FACTORS RELATED TO BASIC NUMERACY SKILLS OF ADULTS IN TURKEY

PINAR ALBAYRAK ATAKLI

BOĞAZİÇİ UNIVERSITY

2011

FACTORS RELATED TO BASIC NUMERACY SKILLS OF ADULTS IN TURKEY

Thesis submitted to the
Institute for Graduate Studies in the Social Sciences
in partial fulfillment of the requirements for the degree of

Master of Arts
in
Educational Sciences

by
Pınar Albayrak Ataklı

Boğaziçi University
June 2011

Thesis Abstract

Pınar Albayrak Ataklı, ‘‘Factors Related To Basic Numeracy Skill of Adults

in Turkey’’

The first aim of this study is to investigate the level of basic numeracy skills of adults in Turkey. Secondly, it aims to determine educational and non-educational factors in predicting the basic numeracy skills of adults. The data was collected with three instruments; these are demograpic information form, numeracy attitute scale, and basic numeracy skill test paper. Research participants were selected from six Ismek course centers at the beginning of 2010-2011 course term. The level of basic numeracy skills of adults were analyzed descriptively. The result indicates that the participants were found as highly in need of numeracy education, especially for these four subjects: using tables, charts, diagrams and line graphs to present results; selecting and use suitable methods and forms to present and describe outcomes; approximating by rounding; and finding the range for a set of data. For analyzing the factors predicting basic numeracy skills, the multiple linear regression method and one way ANOVA was used. Educational backgroud, father’s educational background, mother’s educational background for female participants and numeracy attitude were found as highly significant for predicting the basic numeracy skills of participants, whereas gender, age, and mother’s educational background for male participants were not. The results indicated the necessity of establishing a national policy and curriculum for adult numeracy education in Turkey.

Tez Özeti

Pınar Albayrak Ataklı ‘‘ Türkiye’deki Yetişkinlerin Temel Matematik Okuryazarlığı Becerilerini Etkileyen Faktörler’’

Bu çalışmanın başlıca amacı Türkiye’deki yetişkinlerin temel matematik okuryazarlığı seviyesini incelemektir. İkinci olarak, temel matematik okuryazarlığı becerilerini açıklayabilen eğitimsel ve eğitim dışı faktörleri belirlemektir. Veriler üç ayrı ölçek aracılığı ile toplanmıştır; bunlar kişisel bilgiler anketi, matematik okuryazarlığına karşı tutum ölçeği ve yetişkinlerde temel matematik okuryazarlığı seviye 1 testidir. Katılımcılar 2010-2011 kursları başlangıç döneminde altı İsmek kursu kursiyerlerinden seçilmiştir. Katılımcıların temel matematik okuryazarlığı seviyeleri betimsel olarak incelenmiştir. Sonuçlar katılımcıların özellikle belirtilen dört konuda ciddi şekilde matematik okuryazarlığı eğitimine ihtiyaç duydukları yönündedir: temel istatistik konuları, sonuçları betimleyebilmek için uygum metotları seçip uygulayabilme, yuvarlama yöntemiyle yaklaşık değer hesaplayabilme ve bir veri grubunun aralığını bulabilme. Bunun yanı sıra, temel matematik okuryazarlığı becerilerini açıklayabilen eğitimsel ve eğitim dışı faktörleri analiz edebilmek için çoklu doğrusal regresyon metodu ve tek yönlü ANOVA yöntemi kullanılmıştır. Analizin sonucu olarak katılımcıların eğitim seviyesi, babalarının eğitim seviyesi, kadınlar için annelerinin eğitim seviyesi ve matematik okuryazarlığına karşı geliştirdikleri tutum matematik okuryazarlığı becerilerini tahmin edebilmede geçerli faktörler olarak bulunmuştur. Öte yandan; cinsiyet, yaş ve erkekler için annelerinin eğitim seviyelerinin matematik okuryazarlığı becerilerini etkilemediği bulgusuna ulaşılmıştır. Sonuçlar, yetişkinlerin matematik okuryazarlığı becerilerinin geliştirilmesi için Türkiye’nin bu konuda ulusal bir politikası ve müfredatının olması gerekliliğini ortaya koymuştur.

ACKNOWLEDGEMENTS

First and foremost, I am grateful to my thesis advisor Assist. Prof. Fatma Nevra Seggie for her patience, support, encouragement and guidance throughout this study. She provided constructive assistance necessary to initiate and mold the entire study. Whenever I need her help, she has always been there. I am very happy to have had the privilege of working with her as my thesis advisor.

I am eternally indebted to my committee member Dr. Bengü Börkan for being a great sounding board, and her guidance as a statistical mentor. She enthusiastically and tirelessly shared her SPSS expertise and methodology advice.

I also owe thanks to other my commitee member Assoc. Prof. Emine Erktin for her valuable contributions to my thesis. I always consider myself fortunate to have been her student in my undergraduate education years.

I am grateful to my instructor Assist. Prof. Özlem Ünlühisarcıklı who was the one motivated me to be interested in adult numeracy during my graduate years.

I am grateful my dear friend Taner Tunçel to spend days and nights for format editing the thesis in detail. I would like to thank to the General Coordinator of Ismek Güven Çalışkan and subcoordinator of Ismek Muhammet Altıntaş who help me to collect data from their institution. I also offer thanks to Steven Seggie for his valuable suggestions about statistical analyses of the study.

I wish to express my deepest thanks to my dear parents for all they have done for me. My dear father Yavuz Albayrak was always with me during data collection period. He caried numbers of heavy questionnaires; he gave me a ride to the data collection centers and entered all huge data to computer which takes months. This study would never finish on time without you, thank you so much my dear father.

My dear mother Bahar Albayrak gave up her duities, her home, and her social life for taking care of my daughter to provide me time to study. Thank you so much for your endless love, support, understanding and trust throughout my life. Mom and dad, both of you taught me to trust in myself and to stand strongly wherever I am. I am grateful to you.

I am also grateful to my dear baby Ceren Ataklı for giving me the opportunity to finish this study on time. She never disturbed me, never had trouble while I was studying. For being a wonderful baby, thank you so much Cerenikom. You are a gorgeous present that was given us by God, my angle.

Finally, I especially wish to express my heartfelt thanks to my dearest love, best friend, wonderful instructor and husband; Murat Ataklı. You have consistently encouraged me to finish this study and have been a constant voice of support all the time. Your valuable critiques, comments and contributions made this study worthy. Whenever I was confused, you were with me. Beside my heart, you have been my brain also. I would never be succeeding this study without the loving support and patience of you. Thank you for always being in my life. I love you with all my soul.

DEDICATION

This study is dedicated in loving memory of my beloved grandfather,
Ahmet Yılmaz Yıldırmaz.

My dear grandfather, if I started to tell the things you had been for my education, my self confidence, and my happiness throughout your life, this dedication would be much longer than the exact study. You started to teach me mathematics when I was in primary school, since then you had never given up paying attention to my education. You were always source of support and interest in my education even I have been an adult. You believed in my success all the time. I am always being in dept to you for being source of trust, respect, and source of love through my life.

I wish you would be with me with your admiring and smiling eyes while I was graduating from master degree and throwing my cap. Yet, I feel that you are always seeing me, sharing my happiness, and being proud of me even if you are too far away, now. Thank you for every valuable thing you did for me, my dear granddad. I always miss you so much.

CONTENTS

TABLES

FIGURES

CHAPTER 1

INTRODUCTION

Interests have been increasingly focused on the emergence of some phenomena, such as new jobs and the widespread use of technology all around the world. This requires new capabilities of citizens' such as greater understanding, appreciation, thinking statistically, being better decision makers, and all of these are covered by applications of basic mathematical knowledge. Basic mathematical knowledge should be understood as a wide field of knowledge and skills including experiences from work and everyday life that in some way deal with quantitative or mathematical data, not only the traditional understanding of mathematics such as the school-based subject expressible through paper and pencil.

In English-speaking countries, the term *numeracy* is used to cover this competence, and basic numeracy skills are today a basic qualification for both daily life and the labor market in the same way that literacy is (Lindenskov & Wedege, 2001). Basic numeracy describes an aggregate of skills, knowledge, beliefs, and habits of mind, as well as general communicative and problem solving skills that individuals need in order to effectively handle real-world situations or to interpret mathematical or quantifiable elements embedded in tasks (Coben, 2000). Although, the basic numeracy skills may differ from culture to culture and from context to context, basic numeracy skills such as identifying numbers, using measurements, understanding graphs, and solving problems are high on the list of skills that everyone needs to master (Durgunoğlu & Öney, 2000). The diversity of life contexts in which learners may need to use basic numeracy skills implies that numeracy is

relative and dynamic, rather than a fixed, static set of knowledge and skills (FitzSimons, 2006).

There are various definitions of the term numeracy (i.e. Coben, 2000; Gal, van Groenestijn, Manly, Schmitt, & Tout, 2003; Yasukawa & Johnston, 1994; Lindenskov & Wedege, 2001; and Steen, 2001). While differing in phrasing and emphasis, the definitions recognize that mathematics and numeracy are related but are not synonymous. Pure mathematics is abstract and context-free, yet, unlike mathematics, numeracy does not so much lead abstraction as it moves toward a richer engagement with life's diverse contexts and situations (Orrill, 2001). Most definitions of numeracy refer to this richer engagement by including a connection to context, purpose, or use. In some cases, the emphasis is on critical numeracy needed for active participation in the democratic process (Yasukawa &Johnston, 1994), and in others the emphasis on the workplace or competition in the global economy (Lindenskov & Wedege, 2001).

The necessity for adults to develop as numerate people in order to cope efficiently with the demands of their everyday lives should not be underestimated. The reason for this is that there is a range of situations where numerate behavior by adults would enable them to function more effectively in their everyday lives. For instance, by using basic numeracy in activities such as shopping, paying bills, budgeting, reading the newspaper, administering medicine, reading maps and plans, understanding the weather bulletin and so on. There are many other tasks which require a greater degree of basic numeracy such as dressmaking, planning a holiday, designing a garden, home decorating, and understanding economic indicators, loan repayment schedules or insurance policies.

Since numeracy is a lifeskill, basic numeracy education is important in applying these skills to real-life practical problems mentioned above. Like literacy, it is impossible to function in a modern society without some ability to cope with numbers. Even a limited grasp of arithmetic is usually insufficient, ideas like percentages and statistics are necessary concepts for most adults to understand algebraic ideas and essential for anyone involved in any kind of analytical work.

There are also situations related to participation in the wider community. Recent political decisions all around the world, for example in the areas of taxation and health, are justified using a large amount of information often presented in tables, and using numerical relationships and arguments. Understanding public policy making and action in the areas such as the environment, education and training, communication and media ownership, increasingly requires adults to be numerate. A critical view of such decisions can only be arrived at through understanding numerical concepts, and a capacity for critical thinking. Indeed, recent developments in technology have increased the quantity of information of this type being presented to adults. Hence, the ability to understand and question numerical information is becoming increasingly important.

As a result, acquiring basic numeracy skills serve multiple purposes for adults. Gal (2000) stated that basic numeracy skills were required for adults to promote access, orientation, and ability to keep up with a rapidly changing world. Adults who have basic numeracy skills enable or contribute to the expression of one's ideas and opinions and to effective participation in public life. They promote independent functioning and action, coping with problems and dilemmas, and handling choices as a parent, citizen, or worker. They also serve as an important bridge to further formal

learning (Curry, Schmitt & Waldron, 1996). However, no single agency or group control the definition of the basic numeracy skills that adult may need for these diverse purposes or to be able to effectively manage the range of life contexts.

Basic adult numeracy skills involve the confluence of many components, including domain-specific knowledge and strategies as well as general cognitive skills and world knowledge that may have been acquired inside and/or outside the classroom (Perkins & Salomon, 1988). These skills are often developed from common experiences and can form the foundations of mathematical reasoning skills. For assessing basic numeracy skills and level of numeracy of adults who are in need of basic numeracy education, various international surveys (e.g., Quantitative Literacy Survey [IALS], the National Adult Literacy Survey [NALS], Adult Literacy and Lifeskills Survey [ALL]) were used (Kirsch, Jungeblut, Jenkins & Kolstad, 1993) and adult numeracy certificate programs (e.g., Numberpower in UK and Qualifications of Curriculum Authority), were established.

A large amount of research has been carried out on adult numeracy and a lot of articles have been written by the adult numeracy practitioners (i.e. Coben, FitzSimons, and Gal). The main factors that affect the numeracy skills of adults have been one of the main research topics for national (i.e. ‘‘Skills for Life’’ survey in England) and international (i.e. ALL and IALS) surveys. Gender, age, occupation, income, and ethnicity were the most popular demographic factors whose effects were examined. Even though numeracy attitude is examined only through noncomprehensive surveys rather than international ones, it was commonly stated as one of the crucial predictors for numeracy attitude. Additionally, the quality of education and educational factors were mostly found as highly related to the

numeracy skills of adults in several national surveys (i.e. Canada, Australia, England, Scottland, and New Zealand). However, in Turkey, there has yet been no attempt from the government to introduce numeracy notion in formal and non-formal education system, yet. Hence, there is no existing national policy, curriculum, and survey aiming to detect the basic numeracy needs of society and to improve the numeracy skills of citizens.

Due to the great importance of the concept of adult numeracy, the adult education community in the United States, including practitioners, program developers and policy makers engaged in a dialogue to clarify the goals and appropriate methods for developing adult numeracy in the adult education system (Gal, 2002). For this reason, agendas for research in adult numeracy have been established. Emerging numeracy practitioners and researchers came together and began to explore the adults' numeracy needs, numerical abilities and to develop adult numeracy problems.

According to National Council of Teaching Mathematics [NCTM] Standards, adult numeracy education is identified under seven themes. These are: relevance and connections; problem solving, reasoning and decision making; communication; number and number sense; data, statistics and probability; geometry: spatial sense and measurement; and algebra: patterns and functions (Gal, 2000). The NCTM Standards separated adult numeracy skills into eight main levels. These levels are Entry Level 1, Entry Level 2, Entry Level 3, Level 1, Level 2, Level 3, Level 4, and Level 5 (*Qualifications and Curriculum Authority,* 2000). All entry levels consist of three main units, which are numbers and measures, shape and space, and handling data. No prior knowledge and experience is required for learners at Entry 1. The

prior knowledge required for Entry 2 is defined in the standards for Entry 1 and the prior knowledge required for Entry 3 is in the standards for Entry 2. Successful completion of Entry Level skills will allow the learners to progress to Level 1 and then to Level 2. Both Level 1 and Level 2 contain the same themes that are number and number sense, data-statistics-probability, geometry: spatial sense and measurement, and algebra: patterns and functions however the objectives of each theme get harder from Level 1 to Level 2. Since relevance and connections, problem solving and reasoning, decision making, and communication are the four over-arching standards for adult numeracy; they are included in Level 3, Level 4 and Level 5 (Curry, Schmitt & Waldron, 1996).

Statement of the Problem

Estimates in the USA indicate 40 percent of the population has numeracy problems and the UK Government acknowledged in July 2003 that millions of adults lack the reading and basic numeracy skills that are expected of the average 11 year old. In Canada, 22 percent of people have serious problems dealing with any printed materials with a further 24 percent only able to deal with simple reading tasks. Canada has reported that these problems cost employers $4 billion (Canadian) per year and $10 billion for the nation as a whole. Scotland has estimated that numeracy problems cost employers £500 million in lost production, returned orders and additional recruitment costs *(European Commission,* 2005).

Furthermore, in Turkey, the concept of numeracy has started to be known by participation of Turkey in international education surveys such as Trends in International Mathematics and Science Study [TIMSS] and the Program for

International Student Assessment [PISA] Survey. TIMSS provides reliable and timely data on the mathematics and science achievements of U.S. 4th- and 8th-grade students compared to those in other countries. PISA is a project of the Organisation for Economic Co-operation and Development [OECD] designed to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students in three domains: reading, mathematics, and science (Yelland & Kilderr, 2005). Both surveys aim to assess to what degree students approaching the end of their compulsory education have acquired some of the knowledge and skills that are essential for full participation in society. The poor results of these surveys (e.g. PISA results in 2006) showed that Turkish adolescents lack the ability of basic numeracy skills and reasoning and problem solving. Since two of the surveys are related to adolescents and excluding adults, the poor results caused a few researchers (i.e. Durgunoğlu & Öney, 2000) to be focused specifically on basic numeracy skills of adults and adult numeracy needs in Turkey. For example, Durgunoğlu and Öney (2000), in their research, reported that illiterate adults in Turkey are highly in need of basic numeracy skills in the specific daily life activities such as on bus signs, telephone numbers, hospital room numbers, and water and gas bills.

To overcome these problems, huge numbers of practices and research studies have been done all around the world. Adult numeracy frameworks were formed by some developed countries such as Australia, England, Scotland, Ireland, Canada and the USA. These countries developed their own national policies in adult numeracy field. By the contribution of the adult numeracy researchers, national adult numeracy curriculums were developed in Scotland and England. Further, in Canada, Australia and the USA, national adult literacy and numeracy surveys provided extended used

international surveys, such as IALS and ALL, to be formed.

Although the field of adult numeracy has been a growing area of practice and research all around the world, in Turkey there is little information about the concept of adult numeracy. Numeracy is a newly adapted term in Turkey and most of the numeracy researchers preferred to focus on the student numeracy in formal education rather than adult numeracy in further education. Adult numeracy has recognized role in contributing to the empowerment, effective functioning, economic status, and well being of citizens and their communities in many countries. Yet, Turkey, without any national policy and curriculum in the adult numeracy field supported by the Ministry of Education, has few comprehensive publications and works (i.e. Ersoy, 2002; Demir & Paykoç, 2006) that have been addressed at professionals interested in adult numeracy development.

Purpose of the Study

The purpose of this study is two-fold: measuring the level of basic numeracy skills of adults and understanding the differences in numeracy skills.

Firstly, the study aims to investigate the level of basic numeracy skills of adults according to NCTM Adult Numeracy Standards. The second purpose is to explore the factors related with the adult numeracy skills. A group of factors represent educational backgrounds and parental educational backgrounds of the adults. Another group of factors imply demographic information, such as gender and age. Furthermore, as a non-educational factor, attitude toward numerical information in daily lives of adults is aimed to be investigated.

Six The IMM Arts and Vocational Training Courses [Ismek] course centers, which are Sahrayıcedid, Kayışdağı, Kadıköy, Örnek Mahallesi, Fikirtepe, and Merdivenköy course centers, were chosen among all Ismek course centers in Istanbul as setting of the research for data collection because of the fact that there are various styles and types of courses (e.g., technical, educational and art courses) in these centers. The adult students that participated in the courses had in different ages, educational backgrounds, parental backgrounds and socio-economic status. Hence, they were expected to have different daily life experiences. Furthermore, diversity in educational and non-educational backgrounds might cause different attitudes toward numerical information.

Research Questions

The aim of the study is defined by six research questions. These questions can be grouped into four domains. The first question describes the level of adult participants' basic numeracy skills according to NCTM Adult Numeracy Standards. The second and third questions are related to the demographic information of the participants. The fourth and fifth questions seek to determine the effect of educational factors on basic numeracy skills. The last question searches whether attitude toward numeracy has a significant effect on determining the basic numeracy skills of the adult participants.

The research questions are:

1. What is the level of basic numeracy skills of adults in Turkey according to NCTM Adult Numeracy Standards?
2. Is gender a significant factor in predicting the basic numeracy skills of adults?
3. Is age a significant factor in predicting the basic numeracy skills of adults?
4. Is educational background a significant factor in predicting the basic numeracy skills of adults?
5. Is parental educational background a significant factor in predicting the basic numeracy skills of adults?
6. Is attitude toward numerical information a significant factor in predicting the basic numeracy skills of adults?

In this study, basic numeracy skills are defined as identifying numbers, using measurements, understanding graphs, and solving problems, which are related to the basic mathematical skills that everyone needs to master in daily life and these subjects are covered by the Level 1 according to NCTM Adult Numeracy Standards. The objectives of Entry Level 1, 2 and 3 can be matched to the mathematical information that was taught in the first, second and third classes and Level 1 is mastered in the forth and fifth class of the primary education in Turkey. It means that according to Turkish education system, while graduating from the fifth class of the compulsory to primary education, a person should have mastered Level 1. Since all the participants of this study, graduated at least from primary education, they are all accepted as having practiced the numerical information at Level 1. As a result, in this study basic numeracy skills represent the objectives of Level 1, which are:

- using whole numbers, common fractions, decimals and percentages to present results
- using common measures and units of measure to define quantities
- using tables, charts, diagrams and line graphs to present results, *e.g. for amounts, sizes and scales*
- using approximation to corroborate result.

The Significance of the Study

Around the world, renewed emphasis is being placed by governments and employers on numeracy skills for all people to enhance their employability, job satisfaction, level of remuneration and community participation. Recent OECD research has indicated that raising a country's numeracy score by 1 percent leads to a rise in productivity of 2.5 per cent with the flow-on increase of 1.5 percent in Gross Domestic Product (ACCI, 2005).

However, despite its apparent centrality in people's daily life functioning, civic and work contexts, the numeracy components of adults' skills does not have any visible attention in Turkey. There are just a few governmental and non-governmental courses that aim to teach mathematical knowledge to adults. One of them is 'Mathematics Villages' constructed by Ali Nesin, yet its target group is mathematicians and mathematics teachers. Another one is the second level literacy courses, one of whose aim is to give elementary mathematical knowledge to adults who have not any mathematical educational background in formal education. Since they do not mention numeracy, which is defined apart from mathematics, there are

very few research studies and no national surveys for determining the level of numeracy skills of Turkish citizens.

This study introduces the adult numeracy notion in the adult education field in Turkey. Moreover, it tries to investigate which numeracy skills adults have or have not. Besides, this study exposes the basic numeracy needs of adult citizens in Turkey and it emphasizes the necessity of development of adult numeracy programs according to the needs of adults and dispersing adult numeracy courses by the support of both government and private agendas.

Another significance of the study is that it searches the educational and non-educational factors that may influence progression of numeracy skills. By the way, it questions whether formal educational programs favor for enhancing the numeracy skills or not. While this study does not mean any simple solution to raising numeracy standards in Turkey, a comprehensive approach involving all levels of government, business and the community is an important national priority for both the numeracy and the adult education field.

Definition of Terms

The following are the definitions of some of the terms used in this study:

Adult refers to society members who are 18 and over 18, and who accepts responsibility, and makes independent decisions.

Adolescence refers to a transitional stage of physical and mental human development generally occurring between puberty and age of majority but largely characterized as beginning and ending with the teenage stage.

Numeracy is the ability to reason with numbers and other mathematical concepts,

which mainly include number sense, operation sense, computation, measurement, geometry, probability and statistics.

Basic numeracy skills are defined as identifying numbers, using measurement, understanding graphs, and solving problems, which are related to the basic ar mathematical skills that everyone needs to master in daily life.

Numeracy attitude refers to being favorable or unfavorable related to numeracy. It reflects that how one feel about numeracy.

Educational background refers to the education section of the adult participants' resume, which consists of their academic credentials and all applicable education in formal schooling. Depending on this study, it includes primary school, secondary school, high school, Open University, vocational or two year university, bachelor, and graduate.

Formal education is the process of training and developing people in knowledge, skills, mind, and character in a structured and certified program depending on the National Ministry of Education in Turkey.

Non-formal education refers to all educational activities, programs that take place outside the formal school system and public or private education, and training institutions.

Parental educational background refers the education section of either mothers or fathers of adult participants, consisting of their academic credentials and all applicable education in formal schooling. Depending on this study, it includes: no school experience, primary school, secondary school, high school, bachelor, and graduate.

Demographic factors are those relating to personal characteristics such as age, gender, social class, and race/ethnicity. In this study, it is restricted to gender and age.

PNI is Preference for Numerical Information Scale in order to identify the numeracy attitude of the adult participants in this study.

SBKTC is *Sayısal Bilgi Kullanımında Kişisel Tercih Ölçeği*, which is an adapted form of PNI.

YTMOB is the adapted form of Key Skills Application of Number Adult Numeracy Level-1 Test Paper, which is used for measuring the basic numeracy skills of adult participants.

ALL (The Adult Literacy and Lifeskills Survey) is an international comparative study designed to provide participating countries, including the United States, with information about the skills of their adult populations. ALL measured the literacy and numeracy skills of a nationally representative sample from each participating country.

IALS (The International Adult Literacy Survey) was the first-ever comparative survey of adults designed to profile and explore the literacy and numeracy distributions among participating countries.

CHAPTER 2

REVIEW OF THE LITERTURE

Conceptualizing Adult Numeracy

The term numeracy originated in the United Kingdom in the Crowther Report on the education of children ages 15–18. As "the mirror image of literacy," numeracy was a way of bridging scientific and literary cultures (*English Ministry of Education*, 1959, p. 389). In that report, it is entailed that "not only the ability to reason quantitatively but also some understanding of scientific method and some acquaintance with the achievement of science" (*English Ministry of Education*, 1959, p. 389). The recognition of the increasing importance of numeracy, from day to day, led many liberal art colleges to instill numeracy into courses in the arts and humanities (White, 1981). At the same time, economists expanded the traditional "3 R's" requirement for employment (reading, 'riting, 'rithmetic) to surround five additional competencies: resources, interpersonal, information, systems, and technology (Secretary's Commission on Achieving Necessary Skills [SCANS],1991). More recent publications have examined the role of numeracy in relation to the changing economy, the perspectives of professionals in a variety of fields, and the demands of the high-performance workplace (Forman & Steen,1999). The construct "numeracy" does not have a universally accepted definition, or agreement about how it differs from "mathematics" (Gal, van Groenestijn, Manly, Schmitt, & Tout, 2005, p.157).

Gal et al.'s statement indicates a fundamental problem for anyone reviewing the research literature in this area: there is as yet no consensus about the nature of adult numeracy. The footprints of numeracy can be found throughout a great number of

publications, but not clarity about its definition and meaning, especially when referring to adults. Coben (2003) stated that definitions of numeracy have implications for what adults need to know, what should be taught, how adults should be assessed, and what professional development teachers need, as a recent international comparative study of adult numeracy frameworks makes clear. There are similar and somehow related terms compete for numeracy: mathematical literacy, techno-mathematical literacy, quantitative literacy, functional mathematics, mathemacy, and so on.

Meanings and Definitions of Numeracy

As the first time, Ellerton, Clarkson and Clements (2000) spent some time to define numeracy in a chapter on language factors in the 1996-1999. In the years between 2000 and 2003, there was a hot debate about the definition of numeracy. This debate originated in concerns about numeracy being politicized and contained by literacy. In recent years, the debate has reduced with the National Centre for Vocational Educational Research [NCVER] (2001) concluding that:

> Attempts to propose any single definition of literacy and numeracy are relatively futile when social, cultural and technological changes shape our understandings and alter the way we think about literacy and numeracy. As our concepts change with the times so do approaches to developing these skills (p.1).

This is reflected in FitzSimons (2006) who quoted van Groenstijn (2002) to emphasize that numeracy is "dynamic and contextually bound to time and place" (para.4). In a suite of research-based reports on literacy and numeracy from the NCVER literacy was used as a catch-all term for "English language, numeracy and information technology literacy" (Wickert & McGuick, 2005, p. 11). Hence literacy

and numeracy, at a basic rather than an advanced level, have been tied ever since with numeracy and often included within literacy.

In recent literature a change in the concept of numeracy has been recorded (Kemp, 2005). Between 2004 and 2008 it appeared to be a group of core definitions of numeracy with a number of common characteristics. An international group of mathematics educators from Adults Learning Maths, with some important Australian and New Zealand memberships, has extensively debated the topic with Johnston and Maguire (2005) indicating that numeracy involved:

> Managing a situation of solving a problem in a real context by responding to information about mathematical ideas that is represented in a range of ways and requires activation of a range of enabling knowledge, behaviors and processes. (p. 128)

Coben's (2003) definition expands the Johnston & McGuire definition to include a sense of confidence when describing numerate behavior on the job:

> To be numerate means to be competent, confident, and comfortable with one's own judgments on whether to use mathematics in a particular situation and if so, what mathematics to use, how to do it, what degree of accuracy is appropriate, and what the answer means in relation to the context.
>
> (cited in FitzSimons, 2006, p. 10)

The most recently used definitions include the emphasis of using mathematics for decision making or problem solving. This is reflected in a definition developed by the Australian Association of Mathematics Teachers [AAMT]. Here numeracy is defined as the ability "to use mathematics effectively to meet the demands of life at home, in paid work, and for participation in community and civic life" (AAMT, 1998, p.1).

However, according to the recent numeracy definitions, The Citizens Advice Bureau [CAB] enquirers do not have well developed numeracy skills, because they

are not able to solve the problem of finding the optimal financial decision. In a review by Hartley and Horne (2005) it was noted that:

> …many Citizens Advice Bureau (CAB) enquirers have well developed numeracy and literacy skills but are unable to identify the optimum financial decision or strategy based on the information available to them. (p. 22)

The term academic numeracy was used by Galligan and Taylor (2008) to clarify the skills necessary for success in the university context as:

> a critical awareness which allows the student to situate, interpret, critique use and perhaps even create mathematics in context, in this case the academic context. It is more than being able to manipulate numbers or being able to succeed at mathematics. (p. 87)

Neil (2001) attempted to clarify the idea of numeracy, claiming that there were two deficiencies among many of the definitions he examined. One of them is location (i.e., home, work, society etc.) and the other one is context (i.e., specific problems or situations). In the early twentieth century, a few definitions like Johnson & Maguire's (2005) and FitzSimons's definitions (2006), started to include both of the components of location and context.

FitzSimons (2005) brought a new dimension to the numeracy debate focusing on vertical and horizontal discourse. She says vertical discourse centers mainly on school mathematics, while horizontal discourse is closely linked to numeracy which is related to on-going practices, is affective and has specific immediate goals. She emphasized that these discourses are different with different practices, and vertical discourses will not guarantee numerate activity.

FitzSimons and Coben (2004) referred to Maguire and O'Donoghue's framework of adult numeracy (2002) as a continuum of three phases: These are called the formative, mathematical and integrative phases. The formative phase

implies basic skills, the mathematical phase implies mathematics in the context of everyday life and the integrative phase includes mathematics integrated with the cultural, social, personal, and emotional. At integrative phase, they argue, adults can become knowledge producers as well as knowledge consumers.

Thus adult become technologically, socially, personally, and/or democratically numerate (Maguire & O'Donoghue, 2002).

Finally, Zevenbergen (2004) placed the concept of numeracy in the context of the workforce. She defined numeracy as "the application and disposition for using contextually appropriate mathematics to solve everyday problems" (p.100) and created the idea of multiple numeracies. While there have recently been a number of debates over multi-literacies, until that time there has been no such debate in numeracy. She asked the question of whether there should be different forms of numeracy in these changing times and concluded that we may need to re-conceptualize definitions of numeracy relevant to workforce needs.

Of all definitions mentioned in this section, Coben's (2003), AAMT's (1998) and Zevenbergen's (2004) numeracy definitions are taken into consideration as the starting point of the study.

