	-1.0	.60	54
55	44	23	2.63	.10	.54	-1.7	.50	-1.6	.83	55
56	36	24	2.35	.13	.45	-1.7	.43	-1.5	.72	56
57	72	24	3.14	.08	1.35	1.2	1.29	.9	.75	57
58	68	24	3.07	.09	.82	-.7	.76	-.9	.84	58
59	55	24	2.84	.09	1.12	.4	.99	.0	.67	59
60	51	24	2.76	.09	.50	-2.1	.48	-1.9	.91	60
61	73	24	3.15	.08	.70	-1.3	.75	-.9	.75	61
62	45	24	2.62	.10	.74	-.9	.57	-1.4	.84	62
63	33	24	2.22	.15	.82	-.4	.45	-1.3	.66	63

65	29	24	1.97	.19	.93	-.1	.99	.0	.44	65
66	45	23	2.66	.10	.52	-1.9	.55	-1.5	.82	66
67	36	24	2.35	.13	1.66	1.4	1.44	.8	.44	67
68	45	24	2.62	.10	.62	-1.3	.60	-1.3	.81	68
69	42	24	2.54	.11	.49	-1.8	.51	-1.5	.80	69
70	77	24	3.22	.09	1.73	2.2	2.06	2.8	-.09	70
71	54	24	2.82	.09	.99	.0	1.10	.3	.38	71
73	53	24	2.80	.09	.86	-.5	1.08	.3	.68	73
74	50	24	2.74	.10	1.23	.7	1.78	1.9	.52	74
77	44	24	2.60	.10	1.18	.5	1.34	.8	.11	77
78	40	24	2.49	.11	3.45	4.3	2.88	3.0	.25	78
79	65	24	3.02	.09	1.46	1.5	1.79	2.2	-.19	79
MEAN	44.	24.	2.47	.14	.99	-.2	1.01	-.2		
S.D.	14.	1.	.47	.08	.64	1.5	.89	1.5		

PERSON FIT GRAPH: ALPHA ORDER ON COLUMN: 1.



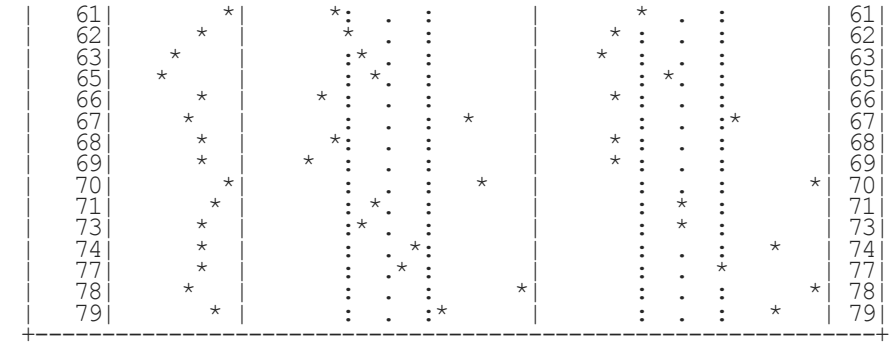


TABLE 20.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

TABLE OF MEASURES ON COMPLETE TEST

SCORE	MEASURE	S.E.	SCORE	MEASURE	S.E.	SCORE	MEASURE	S.E.
24	1.00E	.60	57	2.87	.09	90	3.45	.09
25	1.29	.42	58	2.89	.09	91	3.47	.09
26	1.58	.30	59	2.91	.09	92	3.49	.09
27	1.76	.24	60	2.93	.09	93	3.51	.09
28	1.88	.21	61	2.95	.09	94	3.53	.09
29	1.97	.19	62	2.96	.09	95	3.55	.09
30	2.05	.17	63	2.98	.09	96	3.57	.09
31	2.12	.16	64	3.00	.09	97	3.59	.09
32	2.17	.15	65	3.02	.09	98	3.61	.10
33	2.23	.14	66	3.03	.09	99	3.63	.10
34	2.27	.14	67	3.05	.09	100	3.65	.10
35	2.32	.13	68	3.07	.09	101	3.68	.10
36	2.35	.13	69	3.09	.09	102	3.70	.10
37	2.39	.12	70	3.10	.09	103	3.72	.10
38	2.43	.12	71	3.12	.08	104	3.75	.10
39	2.46	.12	72	3.14	.08	105	3.78	.11
40	2.49	.11	73	3.15	.08	106	3.80	.11
41	2.52	.11	74	3.17	.08	107	3.83	.11
42	2.55	.11	75	3.19	.08	108	3.86	.12
43	2.57	.11	76	3.20	.09	109	3.90	.12
44	2.60	.10	77	3.22	.09	110	3.93	.12
45	2.62	.10	78	3.24	.09	111	3.97	.13
46	2.65	.10	79	3.26	.09	112	4.01	.14
47	2.67	.10	80	3.27	.09	113	4.06	.15
48	2.69	.10	81	3.29	.09	114	4.11	.16
49	2.71	.10	82	3.31	.09	115	4.17	.17
50	2.74	.10	83	3.32	.09	116	4.25	.19
51	2.76	.09	84	3.34	.09	117	4.35	.22
52	2.78	.09	85	3.36	.09	118	4.49	.27
53	2.80	.09	86	3.38	.09	119	4.74	.40
54	2.82	.09	87	3.40	.09	120	5.00E	.58
55	2.84	.09	88	3.41	.09			
56	2.86	.09	89	3.43	.09			