Perspectives on Adult Numeracy

Examining the literature related to adult numeracy, (i.e. Coben, 2003; Galbraith, 1992; Evans 1987, Gal, 2000) three distinct categories can be identified. One of these categories relates to the strong link between numeracy and mathematics, the second one points to the social requirements (i.e. everyday usage of numeracy) and the final one implies numeracy to literacy in terms of communication. Apart from these three categories, a number of practitioners identify a role for numeracy in enhancing the

transmission of information for facilitating a person's understanding of the world (Paulos, 1988), which is highly linked to numeracy and citizenship that will be explained in detail further down.

The Mathematics of Numeracy

When the relationship between mathematics and numeracy is being examined, the notion of numeracy arises as the ability to perform basic arithmetic problems. Such an approach to numeracy is very limited in scope which means to deliver the right answer by doing one of the four operations. This approach also does not require any real comprehension of many concepts in mathematics such as symmetry, rate of change and probability. Furthermore, it does not suggest one to make judgments regarding relevant or irrelevant data (Coben, 2003).

The Cockroft Report in1986 enlarged the perspective of the mathematics of numeracy as that ''numeracy requires understanding and application of the mathematics that a person needs for work, study and every day life'' (p.7). The report also stood for the idea that numeracy merely could play a role in the contexts wherein mathematics is required. After the report had been published, there seemed a widespread agreement that numeracy was indeed concerned with numbers. Furthermore, the majority of the references to numeracy (i.e. Gabony & Traxler, 1982; Edwards, 1988; Sowder, 1990) created strong links with mathematics and mathematics education.

However, differences come in sight when efforts are made to specify the relationship between mathematics and numeracy. The notion of critical awareness and the number sense is supported by many authors (i.e. Trefflers, 1987; Edwards,

1988). For instance; Edwards's idea (1988) about number sense involves having a general level of numeracy and mathematical understanding. In his words, ''being numerate requires one to be capable of doing mental arithmetic and having the ability to compare the numbers'' (p.282). Edwards elaborated that numerate people did not need to use of pen and paper while doing addition, subtraction, finding the mean, multiplication, division and percentages. Sowder (1990) further set down the criteria of being numerate as being able to apply both the associative and the distributive properties of numbers correctly.

The core curriculum subject most closely linked to the idea that the development of numeracy was mathematics. However, the tension between school mathematics and numeracy education has been emphasized by a number of authors. Forman and Steen (1995) pointed out the existence of harmony between classroom mathematics and workplace mathematics. They pointed out that everyday mathematics was generally concrete but not necessarily straightforward. Moreover, they emphasized the fact that estimation, beyond the classroom, was a vital skill, yet it was given little importance in the mathematics classrooms.

According to the result of Stigler and Baranes's research (1988), numeracy was often developed irrespective of the educational system as people devise their own calculation methods which were quite dissimilar to those taught in formal mathematics education. Finally they pointed out the importance of practice of numeracy in working which was in isolation in mathematics classrooms.

The Royal Society of Arts (1980) differentiated numeracy and arithmetic by declaring that numeracy was specific for an individual while arithmetic was devised in that ''problems contain data necessary to solutions, as a result students never need

to develop skills of selection what is relevant'' (cited in Coben, 2004, p.37). Thus, apart from pure arithmetic, O'Rourke & O' Donoghue (1998) claimed that the idea of numeracy should have involved some elements of critical awareness and intuition.

Numeracy and Everyday Life

A number of authors (i.e. O'Rourke & O' Donoghue, 1998; Evans 1987) link numeracy to activities engaged in during everyday life. Galbraith (1992) claimed that motor skills may have been defined as open or closed depending on the context in which they were carried out. The same situation is valid for numeracy as much in the same way. Galbraith (1992) said numeracy was said to be an open dimension of mathematical knowledge which means that a number of external factors influence the everyday life decisions regarding what strategy to use while dealing with a situation requiring the application of mathematics. Thus the context has a major significance in the daily life application of numeracy.

Evans (1987) identified a number of differences between classroom mathematics and everyday numeracy. In the first place, he identified the goals and values of an activity which made sense to pose the problem. Within the classroom mathematics accuracy was valued and required in all instances however number approximation was usually sufficient in most daily applications of numbers.

Secondly, Evans commented on the social relations in the setting in which the problem was posed. In the school setting, the relationship between teacher and learner is formal as opposed to situations encountered in the workplace and in the home, where relationships are considered more informal (1987). As a result, there is difference not only in terms of cognitive demands but also the affective environment.

Finally, Evans also examined the material resources which assisted the activity. Calculators are common in daily situations in to application of mathematical knowledge but they are still a taboo in the majority of the classroom settings where there is a suspicion about calculators destroying learning

When mathematical knowledge matches the personal requirements of the individual within his/her roles, the link between numeracy and everyday life carry more importance. Thus it is understood that context is a significant factor which relates to the idea of an open skill.

Numeracy and Literacy

The linkage between literacy and numeracy could be examined in three ways; numeracy as a language, language factors in learning numeracy and numerical language in real world contexts (Gal, 2000). In the first place, numeracy can be viewed as a separate language system with its own symbols, vocabulary, and grammar (Halliday, 1979). The language of numeracy can be used to describe situations or to communicate both concrete and abstract descriptions (Gal, 2000). Numeracy appears as a language, for example, when we examine the process of using a formula, which involves reading each step of a formula, comprehending the meaning of each element of a formula and constructing a sense for the intention of the whole process. In addition, the expression of mathematical ideas depends in part on a one's natural language, a situation that can create difficulties for adults who are fluent in one language but trying to learn how to speak mathematically in another language (Gal, 2000).

Secondly, Laborde (1990) stated that in oral and written forms, language was

the prime factor through which the learning of numeracy was mediated in both formal and informal numeracy education. Students have to read and decode written mathematical terms and comprehend the implications of these elements. In addition, the adult numeracy learner should communicate with local vocabularies that are used by teachers or textbooks and should be aware of the meanings of the terms used in a numeracy classroom, such as average, minus, group, are usually different than when these terms are used in everyday speech (Laborde, 1990)

Furthermore, the learners are expected to be able to have strategies for reading and comprehending which implies effective communication with peers and teachers through verbal and written means. This emphasis on communication is used to support the learning process because of the fact that it provides realization of communicative acts as part of the fabric of many real world numeracy situations (Sterrett, 1990).

In the third place, Gal (2000) viewed numeracy as a tool to enhance our understanding of the world that surrounds us. He said that numeracy had a positive role in enhancing an individual's appreciation. Besides, Le Roux (1979) unified numeracy to natural sciences by calling numeracy as the most basic level enabling one to obtain and use information for the purpose of description and formulating and validating a theory (cited in O'Rourke & O' Donoghue,1998, p.4). In mid twentieth century, American view of numeracy was very close to functional literacy and numeracy also started to be recalled as quantitative literacy. Curry (2000) proposed that true literacy can only be achieved by comprehension of quantitative concepts and developed ability for communicating quantitative information.

Numeracy and Citizenship

Many authors (i.e. Gal, 2000; Evans, 1989a; Paulos, 1988) wrote about the link between numeracy and citizenship, not only in terms of its contribution to the individual for facilitating quality employment and guarding against exploitation of the person but also its role for aiding the individual to make a more meaningful contribution to the community (O'Rourke & O' Donoghue, 1998). Levinger (1996) discoursed about citizenship in terms of participation. He submitted that a numerate person was both better equipped to understand and to contribute to debates on health, education, justice, economy and so on and also better able to be useful for the benefits of the society. Thus he recommended that the above themes should have been examined within the context of numeracy education.

Almost a decade earlier, Gabony and Traxler (1982) had practiced numeracy education along these lines viewing it as ''a basis for criticisms…and a basis for action'' (cited in O'Rourke & O' Donoghue, 1998, p.6). Moreover, Evans (1989b) accepted statistics as forming the bases of adult mathematics education. He supported putting in place what he calls ''Barefoot Statisticians'' who could become actively involved in community research (p.204).

According to the NALS results in 1993, the implications of innumeracy for the individual are at the two levels; material and ideological levels (Gal, 2002). On a material level, innumeracy means restriction of opportunity of assess to training, further education, and employment. Furthermore, high levels of innumeracy, for a society in general, results in waste of production and loss of resources. On an ideological level innumeracy means spreading myths which may influence the society's values.

Analyzing these three perspectives of adult numeracy is essential, because of the fact that they symbolize the starting point of different national and international adult numeracy surveys and also in which aspect the adults need numeracy education in different societies. In this study, the adult numeracy survey includes three of these perspectives; the mathematics of numeracy, numeracy in social requirements and the relationship between numeracy and literacy. Through the survey in this study, the numerical knowledge and skills of the participants are assessed via the basic mathematical operations which represent the first perspective, the mathematics of numeracy. Moreover, in the case that the adult participants are not able to communicate with the local numeracy vocabularies or to read and comprehend the numeracy items, they do not get a sufficient score. The effect of the relationship between numeracy and literacy can be obviously seen while assessing the scores. Besides, in this study, some factors related to social requirements of adult numeracy (e.g., education, occupation, and daily life experiences) are also examined in order to find whether a significant relationship exists or not. On the other hand, the other sub perspective, which emphasizes the effect of numeracy in the one's comprehension of the world in terms of numeracy and citizenship, are not directly stressed and are left out of this study.

Adult Learning Numeracy

Each of the main definitions of adult numeracy has ties to adult learning theory. In turn, definition, theory, and instruction are tied together: one's view of what numeracy leads to a theory of learning, and this theory affects preferred approaches to instruction (Forman & Steen, 1999). There are four main learning models related

to adult numeracy learning theory. These are behaviorist models of adult numeracy, constructivist models of adult numeracy, absolutist and fallibilistic views, and adult numeracy and cognition.

Behaviorist Models of Adult Numercy

Up until the mid-1990s, behaviorist approaches dominated adult numeracy instruction. In the behaviorist numeracy instruction, the teacher transports knowledge (e.g., a number fact embedded in a word problem as the stimulus) to the students who absorb it and produce a solution as the response (Kieran, 1994). Since learning is considered to have occurred when the correct solution is given consistently, numeracy includes immediate recall, retention, and transfer, and understanding that are equated with computation and operations, as measured by achievement tests or performance tasks (Coben, 2000).

Constructivist Models of Adult Numeracy

The last ten years have brought a major change in ideas about learning numeracy, from a behaviorist perspective to a constructivist perspective (Kieran, 1994). Nowadays constructivism has a great influence on contemporary adult numeracy education. The keystone of constructivism is the opinion that all knowledge is constructed by individuals acting upon external stimuli and assimilating new experiences by building a knowledge base or altering existing schemas. Two main branches in constructivism have emerged; at one hand Piagetian theories in adult numeracy that focuses on the importance of an adults' cognitive developmental stage and adult learners who make sense of mathematics. On the other hand Vygotsky is

who sees learning as an activity in which shared mathematical meanings are constructed socially (Billett, 1996).

The concrete operational and formal operations levels of Piaget's four major developmental stages have been the subjects of a few studies specific to adult populations. These studies include Mayta (1990), who correlated achievement in numeracy to the concrete stage among a group of imprisoned males, and Martelly (1998), who found the same relationship among community college students registered in developmental numeracy courses. Another aspect of Piaget's theory of intellectual development, which is his notion of intellectual growth as involving three fundamental processes: assimilation, accommodation, and equilibration, has received less attention in the adult numeracy field (Coben, 2000). Llorente's (1996) study about the problem-solving behavior of adults in Argentina with little formal education in work situations uses Piaget's theory of equilibration to emphasize the interactive and constructive nature of everyday knowledge and the social constraints that influence problem solving ability.

Vygotsky (1978) emphasized the social aspect of learning by two of his major contributions to constructivist theory; the ideas of ''a zone of proximate development'' [ZPD] and ''scaffolding'' (p.83). Vygotsky's work has many applications to the teaching of adult numeracy and has been referenced by supporters of cooperative learning and problem-solving activities. Like Piaget, Vygotsky also studied children, but his theories of ZPD and scaffolding both can be translated smoothly to the design of instruction for adult numeracy students.

Absolutist versus Fallibilist Views of Numeracy

Lakatos (1976) found the distinction between absolutist and fallibilist views of numeracy. In the absolutist view, numeracy is seen as a set of absolute truths determined by authority and doing mathematics means following the rules correctly (Coben, 2000). Thus, behaviorist approach is associated with the absolutist view. By contrast, in the fallibilist view, numeracy is seen as a social construct and therefore culturally determined, and opens to revision (Ernest, 1994). Therefore, constructivism is directly associated with the fallibilist view. Benn (1997) argued that fallibilist approaches lead to more surrounding and adult-friendly learning. Yet, the absolutist view is associated with the product of numeracy, in which numeracy skills and concepts are seen as external to the learner.

Numeracy and Cognition: Experience and Situations

Despite the importance of understanding cognition, which means what and how people know what they know, such studies in adult numeracy education are rare, and most studies of cognition and numeracy in the education fields have been developed through research with children (Gal, 2000). However, there is clear evidence that numerical knowledge develops both in and out of school, for adults and children, and is deeply influenced by experience and cultural practice, as socio-cognitive theorists have shown (i.e. Saxe, 1991; Schliemann & Acioly, 1989). Such studies emphasize the ability of people to control and regulate their own behavior that relates to their experience in the environment, rather than react automatically to stimuli, as behaviorist epistemologists predict. Adults bring this prior knowledge and life

experience to the classroom and apply it when they use of numeracy in a wider range of situations (Ernest, 1994).

Gal (2000) took a different approach, beginning from the learner's perspective. He noted that real-life numeracy situations were always embedded in the life stream with personal meaning to the individual involved. Adults need numerate skills to enable them to manage diverse types of quantitative situations. He identified three types of numeracy situations that adults must manage; these are generative, interpretive, and decision situations.

Generative situations require people to count, quantify, compute, and manipulate numbers. Examples are dealing with simple operations, such as calculating a total price of products while shopping. Interpretive situations require people to make sense of verbal or text-based messages based on quantitative data but do not require them to manipulate numbers. Examples include interpreting a chart in a newspaper article reporting crime statistics or reading a report of a survey with poll results. Decision situations require people to find and consider multiple pieces of information to determine a course of action. Such situations include identifying ways to use limited resources, such as money or time, and choosing among alternatives such as renting the right apartment (Gal, 2000).

In this section, four distinct learning models related to adult numeracy learning are explained. In this study, the measuring instrument includes some of these learning models. First of all, since the measuring instrument is a performance test, numeracy skills of the participants are equated with computation and operations, which forms the main notion of behaviorist models. Secondly, whether everyday knowledge and social constraints influence numerical ability, which is the basis of

Piaget's learning theory of equilibration, is also researched in this study. These research questions are also highly related to Gal's (2000) three types of real life numeracy situations. The instrument mostly include items that assess participants according to Gal's generative situations (e.g., calculating the total price while shopping), interpretive situations (e.g., interpreting a chart or a diagram), and decision situations (e.g., deciding on the best economical way). As a result, being informed about these learning models is essential in order to comprehend the issue in the construction of the items in the measuring instrument.

Factors Affecting Adults' Numeracy Skills

Beyond the learning theories for adult numeracy, individual's numerical learning capacity is the result of the interaction of one's physical and neurological condition, cognitive and intellectual structures and social roles. The dynamics of biological, social, psychological, historical, environmental and contextual factors influence the numeracy skills of the adults and his/her capacity for numeracy learning (Merriam & Cunningham, 1989).

Gender

In recent years, gender has been a central concept, both in numeracy education and in social research studies. A considerable amount of work has been done on gender issues in adult numeracy, especially in North America and also in the UK and Australia (Fennema, 1979; Hyde, Fennema, & Lamon, 1990). Gender differences have been a concern in research studies in the USA since at least the 1970s, even longer than in the UK. In the USA, Fennema (1979) interpreted the gender

differences in national standardized tests as indicating that mainly young men had taken more numeracy courses at school than young women. This pointed out to the importance of controlling for participation when comparing performance of women to men. Additionally, researchers such as Fennema and Sherman (1976) emphasized the role of affective factors in numeracy education influenced by social variables, such as perceptions of parents and teachers, which were also linked with gender.

Surveys of adults' numerical abilities and their effects routinely differentiate between men and women, so that there is an increasing amount of data available, for example, from UK studies drawing on data from the Birth Cohort Survey in 1970 [BCS70]. In the UK, statistics for higher education in the 1980s showed a pattern of gender differences similar to those in the USA (Bynne & Steedman, 1995). One of the Fennema's research studies (1995) found that numeracy skills decline in people who are out of paid employment for a long time, especially for men who had poor mathematics scores at age 16. Another study, which was carried by the Basic Skills Agency [BSA] (1995), found a strong relationship between poor numeracy skills and the number of times 30 year old women in BCS70 reported having been arrested.

Research on gender has tended to focus on women, encouraged by organizations such as the International Organisation of Women in Mathematics Education [IOWME] and in the UK by the Gender (formerly Girls) [GAMMA], and Numeracy Association. Publications by Burton (1990), Fennema (1995), Harris (1997), Rogers and Kaiser (1995), and Smart and Isaacson (1989) have all contributed to the development of ideas about women's numeracy learning and practice. Burton (1990) offered an international perspective on gender and numeracy in her edited collection. Moreover, Rogers and Kaiser (1995) looked at the influences

of feminism and culture on issues of equity in mathematics education. Smart and Isaacson (1989) also celebrated women's cooperative learning of numeracy.

Another research branch about gender and numeracy is with women who are mothers. Civil (2001), in her work, described a group of Hispanic women in Arizona, USA, in which the group developed trust and dialogue through learning numeracy. Brew (2001) has also looked at the implications for women and children of mothers returning to study mathematics. She found that there were benefits for such women of having older children at home; in terms of the encouragement that gave them to verbalize their numerical knowledge. She also found positive changes in children's attitudes to mathematics and their achievements in mathematics.

Such research studies have arisen as a response to the perceived invisibility of women in numeracy education and the underestimating women's numerical abilities (Coben, 2003). For example, spatiality is one area where female numerical skills have been supposed to be defective; despite the fact that the evidence is ambiguous (Fennema, 1995). Furthermore, Harris (1997), in her research, concluded that some of the geometrically-rich creative work traditionally was done by women such as turning the heel of sock knitting.

Johnston (1998) noted that the general agreement on numeracy and gender strongly rejected biological explanations of difference. By using the methodology of memory work, she suggested that it could have been a useful tool for understanding numeracy as practice and the gendered experience of the use and abuse of mathematical power. Henningsen (2002) also explored issues of gender in relation to women and men learning numeracy. She pointed out that there is ‘‘considerable literature on what makes women feel bad about numeracy. There is some research on

what makes women feel better about numeracy but very little about what makes women feel good about numeracy''(p.229).

On the other hand, there exist some national and international surveys (e.g., The *Adult Literacy and Skills Survey* [IALLS] and ALL) for measuring the literacy and numeracy levels of adults and categorize them according to affective, demographic and social factors that the adults have. Due to the results of ALL in 1996, in New Zealand, the mean numeracy score for men (around 275) was greater than that for women (around 265). The main gender difference is that a higher proportion of men than women have high numeracy skills while the low end of the numeracy distribution is similar for men and women (Satherley, Lawes & Sok, 2008). The IALLS in 2003 showed similar results. The results of all twelve countries from the second round of the survey showed that men were outscoring women on the numeracy scale. While in Canada this difference was small, in some countries (e.g., Belgium, the Netherlands, and the United Kingdom) the difference was significant (''OECD'', 2007).

Generally, the recent results of the research studies have suggested that the male advantage in numeracy performance has been lessening or disappearing in many advanced industrial societies (Evans, 2000). Benn (1997) identified five phases of numeracy in relation to gender:(1) womanless numeracy- common until the 1970s; (2) women in numeracy- with women entering numeracy, but on men's terms; in the 1980s; (3) women as a problem in numeracy, with the emphasis on intervention projects; (4) women are seen as central to numeracy; and (5) as yet ill-defined, ''might be numeracy for all, a reconstruction of numeracy as a connected and constructivist discipline'' (cited in Coben et. al., 2003, p.76).

Age

Age as a factor in adult numeracy skills has been less explored than gender, although many surveys use age as a secondary dimension. Age, generally, was not perceived as a barrier to performing numeracy but in combination with other factors, such as lack of exposure to numeracy concepts, it could be presented as a difficult block. For instance, Zevenbergen, (2004), found that the numeracy skills of older adults are poorer than the younger adults. However, the reason for this, whether that is due to skills or memory detenoration with age, or to lower standards set by those adults in initial education in years gone by, or changes in numeracy education over time, is not clear (Johnston, 2002).

On the other hand, the picture is not one of younger adults consistently out-performing older adults at all levels of numeracy. For example, in the UK National Survey, in 1994, of 3001 people aged between 22 and 74, it was found that the oldest age group assessed in the survey, 72-74 year olds, did much worse than any other age group; 62-64 year olds and 52-54 year olds, did about the same, although significantly worse than younger people; those aged 42-44 and 32-34, performed consistently better in numeracy than older people; and the 22-24 year olds in the survey performed worse, in the numeracy assessment tasks at the higher levels than 32-34 year olds and 42-44 year olds (‘‘BSA’’, 1995).

Moreover, the International Adult Literacy and Skills Survey [IALSS] in 2003 results showed that when compared to older age participants, younger cohorts tended to score higher and had larger proportions at higher levels of skill on each of the document; including, numeracy and problem-solving scales. There is also a wider range in scores among older adults, aged 46 to 65, compared to 16 to 25-year olds.

The accumulation of differing life experiences is likely to be an important factor explaining the wider variation in performance among older adults (Statistic Canada & OECD, 2005).

Also, IALS data, in 1998, showed that there was a strong relationship between numeracy level and age, with levels in most countries declining substantially from around ages 40-45. In all countries, except the USA, it was found that a considerably higher proportion of young people than of older people were better at numerical skills achievement. In fact the proportion of well skilled young people was 2.5 times that of Canada, and not much less than that of Poland, with the highest proportion. Notably, in Sweden almost 40% of young people were at these highest levels of quantitative literacy with Switzerland, Germany and the Netherlands following substantially behind with proportions of between 21% and 26%, Canada and the USA with between 13% and 18%, and Poland with less than 10% of young people at these highest levels (‘‘OECD’’, 2000).

Zevenbergen (2004) suggested that as time progresses, adults might have experienced reduced cognitive performance as a result of the ageing processes. However, her research suggested that, depending on life experiences, cognitive performance might have been enhanced over time. Indeed, Johnston’s study (2002) suggest that one’s life experiences could lead to an accumulation of knowledge and skills until an advanced age, after which they might have begun to level off. The latter phenomenon is referred to as practice effects. She stated that the outcome of the interaction between ageing and practice effects depended on the extent and nature of an individual’s life experiences.

Withnall (1995) found that lower numeracy skills among older age groups might also have been attributable to other types of effects. For example, most young people today receive more years of formal schooling than older individuals and more emphasis may be placed on the acquisition of cognitive skills now than in an earlier period. In fact, there are wide differences in educational attainment among individuals in different age groups and this particular life experience has a major factor influence in the relationship between age and skills. In particular, younger adults are much more likely to have completed some kind of formal education compared to their parents and grandparents. Finally, younger adults also benefit more from schooling (Withnall, 1995).

There are also some research studies that focus on older adults. For example, Withnall (1995) has reported the older adults' numeracy needs and usage of numerical skills in everyday life. She explored the numerical skills that older adults used mostly in their everyday lives and she questioned that whether different periods of retirement demanded the acquisition of new skills or not. In her research, she also recommended ways in which the provision of adult education could facilitate learning opportunities in numeracy for older adults.

Educational Background

There exists a common idea, from the research results from different nations and countries that the whole formal education experience of adults, including preschool education and early schooling, is highly related to their numeracy skills. There are huge number of educational research studies that exposed the strength of the relationship between adult numeracy skills and levels and their educational

background. For instance, cognitive ability tests taken at ages from thirty to forty in the UK showed that adults with numeracy difficulties had struggled at the first stage of their formal education (Bynner & Steedman, 1995).

ALL Survey, in 2003, examined the relationship between individual formal educational experience and observed measures of numeracy skills in Bermuda, Italy, Norway, Mexico, Switzerland, Canada and the USA. The analysis focuses on the findings that there is a strong, positive relationship between formal educational attainment and numeracy skills on all domains measured, and formal education plays a key role in the formation of numeracy skills comparing the skills of younger adults with varying experiences of upper-secondary education, and on the impact of additional years and levels of post-secondary schooling (‘‘The Daily’’, 2005).

Moreover, in ALL in 2003, there are also substantial variations in performance within each level of formal education. In all participant countries, early school leavers are most likely to score at just Levels 1 or 2, which are the low levels, compared with those who have stayed in school, young adults aged from 16 to 35 with more years of post-secondary schooling on average consistently show higher (‘‘The Daily’’, 2005).

Other research results by Shonkoff and Phillips (2000), indicated that the past formal educational attainments of adults have been found to be a more significant factor than economic factors in explaining their numeracy achievement and there were replicated results in child development studies. Moreover, according to finding of Williams’s research (1987), better educated adults foster a higher level of numeracy achievement as it is valid for children coming from higher educated families.

Casey, Purcell and Whitlock (2006) did a research about factors affecting in community based literacy programs in Canada. They found that there was a significant relationship between numeracy scores of the participants and the number of years they had spent in the formal education. However, there was not found any significant relationship between the numeracy scores and whether had a repeated grade in formal education, the number of schools attended, and whether the participant ever received special education help in school.

Achievement in literacy and numeracy has been shown to be a key determinant of educational outcomes (Rothman & McMillan, 2003). In another related research, Marks, Fleming, Long and Mc Millan (2000) stated that adult participants from Australia, who achieved higher levels of numeracy and literacy, were higher achieving students in their schools. They also added that making a successful transition from school to full time employment, the type of occupation obtained, and earnings were positively related to numeracy scores.

In different research surveys, there are various ways of grouping the educational background of adults, for example in terms of number of years that adults attended formal education or grouping formal education as primary school, secondary school, high school, colleage and higher education. In this study, formal education is grouped as primary school, secondary school, high school and higher education. Higher education is also separated as two years junior technical college, Open University, university and master /doctorial degree. The higher education programs are examined in terms of social science, mathematics and science, mathematics and literature, language, and art departments. Adults who do not have any formal education experience are left out of the study because of the fact that they may lack

the prerequisite numeracy knowledge (e.g., Entry Level 1, 2, and 3) for answer the items in the measuring scale.

Parental Educational Background

Adult numeracy acquisition can be seen as being supported by a number of interrelated family socio-economic and educational experiences. Fixed characteristics present at birth such as sex, birth weight, social and economic factors in childhood, and family social class, etc., cannot be changed, but disadvantaged by family circumstances. If parents' own educational experiences had been poor, a crucial element of learning support may be missing in the early years of skills acquisition which affects the numeracy skills in adulthood (Bynner and Steedman, 1995). Such variables are not direct influences on adult numeracy skills but are indicators reflecting social background of the child's home- life, building up a picture of the type of home environment which works for or against the learning process. These fixed characteristics are built upon by circumstances and experiences later on in life (Pilling, 1990).

Evidence from the 2004 survey of the BCS70 showed that the adult participants with the poorest literacy and numeracy skills had a relatively disadvantaged home life in childhood, both economically and in terms of education levels of parents and educational support offered by parents (Parsons and Bynner, 2000). Furthermore, even for adults, the level of mother's education plays an important role on literacy and numercy skills (Desjardins, 2003; Kapsalis, 1999; Willms, 1999). Although there are no studies found that measure directly parent's level of numeracy of adult participants, Chettri & Baker (2005) stated that because of the fact that mothers play an important role in establishing both early literacy and numeracy skilss, there is a

link between the mother's literacy and numeracy level and that of her children and the same result is valid for adults and their mothers.

In addition, the ALL Survey, in 2003, explored the extent to which observed differences in numeracy skills could be attributed to the education levels of the participants' parents, considering the adults from age 16 to 65. Comparison of socio-economic inequalities in skills among adults suggests that Norway is the most successful at reducing the numeracy skills disadvantages typically associated with low levels of parental education. Another finding of the ALL survey in 2003 is that the numeracy skills of the young adults, aged from 16 to 25, and who have low-educated parents are lower than the numeracy skills of the same group who have educated parents (''The Daily'', 2005).

In this study, parental educational background is examined for mothers and fathers of the participants separately. In the demographic information form, parents' educational background is divided into five categories as no formal education experience, primary school, secondary school, high school, university graduates, and master /doctorial degrees.

Attitude toward Numerical Information

Several measures of attitudes toward domains involving numerical information are available in the literature. Wise (1985) developed a scale of attitude toward statistics to measure change in attitude among students of introductory statistics. Aiken (1974) developed two scales of attitude toward mathematics; ''an Enjoyment of Mathematics scale'', which is argued to include a liking for mathematics as well as a liking for mathematic terms, symbols, and routine computations; and ''a Value of

Mathematics scale'', which relates to the recognition of the importance of mathematics to individuals and to society'' (p. 67). Although these constructs tap attitudes toward domains involving numerical information in Aiken's scale, a basic attitude toward numerical information is not in primary focus.

Moreover, Shepherd (1984) has reported on the levels of numeracy among adults and children using a survey that had items regarding practical math. The survey poses questions involving the application of mathematical skills to everyday problems. Although the confidence of respondents was observed and recorded in administering this survey it primarily focused on skills for performing practical mathematical problems rather than on attitude toward numerical information.

Although some researchers have recognized its importance, the construct of attitude toward numerical information has rarely been isolated and measured (Evans, 1989b). Several research studies (i.e. Gronlound, 1985; Payne, 1992) have suggested the importance of studying attitude in a domain as distinct from skills in that domain. Gronlund (1985) pointed out that attitudes might have served as important educational goals and that attitude measurement could be used to adjust teaching methods. Further, Payne (1992) pointed out that attitudes might have influenced skills and ability and that such variable need to be assessed for their influence on learning. Moreover, Viswanathan (1993) argued that attitude toward numerical information influences the acquisition and usage of numerical skills in various settings. He claimed that attitude toward numerical information was particularly important in settings that require only a minimum level of numerical ability to use numerical information.

Aiken (1974) stated that attitude toward numerical information might have influenced individuals' tendency to acquire numerical skills, as well as their willingness to apply the numerical skills that they possess to problems encountered in various settings. Individuals with low preference for numerical information may be less likely to acquire skills that are required in everyday usage than are individuals with high preference for numerical information. They may also be less likely to use or apply the numerical skills that they possess such as in making computations about dietary intake in a consumer setting or performing statistical analyses in an educational setting (Aiken, 1974). Therefore, a basic preference for numerical information could influence the acquisition of practical numeracy skills as well as the application of these skills in everyday life (Evans, 1989b).