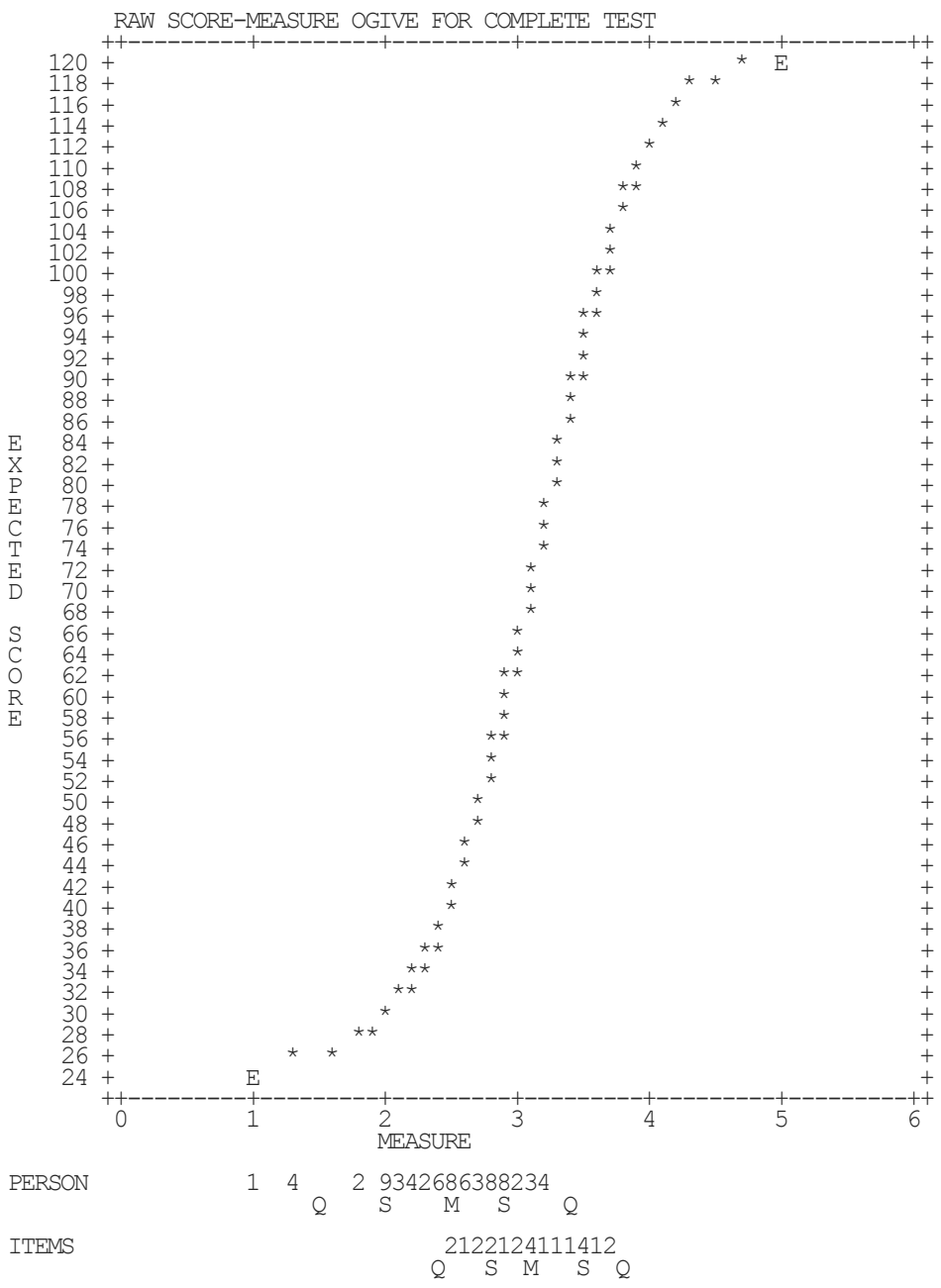

RAW SCORE-MEASURE OGIVE FOR COMPLETE TEST
EXPECTED SCORE
MEASURE
PERSON 1 4 2 9342686388234
Q S M S Q
ITEMS 2122124111412
Q S M S Q