Although the relevance of attitude toward numerical information is apparent, some level of numerical ability is required in situations such as consumers using numerical nutrition information to evaluate products, individuals interpreting information about the likelihood of contracting a disease, or managers using numerical data (Viswanathan, 1993). Otherwise, the neglect of numerical information may lead to poor decisions. For instance, consumers may need to interpret the meaning of ''9 grams of fat in an ice-cream bar'', or individuals may need to interpret the meaning of a ''5% chance of contracting a disease'', to make informed decisions. Such interpretations may require only a minimum level of numerical skills, just for comparing numerical information to some baseline information to derive the meaning conveyed by it. In such situations, the usage of numerical information may be largely influenced, not by ability and skills, but by attitude toward numerical information (Viswanathan, 1993, p.742).

In this study, whether there is a significant relationship between numeracy skills of the participants and their attitudes toward numerical information is questioned. The Individual Differences in Preference for Numerical Information Scale [PNI], which was developed by Viswanathan in 1993, is used for measuring the attitudes of participants toward numerical information.

In this section, related literature about factors affecting adults' numeracy skills is summarized. These factors (i.e. gender, age, educational factors, parental educational background and attitudes towards numeracy) are highly related to the research questions of this study in which it is searched whether there is a significant relationship between each of the factors and numeracy skills of the participant group. Further, in this part of the study, the national / international survey results and related research findings are established in order to compare and contrast them with the results of this study.

The Adult Numeracy Network

In this section, first, the starting point of adult numeracy frameworks all around the world is established. Secondly, the international policies of most developed countries in adult numeracy field are explained. Moreover, the research studies about the international adult numeracy curriculums and international survey results of these countries are mentioned. In the last part, the adult numeracy research in Turkey is examined.

Despite the fact that improving the nation's literacy and numeracy skills is one of the governments' top priorities all around the world; it has not been already brought about significant improvements at adult numeracy in Turkey. In this study, it

is mainly aimed to put forth the level of adults' basic numerical skills and the affecting factors of these skills in Turkey for consideration. Since the deficiencies in Turkey that is disclosed by the results of this study can be eliminated by examining the innovations and policies of developed countries in adult numeracy field, this section of this study has a vital importance.

The Adult Numeracy Frameworks

In 1989, the NCTM published the ''*Curriculum and Evaluation Standards for School Mathematics''*, a document that served as a template for reforming and improving K-12 mathematics education across the nation (Gal & Stoudt, 1997, p.14). In 1994, sixteen mathematics teachers formed the Adult Basic Education [ABE] Math Team studied the K-12 standards to see how some of the ideas might have played out in their adult education classrooms. After a year of action research in their classes, these teachers published two documents, which are a set of adult education math standards and stories of what changes looked like in their classrooms. Their adult math standards were the first set of ABE frameworks to hit the press and these early frameworks also served as a model for other states (Gal & Stoudt, 1997).

In 1990, three Massachusetts teachers joined several others in approaching the NCTM with a paper, ''*A Call to Action''*, asking that the NCTM include adult learners in their reform agenda (Gal & Stoudt, 1997, p.14). The NCTM responded by forming a task force on adult learners and subsequently hosted the first national Conference on Adult Mathematical Literacy in March 1994. This conference brought policymakers, researchers, and practitioners together to discuss the status of adult numeracy education and to determine future directions. Out of this conference came

at least two significant events; one is the formation of a national network of practitioners and the other is the development of a list about what math we should be teaching adults. (Leonelli & Schmitt, 2001). After that, The Adult Numeracy Practitioners Network [ANPN] was formed by the adult education practitioners at the 1994 Conference on Adult Mathematical Learning. In 1997, the ANPN board voted to change the name of the Network to the Adult Numeracy Network [ANN] after it became officially affiliated with the NCTM (Gal, 2000).

In 1995, after World Education accepted the grant on behalf of the ANPN, the teacher teams studied and discussed other documents and developed seven themes that serve as the foundation for adult numeracy standards. These adult numeracy standards are Relevance and Connections; Problem-Solving, Reasoning, and Decision-Making; Communication; Number and Number Sense; Data; Geometry: Spatial Sense and Measurement; and Algebra: Patterns and Functions (Gal, 2000).

International Policies on Adult Numeracy

International influences have begun to find their way into the USA numeracy practice through frameworks from other countries, including Australia, the United Kingdom, and the Canada. Since the 1980s, work by adult educators in Australia, the United Kingdom, and other countries has expanded the definition of numeracy. The countries with the most interesting developments in adult numeracy are Ireland, Australia, Canada, Scotland, England and the USA (National Adult Literacy Agency [NALA], 2003)

Adult Numeracy in Australia

It may be seen that Australia has a well developed provision for adult numeracy, which incorporates professional development for the tutors in the field (‘‘NALA’’, 2003, para.8). In the Australian curriculum frameworks, numeracy denotes the ability to perform a wider range of math skills, such as measuring and designing, interpreting statistical information, giving and following directions, and using formulas (Johnston, 2002). The Australian frameworks are written to address the purposes for learning mathematics and do not proceed from a school-based mathematics curriculum model. Rather, the frameworks look at the mathematics that is used in the context of adult lives. This level of provision has been achieved despite the fact that adult numeracy continues to be defined within literacy in the body of national policy documentation (Johnston, 2002).

In terms of Kell’s epochs, it was identified as four epochs in the development of the literacy field by Kell (1998), adult numeracy can be seen as ‘‘the poor cousin’’ (p.5). In some ways, realization that there was a low level numeracy achievement in a large proportion of the adult population preceded the growing realization of the extent of low adult literacy. Thus, as second chance literacy classes took of for adults from the community, so did numeracy classes (Johnston, 2002). Equity issues were high on the government agenda, community classes with volunteer tutors proliferated and funding was available. Recent years brought more funding and increasing professionalisation of the adult numeracy field (Seddon, 2002).

Currently, the Australian Quality Training Framework [AQTF], which is a framework for setting a national consistent and high quality vocational education and training system, claimed to include literacy and numeracy in all training. Mainly these effects on the Australian Adult Numeracy community have developed of

national governmental policy on adult numeracy as a critical approach to mathematics and as the meaning making system. This policy provided a number of Australian adult numeracy practitioners (i.e. Cumming, 1996; Johnston, 1996; Kelly, 1997; Yasukawa, 1995) to be brought up and a lot of researches and survey results have came out (cited in Johnston, 2002, p.4).

There have been six surveys over the last twenty five years; three of them focus on literacy and three on numeracy. These surveys are the Goyen Survey, the Cockcroft Report, the Wickert Survey, the International Numeracy Survey and the IALS (Johnston, 2002). In IALS 1999, a comparison of twenty countries involved and based on the average scores for each country results show that Australia places in the middle, significantly lower than Sweden and the Netherlands, the same as Canada and USA, and higher than the UK and Ireland (‘‘OECD’’, 2000).

Adult Numeracy in the United Kingdom

The United Kingdom has recognized the importance of building up the numeracy capability in the population and has also recognized that the foundation for this objective was set in the early school years. It is the only country which has put in place a numeracy curriculum that extends throughout all levels of the education system (‘‘NALA’’, 2003). The numeracy framework in the United Kingdom is organized by mathematical topic rather than by function. The UK framework also shows examples of where adults use numeracy skills, and includes, at every level, number work, geometry, measurement, and data and statistics (Johnston, 2002).

In England

In England the provision of adult numeracy education developed in the wake of the adult literacy campaign of the 1970s (Coben, 2001). According to the review of research of Adult Literacy and Basic Skills Agency, the first review to deal with adult numeracy was undertaken for the National Institute of Adult Education in England and Wales by Withnall and her colleagues in the early 1980s (Withnall, Osborn, & Charnley, 1981). It remained underdeveloped until the Further and Higher Education Act in 1992, which regulated adult numeracy. The Publication of the Moser Report, which is called ‘‘A Fresh Start,’’ in 1999 (The Department for Education and Empoyment [DfEE], 1999, para.8) proceeded a new era for adult numeracy in England. The Moser Report, which is the government’s Skills for Life Strategy for improving adult literacy and numeracy skills in England, has transformed the scene and adult numeracy has started to be seen as an essential element in a range of measures designed to raise the skills levels of the population (‘‘DfEE’’, 2001).

The centerpiece of the Skills for Life strategy with regard to teaching and learning adult numeracy is the Adult Numeracy Core Curriculum [ANCC], which covers the ability to understand and use mathematical information; calculate and manipulate mathematical information, interpret results, and communicate mathematical information (‘‘BSA’’, 2001). With the introduction of the ANCC in 2001, for the first time there is a national curriculum for adult numeracy in England. The National Standards for Adult Numeracy are statements about what adults can do in several math-related areas at five levels, and they underlie the country’s national tests for numeracy, screening and diagnostic materials, national survey of adults, new

qualifications for teachers of numeracy, and the adult numeracy core curriculum (Coben, 2001).

The government's Skills for Life strategy targeted one and a half million adults to succeed in the National Tests by 2007, so the Skills for Life strategy has undoubtedly raised the profile of adult numeracy education in England. According to the latest Annual Review of Skills for Life, 300,000 adults improved their literacy and numeracy skills between April 2001 and July 2002, with learning opportunities provided to over 1.5 million learners (The Department for Education and Skills [DfES], 2003).

In short order, it can be seen that the introduction of National Standards, National Tests and the ANCC, along with a new regime of teacher qualifications and other developments, including the establishment of the National Research and Development Centre for Adult Literacy and Numeracy [NRDC], makes England one of the most highly achieved countries in adult numeracy field all around the world (''BSA'', 2001).

In Scotland

In Scotland in 2001, a report was published to provide a focus for the development of national policy and strategy on adult literacy and numeracy (Scottish Executive, 2001). The report defines literacy and numeracy in the same statement:

> The ability to read, write and use numeracy, to handle information, to express ideas and opinions, to make decisions and solve problems, as family members workers, citizens and lifelong learners.
>
> (Scottish Executive, 2001, p. 7)

Also, the report proposed that a development engine be established in the national government, to drive national literacy and numeracy strategy. This has come to be set

up in the Communities Scotland department of the government, and is called The Development Centre for Community Learning and Development and Adult Literacy and Numeracy (Scottish Executive, 2001).

The Adult Literacy and Numeracy in Scotland [ALNIS] report, which was produced by an Adult Literacy and Numeracy Team appointed in 2000 by the then Minister for Enterprise and Lifelong Learning, was published in July 2001. That report provided a focus for the development of national policy and strategy on adult literacy and numeracy. In the ALNIS report, it was presented that about 2% of the 800,000 adults with numeracy needs, in terms of being able to function effectively in their personal lives, as family members, in work and as lifelong learners (Communities Scotland, 2003).

After that, The Scottish Further Education Unit and the University of Edinburgh developed an adult literacy and numeracy curriculum framework, which was completed at the end of December, 2004. In the Core Skills Frameworks, numeracy achievement is identified as ‘‘coping with the demands of everyday life, including work and study; and being comfortable with numbers and with graphs, symbols, diagrams and calculators’’. (Scottish Qualifications Authority, 2003, p. 2) Core Skills Frameworks divided numeracy into two sub topics, ‘‘using number’’ and ‘‘using graphical information’’ at five levels (Scottish Qualifications Authority, 2003, p.3).

In Ireland

The NALA started to work on its assessment framework in 2000. In Ireland, adult numeracy is explicitly contained within NALA’s definition of adult literacy, and

therefore is implicitly represented within all of the aims, objectives, and action steps in the NALA Strategic Plan for 2002–2006 (National Adult Literacy Agency, 2003). Developing a numeracy strategy is also one of the core objectives of this strategic plan. The Government's Green Paper Adult Education in an Era of Lifelong Learning in 1998, similarly states, "In keeping with existing practice in the literacy services and the scope of the International Adult Literacy Survey, any reference to literacy should be interpreted as covering numeracy skills also." It also adds, "Tackling low numeracy levels must rank as the primary adult education priority in Ireland" (National Adult Literacy Agency, 2003, p.2)

Numeracy is also contained within the adult literacy agenda of the new National Adult Literacy Programme and workplace numeracy is specifically mentioned within the Special Initiative of the Government's new national Social Partnership Agreement for 2003 (National Adult Literacy Agency, 2003).

At present in Ireland, adult numeracy is being delivered within both Vocational Education Committee [VEC] literacy schemes and other Adult Basic Education [ABE] settings, and has been incorporated in most aspects of adult literacy provision such as training, tuition, regional and national forums, distance learning, and the NALA Quality Framework and the NALA Assessment Framework (Merrifield, Coleman, McDonogh, 2001). The current situation benefits from the extensive nature of the range of provision that is offered by the different organizations that are working to meet the needs of adult learners.

However, there is a serious lack of consistency in the level and quality of adult numeracy provision nationally. A contributing factor is the lack of a unified concept of numeracy amongst service providers, who are not operating to a generally agreed

vision or concept of numeracy in the context of ABE in Ireland. It is important that a consistent approach is applied across the ABE sector and that service providers have a clear national definition of numeracy to follow in providing numeracy services and interpreting published government policy documents (Merrifield, et. al, 2001).

Adult Numeracy in the USA

Since the NALS in 1992, numeracy had been buried under literacy, and literacy was measured along three critical dimensions as prose literacy, document literacy, and quantitative literacy in the USA. The NALS defined the quantitative literacy as the knowledge and skills required to apply arithmetic operations to numbers embedded in printed materials such as figuring out a tip, completing an order form, or determining the amount of interest on a loan from an advertisement (Division of Adult Education and Literacy, 2001).

Yet numeracy was finally acknowledged as an independent inquiry area when the US Department of Education's Office of Vocational and Adult Education awarded the American Institutes for Research, with the Adult Numeracy Initiative project in 2005. It is the first systematic effort to investigate adult numeracy education in the USA (Division of Adult Education and Literacy, 2001).

There is still no national policy on numeracy in the USA, but a framework for Adult Numeracy Standards was published by the National Institute for Literacy in 1993 (‘‘NALA’’, 2003). However, thousands of organizations in the United States offer adult numeracy and basic skills programs under the Adult Education and Family Literacy Act of 1998. Two most important of these support organizations are; the Making Math Real Institute [MMRI] in Pennsylvania, which support tutors

who lack confidence in their own Maths skills, and the ANN, which supports numeracy tutors and also aiming to influence policy and practice (Sticht, 2001).

The ANN was formed by adult education practitioners at the first national Conference on Adult Mathematical Literacy held in Virginia, in 1994. They had joint researchers, program administrators, government officials and others to discuss the status of adult numeracy education and to determine future directions. The conference was co-sponsored by the NCTM and the Office of Vocational and Adult Education of the USA Department of Education. Since its founding, the ANN has done a lot of works such as publishing an electronic forum of the Numeracy List, obtaining funding to enable adult numeracy teachers and learners, republishing A Framework for Adult Numeracy Standards, and submitted a policy statement on numeracy to the National Literacy Summit Initiative (National Research Council, 2002).

Although, adult learners in the USA are encouraged in numeracy via numerous organizations, 35 % of all American adults are still scoring below basic on the National Assessment of Educational Progress. The proportions of Hispanic, African-American, and low-income students in that category are even higher (National Research Council, 2002). This situation is caused by the inadequate preparation of adult numeracy education programs to a diverse adult population that brings unique and different needs, interests, skills, behavior, and attitudes toward numeracy (Sticht, 2001).

Adult Numeracy in Canada

In Canada, adult numeracy is more developed than most of the other countries, with Ontario leading the way. Their integrated basic skills program includes numeracy with an emphasis on skills-based outcomes. There are also national skills profiles related to one hundred fifty occupations and these include numeracy elements (‘‘NALA’’, 2003).

Canadian adult numeracy strategy began in 1994 to reform literacy training in Ontario through developing learning outcomes, common assessment, articulation of agencies, and recognition of learning. In 1998, the government published ‘‘Working with learning outcomes’’ through Literacy and Basic Skills program (Literacy and Basic Skills Section [LBSS], 1998, p. 3). Working with learning outcomes states, “The Learning Outcomes is not a curriculum” (‘‘LBSS’’, 1998, p. 2); ‘‘instead, instructors are to develop their own curriculum based on learners’ needs and abilities’’ (p. 3) and ‘‘learners do not need to learn everything, they need only develop skills, required by their goal” (p. 11). So, the LBSS Program does not approve a specific method of assessing literacy and numeracy learning, but encourages agencies to use a mix of tools and methods that are appropriate to the goals of the learner, the nature of the agency, and the purpose of the assessment (‘‘LBSS’’, 1998, p. 1).

The numeracy learning outcomes were developed by the Ontario Literacy Coalition, funded by the Ministry of Education and Training, Colleges and Universities of Ontario, and Canada’s National Literacy Secretariat. Examples of learning activities and real-life contexts were given high importance in the learning

outcomes to illustrate the level of complexity of numeracy skill in everyday activities (‘‘LBSS’’, 2000).

After that, there have been a number of projects brought altogether through the Recognition of Adult Learning Project and all projects worked towards ensuring a learner centered approach. The approach used for the learning system was a functional approach based on what learners needed to know (Dingwall, 2000).

Adult Numeracy in Turkey

In Turkey, the concept of numeracy has started to be known by participation in international education surveys such as TIMSS and PISA (Berberoğlu, Özdemir & Yayan, 2003). In part of these surveys, there are such numeracy questions about that how students can adapt the science and mathematical skills that are gained in formal education to their daily life activities. Berberoğlu, et, all. (2003) analyzed the 2003 PISA results and emphasized the importance of numeracy skills. After analyzing the survey results, Berberoğlu and Kalender (2005) concluded that students in Turkey were one of the lowest achievers in mathematics and science comparing the other OECD participant countries. After the results of low achievement in math and science education had been examined, the notion of numeracy has been encountered by some researchers (i.e. Ersoy, 2002; Baykal, 2006). However, numeracy is still a rarely used concept in Turkey and most of the numeracy research studies have focused on student numeracy in formal education rather than adult numeracy. Besides, adult numeracy, apart from mathematics, is not a well known concept and has been mostly confused with mathematics and has been placed in mathematics

education in Turkey. Thus, there are very few pieces of research and publications, which are mostly taken as the part of the literacy work.

Baykal (2006) identified the main challenges of literacy in Turkish society and stated that numeracy in Turkey was an underestimated subject, with the exception of a few academicians. Demir and Paykoç (2006) tried to investigate the major issues and problems of Turkish society that might have had an impact on people's daily lives. Data was collected from parents and professionals. After the results had indicated, participants were found to be deficient in critical thinking, problem solving, and basic numeracy and life skills.

In addition, Mother Child Education Foundation [AÇEV] developed a Cognitive Training Program in 2002, which aimed to prepare the children for school and aimed to enhance the mothers' potential roles as educator. In the program, pre-numeracy education was one of the objectives of the program for children and their mothers. Before and after the training program, pre-numeracy skills of both the children and the mothers were measured. The results showed that after the training, children had better academic performance levels in mathematics in schools and the mothers have been found to be more involved in decision making at home.

In his work, Ersoy (2002) mentioned the numeracy notion directly as the primary focus. He emphasized the necessity of basic numeracy education for all youth and adolescence in Turkish society. The researcher identified the basic numeracy abilities and skills that Turkish society needs as estimation, mentally calculation, number intuition, comprehending numerical information, measuring, handling data, using calculator, ordering the information, numerical communication, and problem solving. Ersoy (2000) also stated the primary innovations in

mathematics education (e.g., modification of objectives, content, instructional method, and learning instruments) that should have been targeted to form a national policy on numeracy education in Turkey. Moreover, he cautioned society about the urgency and vitality of transformation in the mathematics education policy in Turkey in order to make citizens become more critical thinkers and better decision makers through daily life.

Furthermore, Durgunoğlu and Öney (2000) identified the basic numeracy needs of adult literacy participants in Functional Adult Literacy Program in Turkey. The researchers conducted an in-depth study of predominantly female participants. More than half of the participants expressed that they are in need of learning basic numeracy skills; especially for particular situations such as banking, shopping, health care, transportation, and work. The researchers recommended that the adult literacy programs should have focused on teaching real life applications of skills to address participants' expressed cognitive and emotional needs.

Besides, Ataklı (2008) developed a training program, named Basic Numeracy Skills for Adults, for seventeen parents of the students in a private education center. The goal of the training program was to enhance the numeracy comprehension of the participants and the quality of their numeracy work. The training program included four basic numeracy concepts, which were Skills of Calculation Mentally, Patterns of Numbers, Problem Solving Strategies, and The Game Theory. According to the results, it was emphasized that adult learners were in need of developing an understanding of the concept of numbers and of the relationships between operations. Ataklı (2008) also concluded that adults should have been encouraged to develop a

‘‘relational’’ understanding of number rather than simply an ‘‘instrumental’’ understanding (p.6).

In Turkey, there has yet not been any adult numeracy national policy and curriculum supported by Ministry of Education. However, elementary level mathematics courses for adults are established in the second level literacy courses in People Education Centers and in Education Quarters. The aim of these courses is to give elementary level mathematical information, which can be matched by Entry Level 1 and 2 in international numeracy curriculums, to adults who have no mathematics background in formal education. All in all, numeracy, with its various definitions, different perspectives, and number of international policies, is a rapidly developing concept all around the world however it has not had sufficient visibility in Turkey yet.

Summary

In this literature review, the definitions to be used in the study are explained first. Moreover, the three perspectives of adult numeracy (i.e. mathematics of numeracy, numeracy and everyday life, literacy and numeracy) and a sub perspective (i.e. numeracy and citizenship) are analyzed. In the second part, four adult numeracy learning models (i.e. behaviorist model, constructivist model, absolutist and fallibilistic view of numeracy, and numeracy and cognition) are explained. Thirdly, related literature about educational and non-educational factors affecting adults' numeracy skills is summarized. These factors are gender, age, occupation, educational background, parents' educational background, and attitudes towards numeracy. In the last part, adult numeracy frameworks all around the world is overviewed. By the way, the national adult numeracy curriculums, international

survey results, and the national policies of most developed countries in adult numeracy field (i.e. Australia, England, Scotland, Ireland, Canada and the USA) are explained. Finally, the circumstances in the adult numeracy field in Turkey are analyzed. It is concluded that although there are huge number of works about adult numeracy field all around the world, in Turkey there is found a little restricted information about the concept of adult numeracy.

CHAPTER 3

METHODS and PROCEDURES

The purpose of this study is to investigate the level of numeracy skills of adults and the educational and non-educational factors related with the adult numeracy skills. Chapter one introduced the problem and presented the research questions. Chapter two presented a review of related literature to provide background and credence for the investigation. This chapter includes the design of the study, description of the population and the sample, description and adaptation of the instruments, the procedure of the study and the data collection, and analysis.

Design of the Study

According to Hara (1995), quantitative and qualitative research approaches in education have arisen from different research needs. The quantitative research approach endlessly pursues facts and it is used when the researcher desires to obtain entire trends or statistical truth in the research . Generally, quantitative research relies on deduction, moving from general to specific with goals of finding cause and effect relationships between variables (Frey, 2000). For the purpose of this study, which aims to search for patterns in data and for ideas that help explain why those patterns exist, quantitative method is chosen.

Bernard (2000) stressed that quantitative research methods are more than just numbers. A scientific research depends on two things; one of them is the nature of the question being asked and the other one is the methods that are being used. Furthermore, quantitative research methodologies include questionnaires, surveys,

participant observation, interviews, and content analysis. In this study, demographic surveys and questionnaires are used as instrumentation.

According to Creswell (2003), the purpose of the study, the nature of the problem and the appropriateness for the investigation, determines the type of design to use. These are four major types of quantitative designs: (a) descriptive, (b) correlational, (c) causal-comparative, and (d) experimental.

This study is a correlational type of study, which involves the search for relationships between variables through the use of various measures of statistical association (Ross, 2005). Correlational research involves the collection of two variables, usually both on the same individual. In this study, it is searched whether a number of variables (i.e. gender, age, educational factors, attitude toward numerical information) correlate with the variable of basic numeracy skills of adults. Moreover, the data collection techniques in this study involve surveys, questionnaires, and direct measurement, which are also the techniques of correlational research.

Population and Sampling

The target population of this study is adults who were living in Turkey between 2010-2011. Since legal voting age is set at 18 in Turkey and defines who is an adult, society members who are 18 and over 18 are considered as the target population in this study. The population includes male and female adults, from various socio-economic statuses, and educational and parental educational backgrounds. It is thought that diversity in the backgrounds of the population might also provide different attitudes toward numerical information.

The sampling adults were the participants of six Ismek course centers, which are

Sahrayıcedid, Kayışdağı, Kadıköy, Örnek Mahallesi, Fikirtepe, and Merdivenköy course centers, at the beginning of 2010-2011 course terms. These course centers were selected as the setting of the research among all Ismek course centers in Istanbul because of the fact that there were various styles and types of courses (e.g., technical, educational and art courses) in these centers. As a result, it was thought that the adults who participated in these courses come from various socioeconomic, educational, and parental educational backgrounds. All of the participants, excluded literacy course participants, of these course centers were taken as the sampling adults of the study. Since the time was the beginning of the course term, literacy course participants (N = 101) did not have any literacy knowledge yet and they were not enable to read the numeracy questions in the measuring instrument. Thus they were discarded from the study.

During the months of October and the beginning of November, the researcher went the six Ismek course centers in order to collect the data. In each course center, all the instructors were invited to the teacher's room and were informed by the researcher about data collection instruments. Through a two hour time period, from 10.00 am to 12.00 am, the three data collection instruments were given altogether to each Ismek course participants by course instructors. While, the instruments were applied by classroom instructors, the researcher visited each classroom and answered the participants' questions. Firstly, participants were required to answer the demographic information form in order to identify their educational and non-educational backgrounds. They were also given a questionnaire which contained 20 items in order to identify their attitudes toward numerical information using in daily life. As the last part, the participants were tested by basic numeracy skills Level-1

test, which contains 40 items and took one hour and fifteen minutes. The participants who got grade 0 in basic numeracy skills test were discarded from the study because they might not have had the requisite basic numeract concepts and skills. Although 738 course participants were reached through the data collection period, 12 of them did have grade 0 and 20 of them, from different types of courses, gave the instruments back and indicated not to desire to answer the data collection instruments. Hence, a total of 706 responses were received.

Demographic Data

The demographic data includes data on gender, the subjects' age groups by gender, the subjects' education level by gender, the subjects' education level by gender, and education level of parents' in terms of mothers and fathers of the sample.

The sample population (N = 706) consists of female (N = 494) and male (N = 212) course participants. The 70% of the participants in the sample are female and 30 % are male. Table 1. represents the data on gender.

Table 1. Data on Gender

Variable	Frequency	Percentage
Gender		
Female	494	70.0
Male	212	30.0
Total		706

Sampling adults' ages range from 18 to 83 as its range is 65. Approximately 18% of the participants are under 25 years old (N = 123). Approximately 33% of the participants are between the ages of 25 and 40 years (N = 210). Approximately 39% of the participants are reported that as being between the ages of 41 and 56 years

(N = 270) while approximately 10% of the participants are between the ages of 57 and 71 years (N = 83). More than 1% of the participants reported that they are over 71 years old (N = 8). The mean of the age is 40 (S.D. = 13.80). Table 2.represents the subjects' age groups by gender.

Table 2. The Subjects' Age Groups by Gender

Age Group	Gender					
	Female		Male		Total	
	f	*%*	*f*	*%*	*f*	*%*
Less than 25	79	16.1	44	21.6	123	17.7
25-40	147	30.0	63	30.9	48	32.4
41-56	210	42.9	60	29.4	79	38.9
57-71	49	10.0	34	16.7	41	9.8
72-	5	1.0	3	1.4	12	1.2
Missing	4		8		12	
Total	490	100	204	100	694	100

Approximately 4% of the population reported having either a graduate degree (N = 29), while 21% of the population reported having a undergraduate education (N = 148). Approximately 15% reported having a level of education that included vocational school, two year university or Open University (N = 103). Overall, approximately 33% of the population reported having high school education (N = 229), while approximately 29% percent of the population reported having secondary education or less (N = 190). Table 3. represents the The subjects' education level by gender.

Table 3. The Subjects' Education Level by Gender

Education	Gender					
	Female		Male		Total	
	f	*%*	*f*	*%*	*f*	*%*
Primary School	79	16.0	26	12.6	105	14.9
Secondary School	63	12.9	22	10.7	85	12.0
High School	175	35.6	54	26.2	229	32.4
Open University	40	8.1	18	8.7	58	8.2
Vocational / Two year Unv	34	6.9	11	5.3	45	6.4
Undergraduate	90	18.3	58	28.1	148	21.0
Graduate	11	2.2	18	8.4	29	4.1
Missing	1		6		7	
Total	493	100	206	100	699	100

Sampling adults reported that approximately 4% percent of their mothers graduated from higher education (N = 29), approximately 12% percent of the mothers graduated from high school (N = 86), 59% of them graduated from secondary school or less (N = 415), while, approximately 23% percent have no school education (N = 163).

Sampling adults reported that approximately 11% percent of their fathers graduated from higher education (N = 87), approximately 18% percent of the fathers graduated from high school (N = 129), 58% of them graduated from secondary school or less (N = 410), while approximately 9% percent have no school education (N = 64). Table 4. represents education level of the parents' of the samples.

Table 4. Education Level of Parents' of the Sample

Education	Parents			
	Female		Male	
	f	%	*f*	%
No School	163	23.1	64	9.1
Primary School	335	47.5	308	43.6
Secondary School	80	11.3	102	14.4
High School	86	12.2	129	18.3
Undergraduate	25	3.5	75	10.6
Graduate	4	0.6	12	1.7
Missing	13		16	
Total	693	100	690	100

Data Collection Instruments

Three instruments were used for this study. The first instrument is demographic information form (Appendix A). The second instrument is Preference for Numerical Information Scale (PNI) (Appendix B) (Sayısal Bilgi Kullanımında Kişisel Tercih Ölçeği) (SBKTC), which measures the participants' attitudes toward numerical information using in daily life (Appendix C). The third instrument is Key Skills Application of Number Adult Numeracy Level-1 Test Paper (Appendix D) (Yetişkinlerde Temel Matematik Okuryazarlığı Becerileri Uygulama Soruları) (YTMOB), which is used for testing basic numeracy skills of the participants (Appendix E).

The following sections present the process of developing demographic information form and adaptation of SBKTC and YTMOB instruments including procedures for assuring validity and reliability of these two instruments and information about each instrument.

Demographic Information Form

First part of the data collection instruments is the questionnaire for the demographic characterisics of the participants. Demographic information form of this study was being developed by the researcher. The development of the demographic information form was completed in three steps: First, items were selected from available instruments or developed on the basis of the literature. Next, the draft instrument was examined by experts working in this field. Finally, an interview was conducted with ten adults from different age groups and different educational backgrounds to determine whether the respondent comprehended the questions as intended and to test the clarity of items. Demographic information form includes the following questions: gender, age, occupation, educational level, type of high school, department of high school, faculty of university, and educational status of the parents.

Differences in Preference for Numerical Information Scale

(*Sayısal Bilgi Kullanımında Kişisel Tercih Ölçeği (SBKTC)*)

Sayısal Bilgi Kullanımında Kişisel Tercih Ölçeği (SBKTC) is adapted from Individual Differences in Preference for Numerical Information Scale (PNI) by Madhubalan Viswanathan (1993). The PNI is defined as a preference toward using numerical information. Firstly, the focus is on preference rather than on ability because the aim is to focus on attitude toward numerical information. Secondly, the focus is on numerical information rather than on such domains as statistics or mathematics. Thirdly, the PNI is conceptualized as a broad construct that is relevant

in a variety of settings by using a general context rather than a specific context, such as an academic setting (Viswanathan, 1993).

The items were generated for the PNI scale with an operationalization of the definition of the construct. The domain of the construct was operationalized by using terms that represent numerical information, such as numbers, numerical information, and quantitative information. The PNI was operationalized using a diverse set of elements, such as the extent to which people enjoy using numerical information, liking for numerical information, and perceived need for numerical information. Other aspects included usefulness, importance, perceived relevance, satisfaction, and attention or interest.

A pool of 35 items was generated in the form of statements that could be agreed with or disagreed with to varying degrees. Twenty items were chosen from this pool and inspected in terms of content for coverage of these different aspects, usage of different terms to represent numerical information, and generality of context. The items were also chosen that half of the items are worded in a positive direction and half in a negative direction. Responses are obtained on a Likert-type scale from strongly disagree (1) to strongly agree (7)

In adapting the SBKTC from the PNI, the researcher followed the formalities and procedures adopted in framing a research questionnaire.The adaptation of the instrument were completed in four steps. In the first step of the adaptation of the SBKTC from the PNI, the researcher reviewed the related literature. Secondly, the draft instrument was examined by six experts from the field of adult education and mathematics education. As a result, necessary changes to the language of the items were made. Besides, some of the experts explained that seven responsed Likert-type

scale might have been confusing for the participants who were coming from various educational backgrounds. As a result, it was decided to use five responsed Likert-type scale (from strongly disagree (1) to strongly agree (5)) instead of the seven responsed original one. In the third step, an interview was conducted with four adults from different age groups and different educational backgrounds to determine whether the respondent comprehended the questions as intended and to test the clarity of items. Finally, a pilot study was conducted in order to establish validity and reliability of the instrument. After reliability and validity analysis, necessary changes and adjustments to the instrument, which will be explained in detail in pilot study section, were made.

Key Skills Application of Number Adult Numeracy Level–1 Test Paper

(Yetişkinlerde Temel Matematik Okuryazarlığı Becerileri Uygulama Soruları (YTMOB))

Yetişkinlerde Temel Matematik Okuryazarlığı Becerileri Uygulama Soruları (YTMOB) was translated from Key Skills Application of Number Adult Numeracy Level–1 Test Paper. The test, which is a paper-and-pencil test, was constructed by Qualifications and Curriculum Authority [QCA] * to provide a measure of basic numeracy skills of adult population in Great Britain in 2005.

* Qualifications and Curriculum Authority [QCA]] is an executive non-departmental public body of the Department for Children, Schools and Families, and Department of Adult Education in the United Kingdom. In England, [QCA] maintains and develops the National Curriculum and associated assessments, tests and examinations, advising the Secretary of State for Children, Schools and Families, and Adults.

Each question is followed by four possible answers. The participant was required to select the one correct answer from the choices given. There are 40 questions to be completed in one hour and 15 minutes. Each question is awarded one mark. Participants were not allowed to use calculators. The test was designed to have a pass mark in the range 22 – 30 marks out of 40.

The nature of the Key Skills Application of Number Adult Numeracy Level–1 Test is a multiple-choice test. The test was made up of groups of questions based around different scenarios together with some free-standing questions.

The test contains problems in whole numbers, fractions, decimals, percentages, common measures, shapes and space, and data and statistical measures.As a basic skills test, it simply determines whether or not adult participants possess the knowledge and skills to understand, use, calculate, and manipulate the numerical information in daily life. Each item represents the objectives of National Standards for Adult Numeracy Level–1 (Table 5.), which is accepted as Adult Numeracy Core Curriculum in Australia, United Knigdom, USA, Netherland, and Canada (‘‘NALA’’, 2003, para.21.).

The translation of theYTMOB from Key Skills Application of Number Adult Numeracy Level–1 Test was completed in four steps. First items were translated from the original instrument. Next, the draft instrument was examined by four mathematics teachers. As a result, necessary changes to the language of the items were made. Then, the test was applied to ten adults from different educational backgrounds to determine whether the respondent comprehended the questions as intended and to test the clarity of items. After their comments, the necessary vocabulary changes were made.

Table 5. Objectives Represented Each Item on YTMOB

ITEMS	OBJECTIVES
Item 1 - Item 12 - Item 15 - Item 36	1) To work out simple ratio and direct proportion
Item 2	2) To chose and use appropriate units and instruments to measure lenght,
Item 3	3) To chose and use appropriate units and instruments to measure time and temperature,eg distances in road maps, scales to the nearest labelled division
Item 4	4) To read, measure and record time in common date formats and in the 12-hour and 24-hour clock
Item 5 - Item 10 - Item 19 - Item 37	5) To identfy appropriate methods that best match the practical situation
Item 6 & Item 30	6) To find simple percentage parts of qualities and measurements
Item 7 - Item 22 - Item 39 - Item 40	7) To add, subtract, multiply, divide and record sums of money and record, eg competing financial transactions, calculating benefits
Item 8 - Item 27 - Item 28	8) To approximate by rounding to a whole number or two decimal places,
Item 9	9) To chose and use appropriate units and instruments to measure capacity
Item 11 - Item 33	10) To recognize equivalencies between common fractions, percentages and decimals, and use these to find part of whole number of quantities
Item 13	11) To use tables, charts, diagrams and line graphs to present results
Item 14	12) To work out simple volume
Item 16	13) To add, subtract, multiply, divide using efficient written methods
Item 17 - Item 29	14) To read, write, order, and compare numbers, including large numbers
Item 18 - Item 35	15) To use information from tables, diagrams, charts and line graphs
Item 20	16) To find parts of whole number quantities or measurements
Item 21	17) To work out the area of rectangles
Item 23	18) To collect and record discrete data in tests and from observations
Item 24	19) To select and use suitable methods and forms to present and describe outcomes
Item 25 - Item 38	20) To find the arithmetical average (mean)
Item 26	21) To find parts of whole number quantities or measurements
Item 31	22) To approximate by rounding
Item 32	23) To extract and interpret inormation in tables, diagrams, charts and line graphs
Item 34	24) To find the range for a set of data

Finally, a pilot study was conducted in order to establish reliability of the instrument. After reliability analysis, necessary changes and adjustments to the instrument, which explained in detail in pilot study section, were made.

Pilot Study

The purpose of the pilot study was to test and revise the instruments. The SBKTC and the YTMOB instruments were checked for reliability and validity for diagnosing poor and inadequate items. The participants in the pilot study were also encouraged to make comments and suggestions concerning the demographic information form and the two instruments. The pilot study was conducted with 106 adults registered the handicraft, painting, diction, and English course classes in Sahrayıcedid İsmek Course Center. This was a convenience sample because the participants represented a big age range from 18 to 80 and they represented various educational background and daily life experiences.

In the pilot study, the content validity of the SBKTC and the YTMOB instruments, the construct validity of the SBKTC, and the internal consistency reliability of the two instruments were examined.

For the content validity, the feedback received from the participants was given particular attention with respect to refining both of the instruments. None of the participants, except one, stated any suggestions and negative comments about the items on the scales.

However, one participant commended on particularly item 32 in the YTMOB instrument, which was he said that there was a missing part about what was required in the question. Because this item was also found problematic based on his

comments, the sentence ‘‘which one of the followings is right?’’ was added at the end of the item. Yet the item was not found problematic according to reliability analyses so it was not eliminated from the scale.

Construct validity of the SBKTC was assessed by using factor analysis procedures. It was found that the items were not inconsistent enough to require discarding. Allowing the small sample size, none of the items were discarded based on these findings.

The reliability for the SBKTC was calculated as 0.89, indicating a very good reliability, based on N of 20. Through the reliability analysis of the original form of the scale (PNI), Viswanathan found the coefficient alpha of the scale as 0.91. and found the corrected item total correlation within the range from 0.43 to 0.82 (1993). Since the coefficient alpha of the SBKTC is 0.89 and the corrected item total correlation is within the range from 0.30 to 0.72, the reliability analysis of the SBKTC and the original form of it have corresponding results. Thus, none of the items in the SBKTC scale was found problematic through both factor analysis and reliability analysis processes. Therefore, there was not any need to consider eliminating any items.

The reliability for the YMTOB was calculated as 0.94, indicating a very good reliability, based on N of 40. Through item analyses results, it was observed that Item 4’s (0.15), and Item 34’s (0.08) corrected item-total correlation values were very close to zero, which suggested that Item 4 and Item 34 are inconsistent with total test scores in general. Although Item 4’s (D = 0.24) and Item 34’s (D = 0.06) discrimination index were greater than zero, these values were relatively low. However, the test’s reliability would not change if Item 4 and Item 34 removed from

the scale, which is inconsistent with the previous results that demonstrated Item 4's and Item 34's inconsistency with the other items. Since only a study of the content of Item 4 and Item 34 can diagnose the reason for the failure of these items, the scale was reassessed by content experts' suggestions.

Item 4 and Item 34 were not removed as a result of experts' suggestions. One of the rationales for this decision was that both items implied unique objectives of National Standards for Adult Numeracy Level–1. Item 4 is the only item that expresses the objective ''to read, measure and record time in common date formats and in the 12-hour and 24-hour clock'' in the scale. Similarly, Item 34 is the only one that expresses the objective ''to find the range for a set of data'' in the scale. Besides, one of the experts indicated that the source of the problem about Item 4 might have related to the clock pictures. Since there were middle aged adults among the participants, they might have had difficulty about reading the clock without having numbers. Experts suggested modifying Item 4 as showing the time in a digital clock form instead of showing the time in the form of clock pictures.

In Item 34, it was asked to find the range for a data. ''Range for a data'' was an unfamiliar term for the adults, which was understood from the feedbacks of the participants during the pilot study. Besides, ''finding range for a data'' was included in the primary mathematics education curriculum just a few years ago. Since finding range for a data is one of the objectives of National Standards for Adult Numeracy Level–1, it was not be able to exclude from the scale. Since item difficulty index value ($p= 0.10$) is very close to zero, which means that it is a very difficult item, the unfamiliarness of the objective was supported. Since one of the research questions of the study was examining the level of numeracy skills of adults in Turkey according

to NCTM Adult Numeracy Standards, experts indicated that Item 34 should not have been modified and removed from the scale.

Validity and Reliability of the Instruments After Actual Data Collection

In the instrument evaluation process, reliability and validity are the most significant considerations. Reliability refers to the internal consistency of a measure and validity is the extent to which an instrument measures what is intended to measure (Popham, 2007). In this study, the content validity of the SBKTC and the YTMOB instruments, the construct validity of the SBKTC, and the internal consistency reliability of the two instruments were examined.

Content validity of the two instruments was assessed during the pilot study, which was explained in detail in pilot study section.

Construct validity of the SBKTC was assessed by using factor analysis procedures. Factor analysis is a method of data reduction. It does this by seeking underlying unobservable variables that are reflected in the observed variables. Factor analysis is used to ensure that the questions asked relate to the construct that you intend to measure (Field, 2005a). When conducting a factor analysis, the first thing is to look at the inter-correlation between variables. If the test items measure the same underlying dimensions then these items are expected to correlate with each other because they are measuring the same thing. Besides, the opposite problem occurs when variables correlate each other too highly. Extreme multicollinearity, which means variable is very highly correlated, and singularity, which means variables that are perfectly correlated, is a problem for factor analysis. The

correlation between variables can be checked by creating a correlation matrix of all variables.

In this study, the factor analysis used the extraction method of maximum likelihood and the determinant of the R-matrix (Appendix G) was checked in order to examine multicollinearity and singularity problems if they exist. The top of the table (Appendix G) contains Pearson correlation coefficient between all pairs of items whereas the bottom half contains the one-tailed significance of these coefficients. Firstly, significance values, which the majority of the values should be smaller than 0.05, were examined. Then, the correlation coefficients, which should be smaller than 0.9, were checked. Since majority of the significance values are smaller than 0.05 and the correlation coefficients are smaller than 0.9, there is not singularity problem in the data. Furthermore, the determinant of the R- matrix was checked and its value was found as 7,57 E – 005 (which is 0.0007570), which is greater than the necessary value of 0.00001. Therefore, multicollinearity is not a problem for these data. To sum up, all questions in the SBKTC correlate fairly well and none of the correlation coefficients are particularly large. Therefore, there was no need to consider eliminating any items at this stage.

KMO and Bartlett's test of sphericity produces the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test (Field, 2005b). The value of KMO should be greater than 0.5 if the sample is adequate. The KMO statistic varies between 0 and 1. A value of 0 indicates that the sum of partial correlations, indicating diffusion in the pattern of correlations. A value close to 1 indicates that patterns of correlations are relatively compact and so factor analysis should yield distinct and reliable factors. Kaiser (1974) recommends accepting values greater than 0.5 as acceptable.

Furthermore, values between 0.5 and 0.7 are mediocre, values between 0.7 and 0.8 are good, values between 0.8 and 0.9 are great and values above 0.9 are superb (Kaiser, 1974). For these data, the value is 0.929 (Appendix G), which falls into the range of superb; so it is confident that factor analysis is appropriate for these data.

Bartlett's measure tests the null hypothesis that the original correlation matrix is an identity matrix. For factor analysis to work, it is needed some relationships between variables and if the R-matrix were an identity matrix then all correlation coefficients would be zero. A significance test tells that the R-matrix is not an identity matrix; therefore there are some relationships between the variables in the analysis. For these data, Bartlett's test is highly significant ($p < 0.001$) (Appendix G), and therefore factor analysis is appropriate.

Through the factor extraction process, table of Total Variance Explained (Table 6.) was constructed. In the table, the eigenvalues associated with each linear factor before and after extraction were listed. Before extraction, 20 linear components within the data set were identified in Table 6. since there should be as many eigenvectors as there are variables. The eigenvalues associated with each factor represent the variance explained by that particular linear component. In Table 6., the eigenvalue in terms of the percentage of variance is explained. The first factor explaines relatively large amounts of variance (factor 1 explaines 38.677 % of total variance) whereas subsequent factors explain only small amounts of variance.

Table 6. The Eigenvalue in Terms of the Percentage of Variance

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7,735	38,677	38,677	7,735	38,267	38,267
2	2,124	10,618	49,295			
3	1,226	6,13	55,426			
4	0,997	4,985	60,411			
5	0,807	4,036	64,447			
6	0,783	3,917	68,363			
7	0,715	3,573	71,936			
8	0,659	3,294	75,23			
9	0,64	3,202	78,432			
10	0,587	2,933	81,365			
11	0,541	2,703	84,068			
12	0,499	2,494	86,562			
13	0,468	2,34	88,902			
14	0,411	2,055	90,956			
15	0,392	1,958	92,915			
16	0,362	1,811	94,725			
17	0,341	1,704	96,429			
18	0,246	1,231	97,66			
19	0,245	1,227	98,887			
20	0,223	1,113	100			

Extraction Method: Maximum Likelihood.

There are a number of methods to determine the optimal number of factors by examining the data. Through the construct validity analysis of the original form of the scale (PNI), Viswanathan, who is the developer of the PNI, implied that most of the items were tapping one dominant factor (1993). He said that a scree test suggested a dominant first factor (ratio of eigenvalues of the first factor to the second factor is 6.53). Therefore number of factors section was chosen as 1 through the extraction analysis in this study. As a result, after extraction SPSS leaves with one factor.

The Scree Test states that the eigenvalues of the correlation matrix should be plotted in descending order, and then a number of factors are used, which are equal

to the number of eigenvalues that occur prior to the last major drop in eigenvalue magnitude (DeCoster, 1998).

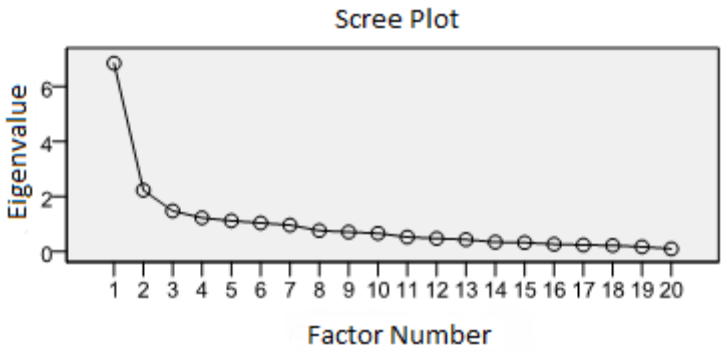


Figure 1. Scree Plot

The scree plot is shown in Figure 3.1. indicating the point of inflaction on the curve. It is seen that the curve makes a sharp drop at one point and the value in the first column of the table immediately above. From the second factor, the line is almost flat, meaning the each successive factor is accounting for smaller and smaller amounts of the total variance. Therefore, retaining only one factor is probably justified.

In Table 7., Factor Matrix, which displays the factor loadings of all variables on each factor, is seen. Factors are presented as columns and the variables are presented as rows. Factor loading represents correlation between a variable and a factor, and the key to understanding the nature of a particular factor.

Table 7. Unrotated Factor Loading

Factor Matrix[a]

	Factor
	1
SBKTC10	0,758
SBKTC1	0,743
SBKTC11	0,734
SBKTC13	0,71
SBKTC4	0,702
SBKTC20	0,692
SBKTC16	0,656
SBKTC8	0,611
SBKTC17	0,605
SBKTC18	0,55
SBKTC7	0,544
SBKTC19	0,538
SBKTC6	0,517
SBKTC2	0,512
SBKTC3	0,509
SBKTC9	0,509
SBKTC15	0,426
SBKTC14	0,419
SBKTC12	0,328
SBKTC5	0,321

This table contains the unrotated factor loadings. Because these are correlations, possible values range from -1 to +1. However, it is seen that none of the correlations are less than 0.30., which makes the output probably meaningful.

In usual factor analysis procedures, the interpretability of factors can be improved through rotation, which is a process that maximizes the loading of each variable on one of the extracted factors while minimizing the loading on all other factors (Field, 2005b). Since only one factor was extracted, the solution could not be rotated in this data analysis process.

In summary, none of the items was inconsistent enough to require discarding. Thus, none of the items was discarded based on these findings. In addition, these items were strongly supported by the content validity analysis.

The reliability is as the degree to which test scores are free from errors of measurement (Linacre, 1999). Reliability of the SBKTC was established using Cronbach's Coefficient Alpha (internal consistency estimates) along with item. Cronbach's Coefficient Alpha was used as a measure of internal consistency. Item total correlations and estimates of Cronbach's alpha based on possible item deletion were also calculated in the scale.

The reliability for the SBKTC was calculated as 0.91, indicating a very good reliability, based on N of 20. The item total correlations, if item deleted, are summarized in Table 8. A value of Cronbach's Alpha for each item on the scale is displayed in the table. It shows what the value of alpha would be if that particular item were deleted.

If the scale is reliable, it is not expected that any one item will greatly affect the overall reliability, which means that none of the items should cause a substential decrease in alpha. If it does, it means that there is a serious cause for concern and that item should be dropped from the scale.

In Table 8., the values in the column labeled Corrected Item-Total Correlation are the correlations between each item and the total score from the scale. In a reliable scale, all items should correlate with the total. If any of these values are less than about 0.3, it means that a particular item does not correlate very well with the scale overall. For these data, none of the data have item-total correlations less than 0.3, which means that there is no need any of the items to be dropped.

Table 8. Item-Total Correlation Coefficients and Cronbach's Alphas for the SBKTC Scale

Item	Corrected Item-total correlation	Alpha if item deleted
SBKTC 1	0.73	0.91
SBKTC 2	0.54	0.91
SBKTC 3	0.49	0.91
SBKTC 4	0.67	0.91
SBKTC 5	0.38	0.91
SBKTC 6	0.48	0.91
SBKTC 7	0.57	0.91
SBKTC 8	0.64	0.91
SBKTC 9	0.52	0.91
SBKTC 10	0.73	0.91
SBKTC 11	0.69	0.91
SBKTC 12	0.35	0.91
SBKTC 13	0.65	0.91
SBKTC 14	0.42	0.91
SBKTC 15	0.45	0.91
SBKTC 16	0.60	0.91
SBKTC 17	0.63	0.91
SBKTC 18	0.55	0.91
SBKTC 19	0.48	0.91
SBKTC 20	0.64	0.91
Alpha = 0.91		
N = 20		

The values in the column labeled Alpha if item deleted are the values of the overall alpha if that item is not included in the calculation. In other words, they reflect the change in Cronbach's alpha that would be seen if a particular item deleted. Since the overall alpha is 0.91, all values in the column should be around that same value. In these data, the values of alpha greater than the overall alpha were examined because of the fact that if the deletion of an item increases Cronbach's alpha, it means that the deletion of that item improves reliability. It was displayed that none of the items in the SBKTC would affect reliability if they were deleted. As a result, all the values reflect a good degree of reliability.

Since the coefficient alpha of the SBKTC is 0.91 and the corected item total correlation is within the range from 0.35 to 0.73, none of the items in the SBKTC scale was found problematic through reliability analysis processes.

Reliability of the YTMOB scale was established using Kuder-Richardson Formula 20 (K-R 20) along with item. K-R 20 is an alternative formula for calculating how consistent subject responses are among the questions on an instrument. In order to use K-R 20, items on the instrument must be dichotomously scored (0 for incorrect and 1 for correct). All items are compared with each other, rather than half of the items with the other half of the items. It can be shown mathematically that the Kuder-Richardson reliability coefficient is actually the mean of all split-half coefficients resulting from different splittings of a test (Ross, 2005). Kuder-Richardson Formula 21 (K-R 21) assumes that all of the questions are equally difficult while K-R 20 does not assume and that is why K-R 20 was preffered instead of using K-R 21.

Since SPSS (17.01) does not have calculation tool for K-R 20, it was calculated by a specially prepared K-R 20 calculator in an excel sheet. The reliability for the YMTOB was calculated as 0.94, indicating a very good reliability, based on N of 40. Although Cronbach's alpha is usually used for scores which fall along a continuum, it will produce the same results as KR–20 with dichotomous data (0 or 1). As a result, Cronbach’s Alpha, item total correlations, and estimates of Cronbach’s alpha based on possible item deletion were also calculated in the scale. Cronbach’s alpha was calculated as 0.94, which is the same value with the one calculated by K-R 20. Besides, the item total correlations, if item deleted, and the value of Cronbach’s Alpha for each item on the scale are displayed in Table 9.

In the column labelled Alpha if item deleted, it is seen that all values in the column are around that same value of coefficient alpha, which is 0.94. In these data, none of the values of alpha greater than the overall alpha, this means that none of the items in the YTMOB would affect reliability if they were deleted. Therefore, there was not any need to consider eliminating any items at this stage.

However, there are a few suspicious items that are stand out in the column labelled Corrected Item-Total Correlation. If any of the item correlations are less than about 0.3, it means that a particular item does not correlate very well with the scale overall in a reliable scale. For these data, it is seen that Corrected Item-Total Correlation of Item 34 (which is 0.03) are less than 0.3. The item was identified as problematic one yet it was not thought to be dropped before item analysis procedures. Item analysis provides information regarding the item discrimination and the item difficulty.

Table 9. Item Total Correlation Coefficients and Cronbach's Alphas for the YTMOB Scale

Item	Corrected Item-total correlation	Alpha if item deleted
YMTOB 1	0.41	0.94
YMTOB 2	0.40	0.94
YMTOB 3	0.50	0.94
YMTOB 4	0.40	0.94
YMTOB 5	0.40	0.94
YMTOB 6	0.50	0.94
YMTOB 7	0.50	0.94
YMTOB 8	0.37	0.94
YMTOB 9	0.45	0.94
YMTOB 10	0.54	0.94
YMTOB 11	0.52	0.94
YMTOB 12	0.52	0.94
YMTOB 13	0.37	0.94
YMTOB 14	0.52	0.94
YMTOB 15	0.50	0.94
YMTOB 16	0.57	0.94
YMTOB 17	0.61	0.94
YMTOB 18	0.57	0.94
YMTOB 19	0.53	0.94
YMTOB 20	0.61	0.94
YMTOB 21	0.57	0.94
YMTOB 22	0.62	0.94
YMTOB 23	0.61	0.94
YMTOB 24	0.42	0.94
YMTOB 25	0.66	0.94
YMTOB 26	0.67	0.94
YMTOB 27	0.32	0.94
YMTOB 28	0.57	0.94
YMTOB 29	0.63	0.94
YMTOB 30	0.64	0.94
YMTOB 31	0.52	0.94
YMTOB 32	0.59	0.94
YMTOB 33	0.63	0.94
YMTOB 34	0.03	0.94
YMTOB 35	0.52	0.94
YMTOB 36	0.60	0.94
YMTOB 37	0.66	0.94
YMTOB 38	0.54	0.94
YMTOB 39	0.60	0.94
YMTOB 40	0.58	0.94
Alpha = 0.94		

N = 40

Item discrimination is the degree to which an item differentiates people who score high on the total test from those who score low on the total test (Hopkins, 1998). From the perspective of reliability, items that have high discrimination values are preffered over those that have low discrimination values. Because high item discrimination indicates that the item is consistent with the test as a whole, which is a desirable characteristic.

There are various ways of operationalying an item's discrimination. What we chose for these data is that after the test has been given, it was scored and 706 papers were ordered by score, placing the one with the highest score on top and continuing sequentially until the one with the lowest score. Then, the highest third of the test was taken as the high group and the lowest third of the test was taken as the low group.

Since the sample of the study consists of 706 participants; 255 participants, who had the score 31 and more than 31 over 40 were taken as the high group, and 233 participants, who had the score 19 and less than 19 over 40 were taken as the low goup. Then, the proportion of in the high group (pH), answering a particular item correctly by dividing the number of correct answers for the high group by 255 and the proportion of in the low group (pL), answering a particular item correctly by dividing the number of correct answers for the low group by 233 were determined. In order to obtain the measure of item discrimination (D), pL was subtracted from pH.

Item discrimination index values are relevant for describing the contribution of an item to a test's reliability. Items with zero or negative D-values may have been miskeyed inadvertently. In Table 3.6. a guideline for interpreting item discrimination

index values are displayed when the number of participants is at least 30 (Hopkins, 1998).

Table 10. Item Discrimination Index Values

Index of Discrimination	Item Discrimination Evaluation
0.40 and up	Excellent discrimination
0.30 to 0.39	Good discrimination
0.10 to 0.29	Fair discrimination
0.01 to 0.10	Poor discrimination
Negative	Item may be miskeyed or intrinsically

Based on this item discrimination index values, none of the items in the YTMOB has negative discrimination index values. However, there are thirty four items representing excellent discrimination, four items representing good discrimination, one items representing fair discrimination, and 1 item representing poor discrimination.(Appendix H). According to the results, Item 1 (D = 0.26) has fair discrimination, while Item 34 (D = 0.02) has poor discrimination. Item 4 had been also found suspicious through Corrected Item-Total Correlation analysis. After the item difficulty analysis, decision about whether to drop the item or not was made by the researcher a statistics expert.

Item difficulty is the percent of the group tested that answered the item correctly (Hopkins, 1998). If every participant answers an item in the same way, then the item will not have any variability. If an item has not any variability, then it means that it is a poor test item, from a reliability perspective. Thus, items that have extreme item difficulty index (i.e., either very high or very low) are likely to have limited variability.

Item difficulty index (p) that is the proportion of the total group that answered the item correctly is obtained by taking the average pH and pL. The maximum measurement of individual differences by an item is at a maximum when the item difficulty level is 0.5 that is, when only one-half of the participants are able to answer the item correctly. Thus, there is little opportunity for an item to assess individual differences if the item is very easy or extremely difficult.

In this study, item difficulty index was categorized as five that are equal intervals from very easy to very difficult. In Table 11., a guideline for interpreting item difficulty index values are displayed.

Based on this item difficulty index values, the value of Item 1 is 0.87, which tells that 87% of the participants answered Item 1 correctly, which makes it a very easy item. In contrast, the item difficulty index value of Item 34 is 0.12, which tells that only 12% of the participants answered Item 34 correctly, which makes it a very difficult item. Thus, there are 2 very easy items, 22 easy items, 14 medium items, 1 difficult item, and 1 very difficult item in the YTMOB test instrument (Appendix H).

Table 11. Item Difficulty Index Values

Index of Difficulty	Item Discrimination Evaluation
0.80 and up	Very Easy
0.80 to 0.60	Easy
0.60 to 0.40	Medium
0.40 to 0.20	Difficult
0.20 to 0.00	Very Difficult

According to the reliability analysis and item analyses results, it was observed that Item 34's (0.03) corrected item-total correlation values were very close to zero, which consists the results of pilot study about Item 34. Although Item 1's (D = 0.26)

and Item 34's (D = 0.06) discrimination index were greater than zero, these values were relatively low. The result of low discrimination value of Item 1 could be explained by item difficulty. Since it was found as very easy item (p = 0.87), its low discrimination value was an expected result.

Item 34 was not removed from the scale. One of the rationale for this decision was, as explained in pilot study section, that the item implied one of the unique objectives of National Standards for Adult Numeracy Level–1. Item 34 is the only one that expresses the objective ‘‘to find the range for a set of data’’ in the scale. ‘‘Finding range for a data’’ was included in the primary mathematics education curriculum just a few years ago and range might an unfamiliar term for adults who never learn what it means in formal education. Since finding range for a data is one of the objectives of National Standards for Adult Numeracy Level–1, it was not be able to exclude from the scale. Since item difficulty index value (p= 0.12) is very close to zero, which means that it is a very difficult item, the unfamiliarness of the objective was supported.

Procedures

The data collection instruments package including the cover page (Appendix F), the demographic information form, the SBKTC questionnaire, and the YTMOB test instruments are distributed 738 course participants. Twelve of them have grade 0 and discarded from the study, and twenty of them give the instruments back and indicate not to desire to answer the data collection instruments. Thus, it is received for a total of 706 responses. For follow-up purposes, an identification number will be placed on the cover page. The cover page included the purpose of the study, description of the

study, why the adult participant is selected to be a respondent, and assurance of confidentiality. Furthermore, before starting, the participants are informed about the three instruments in orally by the classroom instructors. Testing takes place in the regular classroom setting in six Ismek course centers, which are Sahrayıcedid, Kayışdağı, Kadıköy, Örnek Mahallesi, Fikirtepe, and Merdivenköy course centers, at the beginning of 2010-2011 course term. The reason for choosing these settings is that there are various styles and types of courses in these centers which provide sample variety in the study. Data collection procedures are two hours totally in length, from 10.00 am to 12.00 am.

The data was collected within two weeks of October and one week at the beginning of November in 2010. Before data collection process, the researcher informed all classroom instructors, who distributed the instruments to the adult participants in their classrooms, about the aim of the study and the application of the instruments. While, the instruments were applied by classroom instructors, the researcher visited each classroom and answers the participants' questions.

Analysis of Data

This study used both descriptive and inferential statistics in the analysis of the data. The preliminary analysis from the pilot study determined that the statistical analysis proposed for this study was appropriate. These analyses were conducted by using statistical analysis software, SPSS version 17.0.