TABLE OF SAMPLE NORMS (500/100) AND FREQUENCIES CORRESPONDING TO COMPLETE TEST

SCORE	MEASURE	S.E.	NORMED	S.E.	FREQUENCY	%	CUM.FREQ.	%	PERCENTILE
24	1.00E	.60	206	122	1	1.4	1	1.4	1
25	1.29	.42	266	86	4	5.5	5	6.8	4
26	1.58	.30	324	61	0	.0	5	6.8	7
27	1.76	.24	359	49	2	2.7	7	9.6	8
28	1.88	.21	383	43	0	.0	7	9.6	10
29	1.97	.19	403	39	5	6.8	12	16.4	13
30	2.05	.17	418	35	4	5.5	16	21.9	19
31	2.12	.16	432	33	3	4.1	19	26.0	24
32	2.17	.15	443	31	1	1.4	20	27.4	27
33	2.23	.14	454	29	3	4.1	23	31.5	29
34	2.27	.14	463	28	1	1.4	24	32.9	32
35	2.32	.13	472	27	1	1.4	25	34.2	34
36	2.35	.13	480	26	5	6.8	30	41.1	38
37	2.39	.12	487	25	1	1.4	31	42.5	42
38	2.43	.12	494	24	0	.0	31	42.5	42
39	2.46	.12	501	23	1	1.4	32	43.8	43
40	2.49	.11	507	23	1	1.4	33	45.2	45
41	2.52	.11	513	22	1	1.4	34	46.6	46
42	2.55	.11	518	22	5	6.8	39	53.4	50
43	2.57	.11	524	21	0	.0	39	53.4	53
44	2.60	.10	529	21	2	2.7	41	56.2	55
45	2.62	.10	534	21	4	5.5	45	61.6	59
46	2.65	.10	539	20	1	1.4	46	63.0	62
47	2.67	.10	544	20	1	1.4	47	64.4	64
48	2.69	.10	548	20	0	.0	47	64.4	64
49	2.71	.10	553	19	0	.0	47	64.4	64
50	2.74	.10	557	19	1	1.4	48	65.8	65
51	2.76	.09	561	19	3	4.1	51	69.9	68
52	2.78	.09	565	19	2	2.7	53	72.6	71
53	2.80	.09	569	19	1	1.4	54	74.0	73
54	2.82	.09	573	18	1	1.4	55	75.3	75
55	2.84	.09	577	18	1	1.4	56	76.7	76
56	2.86	.09	581	18	2	2.7	58	79.5	78
57	2.87	.09	585	18	1	1.4	59	80.8	80
58	2.89	.09	589	18	2	2.7	61	83.6	82
59	2.91	.09	592	18	0	.0	61	83.6	84
60	2.93	.09	596	18	2	2.7	63	86.3	85
61	2.95	.09	599	18	1	1.4	64	87.7	87
62	2.96	.09	603	18	0	.0	64	87.7	88
63	2.98	.09	607	17	0	.0	64	87.7	88
64	3.00	.09	610	17	0	.0	64	87.7	88
65	3.02	.09	614	17	1	1.4	65	89.0	88
66	3.03	.09	617	17	1	1.4	66	90.4	90
67	3.05	.09	621	17	0	.0	66	90.4	90
68	3.07	.09	624	17	1	1.4	67	91.8	91
69	3.09	.09	627	17	0	.0	67	91.8	92
70	3.10	.09	631	17	1	1.4	68	93.2	92
71	3.12	.08	634	17	0	.0	68	93.2	93
72	3.14	.08	638	17	1	1.4	69	94.5	94
73	3.15	.08	641	17	1	1.4	70	95.9	95
74	3.17	.08	645	17	1	1.4	71	97.3	97
75	3.19	.08	648	17	1	1.4	72	98.6	98
76	3.20	.09	651	17	0	.0	72	98.6	99
77	3.22	.09	655	17	1	1.4	73	100.0	99
78	3.24	.09	658	17	0	.0	73	100.0	100
79	3.26	.09	662	17	0	.0	73	100.0	100
80	3.27	.09	665	17	0	.0	73	100.0	100
81	3.29	.09	669	17	0	.0	73	100.0	100
82	3.31	.09	672	17	0	.0	73	100.0	100
83	3.32	.09	676	17	0	.0	73	100.0	100
84	3.34	.09	679	17	0	.0	73	100.0	100
85	3.36	.09	683	18	0	.0	73	100.0	100
86	3.38	.09	686	18	0	.0	73	100.0	100
87	3.40	.09	690	18	0	.0	73	100.0	100
88	3.41	.09	694	18	0	.0	73	100.0	100
89	3.43	.09	697	18	0	.0	73	100.0	100
90	3.45	.09	701	18	0	.0	73	100.0	100
91	3.47	.09	705	18	0	.0	73	100.0	100
92	3.49	.09	709	18	0	.0	73	100.0	100
93	3.51	.09	713	18	0	.0	73	100.0	100
94	3.53	.09	716	19	0	.0	73	100.0	100
95	3.55	.09	721	19	0	.0	73	100.0	100
96	3.57	.09	725	19	0	.0	73	100.0	100
97	3.59	.09	729	19	0	.0	73	100.0	100
98	3.61	.10	733	19	0	.0	73	100.0	100
99	3.63	.10	737	20	0	.0	73	100.0	100
100	3.65	.10	742	20	0	.0	73	100.0	100

101	3.68	.10	747	20	0	.0	73	100.0	100	
102	3.70	.10	751	20	0	.0	73	100.0	100	
103	3.72	.10	756	21	0	.0	73	100.0	100	
104	3.75	.10	761	21	0	.0	73	100.0	100	
105	3.78	.11	767	22	0	.0	73	100.0	100	
106	3.80	.11	772	22	0	.0	73	100.0	100	
107	3.83	.11	778	23	0	.0	73	100.0	100	
108	3.86	.12	784	23	0	.0	73	100.0	100	
109	3.90	.12	791	24	0	.0	73	100.0	100	
110	3.93	.12	798	25	0	.0	73	100.0	100	
111	3.97	.13	806	26	0	.0	73	100.0	100	
112	4.01	.14	814	28	0	.0	73	100.0	100	
113	4.06	.15	823	29	0	.0	73	100.0	100	
114	4.11	.16	834	31	0	.0	73	100.0	100	
115	4.17	.17	847	34	0	.0	73	100.0	100	
116	4.25	.19	862	38	0	.0	73	100.0	100	
117	4.35	.22	882	45	0	.0	73	100.0	100	
118	4.49	.27	910	55	0	.0	73	100.0	100	
119	4.74	.40	961	81	0	.0	73	100.0	100	
120	5.00E	.58	1014	117	0	.0	73	100.0	100	