Before conducting the regression analysis, descriptive analysis of the data was performed exploring any patterns in the data and identifying anomalies in the data thatnwere present (Cohen, West & Aiken, 2003). The mean, median, standard

deviation and variance for each variable was calculated. A frequency distribution looking at normality of the data with analysis of the skewness and the kurtosis of the distributions for each variable was run (Field, 2005b). High and low values and the percent of missing values were computed and graphic displays of the descriptive data were produced with histograms.

After the descriptive analysis was done, the correlation analyses of the variables were done to examine the relationships between the variables. Correlation analysis between the demographic variables, numerical attitude, and the independent variable were computed by calculating Pearson product moment correlations for each pairing of variables. A correlation matrix including correlations for each pairing of variables was produced because ‘‘it provides considerable information on the direction and magnitude if the linear relationships among the variables’’ (Cohen et al., 2003, p. 115). Then scatterplots were examined for possible nonlinear relationships between two variables (Cohen et al., 2003, p. 115). The degree of multicollinearity of the variables was also evaluated. It was found that neither nonlinearity nor multicollinearity were a problem.

In the multiple linear regression analysis part, assumptions for proper regression analysis were checked. Field (2005b) described the assumptions necessary to conduct regression analysis (pp. 169-170). One of the assumptions is that no predictor's variance should be zero. This assumption was met by descriptive analysis. Another assumption, which is that there should be no perfect multicollinearity between variables, was also met. Inspection of the correlation matrix of variables showed no correlations above .80 and VIF (variance inflation factor) of all explanatory variables

are below 10. Thus there was no evidence of multicollinearity among the predictor variables entered for regression analysis.

The assumptions about independent errors and independence of the outcome variable were confirmed by Durbin-Watson test that check autocorrelation. Its value was found as 2.20, which is an acceptable limit for confirming this assumption. Since Field (2005b, p.170) states that each value of the outcome variable comes from a separate entity, there was no problem with autocorrelation in this study.

Three assumptions mentioned were verified by analysis of plots and graphs produced after the regression analysis. The homoscedasicity of variance assumption was confirmed by analysis of the scatter plot produced by SPSS, showing the regressions standardized residuals plotted against the regressions standardized predicted values. Data are homoscedastic if the residuals plot is the same width for all values of the predicted dependent variables (Field 2005 b). Since the residual plot is rectangular, with a concentration of points along the center in this analysis, the homoscedasicity assumption was confirmed. The linearity assumption was also acceptable as there was no indication of any curvature in the pattern of dots in the scatter plot.

According to Field (2005b), any curve in the dots would have indicated a possible lack of linearity. The assumption of normally distributed error was also met as the histogram of regression standardized residuals showed a normal plot of residuals with only a few outliers at the lower values. (Field, 2005b, pp. 204-205). The assumptions for regression were met for the sample. Since all assumptions were met, it was deemed appropriate to conduct the regression analysis.

The standard multiple regression analysis was used in order to indicate the strength of the relationship between the predictive variables and the criterion variable in this study. Multiple regression is a statistical technique that is based on Pearson correlation coefficients both between each predictor variable and the criterion variable, and also among the predictor variables themselves. The advantage of the multiple regression approach is that it allows the researcher to consider how all of the predictor variables together relate to the outcome variable (Strangor, 2007). Demographic informations (i.e., gender, age, educational bakground, and parental educational background) and numerical attitute were selected as predictive (i.e., independent) variables for the multiple regression analysis. The criterion (i.e., dependent) variable is numeracy scores. Gender and educational background predictive variables were entered as five dummy variables in the multiple regression analysis.

The multiple regression analysis was depicted and computed with the following equation:

$$Y = €+ \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \beta5X5 + \beta6X6 + \beta7X7 + \beta8X8+ \beta9X9$$

In this equation, ‘‘Y’’ represents the samples’ numeracy scores, the β's are the regression coefficients, representing the amount the dependent variable, numeracy scores ,changes when the corresponding independent changes 1 unit. ‘‘X2’’ represents age, ‘‘X3’’ represents mother education, ‘‘X4’’ represents father education, and ‘‘X5’’ represents the samples numeracy attitude scores on respect SBKTC scale while ‘‘X1, X6, X7, X8, and X9 represent "dummy variables" in the

sample which in context to the study are differences in numeracy scores associated with gender and educational background;

where X1 = 0 if male,

1 if female

X6 = 0 otherwise,

1 if secondary school

X7 = 0 otherwise,

1 if high school

X8 = 0 otherwise,

1 if university

X9 = 0 otherwise,

1 graduate

The € is the constant, where the regression line intercepts the y axis, representing the amount the dependent y is when all the independent variables are 0. Test of statistical significance and residual analysis of regression results are used.

Furthermore, one way Analysis of Variance (ANOVA) was used in order to determine whether mother education and father education separately have a significant effect on basic numeracy skills of adults across females and males. A significant p-value resulting from a one way ANOVA test indicated that basic numeracy skills of mothers and fathers were differentially expressed in males and females. The results of the analysis for both descriptive and inferential statistics are presented in Chapter 4.

Summary

In this chapter design of the study was explained as correlational type of study. Population and sample were described. The demographic data included data on gender, the subjects' age groups by gender, the subjects' education level by gender, the subjects' education level by gender, and education level of parents' in terms of mothers and fathers of the sampling are stated. The measurement instruments for demographic variables, numerical attitude, and numeracy skills were stated. Adaptating the numerical attitude scale and transformation of numeracy skills test paper were explained. Then statictical techniques for analyzing the data were presented after testing the feasibility of the study through pilot study, and validity and reliability analysis of the measurement instruments. The method of obtaining the final data set and the variable sources were given in the procedure part. At the statistical analysis part, the statistical analysis procedures performed included using were explained. After the assumptions for multiple regression analysis were addressed, the model for the multiple regression analysis was given. Lastly, one way ANOVA technique was applied to establish whether there was difference in the mean criterion variable in the groups tested.

CHAPTER 4

RESULTS

In this part of the study, firstly the distributions of the scores obtained from the instruments used to measure the variables are revealed in descriptive analysis section. Then the correlation coefficients between the variables are calculated. Finally, multiple linear regression analysis is conducted to ascertain whether predictive variables are strong predictors of basic numeracy skills of adults.

Descriptive Statistics

In this part, means, standard deviations and range of the scores from the scales used to measure the variables are presented. In order to crystallize the observation of the distribution, histograms are used.

The sample is fairly evenly divided by gender. For age, with a range of 18 to 83, the mean of age is 40.21 with a standard deviation of 13.81. Frequencies indicate that the age of the sampling adults is distributed almost normally. For the normality checking, the Shapiro- Wilk normality test is also used. According to the Shapiro-Wilk normality test, the ratio of the best estimator of the variance to the usual corrected sum of squares estimator of variance should be close to one in order to indicate normality (Shapiro & Wilk, 1965). Since the value is 0.969 (Appendix I), distribution of the age of the sampling adults is confirmed as normally (Figure 2.).

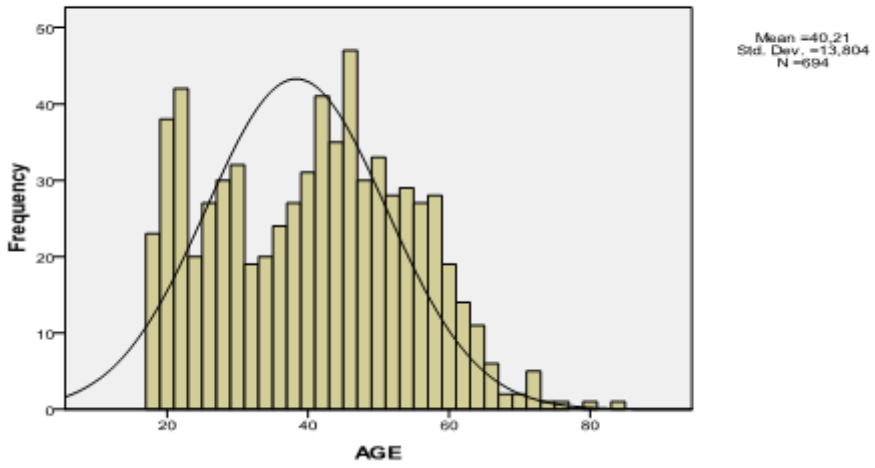


Figure 2. Histogram of Age of the Sample

For the sample in this research, education is in a range from 1 indicating ‘‘completed primary school’’, 2 indicating ‘‘completed secondary school’’, 3 indicating ‘‘completed high school’’, 4 indicaing ‘‘completed Open University’’, 5 indicating ‘‘completed vocational or two year university’’, 6 indicating ‘‘completed university’’, and 7 indicating ‘‘completed graduate’’. The median for this measure is 3. The mean score is 3.59 with a standard deviation of 1.82. Frequencies indicate that the mean score value is slightly higher than the median for this measure which means, on average, most of the sampling adults who have graduated from high school (Figure 3). University graduates follow it with 21 %.

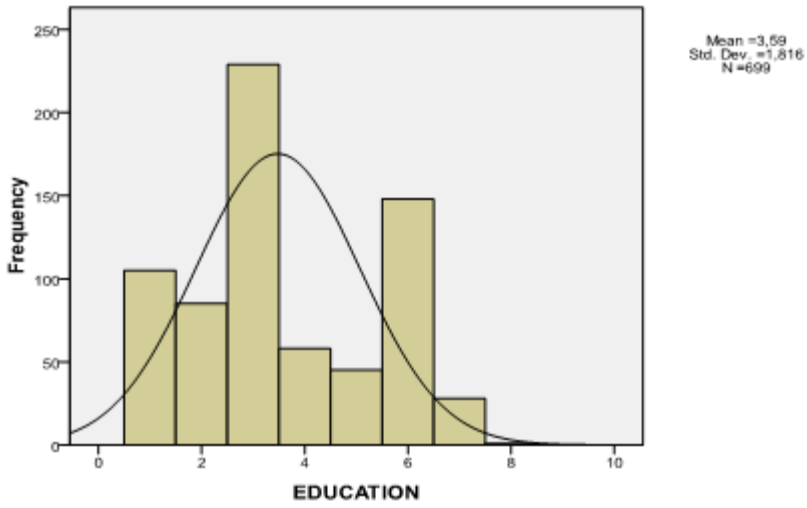


Figure 3. Histogram of Completed Education of the Sample

In this study, the range for mother education is 1 to 6, with 1 indicating ‘‘no school experience’’, 2 indicating ‘‘completed primary school’’, 3 indicating ‘‘completed secondary school’’, 4 indicaing ‘‘completed high school’’, 5 indicating ‘‘completed university’’, and 6 indicating ‘‘completed graduate’’. Since samples reported that none of the mothers having a doctorate degree, 6 indicates the highest degree of education for mothers. The median for this measure is 2. The mean score is 2.26 with a standard deviation of 1.10. This value is slightly higher than the median for this measure. This results that, on average, most of the mothers of the sampling adults completed primary school education and do not attend further formal education program. Moreover, frequencies indicate that the number of adults whose mothers never attend formal education is high with the percent of 23.1 % (Figure 4).

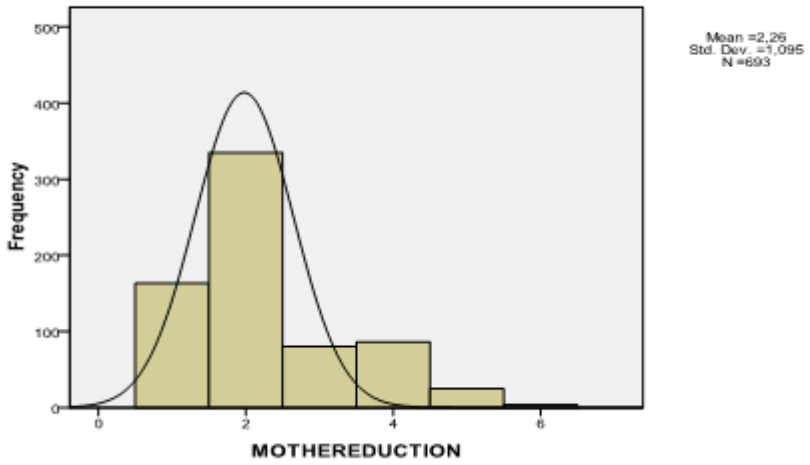


Figure 4. Histogram of Completed Education of the Mothers of the Sample

For the father education in this research, the range is from 1 to 6. Each number indicates the same property as for the mother education does. 1 indicates ‘‘no school experience’’ and 6 indicates ‘‘having a graduate degree’’. The median for this measure is 2.

The mean score is 2.83 with a standard deviation of 1.27. Frequencies indicate that, on average, most of the mothers of the sampling adults completed primary school education and do not attend further formal education program as the mothers do. Yet, different from mothers number of high school graduates have the second highest value with the percent of 18.3 % (Figure 5).

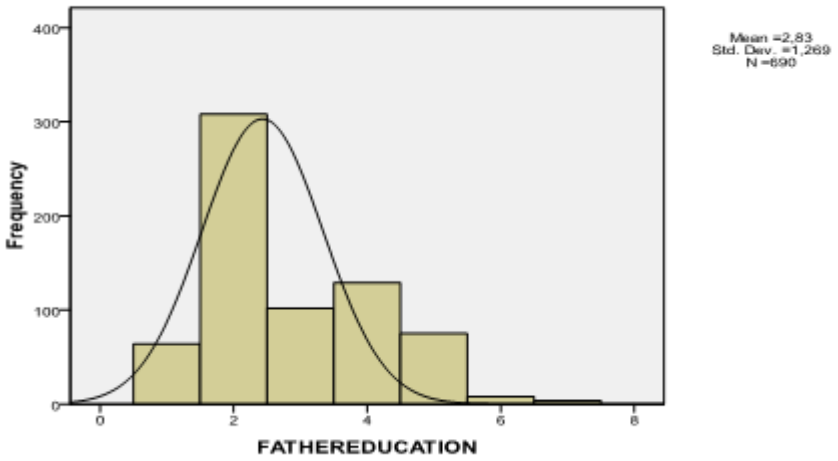


Figure 5. Histogram of Completed Education of the Fathers of the Sample

Basic Numeracy Skill's (YTMOB) Score

Basic adult numeracy skills variable is operationalized as scores on the Key Skills Application of Number Adult Numeacy Level 1 Test Paper (YTMOB). The range of possible scores obtained from the scale is between 1 and 40. The median for this score is 27. The mean score is 24.59 with a standard deviation of 10.14. This score is slightly lower than the median for this measure. This data is presented in Figure 6.

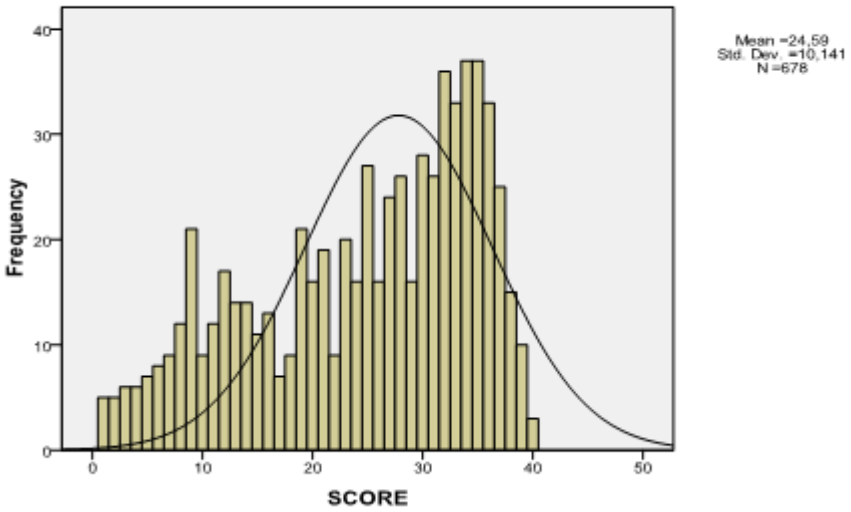


Figure 6. Histogram of Basic Numeracy Skill's Score

Frequencies indicate that scores are distributed almost normally (Figure 6). Moreover, the normality is confrmed by the Shapiro-Wilk normality test and the value is found as 0.932, which is close to one (Appendix I) Among the sampling adults, 35 % have a score higher than 30, which indicates that the level of their basic nmeracy skills are high; 32 % have the score between 20 and 30 indicating the level of their basic numeracy skills as moderate; 20 % have the score between 10 and 20, which indicates the level of basic numeracy skills as lower; and 13 % have the score below 10, which indicates that they have poor basic numeracy skills.

In addition to the overall basic numeracy skills the mean score of the sampling adults, the mean scores for demographic predictive (i.e., independent) variables in this study were examined to get detailed information about the level of basic numeracy skills. The data on Table 12. illustrates an idea about the positive and negative relationship between basic numeracy skills and the predictive (i.e., independent) variables listed for female and male participants separately.

Table 12. Mean Scores of Numeracy Scale for Selected Predictive Variables by Gender
(Lowest Score = 1.00 ; Highest Score = 40.00 ;Overall Mean Score = 24.59)

Predictive (Independent) Variables	Mean Score of YTMOB		
	Female	Male	Together
Mean Scores by Gender	(24.19)	(25.51)	(24.59)
Age			
Less than 25	25.08	27.07	25.33
25-40	27.02	24.38	26.22
41-56	23.19	24.33	23.44
57-71	21.22	29.75	24.65
72-	14.92	21.58	18.25
Education			
Primary School	16.72	13.30	15.85
Secondary School	18.48	17.38	18.18
High School	23.57	25.53	24.04
Open University	26.97	27.31	27.07
Vocational / Two year Unv	25.27	32.63	28.95
Undergraduate	32.10	32.83	32.38
Graduate	31.41	31.95	31.37
Mother Ed.			
No School	20.78	25.06	22.57
Primary School	24.25	25.72	24.61
Secondary School	25.09	26.12	25.84
High School	26.27	29.21	27.08
Undergraduate	28.94	30.83	29.04
Graduate	31.00	33.66	33.00
Father Ed.			
No School	17.03	22.43	19.68
Primary School	23.29	24.28	23.56
Secondary School	24.67	28.84	26.03
High School	25.54	28.12	26.66
Undergraduate	27.76	30.87	28.46
Graduate	30.33	34.00	31.98

Looking at means calculated from this data set, basic numeracy skills scores range from a minimum of 1 to a maximum of 40 with a sample mean scores of 24.59. The mean score for male adults is 25.51, followed by a mean score of 24.19 for females. The mean score of female sampling adults is slightly below the overall mean score while the mean score of male sampling adults is slightly upper. Additionaly, Table 12. indicated the mean scores of basic numeracy scale for age, education, and

parental education for female and male participants separately in order to get a detailed information about gender differencxes on basic numeracy skills. The mean score of females who are between the age of 25 and 40 (27.02) is higher than the mean score of the male participants (24.38) in the same age group. Moreover, the mean score of females who are older than 56 years old is quite lower than the mean score of the male participants who are older than 56.

Additionally, the mean score of female participants (16.72 for primary school graduaters and 18.48 for secondary school graduaters) who had lower education level from high school was found as higher than the mean score of male participants (13.30 for primary school graduaters and 17.38 for secondary school graduaters) who had lower education level from high school. Apart from these exceptional results, the mean score of the male participants were slightly higher than the mean score of the female participants for each category. As a result, the mean scores of basic numeracy skills do not differ greatly along the lines of gender.

The mean score for sampling adults who are less than 25 years old is 25.33, compared with the mean score, which is 26.22, for whose age is between 25 and 40. The mean score, which is 23.44, for sampling adults who are between 41 and 56 is slightly below the mean score, which is 24.65, of the sampling adults, who are between 57 and 71 years old. Sampling adults, whose age is upper than 72 have the lowest mean score, which is 18.25. The value is also distinctly lower than the overall mean.

The mean score for primary school graduates is 15.85, for secondary school graduates is 18.18., for high school graduates is 24.04, for open university graduates is 27.07, for vocational or two year university graduates is 28.95, for undergraduate

graduates is 32.38, and for graduate graduates is 31.37. Since the level of education increases so do the mean scores of basic numeracy skills. Yet there is an exception for the graduate graduates, whose mean scores are slightly below than the undergraduate graduates. Since only 4,1% of the sample have reported to complete the graduate education, most of them might study in social science departments. As a result, their basic numeracy skills might be lower than the sampling adults' skills who graduated from a university in a science or math department. If this is the case, having mean score slightly lower than the undergraduate graduates' mean score might be an expected result.

The mean basic numeracy skills score for sampling adults whose mothers do not have any school experience is 22.57 while for sampling adults whose mothers are primary school graduaters, the mean score is 24.61. For sampling adults whose mothers are secondary school graduaters, the mean score is 25.84; for whose mother did finish high school, the mean score is 27.08; for whose mother graduated from a university, the mean score is 29.04; and for whose mother have a master / doctorate degree, the mean score is 33.00. Since the mothers of the sampling adults' education level increases, the basic numeracy skills mean scores also increase.

The mean basic numeracy skills score for sampling adults whose fathers do not have any school experince is 19.68 compared with the mean score of 23.56 for sampling adults whose fathers completed primary school and did not go on further education. For sampling adults whose fathers are secondary school graduaters, the mean score is 26.03 compared with the mean score of 26.66 for sampling adults whose fathers completed high school. The mean score for sampling adults whose fathers graduated from university is 28.46 while for sampling adults whose fathers

have a graduate degree, the mean score is 29.62. As it is the case for the mothers of the sampling adults; the basic numeracy skills mean scores increase depending on the increase of the education level of the fathers of sampling adults.

In Basic Adult Numeracy Skills Test Paper, each objectives of National Standards for Adult Numeracy Level – 1 is represented by different items. The means, in terms of percentage, and standard deviations of each objective is provided in Table 13.

When an objective is represented by more than one item, the mean of the mean scores of the items is calculated and represented as the mean score of that objective. This is also the case when calculating the standard deviation of an objective which is represented by more than one item. The overall basic numeracy skill's mean score is recalculated in terms of percentage in order to prevent any confuse while comparing the overall basic numeracy skill's mean score and the mean scores of each objective. The basic numeracy skills of adults reflected in this data set is also given in line with means and standard deviations of objectives.

Table 13. Mean Scores of Objectives (Overall Mean Score = 61.48%)

Objective Number	Objectives	Mean (%)	Standard Deviation
1 (Items 1-12-15-36)	To work out simple ratio and direct proportion	0.71	0.421
2 (Item 2)	To chose and use appropriate units and instruments to measure length	0.79	0.408
3 (Item 3)	To chose and use appropriate units and instruments to measure time and temperature,eg distances in road maps, scales	0.68	0.467
4 (Item 4)	To read, measure and record time in common date formats and in the 12-hour and 24-hour clock	0.69	0.463
5 (Items 5-10-19-37)	To identify appropriate methods that best match the practical situation	0.56	0.487
6 (Items 6-30)	To find simple percentage parts of qualities and measurements	0.57	0.494
7 (Items 7-22-39-40)	To add, subtract, multiply, divide and record sums of money and record, eg competing financial transactions, calculating benefits	0.68	0.452
8 (Items 8-27-28)	To approximate by rounding to a whole number or two decimal places	0.56	0.489
9 (Item 9)	To chose and use appropriate units and instruments to measure capacity	0.66	0.475
10 (Items 11-33)	To recognize equivalencies between common fractions, percentages and decimals, and use these to find part of whole number of	0.66	0.476
11 (Item 13)	To use tables, charts, diagrams and line graphs to present results	0.22	0.416
12 (Item 14)	To work out simple volume	0.55	0.498
13 (Item 16)	To add, subtract, multiply, divide using efficient written methods	0.73	0.447
14 (Items 17-29)	To read, write, order, and compare numbers, including large numbers	0.79	0.410
15 (Items 18-35)	To use information from tables, diagrams, charts and line graphs	0.69	0.429
16 (Item 20)	To find parts of whole number quantities or measurements	0.72	0.450
17 (Item 21)	To work out the area of rectangles	0.58	0.494
18 (Item 23)	To collect and record discrete data in tests and from observations	0.79	0.406

Table 13. Continued

Objective Number	Objectives	Mean (%)	Standard Deviation
19 (Item 24)	To select and use suitable methods and forms to present and describe outcomes	0.32	0.469
20 (Items 25-38)	To find the arithmetical average (mean)	0.63	0.483
21 (Item 26)	To find parts of whole number quantities or measurements	0.64	0.481
22 (Item 31)	To approximate by rounding	0.44	0.497
23 (Item 32)	To extract and interpret inormation in tables, diagrams, charts and line graphs	0.62	0.487
24 (Item 34)	To find the range for a set of data	0.09	0.289

Among 24 objectives of National Standards for Adult Numeracy Level – 1, 9 of the objectives have mean scores that are less than the overall mean score of the scale. The mean score of objective 5 (To identify appropriate methods that best match the practical situation),0.56; the mean score of objective 6 (To find simple percentage parts of qualities and measurements), 0.57; the mean score of objective 8 (To approximate by rounding to a whole number or two decimal places), 0.56; the mean score of objective 12 (To work out simple volume), 0.55; and the mean score of objective 17 (To work out the area of rectangles), 0.58 are slightly lower than the overall mean score of the scale. Furthermore, the mean score of objective 11 (To use tables, charts, diagrams and line graphs to present results), 0.22; the mean score of objective 19 (To select and use suitable methods and forms to present and describe outcomes), 0.32; and the mean score of objective 22 (To approximate by rounding), 0.44; fairly lower than the overall mean score of the scale. From the 11th objective represents that 88 % of the sampling adults are insufficient in data and statistical measure concept. Besides, the mean score of objective 19 could be interpreted as 68

% of the sampling adults are disqualified in manipulating the numerical information. Moreover, objective 22 directly shows that 66 % of the sample lack of knowledge about rounding. Since only 65 sampling adults give the right answer for the objective 24 (To find the range for a set of data), its mean score, 0.09; is extremely low. As it was explained in pilot study section in detail, the reason for this might be that ‘‘range’’ is an unfamiliar term for most of the sampling adults who reported to have no idea about the meaning of range.

Numeracy Attitude (SBKTC) Score

The attitute scores for this study is derived from the responses of the sampling adults to the Individual Differences in Preference for Numerical Information Scale. In the attitute scale, the sampling adults were asked to rate twenty items on a 5 – point Likert scale. The ranges of the scale is between 1 =‘‘strongly disagree’’ to 5 =‘‘strongly agree’’. In the scale, there are 10 positive statement items and 10 negative statement items. For positive statement items, the value of 1 is calculated as 1 point to the value of 5 is calculated as 5 point. However, for the negative statement items, the point of the values are reversed as that the value of 1 is calculated as 5 point to the value of 5 is calculated as 1 point. All the points for each items were summed and the mean value of the scale was calculated. The mean score is 3.47 with a standard deviation of 0.63. The median for the attitute scale is 3.40. The mean score is slightly upper than the median for this measure. This data is presented in Figure 7.

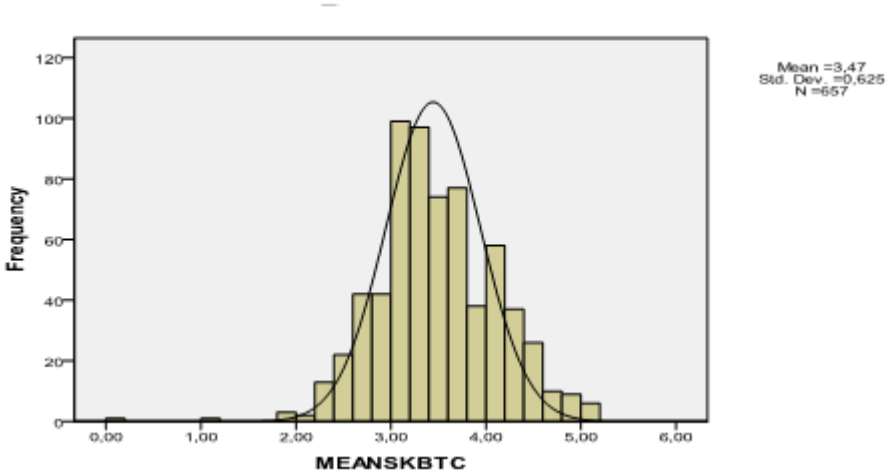


Figure 7. Histogram of Numeracy Attitute Scale Scores

Frequencies indicate that scores were distributed almost normally (Figure 7). Furthermore, the normality is confrmed by the Shapiro-Wilk normality test and the value is found as 0.983, which is close to one (Appendix I). Among the sampling adults 33 % have a score higher than 3.75, which indicates that they have high numeracy attitude; 66 % have a score between 2.25 and 3.75, which indicates that they have moderate numeracy attitude; and 1 % have a score below than 2.25, which indicates that they have low attitude.

Mean Score of Numeracy Scale by Numeracy Attitude

A review of the means of the basic numeracy scale as they differ by attitude as high attitute, moderate attitute, and low attitute, is shown in Tabe 4. 8. The data illustrates an idea about the positive and negative relationship between basic numeracy skills and attitude.

Table 14. Mean Scores of Numeracy Scale for Numeracy Attitute

Numeracy Attitute	Mean Score of YTMOB
Low Attitutte (1 to 2.25 scores)	21.67
Moderate Attitute (2.25 to 3.75 scores)	22.95
High Attitute (3.75 to 5 scores)	29.92

The mean basic numeracy score for sampling adults who have low numeracy attitute is 21.67 compared with the basic numeracy mean score, which is 22.95, for whose numeracy attitute is moderate. Both of the mean scores are less than the overall mean score for basic numeracy scale. However, the mean score, which is 29.92, for sampling adults who have high numeracy attitute is quite higher than the overall mean. Thus attitute for numeracy increases, so does the basic numeracy skills mean scores.

Correlational Analysis

In this section, the relationships between the variables included in the study are focused on. Two kinds of correlation anaylsis techniques, which are Spearman rank correlation technique and Point – biserial correlation technique, are used in this study. The Spearman rank correlation is a nonparametric equivalent to the Pearson correlation. The Pearson correlation assumes that all variables have normal distributions. Since this assumption is violated for the variables (DeCoster & Claypool, 2004), which are education, mother's education, father's education, and numeracy attitute, because of the fact that they are ordinal (discrete) data, Spearman rank correlation technique is chosen to perform the data. Spearman rank correlation technique is also used in order to determine the relationship among education and numeracy attitute, which both are ordinal data, and basic numeracy score and age,

which are continuous data. Bonett & Wright (2000) states that Spearman's rank correlation is technically the appropriate statistic and commonly practiced while correlating ordinal and continuous data, as long the ordinal variables are actually ordered, which means that the higher ranks actually reflect something more than the lower.

Moreover, the point-biserial correlation captures the relationship between a dichotomous (nominal) data and a continuous data. If the analyst codes the dichotomous variable with values of 0 and 1, the point-biserial correlation is used (DeCoster & Claypool, 2004). The interpretation of this variable is similar to the interpretation of the Pearson correlation. Since correlation is a statistical technique that shows at what degree two variables are related to each other, these correlation findings only describe associations and not causal relationships among variables. In order to investigate model fit, multiple regression modeling is used and the results are given in the next section. Spearman rank correlation coefficients among the variables (i.e., education, mother education, father education, numeracy attitute, age, and basic numeracy core) are calculated and presented in Table 15.