TABLE 21.1 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82

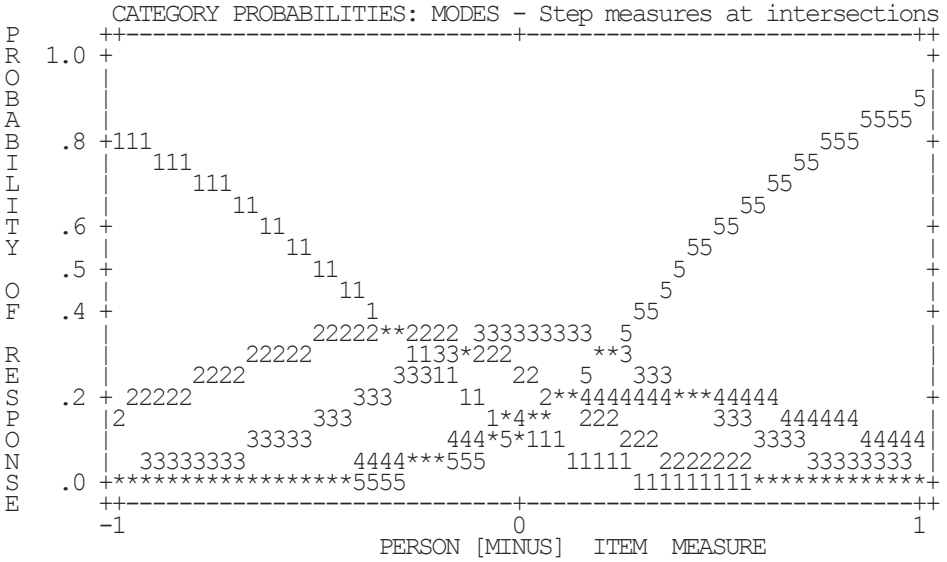
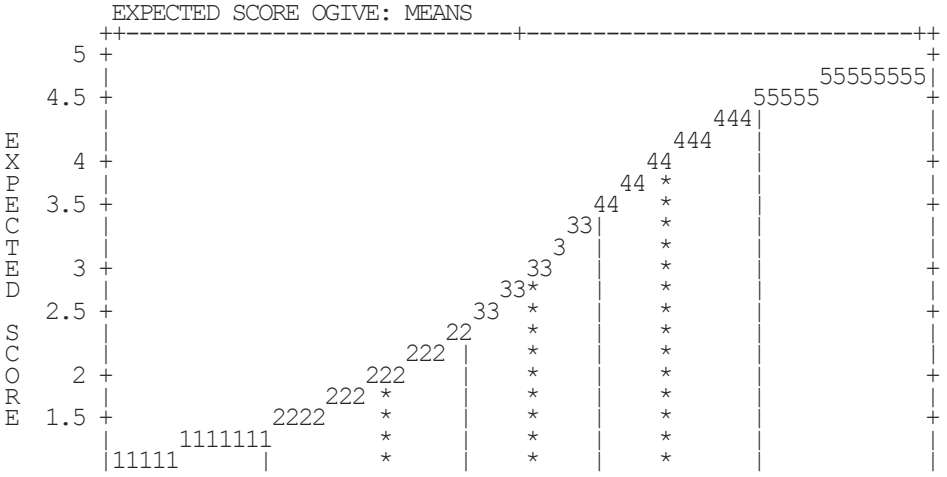
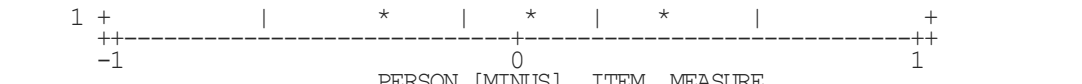
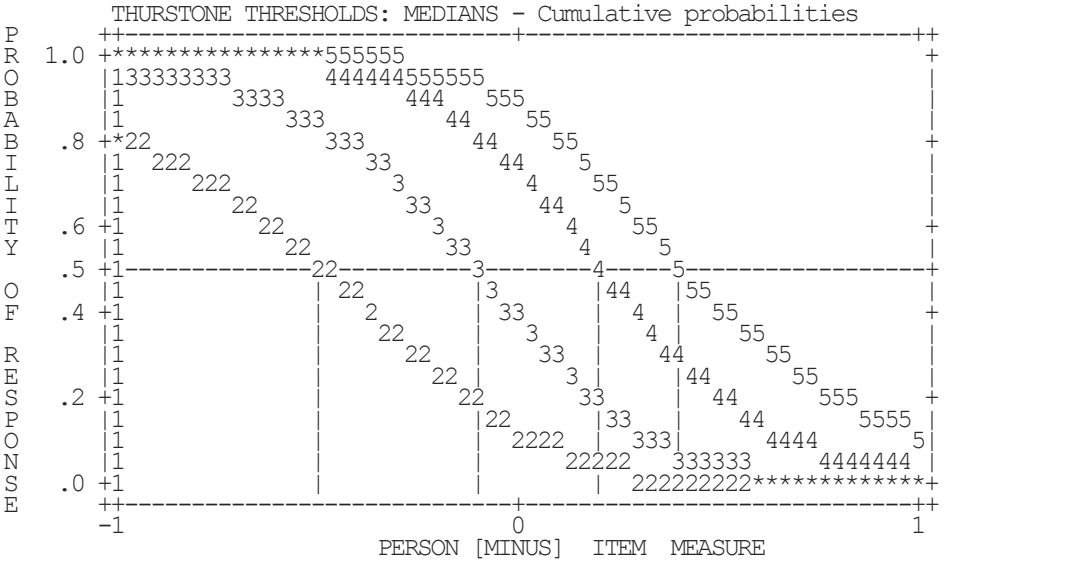


TABLE 21.2 MATHEMATICS ANXIETY step8.txt Mar 30 0:17 2012
INPUT: 79 PERSONS, 30 ITEMS ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS v2.82