Table 15. Bivariate Correlations among Ordinal Variables and Continuous Variables

Variable	Education	Mother Education	Father Education	Attitute	Age	Numeracy Scores
Education	1	.319**	.373**	. 226**	-.100**	.584**
MotherEducation		1	.654**	-. 050	-.181**	.165**
Father Education			1	-. 009	-.097**	.235**
Attitute				1	.091**	
Age					1	-.083**
Numeracy Scores						1

** Correlation is significant at the 0.01 level (2-tailed)

The matrix of correlations among the variables revealed that education has a significant correlation with the other variables. Education has the highest correlation to numeracy scores ($r = .584$, $p < .01$). This is followed by the correlation coefficient between education and father education ($r = .373$, $p < .01$), and by the correlation coefficient between education and mother education ($r = .319$, $p < .01$), and by the correlation coefficient between education and numeracy attitute ($r = .226$, $p < .01$). These findings indicate that sampling adults, whose education level is higher, have parents whose education level is higher. Besides, the education level of the sampling adults increase, so do the numeracy attitute and numracy scores of them. For the relationship between education and age, the correlation coefficient is found to be low and negative but significant

($r = -.100$, $p < .01$). This also indicates that older sampling adults have lower education level.

The education level of parents of the sampling adults are also highly correlated to each other ($r = .654$, $p < .01$). This result indicates that as the education level of mothers of the sampling adults' increases, the education level of fathers of the sampling adults also increases. For the relationship between mother education and numeracy scores ($r = .165$, $p < .01$), and between father education and numeracy scores ($r = .235$, $p < .01$), the correlation coefficients are found to be low but significant. These results show that as the education level of parents of the sampling adults increase, the numeracy scores also increase. The education level of parents of the sampling adults are also negatively correlated to age ($r = -.181$ and $r = -.097$, $p < .01$) which implies that the parents of the older adults are less educated. Otherwise, neither mother education nor father education correlates with numeracy attitute significantly.

Numeracy scores are related significantly to numeracy attitute ($r = .388$, $p < .01$), which indicates that sampling adults who have more numeracy attitute are the ones whose numeracy skills scores are higher. Finally, the relationship between age and numeracy score are low and negative but significant ($r = -.083$, $p < .01$), which implies that older sampling adults have less numeracy score, otherwise there is no significant relationship between age and numeracy attitute. All correlations are significant at the 0.01 level.

The point-biserial correlation technique is used for interpretation the association between sex, age, and basic numeracy skills score. The point-biserial correlation coefficients among the variables are calculated and presented in Table 16.

Table 16. Bivariate Correlations among Nominal (i.e., sex) Variable and Continuous (i.e., age, numeracy scores) Variables

Variable	Age	Sex	Numeracy Scores
Age	1	. 024	-.085*
Sex		1	-.060
Numeracy Scores			1

The correlation coefficient between age and the numeracy score are calculated as r = -.085, (p< .05), which implies negative and low but significant correlation. As it is stated by Spearman rank correlation analysis, older sampling adults have lower numeracy scores. Moreover, for the relationship between sex and age, and between sex and numeracy scores the correlation coefficient is found as not significant.

These significant relationship coefficients were accepted as justification to put the variables in a multiple regression model to be tested on the data.

Multiple Linear Regression Analysis

A multiple linear regression analysis is conducted to ascertain whether demographic backgrounds (i.e., sex, age, education, mother education, father education) and numeracy attitute are strong predictors of basic numeracy skills of adults. In this regression model, demographic backgrounds (i.e., sex, age, education, mother education, father education) and numeracy attitute are entered as predictor or

independent variables. Basic numeracy skills serve as the criterion or independent variable.

Table 17. displays the the unstandardized regression coefficients (B), the standardized regression coefficient (β), R2, and adjusted R2. The R2 for this model is. 347, indicating that this model explains 34.7 % of the variation in the dependent variable basic numeracy skills. The adjusted R2 (R2 = .338) values are very close to the R2 values with only a difference of .009 between the R2 and adjusted R2. This indicates that, if the model came from the population other than a sample, it would account for approximately 0.09 % less variance in the outcome variable of basic numeracy skills.

The model is a good fit for the data. There are two basic measures for the goodness-of-fit for the regression models; the coefficient of determination, and the F test. The F test is less powerful but indicates if a significant portion of the variance in the dependent variable is explained by the regression model's variables (Toutkoushian, 2005). The F test is significant $p < .05$ for the model (ANOVA table in Appendix J). The most common measure of goodness-of-fit of a model is R2 the ''coefficient of determination'' (Toutkoushian, 2005, p.95). It is stated that ''the coefficient of determination measures the proportion of deviation in the dependent variable that is explained by deviations in the independent variables in the model. The value of R2 must fall between 0 and 1, as it increases the regression model is said to explain a greater proportion of varaitions in the dependent variable''. In the prediction of basic numeracy skills by the independent variables, the regression model is significant, $R = .59$, $F(8,698) = 35.44$, $p < .05$. This means that gender, age,

education, father education, mother education, and numeracy attitute jointly and significantly predict basic numeracy skills.

Education major dummy variables are entered into the regression model. Four dummy variables are entered with secondary school being the omitted category against which all other education major variables are compared. The results show that three majors (i.e., high school, undergraduate, and graduate) have significance and show a strong relationship with basic numeracy skills indicated by the unstandardized regression weights (B) shown in
Table 17.

SPSS tests the significance of each predictor in the equation using t tests. The null hypothesis is that a predictor's regression weight is effectively equal to zero when the effects of the other predictors are taken into account (Meyers, Garnst & Guarino, 2006, p.171). Before conducting an independent t test the assumptions are checked. The assumptions for an independent t test are confirmed as there is an equal variance of the population. The analysis are conducted to explore the influence of the independent variables on the dependent variable in this study. Specifically, it is aimed to find out that whether there is a significant difference (a) between male and female participants, (b) among different age groups, (c) among different educational backgrounds, (d) among different parental educational backgrounds, and basic numeracy skills of adults. All the t tests are yielded insignificant results ($p > .05$).

The undergraduate education, numeracy attitute, high school education, and graduate education and father education show a high significant relationship to basic numeracy skills. The statistical significance for each group is: undergraduate education ($B = 11.872$, $t(9,705) = 10.981$, $p < .05$); graduate education ($B = 11.727$,

t (9,705) = 6.324, p < .05); high school education (B = 6.753, t (9,705) = 6.429, p < .05); numeracy attitute (B = 3.858, t (9,705) = 7.445, , p < .05); and father education (B =.731, t (9,705) = 2.041, p < .05). Neither the interaction between gender and basic numeracy skills, nor interaction between age of the participants and basic numeracy skills is statistically significant. Besides, secondary education and mother education are not significant respectively as shown in Table 17.

Table 17. Multiple Linear Regression Results

	Unstandardized Coefficients		Standardized Coefficients		
Predictive Variables	B	Std. Error	Beta	t	Sig.
Sex	-,730	,732	-,034	-,997	,319
Age	-,011	,024	-,016	-,474	,636
Mother Education	-,332	,401	-,038	-,827	,408
Father Education	,731	,358	,095	2,041	,042
Numeracy Attitute	3,858	,518	,254	7,445	,000
Dummy Secondary School	1,818	1,314	,057	1,383	,167
Dummy High School	6,753	1,050	,330	6,429	,000
Dummy University	11,872	1,081	,596	10,981	,000
Dummy Graduate	11,727	1,854	,250	6,324	,000
R = .589 [a]					
R^2 = .347					
Adjusted R^2 = .338					
St. Error of Estimate = 7.861					

Durbin-Watson Test = 2.20 indicates no serial correlation between variables

One Way ANOVA Analysis

Through the multiple regession analysis, mother education of the participants was found insignificant while father education of the participats were found as significant in predicting the basic numeracy skills of adults. Since predictive variables jointly predict how all of the predictor variables together relate to the outcome in multiple linear regression analysis, it was needed to examine the effect of mother education and father education on basic numeracy skills differentially of male and female participants in detailed. ANOVA tests the null hypothesis that the means of all the groups being compared are equal, and produces **F** test.

The data on Table 18. illustrates test of homogeneity of variances and Table 19 represents the ANOVA analysis comparing the educational level of mothers of female participants on basic numeracy skills.

Table 18. Test of Homogeneity of Variances for Mother Eduction of Females

Test of Homogeneity of Variances

Score of Female 1

Levene Statistic	df1	df2	Sig.
1,228	4	468	,298

The significance value for homogeneity of variances is p >.05, so the variances of the groups are significantly indifferent. Since this is an assumption of ANOVA, we can interpret the results from the ANOVA Table below.

Table 19. ANOVA Table for Mother Education Level of Female Paricipants

ANOVA TABLE

Score of female 1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2326,475	4	581,619	6,697	,000
Within Groups	40642,959	468	86,844		
Total	42969,433	472			

The significance value comparing the groups (i.e. mother education level of female participnts) is <.05, so the null hypothesis could be rejected which means that there is a difference in the mean basic numeracy scores with the education level of mothers of females. As a result, mother education level of the female participants is responsible for the difference of basic numeracy skills of them.

The data on Table 20. illustrates test of homogeneity of variances and Table 21. represents the ANOVA analysis comparing the educational level of mothers o female participants on basic numeracy skills.

Table 20. Test of Homogeneity of Variances for Father Education of Females

Test of Homogeneity of Variances

Score of female 2

Levene Statistic	df1	df2	Sig.
1,484	5	462	,194

The significance value for homogeneity of variances is p >.05, so the variances of the groups are significantly indifferent. Since this is an assumption of ANOVA, we can interpret the results from the ANOVA Table below.

Table 21. ANOVA Table for Father Education Level of Female Paricipants

ANOVA TABLE

Score of female2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3180,438	5	636,088	7,593	,000
Within Groups	38701,485	462	83,769		
Total	41881,923	467			

The significance value comparing the groups (i.e. father education level of female participnts) is <.05, so the null hypothesis could be rejected which means that there is a difference in the mean basic numeracy scores with the education level of fathers of females. As a result, father education level of the female participants is responsible for the difference of basic numeracy skills of them.

The data on Table 22. illustrates test of homogeneity of variances and Table 23. represents the ANOVA analysis comparing the educational level of mothers of male participants on basic numeracy skills.

Table 22. Test of Homogeneity of Variances For Mother Education of Males

Test of Homogeneity of Variances

Score of male 1

Levene Statistic	df1	df2	Sig.
2,117	4	190	,180

The significance value for homogeneity of variances is p >.05, so the variances of the groups are significantly indifferent. Since this is an assumption of ANOVA, we can interpret the results from the ANOVA Table below.

Table 23. ANOVA Table for Mother Education Level of Male Paricipants

ANOVA TABLE

Score of male 1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	484,686	5	96,937	,782	,563
Within Groups	23538,187	190	123,885		
Total	24022,872	195			

The significance value comparing the groups (i.e. mother education level of male participnts) is p >.05, so the null hypothesis could not be rejected which means that there is no difference in the mean basic numeracy scores with the education level of mothers of males. As a result, mother education level of the male participants is not responsible for the difference of basic numeracy skills of them.

The data on Table 24. illustrates test of homogeneity of variances and Table 25. represents the ANOVA analysis comparing the educational level of fathers of male participants on basic numeracy skills.

Table 24. Test of Homogeneity of Variances for Mother Education of Males

Test of Homogeneity of Variances

Score of male2

Levene Statistic	df1	df2	Sig.
5,442	4	189	,000

The significance value for homogeneity of variances is p >.05, so the variances of the groups are significantly indifferent. Since this is an assumption of ANOVA, we can interpret the results from the ANOVA Table below.

Table 25. ANOVA Table for Father Education Level of Male Paricipants

ANOVA TABLE

Score of male2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1596,031	4	399,008	3,423	,010
Within Groups	22028,299	189	116,552		
Total	23624,330	193			

The significance value comparing the groups (i.e. father education level of male participnts) is <.05, so the null hypothesis could be rejected which means that there is

a difference in the mean basic numeracy scores with the education level of fathers of males. As a result, father education level of the male participants is responsible for the difference of basic numeracy skills of them.

Through the descriptive and inferential statistics results, gender is found as neither correlating with basic numeracy skills nor statistically significant. Age is quite low and negative in relationship to basic numeracy skills and is not statistically significant. The relationship between education and basic numeracy skills is also positive and becomes a stronger positive with higher levels of education. Since education is entered as four dummy variables in multiple linear regression model, the results show that dummy high school, dummy undergraduate, and dummy graduate have significance and show a strong relationship with basic numeracy skills. Undergraduate education, with its large t statistic value and large standardized coefficient β, beyond the other significant variables is the variable with the strongest predictive ability in the model. No other single predictor variable surpasses it because of its relatively large t value and β coefficient. However, dummy secondary school* is found as statistically insignificant. The relationship between mother education of the participants and basic numeracy skills is low and positive yet, through multiple regression analysis result it is not statistically significant.

* Dummy secondary school is not significant at $p < .05$ confidence interval. However, it is found as statistically significant at $p < .10$ confidence interval ($B = 1.818$, $t\ (9,705) = 1.38$, $p < .10$).

Besides, one way ANOVA analysis results showed that mother education level was a significant factor for predicting basic numeracy skills of females while it was not significant for male participants. Otherwise the variable measuring the relationship between father education of the participants and basic numeracy skills is positive and statistically significant which is confirmed by both multiple linear regression and one way ANOVA analyses. Another predictive variable, numeracy attitude of the participants has a high positive relationship between basic numeracy skills and significant.

Answers to the second, third, fourth, fifth, and sixth research questions are provided by the results from the analysis of the data using multiple linear regression. Additionaly, one way ANOVA anaylses were used for the fifth research question. It is found that education (i.e., high school education, undergraduate education, and graduate education), father education, mother education for female participants, and numeracy attitute are significant factors in predicting basic numeracy skills of adult participants. The R 2 is significant in the regression model. In the model, B values are significant for high school education, undergraduate education, and graduate education, father education, and numeracy attitude. Education beyond having a undergraduate degree is the most important predictor in the model for explaining the variance in the outcome of basic numeracy skills. Finally, there is no difference in the significance of gender, age, lower level of education than high school, and mother education for male participants. The total explained variance in the outcome of basic numeracy skills as reflected by R 2 is 34.7 % for the model.

The results presented so far lead to conclusions about the research questions proposed for this study. These are explained in the discussion chapter.

Summary

In this chapter, means, standard deviations and range of the scores from the scales used to measure the variables are presented in desciriptive analysis part. In order to crystallize the observation of the distribution, histograms are used. From the desciriptive anaylsis of the basic numeracy skills scores, it is found that 88 % of the sampling adults are insufficient in data and statistical measure concept. Besides, 68 % of the sampling adults are disqualified in manipulating the numerical information and 66 % of the sample lack of knowledge about rounding. Since only 65 sampling adults give the right answer to the question about finding the range for a set of data, the reason for this is explained as that ‘‘range’’ is an unfamiliar term for most of the sampling adults who reported to have no idea about the meaning of range. In correlation analyses part, the relationships between the variables included in the study are focused on. Two kinds of correlation anaylses techniques, which are Spearman rank correlation technique and Point – biserial correlation technique, are used. Then, a multiple linear regression analysis is conducted to ascertain whether demographic backgrounds (i.e., sex, age, education, mother education, father education) and numeracy attitute are strong predictors of basic numeracy skills of adults. Education are entered as four dummy variables into the regression model. . Finally, one way ANOVA was conducted in order to examine the effect of mother education and father education on basic numeracy skills of male and female participants separately. High school education, undergraduate education, graduate education, numeracy attitute, father education, and mother education for female participants were found as statistically significant in .05 confidence interval.

CHAPTER 5

DISCUSSION

In chapter 5, the results of the study were discussed in relation to previous research on the topic, the methodological approach to the current study, data collection and data analysis factors of possible influence upon the study results and future directions for the investigation of the topic.

Summary of the Results

The main purpose of the study was to determine the level of basic numeracy skills of adults in Turkey. Besides, the study focused specifically on identifying the educational and non-educational factors that related with the basic adult numeracy skills. The educational factors were represented by the completion of graduation a formal education level, such as primary school, secndary school, high school… etc. The non-educational factors are demographic factors, which are gender, age, parental education, and numeracy attitude. Descriptive statistics for all variables were presented to summarize variables. In addition, all variables of the study were tested for association between educational and non-educational factors, and basic adult numeracy skills.

For these purposes, three survey instruments (called Demographic Information Form, SBKTC, and YTMOB) were applied to 706 respondent adults selected from different types of training and art courses in six Ismek course centers, which are Sahrayıcedid, Kayışdağı, Kadıköy, Örnek Mahallesi, Fikirtepe, and Merdivenköy course centers, at the beginning of 2010-2011 course term.

The first survey instrument is the questionnaire for the demographic characterictics of the participants. Demographic information form was being developed by the researcher. The second instrument is SBKTC, which measures the numeracy attitude of the participants toward numerical information using daily life. Finally, YTMOB was translated for testing the basic numeracy skills of adult participants. The scales showed good psychometric characteristics. The reliability for the SBKTC was calculated as 0.91 and the reliability for the YTMOB was calculated as 0.94, indicating very good reliability values for both of the scales. The scales had substantial validity evidence.

The majority of the sampling adults were female (70 %) and between 41 and 56 years old (38.9 %). The majority of the female participants were between 41 and 56 years old (42.3 %) however most of the male participants were in the age group of 25 – 40 years old (30.9 %). The participants were evenly distributed in terms of graduation level from a formal education center: totally 32.4 % of the respondents had graduated from high school; most of the female participants were also graduated from high school (35.6 %) while most of the males had graduated from university (28.1 %). Further, 47.5 % of the participants had mothers who were graduated from primary school, and 43.6 % of the participants had fathers who were also graduated from primary school.

The statistical procedure used to analyze this data was two-fold; descriptive analysis and inferential analysis technique were used. For model testing, multiple linear regression method was selected. There are three reasons for selecting this method: (1) the results give an assessment of the variance in the dependent variable that can be explained after combining the independent variables, (2) the change in

the amount of variance explained in the dependent variable after entering variables can be assessed, and (3) the statistics show the impact for individual independent variables on the dependent variable while all other independent variables are controlled for. The independent variables were entered into the multiple linear regression analysis using SPSS 17.0.

Findings of this study were distributed in terms of basic numeracy skills of adults, demographic factors (i.e., gender and age), educational background, parental educational background, and numeracy attitute of adults.

Basic Numeracy Skills of Adults

The first research question examines the level of basic numeracy skills of adults in Turkey according to NCTM Adult Numeracy Standards. Findings from the current study indicates that among the sampling adults, 35 % of the participants' level of basic numeracy skills are high; 32 % have basic numeracy skills at the moderate level, 20 % have low basic numeracy skills, and 13 % have poor basic numeracy skills. Thus, high basic numeracy skills are represented by the highest percentage and poor basic numeracy skills are represented by the lowest one. The mean score of the test paper is 24.59 over 40 and the median value is 27. This indicates that majority of the participants were able to reply more than half of the basic numeracy questions.

Each question of the basic numeracy skills test paper represents the 24 objectives of National Standards for Adult Numeracy Level – 1. Nine of the objectives have mean scores that are less than the overall mean score of the scale: Identifying appropriate methods that best match the practical situation, finding simple percentage parts of qualities and measurements, approximating by rounding

to a whole number or two decimal places, working out simple volume, and working out the area of rectangles. Furthermore, the mean scores of using tables, charts, diagrams and line graphs to present results, selecting and use suitable methods and forms to present and describe outcomes, and approximating by rounding are fairly lower than the overall mean score of the scale. These findings from descriptive analysis of the basic numeracy skills' score represent that 88 % of the sampling adults are insufficient in data and statistical measure concept. Besides, it could be interpreted as 68 % of the sampling adults being disqualified in manipulating the numerical information. Moreover, results directly showed that 66 % of the sample lack of knowledge about rounding whole numbers and decimals. Since a very few number of sampling adults (N = 65) give the right answer to the question representing ''finding the range for a set of data'', it was found as the most problematic concept for the participants.

On the other hand, three of the objectives have mean scores (0.79) that are fairly upper than the overall mean score of the scale (61.48 in percent version). This indicates that majority of the sampling adults have improved skills representing these three objectives. ''Chosing and using appropriate units and instruments to measure length'', ''Reading, writing, ordering, and comparing numbers, including large numbers'', and ''Collecting and recording discrete data in tests and from observations'' are the three numeracy concepts that the participants show high ability in answering the questions related to them.

Demographic Factors for Basic Numeracy Skills

The second and third research questions search whether the demographic factors, in

terms of gender and age, are significant factors in predicting the basic numeracy skills of adults.

Gender

Findings from the descriptive analyses of the current study indicate that the mean score of basic numeracy skills test for male adults is 25.51, followed by a mean score of 24.19 for females. The mean score of female sampling adults is slightly below the overall mean score (24.59) while the mean score of male sampling adults is slightly higher. The mean scores of basic numeracy skills do not differ greatly along the lines of gender.

In correlation analyses section, the point-biserial correlation technique was used for interpretation the association between gender and basic numeracy skills score since gender is a dichotomous (nominal) data and basic numeracy skills score is a continous data. For the relationship between gender and numeracy scores, the correlation coefficient was found to be not as significant. Besides, gender was found to be neither correlated with basic numeracy skills nor statistically significant for both $p < .05$ and $p < .01$ confidence intervals through the multiple regression analyses. Thus, gender was found as not being a significant factor in predicting the basic numeracy skills of adults.

Age

Due to the descriptive analyses results, the oldest sampling adults, whose age is higher than 72, had the lowest mean score of basic numeracy skills test. For female oldest participants, the mean score (14.92) is much lower than the oldest male

(21.58). The overall mean score for the oldest sampling adults (18.25) is also distinctly lower than the overall mean. On the other and, the sampling adults, whose age is between 25 and 40, had the highest mean score (26.22). Looking at the mean scores separately in terms of gender difference, it is valid for female participants whose age is between 25 and 40 since they had the highest mean scores (27.02). On the other hand, male participants, whose age is between 57 and 71, had the highest mean scores (29.75) in among all age categories.

Through the correlation analyses, both Spearman rank correlation value and Point-biserial correlation value were calculated. They both implied negative and extremely low but significant correlation. However, the reported statistics were derived from multiple linear regession analysis indicated that age is not statistically significant for both $p < .05$ and $p < .01$ confidence intervals. As a result, given the small percentage of statistically significant correlations and the inconsistent findings with the multiple linear regression analysis, states that age and basic numeracy skills of adults are not significantly correlated. Analysis of findings associated with the third research question provided that age is not a significant factor in predicting the basic numeracy skills of adults.

Educational Factors for Basic Numeracy Skills

The fourth and fifth research questions search whether the educational factors, in terms of educational background and parental educational background, are significant factors in predicting the basic numeracy skills of adults.

Educational Background for Basic Numeracy Skills

The forth resarch question investigates whether educational background in formal education is a significant factor in predicting the basic numeracy skills of adults. Findings from descriptive analyses indicated that while the level of education increased; so did the mean scores of basic numeracy skills. However, there was an exception for the sampling adults who had graduatd from a M.A. / M.S. programme. Their mean scores were slightly below than the undergraduates. The reason for this might be that extremely small size of the sample (4,1%) have reported to complete the graduate education. Moreover, most of them might have studied in social science departments. As a result, their basic numeracy skills might have been lower than the sampling adults' skills who graduated from a university in a science or math department. If this is the case, having mean score for graduate graduaters slightly lower than the university graduaters' mean score might be an expected result. In addition, the mean score of female participants (16.72 for primary school graduaters and 18.48 for secondary school graduaters) who had lower education level from high school was found as higher than the mean score of male participants (13.30 for primary school graduaters and 17.38 for secondary school graduaters) who had lower education level from high school.

Furthermore, the matrix of correlations among the variables revealed that education has the highest correlation to basic numeracy scores ($r = .584$, $p < .01$). Education was entered as four major dummy variables into the regression model. The multiple linear regression analysis results show that dummy high school, dummy undergraduate and dummy graduate showed a strong relationship and were highly significant with basic numeracy skills. Undergraduate education, with its large t

statistic value and large standardized coefficient β, beyond the other significant variables was the variable with the strongest predictive ability in the model. No other single predictor variable surpassed it because of its relatively large t value and β coefficient. Secondary school education was found as statistically insignificant in $p < .05$ confidence interval. Yet, the multiple linear regression analysis were restated in $p < .10$ confidence interval and secondary school education was found as statistically significant at that time.

The findings from the desciriptive and inferential analysis validated that education is the most important factor, among predictors, in predicting the basic numeracy skills of adults. Since education level increases, so do the basic numeracy scores of the sampling adults This means that the basic numeracy score of a participant who graduated from high school was lower than the one's basic numeracy score, who graduated from a university, and was higher than the participant's basic numeracy score, who graduated from a secondary school. Moreover, education beyond having an undergraduate degree is the most important predictor in the model for explaining the variance in the outcome of basic numeracy skills.

Parental Educational Backgrounds for Basic Numeracy Skills

The fifth research question explored whether parental educational background of the adults is a significant factor in predicting the basic numeracy skills of adults. Parental educational background was distributed in terms of mother eduction and father education. Analysis of descriptive findings associated with parental eductional background provided that since the mothers of the sampling adults' education level increases, the mean scores of the basic numeracy skills also increase. Furthermore,

the same conclusion could be drawn for father education; the mean scores of the basic numeracy skills of the participants increase depending on the increase of the education level of the fathers of the participants.

In correlational analyses, Spearman rank correlation value indicated that the relationship between mother's education and numeracy scores ($r = .165$, $p < .01$), and between father's education and numeracy scores ($r = .235$, $p < .01$), were found to be low but significant. On the other hand, the relationship between mother's education of the participants and basic numeracy skills were not statistically significant through the multiple linear regression analysis in $p < .05$. Since predictive variables jointly predict how all of the predictor variables together relate to the outcome in multiple linear regression analysis, one way ANOVA was conducted to examine the effect of mother education and father's education on basic numeracy skills of male and female participants' seperately in detail. Thus, mother's education of adults is a significant factor in predicting the basic numeracy skills of female participants while it is not significant for males. Otherwise, the variable measuring in both multiple linear regression model and one way ANOVA results, the relationship between father education of the participants, both for males and females, and basic numeracy skills is statistically significant. This means that as the education level of fathers of the sampling adults increase, the numeracy scores also increase.

In summation, parental educational background assessed seperately in terms of mother education and father education since the statistical analyses results were different as that father education of the participants is a significant factor in predicting the basic numeracy skills of the sampling adults yet mother education of the participants is significant only for female participants.

Apart from the main findings related to the fifth research question, findings from the correlation analysis indicated that the education level of the sampling adults was correlated to education level of their parents, which means that sampling adults, whose education level is higher, have parents whose education level is also higher. Furthermore, the education level of parents of the sampling adults are also highly correlated to each other ($r = .654$, $p < .01$). This result indicates that as the education level of mothers of the sampling adults' increases, the education level of fathers of the sampling adults also increases. These are considerable results related to the association of parental educational background and education given as extra information.

Numeracy Attitude for Basic Numeracy Skills

The sixth research question focused on whether attitude toward numerical information a significant factor in predicting the basic numeracy skills of adults. Findings from all, descriptive, correlational, and multiple linear regression analyses associated with the final research quesition revealed that numeracy scores are related significantly to numeracy attitute ($r = .388$, $p < .01$). This indicated that sampling adults who had more numeracy attitude were the ones whose numeracy skills scores were higher. In other words, since attitude for numeracy increased, so did the basic numeracy skills mean scores.

In this study, five predictors (i.e., gender, age, education, parental education in terms of mother education and father education, and numeracy attitute) was used for predicting the basic numeracy skills of adults. Educational background, father education, mother education for females and numeracy attitute were found as

significant factors in predicting basic numeracy skills of adults. It was reported significant predictions with the values of the R2 as .347 and adjusted R2 as .338.

Discussion of the Results

Provided that some of the findings (i.e.; gender, age, and mother educational background for male participants) were not significant, there are still important notions to be discussed that can be derived from this study. Considerable implications can be drawn for the future the concept of adult numeracy in Turkey upon discussing the findings of this study. This part were grouped as examining basic numeracy needs of the society, gender as a factor of numeracy, age as a factor of numeracy, education and basic numeracy skills, parents' education as a factor of numeracy, and attitute as a factor of numeracy.

Examining Basic Numeracy Level of The Participants

In this study, basic numeracy skills are defined as identifying numbers, using measurements, understanding graphs, and solving problems, which are related to the basic mathematical skills that everyone needs to master in daily life. These subjects are covered by the Level 1 according to NCTM Adult Numeracy Standards, which are mastered in the forth and fifth class of the primary education in Turkey. This means that according to The Turkish education system, while graduating from the fifth class of the compulsory primary education, a person should have mastered Level 1. Since all the participants of this study, graduated, at least from primary education, they are all accepted as they have practiced the numerical information at Level 1.

On the contrary, the results of the study indicated that majority of the adults lack some of the basic numeracy skills, especially ‘‘basic statistical measure’’ and ‘‘approximation by rounding’’. The reason for being inadequate of these two concepts might be that these subjects were included in the sixth grade primary mathematics education curriculum just a few years ago, in 2005. Since the sampling group consists of adult participants, the adults were unfamiliar this numeracy objectives such as using tables and charts, drawing line graphs, and using approximation by rounding. Moreover, majority of the adults did not know the meaning of range.

Another point to be discussed is that the mean score of the basic numeracy skills test was found as 24.59. The mean score decreased significantly for the adults who had graduated from primary school (15.85) and who had graduated from secondary school (18.18). Since the objectives of the basic numeracy skills were covered by the fourth and fifth grade primary mathematics education curiculum, the score of the participants were expected to be much higher than these mean scores. If this is the case, it could be concluded that the national mathematics curriculum in formal education did not include enough notion of numeracy. Since numeracy, briefly, is defined as a tool for application of mathemaical knowledge in daily life, the previous mathematics curriculum did not serve this goal. The participant group consisted of adults, which the youngest one was eighteen years old, and they were educated the mentioned mathematics curriculum in primary school years. By 2005, the primary mathematics education curriculum was completely changed as being focused on application and portfolio assessments rather than memorizing and paper-pencil tests. Although the numeracy notion was not taken into account while preparing the new

mathematics curriculum, the target of the new curriculum is to improve the application of the mathematical concepts into daily life. However, the outcomes of the current primary mathematics curriculum on numeracy skills have not been questioned yet.

Additionally, such a low mean score of the basic numeracy skills test indicates that adults were in need of numeracy education especially relevance and connections, problem solving, reasoning, spatial sense and measurement, and patterns and functions. Even if the highest percentage of the sample (39.7 %) consisted of adults who had graduated from a kind of higher education school (i.e., open university, vocational / two-year university, university, and graduate), the mean score of the basic numeracy skills indicated that just a few items more than half of the basic numeracy items were answered correctly. Thus, it could be stated that the mathematical knowledge that has been taught in formal education was not appliciable to into daily life which exposes the necessity of numeracy education apart from mathematics in Turkey.

These results about basic numeracy needs and skills of the participants are consistent with previous studies done in Turkey. Even if Demir and Paykoç (2006) investigated the major problems of Turkish society in daily life, being apart from purely numeracy reseach, their findings were highly related to the numeracy needs of society. They suggested that the participants were in need of critical thinking, problem solving, and basic numeracy and life skills. Ersoy (2002), giving parallel results to this study, investigated basic numeracy skills that Turkish society needs as estimation, measuring and handling the data, and problem solving. Durgunoğlu and Öney (2000) also agree that the participants in their research were in need of learning

basic numeracy skills. Moreover, Ataklı (2008), in her previous research, indicated that adult learner's lack of developing an understanding of the concept of numbers and of the relationships between operations. All these national research findings agree that the majority of adults in Turkey are insufficient at some kind of basic numeracy skills. Therefore, an attempt, governmentally or nongovernmentally, should be undertaken in order to supply the numeracy needs of the society.

The results of the current study were based on an extensive literature review showing that inadequate numeracy skills of the population was always a problem, even in developed countires in adult numeracy field. One such country is England, where the government has put in place the Skills for Life national strategy to improve adult numeracy (DfEE, 2001). The recent Skills for Life Survey (DfES, 2003) found that twenty eight million adults (47%) had numeracy skills below Level 1, although most did not think they had a problem in that area. The findings from the (ALL) showed that the majority (58.6 %) of the USA population were not likely to have the basic numeracy skills necessary to function successfully in society today (Statistics Canada & OECD, 2005, p. 50; Tamassia et al., 2007, p.16). Even though Scotland developed a national policy on adult numeracy (Scottish Executive, 2001), in the ALNIS report, it was presented that about 2% of the 800,000 adults have basic numeracy needs (Communities Scotland, 2003).

Previous studies have shown that besides Turkey, even for the developed countires in adult numeracy field, society needs to be impoved in terms of basic numeracy skills. However, it is undoubtedly true that for the countries who have national policies and strategies on adult numeracy, this improvment would be easier. In brief, unless a national policy is identified and a national curriculum is prepared

for the basic numeracy skills, it will be quite difficult to be aware of the basic numeracy needs of the society and to overcome the basic numeracy problems of the society.

Gender as a Factor of Numeracy

The results of this study indicated that gender contributed to the study as an insignificant factor for predicting the basic numeracy skills of the adult participants. On comparison of the mean scores of the basic numeracy test of the males and females, it was found that male's mean score was slightly upper yet this was not a statistically significant difference. However, the mean scores of basic numeracy scale for age, education, and parental education were indicated for female and male participants separately in order to get detailed information about gender differences on basic numeracy skills. The mean score of females who are between the age of 25 and 40 (27.02) was found as higher than the mean score of the male participants (24.38) in the same age group. This was an exceptional result which was in contrast with the main result of the second research question. It might because of that practice effect, which means experiences can lead to an accumulation of knowledge and skills until an advanced age, had more implication on females rather than male participants.

Moreover, the mean score of females who were older than 56 years old was quite lower than the mean score of the male participants who were older than 56. Since underestimating the education of women in the preceding generation, the educational level of females were greatly lower than the educational level of males. Hence, the huge difference of the mean scores of males and females were quite

acceptable result considering the importance of women's education in Turkey about fifty years ago.

In recent years, gender has been a central concept in numeracy education and a considerable amount of work has been done on gender issues in adult numeracy. While some of the findings were consistent with the result of this study (Burton, 1990; Henningsen, 2002; Coben, Colwell & Macrae, 2003), there were a number of different findings that favor males in terms of basic numeracy skills (Hyde, Fennema, & Lamon, 1990; Parsons & Bynner, 1999).

Due to the results of ALL in 1996 and in 2005, and the results of IALLS in 2003, gender interacts with the distribution of adult skills and in general, men tend to display an advantage in basic numeracy skills. However, there were some countries (i.e.; Canada, Italy, Norway, and Switzerland) where basic numeracy skills appear to be gender neutral (''OECD'', 2007). Additionally, men appeared to have higher levels of numeracy in England, even when controlling for differences in education and employment (DfES, 2003).

Another point to be discussed about gender is that Johnston (1998) noted that the general agreement on numeracy and gender strongly rejected biological explanations of difference. Additionaly, some researches have arisen as a response to the perceived invisibility of women in numeracy education and the underestimating women's numerical abilities (Coben et. al., 2003). For example, spatiality is one area where female numerical skills have been supposed to be defective; despite the evidence are ambiguous (Fennema, 1995). Henningsen (2002) also pointed out that there is ''considerable literature on what makes women feel bad about numeracy yet

there is some research on what makes women feel better about numeracy but very little about what makes women feel good about numeracy''(p.229).

Generally, the recent results of the pieces of research have suggested that there exist a male advantage in numeracy performance. However, this result is not because of biological difference, it is because of the cultural acceptance of underestimating women's numerical ability.

In this study, the majority of the sample consisted of females (70%). Since they participated the İsmek courses voluntarily in order to improve their skills and abilities at some kind of art and vocational courses, they seem as having high self conscious and self confidence. Additionly, there was no big difference between the education level of male participants and females. Hence, there not being a significant gender difference in basic numeracy test scores is a quite acceptable result for this study.

Age as a Factor of Numeracy

The relationship between age and skills is complex because age represents an accumulation of life experiences that are likely to impact on the development and even loss of skills throughout the lifespan. Aside from the possible effects of ageing, the influence of age on numeracy skills does not operate in isolation. Rather it is influential in so far as it denotes typical life experiences that occur at various stages of the life span.

In current study, a statistically significant relationship could not be found between age and basic numeracy skills of adult participants. However, descriptive analysis showed that participants who were below the age of 40 were higher achiever

than the rest of the group. Moreover, the oldest group (over 72 years old) was the least achievers. The results about age related to basic numeracy skills of this study are consistent with most of the previous studies (Zevenbergen, 2004; Johnston, 2002; ‘‘BSA’’, 1995; Statistics Canada & OECD, 2005). All these studies indicated that age was not a strong performance discriminator for numeracy however there was a tendency for the oldest respondents to perform at a slightly lower level than those in other age groups.

On the contrary, age and numeracy skills are inversely related in a number of studies (OECD and Statistics Canada, 2005; OECD and HRDC, 1997; Withnall, 1995). Younger cohorts tend to score higher on average and have larger proportions at higher levels of skills. These studies resulted that age is an important demographic factor to consider when devising strategies to improve numeracy skills.

An explanation put forth in the scholarly literature suggests that as time progresses, adults may experience reduced cognitive performance, which is attributable to ageing effects, to declines in cognitive mechanics such as attentional capacity, processing speed, reasoning, working memory capacity and spatial ability (Smith and Marsiske, 1997). This explanation also demonstrates that why the oldest group (over 72 years old) were the lowest achievers in this study.

At the same time, a number of studies suggest that experiences can lead to an accumulation of knowledge and skills until an advanced age, which is referred as practice effect, when they may level off (Horn and Hofer, 1992; Schaie, 1994; Marsiske and Smith, 1998). Practice effect could be clearly seen at the sampling adults in the current study since the participants from the age group between 25 and 40 had the highest scores from basic numeracy test. Since it was found that practice

effect had more implication on females rather than male participants, the mean score of females who are between the age of 25 and 40 was higher than the mean score of the male participants in the same age group.

Another point to be discussed is that younger adults have received extended formal schooling and more recent schooling compared to older adults, and more emphasis may be placed on the acquisition of cognitive skills now than in earlier periods (Withnall, 1995). He suggests that as time advances, numeracy skills can diminish from what they were at the time of school completion. There are wide differences in educational attainment among the same age groups in this study, especially between female and male participants who were older than 56 years old, making this particular life experience a potentially major factor influencing the relationship between age and numeracy skills. It is also important to consider changes in the quality of education over time, or the quality effects of education. The gradual improvement in education systems over time may explain at least part of the numeracy skills and age relationship observed.

Beyond education there are different life experiences such as individual job market experiences, the extent of engagement in adult learning and other practices that are likely to have a significant influence on the numeracy skills and age relationship. It is impossible to separate ageing, and practice effects when working with cross-sectional data. The information needed to assess the cumulative impact of individual life experiences on the development of numeracy skills is not captured in this study. Addressing this would require complex and costly longitudinal designs involving repeated cognitive assessments of the same individuals over time.

Educational Background as a Factor of Numeracy

Consistent with previous studies, the result of this study indicated that evidence of a strong positive association between basic numeracy skills and educational attainment was established (Parsons & Bynner, 1998; Casey et, al., 2006; Marks et. al., 2000; Rothman & McMillan, 2003). In other words, both theory and the findings of this study suggest that education plays a key role in the formation of the basic numeracy skills. The analysis focuses on comparing the basic numeracy skills of the sampling adults with varying experiences of upper secondary education.

Despite the strong relationship between education and basic numeracy skills, it is imperfect which means that relying on measures of educational attainment to predict the adults' basic numeracy skills is more complex than simply attending school or completion a formal education level. There are other factors (i.e. the department of the high school, the faculty of the university) that may play an important role in the development of basic numeracy skills.

In the current study, it was also found that individual differences in upper secondary education status are strongly related to differences in basic numeracy skills of adults. This findings of the study gave parallel result to the results of ALL in 2003, which indicated that in most participant countries (i.e. Canada, Swiss, Italy, and Norway), adults with more years of post-secondary schooling, on average, showed higher numeracy skill proficiencies than those with fewer or no years of postsecondary schooling. Switzerland, especially, displayed the sharpest average differences in numeracy skill proficiencies for every additional year of post-secondary schooling (DfES, 2003).

Another point related to the current study is that, the mean score of female participants (16.72 for primary school graduaters and 18.48 for secondary school graduaters) who had lower education level from high school was found as higher than the mean score of male participants (13.30 for primary school graduaters and 17.38 for secondary school graduaters) who had lower education level from high school It might because of the role of the women at home. The women, who have a primary school and secondary school education level, are generally housewives and do not work outside the home. Thus, one of their roles at home is taking care of children and preparing them to school. They have the responsibility of school work of their children while the father has the responsibility of earning money outside. While helping children do mathamatics homework until high school level, their basic numeracy skills might be improved compared to fathers by practicing basic mathematical concepts.

Therefore, a huge number of research studies suggests that educational attainment is a key determinant of cognitive skills proficiency including adult literacy and numeracy (e.i. Kirsch, Jungleblut, Jenkins, Kolstad, 1993; OECD and Statistics Canada, 2005; Boudard, 2001; Desjardins, 2004). This is not surprising since, in most societies, a principal and widely accepted goal of the educational systems is to produce a population able to read, write and count. But despite the strong relationship, the development and maintenance of basic numeracy skills should be more complex than simply attending school. Results of this study considered, higher levels of educational attainment were associated with higher average basic numeracy scores. Beyond average scores, however, higher levels of education did not necessarily imply higher basic numeracy scores for all. There were

some participants attaining higher levels of education who obtained lower scores than persons with less education. The reason for this might be that differences in the quality of educational provision among age groups For instance, younger participants who may have benefited from beter educational provision may consistently score above average for each level of educational attainment; and older persons may consistently score below average.

Another point to be disccussed is that lower levels of educational attainment are associated with lower levels of basic numeracy skills. For young adults, low basic numeracy skills in turn may signal serious risks in their initial transition from education to work and of failing to benefit fully from further education and learning opportunities throughout life. Even further, early school leavers with low basic numeracy skills might be more likely to face difficulties entering the labour market and maintain employment. This interpretation stressed in this study was also highlighted by OECD's annual indicators on education and associated labour market outcomes, which suggested that it marks the minimum threshold for successful labour market entry and continued employability (OECD and Statistics Canada, 2005).

In summary, education is a major factor affecting the acquisition, maintenance and development of basic numeracy skills. However, because skills are required to succeed in education, and increasingly so at higher levels, higher skill proficiencies are likely to lead to enrollment in and completion of higher education (Coombs and Ahmed, 1974). These two aspects of the education and numeracy skills relationship reinforce each other; numeracy skills learned in schools facilitate access to further schooling that in turn builds numeracy skills. It is impossible to separate these two

effects when working with cross-sectional data. Nevertheless, the results of this study provide compelling evidence confirming the strong and positive relationship between education and basic numeracy skills.

Parents' Education as a Factor of Numeracy

This part considers the impact of parental education upon the basic numeracy skill levels of the adults participating in this study. In this study, parents' educational background were examined seperately as mother educational level and father educational level. While father's education was found as statistically significant for predicting the basic numeracy skills of the adult participants, mother's education was not for male participants.

Adult numeracy acquisition can be seen as being supported by a number of interrelated family socio-economic and educational experiences. There are considerable amount of research studies supporting the notion that adults whose parents have attained higher levels of education are advantaged in the formation of numeracy skills (Parsons and Bynner, 2004; Epstein and Dauber, 1991; Ho and Willms, 1996; Stevenson and Baker, 1987; Tuijnman, 1989). In other words, adults whose parents have relatively low levels of education tend to be low numeracy skilled, and conversely, adults whose parents have higher levels of education tend to be more skilled. Apart from this generalization, it was found that some reversable conclusions could be drawn. For instance, the results of the ALL survey in 2003 indicated that in Italy, there were many adult participants whose parents have high levels of education who nevertheless achieve basic numeracy skills (DfES,2003).

On the other hand, there is another crucial finding from a number of studies (Desjardins, 2003; Kapsalis, 1999; Willms, 1997) in this field. Since mothers play an important role in establishing both early literacy and numeracy skills, the level of mother's education plays an important role on literacy and numercy skills, even for adults. However, the findings of this study showed contrasting in some way to this literatute. Even though the basic numeracy skills mean scores increased depending on increasing of mothers of the sampling adults' education level through descriptie analysis, the multiple linear regression analysis concluded that mother education level was not a significant factor in predicting the basic numeracy skills of adults. Additionally, one way ANOVA test concluded that mother education level was a significant factor for just female participants. On the other hand, father education explained differences in basic numeracy scores of both female and male participants significantly.

The result of this study stated above was an extraordinary finding which could not be found any similarity through the previous literature. The reason for this might be that majority of the research studies in the literature were done in Western societies. In Western societies, both fathers and mothers are important figures at guiding children, at taking decision about their educational planning, and also being a role model to their children about their educational and occupational position in future. On the contrary, in Turkish society, especially for the preceding generation, father is the role model for children, especially for boys. Since being a role model for girls, the role of the mother has been thought as looking after children, cooking, cleaning, and tidying in the society, the voice of the mother on the boys in terms of education, occupation, finance, and career has been underestimated for years.

Because of patriarchy in Turkish society, fathers, generally, have a right to decide about future educational planning of the children, especially on boys and also boys admire fathers and want to follow their career. Hence, the effect of fathers' educational background rather than mothers' on the basic numeracy skills of adults is a quite acceptable result for the Turkish society.

Attitude as a Factor of Numeracy

The use of numerical attitute for predicting basic numeracy skills of adults is scarce in most numeracy education literature. However, in this study numeracy attitute was considered as one of the predicting variable for basic numeracy skills of adult participants. The study findings indicated there was a highly significant relationship between basic numeracy skills of adult participants and their numeracy attitute. In other words, attitute for numeracy increases, so does the basic numeracy skills mean scores. This finding also appears to be consistent with previous studies (Payne,1992; Viswanathan, 1993; Evans, 1989a).

Attitude, generally, might have influenced individuals' tendency to acquire skills, as well as their willingness to apply this skills that they possess in various settings. Particularly for numeracy, individuals with low preference for numerical information may be less likely to acquire basic numeracy skills that are required in everyday usage than are individuals with high preference for numerical information. Therefore, as Evans (1989a) stated that a basic preference for numerical information could influence the acquisition of practical numeracy skills as well as the application of these skills in everyday life. This statement explains the reason for taking numeracy attitude as predicting variable for basic numeracy skills in this study.

In this section, it was concluded from the results that educational background makes the strongest contribution to the prediction of basic numeracy skills' of adults when compared to gender, age, parental educational background, and numeracy attitute. Furthermore, father's educational background, mother's educational background for female participants and numeracy attitude were found as significant while gender, age, and mother education of males were not. Additionally, the national and international research findings were referred and they were compared and contrasted with the results of the study. Lastly, additional information and interpretations related to findings were discussed.

Limitations of the Study

Due to the correlational nature of the study, a causal relationship can not be established. Firstly, the adult population was limited to just one year period between 2010-2011 years. Some of the background predictor variables (i.e. age, numeracy attitute) of adults may change over time.

During the data collection process, some subjects may have felt to answer questions according to "social desirability bias". While answering the demographic information form, people are likely to react in ways they believe are socially acceptable. For example, social desirability bias observed for educational statues; a sample stated that she was a high school graduater however her classmate informed that she graduated from secondary school.

Measurement issue might be another limitation. The lenght of the SBKTC and YTMOB may have bored and deterred some of the participants from completing them along two and half hours, such a long time.

Moreover, the study used global measures and not necessarily measures specific to the basic numeracy skills and numeracy attitute being studied in the current reserach. The limitation in using global measures is that it makes difficult to provide clearer answers that more specific measures have found there to be. Thus, SBKTC and YTMOB may not be the best instruments for measuring.

Another limitation is caused by the characteristics of the SBKTC which consist of 20 statements with five point Likert type scale. In the SBKTC, some of the items are very similar in their content. Several participants were less motivated to respond the scale because of repetition of questions.

Recommendations and Suggestions for Further Researches

The results of this study indicated the importance of basic numeracy skills for adults and educational and non-educational factors that influence these skills. This study might be a basis for further researches about basic numeracy skills of adults in Turkey. Further studies using different kinds of instruments and different samples may contribute to the adult numeracy field. For further researches, it can be suggested to study the other educational factors (i.e. types of high school, department of high school, and faculty of university) or the other non-educational factors (i.e. occupation, income, misconceptions, prejudgement) related to basic numeracy skills. Achievement differences associated with income and occupation, which were excluded in this study, is a common concern facing most international survey results. Research within this area could examine if increased income or job quality has a more direct impact on achievement of basic numeracy skills. Furhermore, daily life

practices enhancing numeracy should be used in intervention studies to further investigate their effects on basic numeracy skills and achievement.

Since educational background and numeracy attitute were found to be important to explain basic numeracy skills of adults, ways to improve attitute for numeracy in daily life and integrate numeracy education in mathematics curriculum through formal education would be worthy of further studies.

Although, in the model, numeracy attitude was the predictive variable for basic numeracy skills of adults, the relationship between numeracy attitude, as a criterion variable, and demographic factors or educational factors might be a question for further researches.

Currently, many studies are using nonexperimental or cross-sectional designs; thus it would be recommended that future studies consider conducting longitudinal and experimental designs. Furthermore, using multiple methods may be beneficial in acquiring a better understanding of the relationship that may or may not exist between the basic numeracy skills and its predictive variables.

In the current research multiple linear regression analysis method were conducted as multivariate analysis to see which of the predictive variables explained the basic numeracy skills significantly. For further explanations, hierarchical multiple regression or stepwise regression analysis would be used with different populations and larger sample in order to see the findings of this study is still valid.

The level of basic numeracy skills and basic numeracy needs of the participants were apparent in this study. The findings were consistent with other national studies and studies in abroad. The findings showed that Turkish society is in high need of a national policy and national curriculum for basic numeracy skills. A need assessment

for numeracy education program should be studied and a basic numeracy curriculum that is suitable for the needs of Turkish society should be developed in further studies. There is a need to study implementation of the numeracy curriculums, not only basic numeracy skills but also on the different level of numeracy skills. Additionaly, it is more important for students rather than adults to introduce numeracy notion on the school textbooks. This recommendation is based on findings which confirmed that states that give high importance to numeracy and have national numeracy curriculum achieved better at numeracy tests compared to states who do not have any attention and policy to numeracy education. It would be pleasing to see if this trend continued across Turkey, too.

A qualitative study can also be carried out to answer some questions for further researches: What can be done to diminish the basic numeracy needs of the adults in Turkey? How could formal and non-formal learning areas help adults to solve their numeracy problems facing through daily life? What kind of educational activities can facilitate adults in this process? The attempt to answer these questions by future researches will enrich the national literature by providing detailed information for numeracy subject.

To conclude, this study bears important implications for basic numeracy skills of adults in Turkey. First of all, the levels of basic numeracy skills of adults according to NCTM Adult Numeracy Standards were identified. Then, the educational and non-educational factors predicting basic numeracy skills of adults were stated. As well as the implications for the adult educators and researchers in mathematics education field, the findings of this study have some further implications for the national education ministry. Although the field of adult

numeracy has been a growing area of practice and research all around the world, in Turkey numeracy, not only for adults but also for students, is a newly adopted term. Thus, the Ministry of Education should consider the ways how to introduce numeracy notion through formal and non-formal education system in Turkey. Additionally, adult numeracy has a recognized role in contributing to the empowerment, effective functioning, economic status, and well being of citizens and their communities in this rapid and constantly changing world. Hence, the Ministry of Education should also consider how to form a national policy and curriculum about numeracy education to catch up with their developed counterparts in this field. Nevertheless, I think that the findings of this study will enable us to take precautions and draw a way to a certain extent about the future of numeracy education both for adults and adolescents in Turkey.

APPENDICES

APPENDIX A: DEMOGRAPHIC INFORMATION FORM (*KİŞİSEL BİLGİLER ANKETİ)*

Aşağıda kişisel bilgilerinizi öğrenmeye yönelik 10 adet soru bulunmaktadır. Lütfen size seçenek sunulmuş olan sorularda (1., 4., 5., 6., 9., 10. sorular) size uygun olan seçeneği çarpı (X) şeklinde işaretleyiniz. Seçenek sunulmayan soruları (2, 3., 7., 8. sorular) yanlarındaki boşluklara cevaplandırınız.

1. Cinsiyetiniz**:** Kadın _____; Erkek _____
2. Yaşınız: _____
3. Mesleğiniz : _____
4. Eğitim Seviyeniz: İlkokul ____

   Ortaokul ____

   Lise (Ortaöğretim) ____

   Üniversite ____

   (Açık öğretim ____; Yüksek Okul ____ ;

   Dört Yıllık Fakülte ____)

   Yüksek lisans ____

   Doktora _____
5. (Eğer Mezun Olduysanız) Mezun Olduğunuz Lisenin Türü:

   Özel _____ Düz Lise _____ Meslek_____

   Anadolu_____ İmam Hatip_____ Diğer_____.
6. (Eğer Liseyi Bitirdiyseniz) Lisedeki Bölümünüz:

Sayısal ____; Eşit Ağırlık (Türkçe-Matematik) ____;

Sözel ____; Yabancı Dil ____; Sanat ____ Diğer____;

7. (Eğer Üniversite Mezunuysanız) Üniversiteden Mezun Olduğunuz Fakülte: _____
8. (Eğer Üniversite Öğrencisiyseniz) Üniversitede Okumakta Olduğunuz Fakülte: ____
9. Annenizin eğitim seviyesi:

   Hiç okula gitmemiş ____; İlkokul____; Ortaokul____;

   Lise____; Üniversite____; Yük. lisans____; Doktora_____.

10. Babanızın eğitim seviyesi:

    Hiç okula gitmemiş ____; İlkokul____; Ortaokul____;

    Lise____; Üniversite____; Yük. lisans_____; Doktora __

APPENDIX B: PREFERENCE FOR NUMERICAL INFORMATION SCALE

ITEMS	(7) Strongly Agree	(6) Mostly Agree	(5) Somewhat Agree	(4) Undecided	(3) Somewhat Disagree	(2) Mostly Disagree	(1) Strongly Disagree
1. I enjoy work that requires the use of numbers.							
2. I think quantitative information is difficult to understand.							
3. I find it satisfying to solve day-to-day problems involving numbers.							
4. Numerical information is very useful in everyday life.							
5. I prefer not to pay attention to information involving numbers.							
6. I think more information should be available in numerical form.							
7. I don't like to think about issues involving numbers.							
8. Numbers are not necessary for most situations.							
9. Thinking is enjoyable when it does not involve quantitative information.							
10. I like to make calculations using numerical information.							
11. Quantitative information is vital for accurate decisions.							
12. I enjoy thinking about issues that do not involve numerical information.							
13. Understanding numbers is as important in daily life as reading or writing.							
14. I easily lose interest in graphs, percentages, and other quantitative information							
15. I don't find numerical information to be relevant for most situations.							
16. I think it is important to learn and use numerical information to make well informed decisions.							
17. Numbers are redundant for most situations.							
18. It is a waste of time to learn information containing a lot of numbers.							
19. I like to go over numbers in my mind.							
20. It helps me to think if I put down information as numbers.							

APPENDIX C: TURKISH VERSION OF PREFERENCE FOR NUMERICAL INFORMATION SCALE
(*SAYISAL BİLGİ KULLANIMINDA KİŞİSEL TERCİH ÖLÇEĞİ*)

Değerli Katılımcı,

Aşağıda sayısal bilginin kullanımında kişisel tercihlerinizi ölçmeye yönelik 20 adet soru bulunmaktadır. Lütfen her bir soruda size uygun gelen derecelendirmenin altına çarpı (X) işareti koyunuz.

SORULAR	(5) Kesinlikle Katılıyorum	(4) Katılıyorum	(3) Kararsızım	(2) Katılmıyorum	(1) Kesinlikle Katılmıyorum
1. Sayılara gereksinim duyulan işleri yapmaktan hoşlanıyorum.					
2. Sayılarla ilgili bilgileri anlamakta zorlanıyorum.					
3. Günlük hayatta sayılarla ilgili problemleri çözmekte zorlanmıyorum.					
4. Sayısal bilginin günlük yaşamda çok faydalı olduğunu düşünüyorum.					
5. Sayısal bilgilerle ilgilenmemeyi tercih ediyorum.					
6. Daha fazla bilginin sayısal formatta olması gerektiğini düşünüyorum.					
7. Sayılar içeren konulara kafa yormayı sevmiyorum.					
8. Sayıların birçok durum için gerekli olmadığını düşünüyorum.					
9. Sayısal bilgi içermediği zaman düşünmenin eğlenceli olduğunu düşünüyorum.					
10. Sayısal bilgileri kullanarak hesaplamalar yapmayı seviyorum.					
11. Doğru kararlar vermek için sayısal bilgilerin çok önemli olduğunu düşünüyorum.					
12. Sayısal bilgileri içermeyen meselelere kafa yormaktan hoşlanıyorum.					
13. Sayıları anlamanın günlük yaşamda okuma yazma kadar önemli olduğunu düşünüyorum.					
14. Grafikler, yüzdeler ve diğer sayısal bilgilere karşı ilgimi kolaylıkla kaybediyorum.					
15. Birçok durum için sayısal bilgileri alakalı bulmuyorum.					
16. İyi ve doğru karar vermek için sayısal bilgileri öğrenmenin ve kullanmanın önemli olduğunu düşünüyorum.					
17. Birçok durum için sayısal bilginin gereksiz olduğunu düşünüyorum.					
18. Çok fazla sayı içeren bilgileri öğrenmenin zaman kaybı olduğunu düşünüyorum.					
19. Zihnimden sayıları tekrar tekrar gözden geçirmeyi seviyorum.					
20. Bilgiyi sayılara dökmek düşünmeme yardımcı oluyor.					

APPENDIX D: Key Skills Application of Number Adult Numeracy Level 1Test Paper

YOU NEED

- This test paper
- An answer sheet
- A ruler marked in mm and cm

You may NOT use a calculator You may use a bilingual dictionary

You may write on this paper if it helps you to work things out

---

Do NOT open this paper until you are told to do so by the supervisor

THERE ARE 40 QUESTIONS IN THIS TEST

Total marks available: 40

Try to answer ALL the questions

YOU HAVE 1 HOUR 15 MINUTES TO FINISH THE TEST

INSTRUCTIONS

- Make sure your personal details are entered correctly on the answer sheet
- Read each question carefully
- Follow the instructions on how to complete the answer sheet
- At the end of the test, hand the test paper, your answer sheet and all notes to the supervisor

---

REMEMBER: YOU HAVE 1 HOUR 15 MINUTES TO FINISH THE TEST

Questions 1 to 5 are about making cakes to sell on a charity stall.

1. A recipe uses three eggs to make one sponge cake.
How many eggs does a cook need to make four of these sponge cakes?

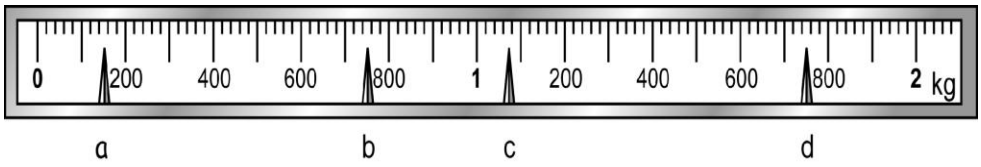
A. 3

B. 4

C. 7

D. 12

2. The recipe uses 175 grams of butter for each cake.



Which pointer shows a reading of 175 grams?

A. Pointer a

B. Pointer b

C. Pointer c

D. Pointer d

3. The cook sets the oven temperature for the cakes. Oven temperature can be measured in degrees.They are called degrees

A. Centimetres

B. Celsius

C. Grams

D. Minutes

4. She puts the cakes into the oven at 10:35am.
They take 25 minutes to bake.

clock a

clock b

clock c

clock d

Which clock face shows the time the cakes should be taken out of the oven?

A. clock a

B. clock b

C. clock c

D. clock d

5. One cake costs £1.50 to make.
The cake is cut into six portions and sold for 50p a portion.
Which calculation finds the difference between the cost of making the cake and the total selling price for one cake?

A. 1.50 - 0.50

B. (6 x 0.50) - 1.50

C. 6 x 0.50

D. 1.50 / (6 x 0.50)

Questions 6 to 10 are about a holiday.

6. A holidaymaker books a holiday costing £1 100
He pays a 15% deposit. What is 15% of £1 100?

A. £15.00

B. £16.50

C. £150.00

D. £165.00

7. The holidaymaker buys 4 bottles of suntan lotion.
Each bottle costs £5.49
How much do 4 bottles of suntan lotion cost?

A. £20.49

B. £20.66

C. £21.96

D. £21.99

8. The holidaymaker has 64.24 euros left from a previous holiday. How much is this to the nearest euro?

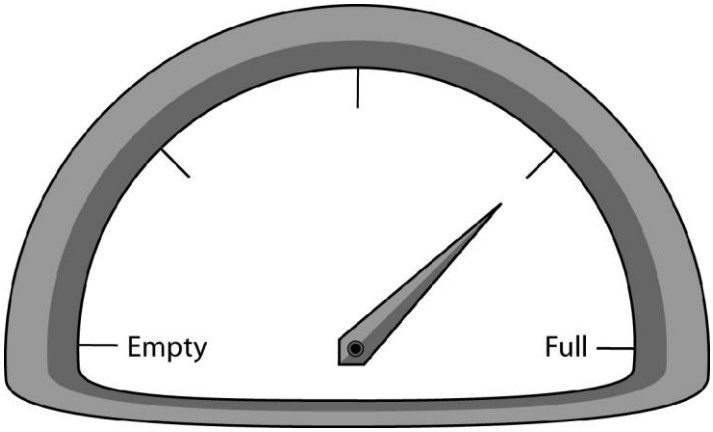
A. 60 euros

B. 64 euros

C. 65 euros

D. 70 euros

9. The holidaymaker drives to the airport.
The diagram shows the reading on his car's petrol gauge.



How much petrol is left in the tank?