GUTTMAN SCALOGRAM OF RESPONSES:

```
PERSON| ITEM
      |       1 211221122122311
      |5431892275406456899010 3
      |-------------------------
   70 +533313334334323345433333
   47 +555553555511554311111111
    1 +554535453522432422211221
   61 +355455553433134221112222
   57 +555553553445115111111113
   44 +553232325341331333333331
   58 +555553545231321232111211
   42 +224352333213341224334331
   79 +223233242432332323343232
   36 +455553111223252211233111
    6 +545425132233523111112121
   33 +455333443214223111111213
   46 +5544432233 2222231111211
   49 +345244332212223323121211
   52 +554353234411232111211111
   15 +342223232321322133332311
   50 +433255222321331212331111
   59 +444451422152113121211211
   71 +333251312222322232332111
   73 +552352321221221221112132
   32 +5554133323 41111111111111
   48 +555551511511111111111111
   43 +534 322232 21135111111111
   29 +132313213122543122112231
   60 +554332332233112111111111
   74 +444421421121111211243112
   38 +443344322212112111111111
   66 +544222223121222 11111112
   55 +433324333112112111111 111
   17 +333214221233221111221111
   62 +355332223112112111111111
   68 +443331333112113111111111
   26 +443322222 22 12111121111
   77 +121223331322122213112112
   23 +233322322222211111111112
   27 +431221211221423311111111
   31 +333121332211231311111111
   34 +222243121222122121221111
```

```
  69 +433322321113112211111111
  30 +111111111111551153  1411
  78 +511111155115111111111111
  45 +311354112121311111111111
  35 +222211112 21221221 12121
  12 +443213111121111111111111
  51 +313312222131111111111111
  54 +222232121123112111111111
  56 +232222123221111111111111
  67 +412152111111121121111112
  21 +3323112221 2111111111111
  16 +222212221212112111111111
  24 +311121211 112311221111111
   8 +321212111231121111111111
  63 +142222212111111111111111
  11 +211212211112112111311111
   3 +1111122221221221 11 11111
  14 +222213121111111111111111
  53 +123231111112111111111111
   7 +212212121121111111111111
   9 +121113211121121111111111
  18 +222212121111111111111111
  28 +112212311121111111111111
   5 +212211211112111111111111
  10 +112111211122112111111111
  19 +221212121111111111111111
  40 +131122211111111111111111
  65 +222111111131111111111111
   4 +211211111211111111111111
  25 +111112113111111111111111
  13 +111112111111111111111111
  20 +111112111111111111111111
  22 +111121111111111111111111
  37 +111111111211111111111111
  39 +111111111111111111111111
     |------------------------
     |543189217211221122122311
     |       2 540645689901073


TABLE 22.2 MATHEMATICS ANXIETY                      step8.txt Mar 30  0:17 2012
INPUT: 79 PERSONS, 30 ITEMS  ANALYZED: 72 PERSONS, 24 ITEMS, 5 CATS        v2.82
-------------------------------------------------------------------------------

GUTTMAN SCALOGRAM OF ZONED RESPONSES:
PERSON| ITEM
      |      1 211221122122311
      |5431892275406456899010 73
      |-------------------------
   70 +5DD3B333E3DED2DDEFEDDDDD
   47 +5555535555BB55ED11111111
    1 +55E535E53522ED2ECCC11CC1
   61 +D55E5555DEDDBDECC111CCCC
   57 +555553355DEE5BBF11111111D
   44 +553C3C3C5DEBDDBDDDDDDDD1
   58 +5555535E52DBD2BCDC111C1B
   42 +CCE35C3DD2BDDEBCCEDDEDDB
   79 +CC3C332E2ED2DDCDCDDEDCDC
   36 +E5555DBBB22DCFCC11CDD1BB
    6 +5E5EC5BD22DDFCD11111C1CB
   33 +E5533DEED21ECCD111111CBD
   46 +55EEED22DD CCCCCD1111CBB
   49 +3E52EEDD2C1CCCDDCD1CBCBB
   52 +55ED5D2DEE11CDC111C1BBBB
   15 +3EC22D2DCDC1DCC1DDDDCDBB
   50 +E3325522CDC1DD1C1CDDBBBB
   59 +EEEE5BE2C1FC11D1C1CBBCBB
   71 +33325BDBCCCCDCCCDCDDCBBB
   73 +552D52D21CC1CC1CCBBBCBDC
   32 +555EBDDDCD E11111BBBBBBB
   48 +55555BF11F1111111BBBBBBB
   43 +53E D22CDC C11DFBBBBBBBB
   29 +B32DBD21D1CCFED1CCBBCCDB
   60 +55EDD2DDCCDD11C1BBBBBBBB
   74 +EEEE2BEC11C1111CBBCEDBBC
   38 +EEDDEEDCCC1C11CBBBBBBBBB
   66 +5EE22CCCD1C1CCC BBBBBBBC
   55 +EDDD2EDDD11C11CBBBBB BBB
   17 +DDD2BECC1CDDCC1BBBCCBBBB
   62 +D5FDDCCCD11C11CBBBBBBBBB
   68 +EEDDD1DDD11C11DBBBBBBBBB
   26 +EEDD2CCCC CC 1CBBBBCBBBB
   77 +B2BCCDDD1DCC1CCCBDBBCBBC
   23 +2DDDCCDCCCCCCC11BBBBBBBBC
```

```
   27 +EDBCC1C11CC1ECDDBBBBBBBB
   31 +DDD1C1DDCC11CD1DBBBBBBBB
   34 +222CED1C1CCC1CCBCBCCBBBB
   69 +EDDDCCDC111D11CCBBBBBBBB
   30 +BBB111111111FF1BFD  BEBB
   78 +FB11111FF11F11BBBBBBBBBB
   45 +DB1DFE11C1CBDBBBBBBBBBBB
   35 +2CCC1111C CBCCBCCB BCBCB
   12 +EEDC1D111BCBBBBBBBBBBBBB
   51 +D1DD1CCCCBDBBBBBBBBBBBBB
   54 +CCCCDC1C1BCDBBCBBBBBBBBB
   56 +CDCCCC1CDCCBBBBBBBBBBBBB
   67 +E1C1FC111BBBBCBBCBBBBBBC
   21 +DDCD11CCCB CBBBBBBBBBBBB
   16 +CCCC1CCCBCBCBBCBBBBBBBBB
   24 +D111C1CBB BBCDBBCCBBBBBB
    8 +DC1C1C1BBCDBBCBBBBBBBBBB
   63 +1ECCCCCBCBBBBBBBBBBBBBBB
   11 +C11C1CCBBBBCBBCBBBDBBBBB
    3 +11111CCCBCCBCCB BB BBBBB
   14 +CCCC1DBCBBBBBBBBBBBBBBBB
   53 +1CDCDBBBBBBCBBBBBBBBBBBB
    7 +C1CCBCBCBBCBBBBBBBBBBBBB
    9 +1C1BBDCBBBCBBCBBBBBBBBBB
   18 +CCCCBCBCBBBBBBBBBBBBBBBB
   28 +11CCBCDBBBCBBBBBBBBBBBBB
    5 +C1CCBBCBBBBCBBBBBBBBBBBB
   10 +11CBBBCBBBCCBBCBBBBBBBBB
   19 +CCBCBCBCBBBBBBBBBBBBBBBB
   40 +1DBBCCCBBBBBBBBBBBBBBBBB
   65 +CCCBBBBBBBDBBBBBBBBBBBB
    4 +CBBCBBBBBCBBBBBBBBBBBBB
   25 +BBBBBCBBDBBBBBBBBBBBBBB
   13 +BBBBBCBBBBBBBBBBBBBBBBB
   20 +BBBBBCBBBBBBBBBBBBBBBBB
   22 +BBBBCBBBBBBBBBBBBBBBBBB
   37 +BBBBBBBBBCBBBBBBBBBBBBB
   39 +BBBBBBBBBBBBBBBBBBBBBBB
      |-------------------------
      |5431892172112211221223 11
      |       2 540645689901073
```

```
**************************************************************************
*                                                                        *
*                   * * * *  B I G S T E P S  * * * *                    *
*                   --------------------------------                     *
*                                                                        *
*               -  RASCH ANALYSIS FOR ALL TWO-FACET MODELS  -            *
*                                                                        *
*   PERSON MEASUREMENT, ITEM & STEP CALIBRATION, PERSON & ITEM FIT ANALYSIS  *
*                                                                        *
*      WINSTEPS                          DOS version of much             *
*      P.O. BOX 811322                   enhanced WINSTEPS               *
*      CHICAGO  ILLINOIS 60681-1322      Tel.: (312) 264-2352            *
*      USA                               FAX:  (312) 264-2352            *
*      E-mail: info@winsteps.com         website: www.winsteps.com       *
*                                                                        *
*              COPYRIGHT (C) JOHN MICHAEL LINACRE, 1991-1998             *
* WRITTEN BY B. D. WRIGHT & J. M. LINACRE    OCTOBER 16, 1998   VERSION 2.82 *
**************************************************************************
      TITLE= MATHEMATICS ANXIETY
CONTROL FILE: step8.con
 OUTPUT FILE: step8.txt
       DATE: Mar 30  0:17 2012
+------------------------------------------------------------------------+
|     OVERVIEW TABLES                |     ITEM CALIBRATIONS             |
|------------------------------------+-----------------------------------|
| 1* PERSON AND ITEM DISTRIBUTION MAP | 12* ITEM MAP BY NAME              |
| 2* MOST PROBABLE RESPONSES/SCORES   | 13* ITEM MEASURES IN DIFFICULTY ORDER|
| 3* PERSON, ITEM AND STEP SUMMARY    | 14* ITEM MEASURES IN ENTRY ORDER  |
|------------------------------------| 15* ITEM MEASURES IN ALPHA ORDER  |
|     PERSON FIT                     |-----------------------------------|
|------------------------------------|     PERSON MEASURES               |
| 4* PERSON PLOT OF INFIT vs ABILITY |-----------------------------------|
| 5* PERSON PLOT OF OUTFIT vs ABILITY | 16* PERSON MAP BY NAME            |
| 6* PERSON MEASURES IN FIT ORDER     | 17* PERSON MEASURES IN ABILITY ORDER |
| 7* DIAGNOSIS OF MISFITTING PERSONS  | 18* PERSON MEASURES IN ENTRY ORDER |
|------------------------------------| 19* PERSON MEASURES IN ALPHA ORDER |
|     ITEM FIT                       |-----------------------------------|
|------------------------------------|     REFERENCE TABLES              |
| 8* ITEM PLOT OF INFIT vs DIFFICULTY |-----------------------------------|
| 9* ITEM PLOT OF OUTFIT vs DIFFICULTY| 20* SCORE TABLE                   |
|10* ITEM MEASURES IN FIT ORDER       | 21* CATEGORY PROBABILITY CURVES   |
|11* DIAGNOSIS OF MISFITTING ITEMS    | 22* SORTED RESPONSES LISTING      |
```

```
       TITLE= MATHEMATICS ANXIETY
CONTROL FILE: step8.con
 OUTPUT FILE: step8.txt
        DATE: Mar 30  0:17 2012
CONTROL VARIABLES:
Input Data Format          PAIRED = N                Item Delete/Anchor
  DATA =                   REALSE = N                IDFILE = BIGSTEPS.$ID
 NAME1 = 1                 STBIAS = N                IDELQU = N
NAMLEN = 2                 ---------------           IAFILE =
 ITEM1 = 3                 Misfit Selection          IANCHQ = N
 ITLEN = 30                  FITI = 2.000            ---------------
    NI = 30                  FITP = 2.000            Person Delete/Anchor
 XWIDE = 1                 OUTFIT = Y                PDFILE = BIGSTEPS.$PD
 INUMB = N                  LOCAL = N                PDELQU = N
---------------            NORMAL = N                  PSEL = *
Data Scoring                PTBIS = Y                PAFILE =
 CODES = "12345"           ---------------           PANCHQ = N
MISSNG = 255               Special Table Control     ---------------
RESCOR =                   FRANGE = .000             Cat/Step Delete/Anchor
NEWSCR =                   LINLEN = 500               CFILE =
KEY1   =                   MRANGE = .000             SDFILE =
KEYSCR =                   NAMLMP = 0                SDELQU = N
 CUTHI = .000              CATREF = 0                SAFILE =
 CUTLO = .000                T1I# = 0                SANCHQ = N
---------------              T1P# = 0                ---------------
Output Tables               PSORT = 1                Export Files
 TITLE = MATHEMATICS ANXI   ISORT = 1                   CSV = N
TABLES = 1111111111111111   CHART = Y                HLINES = Y
 TFILE =                   DISTRT = Y                GRFILE =
FORMFD = ^                 CURVES = 111               IFILE =
MAXPAG = 0                 STEPT3 = Y                ISFILE =
  ITEM =  ITEM             PRCOMP = N                 PFILE =
PERSON = PERSON            ---------------            RFILE =
 ASCII = Y                 Convergence Control        SFILE =
---------------             MPROX = 10                XFILE =
User Scaling                MUCON = 0                ---------------
 UMEAN = 3.115              LCONV = .010             Data Reformat
USCALE = .427               RCONV = .500             FORMAT =
UDECIM = 2                 TARGET = N                GRPFRM = N
 UANCH = Y                 ---------------           KEYFRM = 0
---------------            Scale Structure           MODFRM = N
Adjustment                 GROUPS =                  RESFRM = N
EXTRSC = .500              MODELS = R                SPFILE =
 HIADJ = .250              STKEEP = N                ---------------
LOWADJ = .250              ---------------

 ITEM  DELETIONS:     6    11    18    22-   23    27
   79 PERSON Records Input

PERSON DELETIONS:     2    41    64    72    75-   76
```

CONVERGENCE TABLE

PROX ITERATION	ACTIVE COUNT PERSONS	ITEMS	CATS	EXTREME 5 RANGE PERSONS	ITEMS	MAX LOGIT CHANGE MEASURES	STEPS
1	79	30	6	1.83	1.22	-1.3863	-.7647
2	73	24	5	4.59	2.45	-3.3917	-.6308
3	72	24	5	5.06	2.92	-.4808	-.5746
4	72	24	5	5.30	3.03	-.2484	-.1500

UCON ITERATION	MAX SCORE RESIDUAL*	MAX LOGIT CHANGE	LEAST CONVERGED PERSON	ITEM	CAT	CATEGORY RESIDUAL	STEP CHANGE
1	7.79	.6133	45	16*	1	-65.97	-.1133
2	3.47	.1772	29	7*	2	-19.65	.0677
3	2.20	.1143	55	15*	5	12.61	-.0560
4	1.84	.0756	23	24*	2	-11.09	-.0397
5	1.52	.0570	23	15*	2	-10.09	.0271
6	1.21	.0439	23	15*	2	-9.47	.0271
7	1.02	.0382	78	15*	3	-7.97	-.0284
8	.96	.0362	78	15*	3	-5.99	-.0461
9	1.05	.0367	78	15*	5	4.49	-.0219
10	.82	.0296	78	15*	5	4.30	-.0125
11	.58	.0212	78	15*	5	4.34	.0106
12	.44	.0167	78	15*	5	4.23	.0093
13	.36	.0137	78	15*	5	4.03	-.0100
14	.35	.0126	78	15*	5	3.63	-.0169
15	.39	.0123	23	15*	5	2.97	-.0266
16	.50	.0132	23	24*	5	1.91	-.0067
17	.34	.0097	23	24*	5	1.56	-.0060
18	.25	.0076	23	24*	2	-1.46	.0042
19	.19	.0062	23	15*	2	-1.28	.0037
20	.15	.0052	23	15*	3	-1.16	.0034

Standardized Residuals N(0,1) Mean: -.01 S.D.: 1.00