A. 1/4 of a tank

B. 1/3 of a tank

C. 2/3 of a tank

D. 3/4 of a tank

10. He leaves his car in the car park for 11 days.Car parking at the airport costs £35 for the first seven days then £5 per day for each of the extra four days. Which calculation should he use to find out the cost of parking?

A. 35 + (5 x 4)

B. 35 + (5 x 11)

C. (35 + 5) x 4

D. (35 + 5) x 11

Questions 11 to 13 are based on an article about Switzerland.

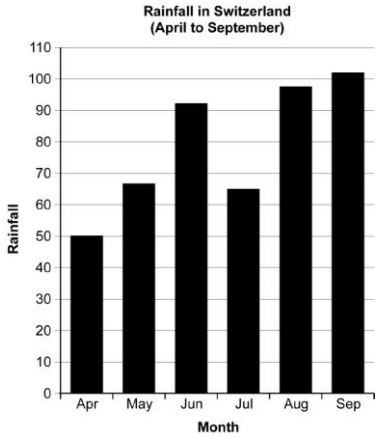
11. The article states that 20% of Swiss people speak French as their main language. What is 20% as a fraction?

    A. 1/2
    B. 1/5
    C. 1/4
    D. 1/20

12. The article states that the population of Switzerland is 7 261 000. One in ten of the population of Switzerland is Italian. How many of the population are Italian?

    A. 100 000
    B. 660 091
    C. 726 100
    D. 806 778

13. There is a bar chart in the article that shows the rainfall per month inSwitzerland from April to September last year.

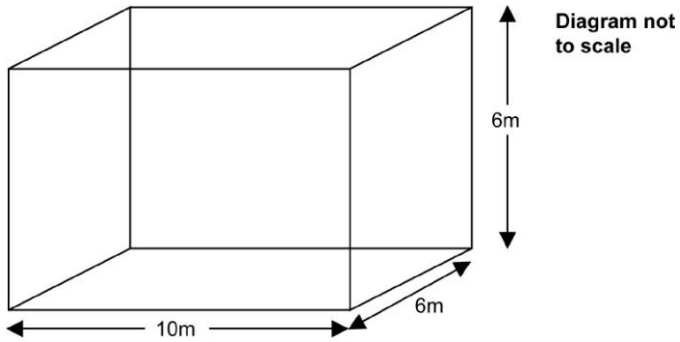


What is missing from the chart?

A. units on the vertical axis
B. a label on the horizontal axis
C. a title
D. a key

Questions 14 to 17 are about building a flat-roofed extension to a house.

14. The householder works out the volume of the planned extension.
The diagram shows the measurements of the planned extension.



What is the volume of the planned extension?

A. 22 m3

B. 60 m3

C. 120 m3

D. 360 m3

15. The builder has a plan of the house and the new extension.
The scale on the plan is 2cm : 1m.
The length of one wall on the plan is 10 centimetres.
How long is this wall?

A. 2 metres

B. 5 metres

C. 10 metres

D. 20 metres

16. One area of brickwork will be 36 square metres.
There are 120 bricks to a square metre.
How many bricks does the builder need for 36 square metres?

A. 3 620

B. 4 220

C. 4 320

D. 4 356

17. The builder works out an estimate of the total cost of the extension and fittings as thirty thousand six hundred and fifty pounds. In figures this is

A. £3 650

B. £30 650

C. £300 650

D. £30 000 650

Questions 18 to 22 are about hiring a company to clean carpets and curtains.

This table shows the cost of carpet cleaning

Cost of carpet cleaning	
Carpet	**Cost (£)**
Lounge	22.50
Dining room	17.50
Hall/stairs/landing	25.00
Bedroom (cost per bedroom)	17.00
Whole house 2 bedrooms	57.50

18. How much does it cost to have just the lounge and dining room carpets cleaned?

A. £39.50

B. £40.00

C. £42.50

D. £47.50

19. The householder has a two-bedroom house. She decides to have the following carpets cleaned

- lounge
- dining room
- hall/stairs/landing
- one bedroom

Which calculation will give the saving if she pays for the whole house cleaning of a two-bedroom house instead of paying for the carpets individually?

A. £22.50 + £17.50 + £25.00 + £17.00

B. £57.50 - £22.50 - £17.50 - £25.00

C. £22.50 + £17.50 + £25.00 + £17.00 + £57.50

D. £22.50 + £17.50 + £25.00 + £17.00 - £57.50

20. There is a special offer.

A four-bedroom house normally costs £72.00 for 'whole house cleaning'. How much id 1/3 of £72.00?

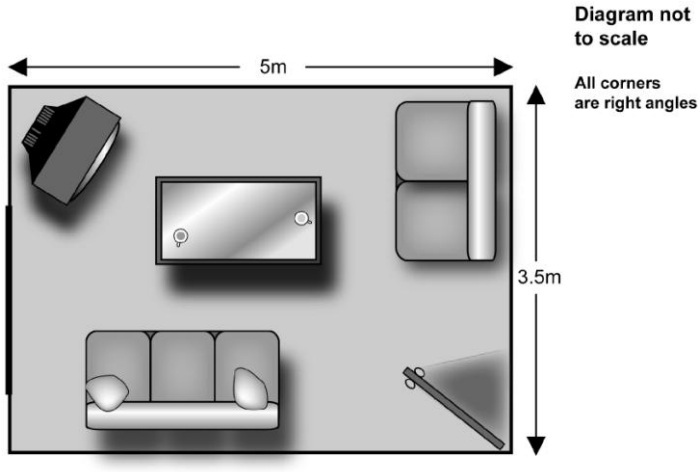
A. £13.00

B. £18.00

C. £24.00

D. £33.00

21. Another firm charges for cleaning by area.The householder calculates the area of this rectangular lounge



What is the area of the lounge?

A. 8.5 m2

B. 17.0 m2

C. 17.5 m2

D. 21.0 m2

22. The table shows the cost of cleaning curtains.

Curtains (per pair)	Price
Full length (over 1.5 metres long)	£22.50
Half length (under 1.5 metres long)	£17.50

How much does it cost to clean two pairs of full length curtains and one pair of half length curtains?

A. £52.50

B. £56.25

C. £61.50

D. £62.50

Questions 23 to 28 are about a charity shop.

23. On one day the manager records the number of customers buying items from the shop at different times.

Time	Number of customers buying items
0900 up to 1100	𝍸 𝍸 ||
1100 up to 1300	𝍸 𝍸 𝍸 𝍸 𝍸 |
1300 up to 1500	𝍸 𝍸 𝍸 𝍸 ||
1500 up to 1700	𝍸 𝍸 𝍸 𝍸

How many customers bought items from the shop on that day?

A. 60

B. 65

C. 78

D. 80

24. The shop sells clothes, books, bric-a-brac and charity cards.
The manager wants to compare the proportions of takings raised by sales of these different items.

Which is the best display to show proportion?

A. a pie chart

B. a line graph

C. a scale plan

D. a pictogram

25. He keeps a record of the number of books sold each day for five days.

Monday	Tuesday	Wednesday	Thursday	Friday
6	21	15	26	32

What is the average (mean) number of books sold each day?

A. 15

B. 20

C. 21

D. 26

26. One Friday the shop raises £120
One-fifth of the money raised goes to a local charity.
How much money goes to the local charity?

A. £15

B. £20

C. £22

D. £24

27. On one day the manager works out the average (mean) amount raised each hour. The calculator display shows this amount in pounds.

What is this amount to the nearest penny?

A. £6.60

B. £6.66

C. £6.67

D. £6.70

28. A customer buys three books at 10p each, one vase at 55p and a dress at £2.75

How much do these cost in total?

A. £3.60

B. £3.50

C. £3.40

D. £2.50

Questions 29 to 33 are about a company carrying out work abroad.

The company is paid in American dollars ($) for supplying and fitting some equipment.

29. The cost of the equipment supplied is $110 000

In words this is

A. eleven thousand dollars

B. one hundred and ten thousand dollars

C. one hundred and eleven thousand dollars

D. one million ten thousand dollars

30. The basic labour cost for installing the equipment is $79 000 plus a 10% allowance paid to anyone working away from home.
What is 10% of $79 000?

A. $10

B. $790

C. $1 000

D. $7 900

31. Another order costs $273 550
What is this rounded to the nearest $1 000?

A. $274 000

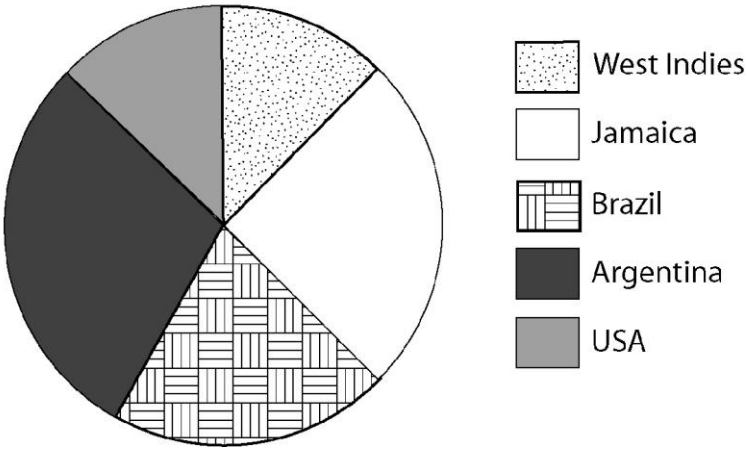
B. $273 600

C. $270 000

D. $270 000

32. The pie chart shows the value of orders received by the company from different regions.

Value of orders received from different regions



The pie chart shows that

A. the value of orders is the same from West Indies and Jamaica.

B. Argentina has the lowest value of orders received.

C. about a quarter of the total value of orders are from USA.

D. the value of orders is higher from Argentina than from Brazil

33. A quarter of the employees work in the Sales department.

What is a quarter as a percentage?

A. 40%

B. 25%

C. 20%

D. 4%

Questions 34 to 40 are about electrical workers and costs.

The table shows the wage rate per hour for electrical workers at a company.

Rates for electrical workers per hour		
Job/Title	**Rate with transport provided**	**Rate with own transport**
Technician	£11.00	£11.50
Electrician	£9.00	£9.50
Electrical improver	£8.00	£8.50
Labourer	£7.00	£7.50
Senior electrical trainee	£8.00	£8.50
Trainee (under 21)	£5.50	£6.00

34. What is the range of all the wage rates shown in the table?

A. £0.50

B. £5.50

C. £6.00

D. £8.50

35. How much does an electrical improver with own transport earn per hour?

A. £7.50

B. £8.00

C. £8.50

D. £9.50

36. A worker at the company uses a map to find the distance to her next job. The map has a scale of 10 millimetres = 1 kilometre. The distance on the map is 55 millimetres.

How far in kilometres is it to her next job?

A. 0.55km

B. 5.5km

C. 10km

D. 55km

37. An electrician with her own transport earns £9.50 per hour. In one week, the number of hours she works each day are

Monday	9
Tuesday	8
Wednesday	10
Thursday	8
Friday	7

Her total pay for this week is £399.00

Which calculation should she use to check her total pay?

A. (9 + 8+ 10 + 8+ 7) x 9.50

B. (9 + 8+ 10 + 8+ 7) / 9.50

C. (9 x 8 x 10 x 8 x 7) x 9.50

D. (9 x 8 x 10 x 8 x 7) / 9.50

38. The worker has her own transport.
She claimed a travel allowance for using her car on 6 journeys last week.

Travel allowances claimed	
Journey	**£**
A	2.40
B	2.80
C	5.20
D	2.80
E	8.00
F	8.80
Total	**30.00**

What is the average (mean) travel allowance she claimed for these journeys?

A. £5.20
B. £5.00
C. £2.80
D. £2.40

39. A trainee earns £5.50 an hour.
How much does he earn for a 40-hour week?

A. £200.50
B. £202.00
C. £220.00
D. £238.00

40. A technician earns £506 per week.
This week he claims £111.50 for travel and two nights' lodging allowance at £26.50 per night.
What is the total of his earnings and expenses for this week?

A. £660.50
B. £669.50
C. £670.50
D. £671.5

APPENDIX E: TURKISH VERSION OF KEY SKILLS APPLICATION OF NUMBER ADULT NUMERACY LEVEL 1 TEST PAPER

YETİŞKİNLERDE TEMEL MATEMATİK OKURYAZARLIĞI BECERİLERİ UYGULAMA SORULARI

SEVİYE 1 TESTİ

Değerli Katılımcı,

Aşağıda temel matematik okuryazarlığı becerilerini ölçmek için hazırlanmış 40 adet çoktan seçmeli soru bulunmaktadır. Her bir soru farklı bir beceriyi ölçme amacına hizmet etmektedir. Her bir soru için doğru olduğunu düşündüğünüz seçeneği yuvarlak içine almanız gerekmektedir. İşlem ve hesaplamalarınızı yaparken kâğıdın boş olan kısımlarını kullanabilirsiniz.

Soruları cevaplarken hesap makinesi kullanmamanız özellikle rica olunur.

Her bir soru 1 puan olup 40 puan üzerinden değerlendirme yapılacaktır.

Testi tamamlamanız için öngörülen süre 1 saat 15 dakika' dır.

Her soruyu dikkatli bir biçimde okuyunuz ve tüm soruları cevaplandırmaya çalışınız.

KOLAYLIKLAR DİLİYORUM

Katkılarınızdan dolayı teşekkür ediyorum,

Pınar ALBAYRAK ATAKLI

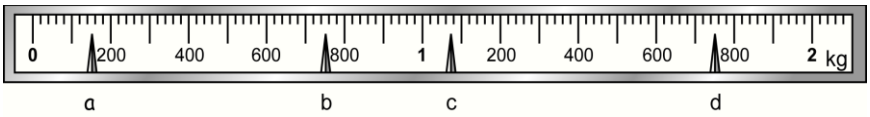
Boğaziçi Ünv. Yetişkin Eğitimi Yüksek Lisans Öğrencisi

. sorudan 5. soruya kadar olan sorularda, bir yardım standında satmak için kek yaptığınızı düşünün.

1. Kek tarifine göre bir paket mayalı hamur için 3 adet yumurta kullanılmaktadır. 4 paket mayalı hamur kullanacaksanız, kaç adet yumurtaya ihtiyacınız vardır?

A) 3
B) 4
C) 7
D) 12

2. Kek tarifine göre 1 adet kek yapmak için 175 gram tereyağı kullanılmaktadır. Aşağıdaki ölçekte hangi gösterge 175 gramı doğru olarak göstermiştir?



A) gösterge a
B) gösterge b
C) gösterge c
D) gösterge d

3. Keki pişirmek için fırının sıcaklığını ayarlıyorsunuz. Fırının sıcaklığı derece olarak ölçülür. Bu dereceyi nasıl adlandırırsınız?

A) santimetre
B) santigrat
C) gram
D) dakika

4. Keki saat 10.35' de fırına koyuyorsunuz. Kek 25 dakikada kabardığına göre, aşağıdakilerden hangisi kekin fırından alınması gereken zamanı doğru olarak gösterir?

A) 
B) 
C) 
D) 

5. Bir adet kek yapmanın size maliyeti 1.50 TL' dir. Bir keki 6 dilime ayırabilir ve her bir dilimi 50 ykr' ye satabilirsiniz.

   Aşağıdaki işlemlerden hangisi bir adet kekin size mal oluş fiyatı ile bir adet kekin satış fiyatı arasındaki farkı göstermektedir?

   A) 1.50 – 0. 50
   B) (6 x 0.50) - 1.50
   C) 6 x 0.50
   D) 1.50 ÷ (6 x 0.50)

6. sorudan 10. soruya kadar olan sorular bir tatil planlaması ile ilgilidir.

6. Hafta sonu gideceğiniz tatil için 1100 TL' lik bir rezervasyon yaptırıyorsunuz. Ancak bu paranın %15 'ini depozit olarak önceden ödemek zorundasınız.

   Ödemek zorunda olduğunuz miktar kaç TL'dir?

   A) 15.00 TL
   B) 16.50 TL
   C) 150.00 TL
   D) 165.00 TL

7. Tatilde güneşten korunmak için 4 adet güneş koruyucu losyon alıyorsunuz. Güneş losyonlarının tanesi 5.49 TL'dir. 4 adet güneş losyonu için ne kadar ödemeniz gerekir?

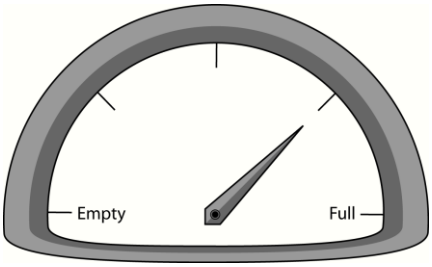
   A) 20.49 TL
   B) 20.66 TL
   C) 21.96 TL
   D) 21.99 TL

8. Bir önceki tatilinizden 64.24 TL para arttırmıştınız. *Yaklaşık olarak* ne kadar para artırımı yapmışsınızdır?

   A) 60 TL
   B) 64 TL
   C) 65 TL
   D) 70 TL

Arabanızla hava alanına doğru yola çıktınız.
Yandaki diyagram arabanızdaki benzin göstergesini sembolize etmektedir. Buna göre arabanızda ne kadar benzin kalmıştır?

A) Tüm deponun $\frac{1}{4}$ 'ü kadar
B) Tüm deponun $\frac{1}{3}$ 'ü kadar
C) Tüm deponun $\frac{2}{3}$ 'ü kadar
D) Tüm deponun $\frac{3}{4}$ 'ü kadar



10. Arabanızı 11 günlüğüne havaalanının otoparkına bırakıyorsunuz. Otoparktaki ücretlendirme şu şekildedir: İlk 7 gün için 35 TL ücret, sonraki her bir gün için de günlük 5 TL ücret alınmaktadır.

Otoparka ödeyeceğiniz ücreti bulmak için, aşağıdaki işlemlerden hangisini yapmalısınız?

A) 35 + (5 x 4)
B) 35 + (5 x 11)
C) (35 + 5) x 4
D) (35 + 5) x 11

11. sorudan 13. soruya kadar olan sorular İsviçre hakkında yazılmış olan bir makale ile ilgilidir.

11. Makalede İsviçreliler'in %20 ' sinin ana dilleri olarak Fransızca konuştukları yazmaktadır.

%20 'yi kesir olarak nasıl ifade edebilirsiniz?

A) $\frac{1}{2}$
B) $\frac{1}{5}$
C) $\frac{1}{4}$
D) $\frac{1}{20}$

. Makale İsviçre nüfusunun 7 261 000 olduğundan bahsetmektedir. Bu nüfusun onda birini İtalyan kökenli vatandaşlar oluşturmaktadır.

Buna göre İsviçre'de yaşayan İtalyan nüfusu kaçtır?

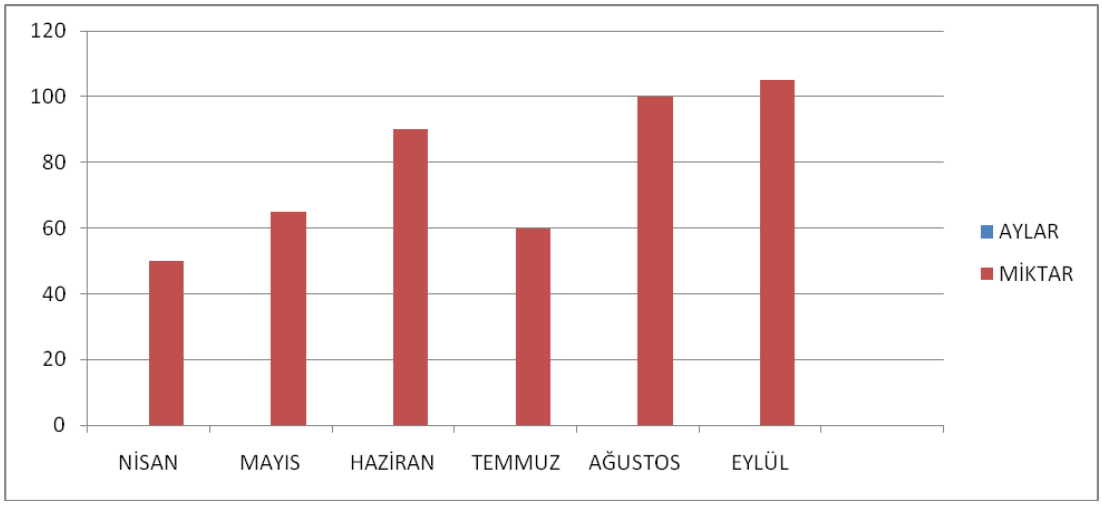
A) 100 000
B) 660 091
C) 726 100
D) 806 778

13. Aşağıdaki sütun grafiği, geçen yıl İsviçre'ye Nisan ile Eylül arasında düşen yağış miktarını aylara göre göstermektedir.

Buna göre grafiğin hangi kısmı eksiktir?

A) Düşey eksen üzerindeki birimler
B) Yatay eksen üzerindeki isimlendirme
C) Grafiğin başlığı
D) Grafikte eksik yoktur

İsviçre'deki yağış miktarı
(nisandan eylüle kadar)

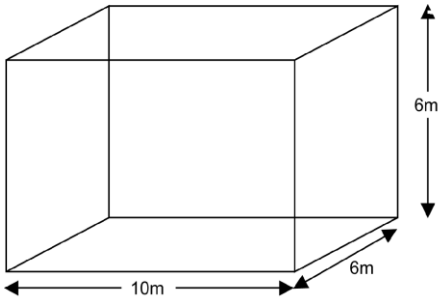


14. sorudan 17. soruya kadar olan sorular evinizin çatı katını restore etmek için yaptığınız çalışmalarla ilgilidir.

14. Restore etmeyi planladığınız yerin hacim planı üzerinde çalışmaktasınız. Aşağıdaki şekil planladığınız yerin ölçülerini göstermektedir.

Buna göre restorasyonu planlanan yerin hacmi ne kadardır?

A) 22 m^3
B) 60 m^3
C) 120 m^3
D) 360 m^3



(Şekil gerçek ölçülendirme yapılarak çizilmemiştir)

15. Restorasyonu gerçekleştirecek olan ustaya evin bir planını verdiniz. Plan 2 cm: 1 m olarak ölçeklendirilmiştir. Planda bir duvarın uzunluğu santimetre olarak ölçülmektedir. (cm: santimetre, m: metre)

Buna göre duvarın gerçek uzunluğu ne kadardır?

A) 2 metre
B) 5 metre
C) 10 metre
D) 20 metre

16. Restorasyon sırasında 36 metrekarelik tuğla örme işi yapılacaktır. 1 metrekarelik alan için 120 tane tuğla gerekmektedir.

36 metrekarelik örme işi için ustanın kaç adet tuğlaya ihtiyacı vardır?

A) 3 620
B) 4 220
C) 4 320
D) 4 356

. Usta restorasyonun yaklaşık olarak ne kadara mal olacağını hesaplıyor ve sizinle otuz bin altı yüz elli liraya anlaşmaya çalışıyor.

Bu miktarı aşağıdaki gösterimlerden hangisi ifade eder?

A) 3 650 TL
B) 30 650 TL
C) 300 650 TL
D) 30 000 650 TL

18. sorudan 22. soruya kadar olan sorular bir temizlik şirketinin ev temizliği, halı ve perde yıkama fiyatlandırmasıyla ilgilidir.

Aşağıdaki tablo şirketin halı yıkama fiyatlandırmasını göstermektedir.

HALI YIKAMA FİYAT LİSTESİ	
HALI ÇEŞİDİ	FİYATLANDIRMA (TL)
Salon	22.50
Mutfak	17.50
Hol, Antre, Merdiven Altı	25.00
Yatak Odası	17.00
İki Oda Bir Salon Tüm Evin Halıları	57.50

18. Sadece salonun ve mutfağın halılarını yıkatmayı düşünürseniz, bu size ne kadara mal olur?

A) 39.50 TL
B) 40.00 TL
C) 42.50 TL
D) 47.50 TL

. İki odadan ve bir salondan oluşan bir eviniz var ve evinizin aşağıda belirtilen bölümlerdeki halılarını yıkatmak istiyorsunuz:

- Salon
- Mutfak
- Hol, Antre, Merdiven Altı
- Yatak Odası

Aşağıdaki hesaplamalardan hangisi, halılara teker teker yıkama fiyatı ödemektense *''İki Oda Bir Salon Tüm Evin Halıları''* fiyatlandırmasını tercih ettiğiniz zamanki karınızı gösterirz?

A) 22.50 TL + 17.50 TL + 25.00 TL + 17.00 TL
B) 57.50 TL - 22.50 TL - 17.50 TL - 25.00 TL
C) 22.50 TL + 17.50 TL + 25.00 TL + 17.00 TL + 57.50 TL
D) 22.50 TL + 17.50 TL + 25.00 TL + 17.00 TL - 57.50 TL

20. Bugün özel indirim günüdür !!!!!

1/3 FİYATINA

BUGÜN !!!

TÜM EV TEMİZLİĞİ

Normalde 4 odalı bir evin tüm odalarının temizliği 72.00 TL'ye mal olmaktadır.

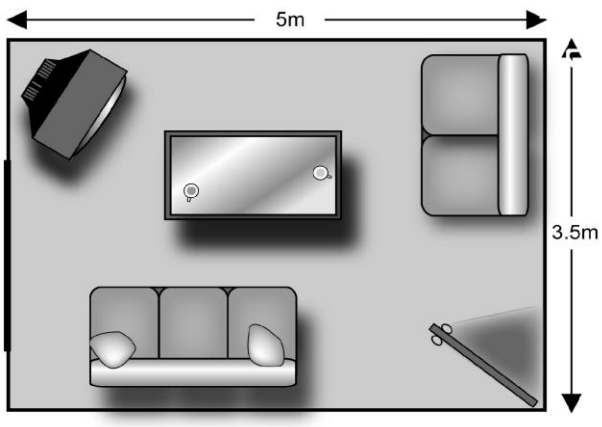
Yandaki afişe göre özel indirim gününde yapılan indirim ne kadardır?

A) 13.00 TL
B) 18.00 TL
C) 24.00 TL
D) 33.00 TL

21. Başka bir temizlik firması da evin temizlik ücretini metrekareye göre fiyatlandırmaktadır. Bu firma ile görüşmek için dikdörtgen şeklindeki salonunuzun alanını hesaplamak istiyorsunuz.

Salonunuzun alanı ne kadardır?

A) 8.5 m^2
B) 17.0 m^2
C) 17.50 m^2
D) 21.0 m^2



. Aşağıdaki tablo şirketin perde yıkama fiyatlandırmasını göstermektedir.

PERDE (BİR ÇİFT)	FİYATLANDIRMA (TL)
Tam perde (1.5 metre uzunlukta ve üzeri perdeler için)	22.50
Yarım perde (1.5 metreden kısa perdeler için)	17.50

İki çift tam uzunluktaki perdeyi ve bir çift yarım uzunluktaki perdeyi yıkatmak için şirkete ne kadar ödeme yapmanız gerekmektedir?

A) 52.50 TL
B) 56.25 TL
C) 61.50 TL
D) 62.50 TL

23. sorudan 28. soruya kadar olan sorular bir alışveriş mağazasındaki satışlarla ilgilidir.

23. Mağazanın müdürü bir günün farklı zamanlarında mağazadan alışveriş yapan müşteri sayısını kaydetmiştir.

ZAMAN	ALIŞVERİŞ YAPAN MÜŞTERİ SAYISI
Saat 9.00'dan 11.00'a kadar	||| ||| ||
Saat 11.00'den 13.00'a kadar	||| ||| ||| ||| ||| |
Saat 13.00'den 15.00'a kadar	||| ||| ||| ||| ||
Saat 15.00'den 17.00'ye kadar	||| ||| ||| |||

Yukarıdaki tabloya göre mağazadan kaç müşteri alışveriş yapmıştır?

A) 60
B) 65
C) 78
D) 80

Bu alışveriş mağazasında kıyafetler, kitaplar, süs eşyaları ve yardım kartları satılmaktadır. Mağazanın müdürü satılan eşyaların çeşidine göre oranını görmek istemektedir.

Aşağıdaki gösterimlerden hangisi mağaza müdürünün isteğini en iyi şekilde ifade eder?

A) Daire Grafiği
B) Doğrusal Grafik
C) Ölçek Planı
D) Piktogram (Resimlerle İfade)

25. Mağazanın müdürü 5 gün boyunca, günlük satılan kitap sayısını kaydediyor.

PAZARTESİ	SALI	ÇARŞAMBA	PERŞEMBE	CUMA
6	21	15	26	32

Buna göre günde ortalama kaç kitap satılmıştır?

A) 15
B) 20
C) 21
D) 26

26. Herhangi bir Cuma günü mağazada kasaya giren para 1200 TL olarak belirlenmiştir. Bu paranın beşte biri o günkü masraflar için harcanacaktır. Masraflar için harcanacak olan para ne kadardır?

A) 150 TL
B) 200 TL
C) 220 TL
D) 240 TL

Mağazanın müdürü bir gün boyunca saat başı ortalama olarak kazanılan parayı hesaplamıştır.

Aşağıdaki hesap makinesi bu paranın miktarını göstermektedir.

Buna göre hesap makinesinde gösterilen miktar yaklaşık olarak kaç yeni kuruş (ykr) dir?

A) 6.60 ykr
B) 6.66 ykr
C) 6.67 ykr
D) 6.70 ykr

28. Bir müşteri tanesi 10 ykr'den 3 tane süs eşyası, tanesi 55 ykr olan bir tane vazo ve fiyatı 2. 75 TL olan bir elbise almıştır.

Bu müşteri yaptığı alışveriş için toplamda ne kadar ödemiştir?

A) 3.60 TL
B) 3.50 TL
C) 3.40 TL
D) 2.50 TL

29. sorudan 33. soruya kadar olan sorular uluslar arası bir nakliyat şirketi ile ilgilidir.

Bu şirket ödemeleri Amerikan Doları ($) olarak kabul etmektedir.

29. Şirket aracılığı ile bir malzemenin taşınması için şirkete ödenmesi gereken para $ 110 000 'dır.

Aşağıdakilerden hangisi bu miktarın sözcüklerle doğru olarak ifade edilişidir?

A) On bin dolar
B) Yüz on bin dolar
C) Yüz on bir bin dolar
D) Bir milyon on bin dolar

Malzeme yüklemek için şirketin aldığı işçilik ücreti $ 79 000' dır. Buna ek olarak malzemeyi yurt dışına çıkaran her bir işçi için 10% cep harçlığı adı altında müşteriden ücret alınmaktadır.

$ 79 000'ın 10%' u ne kadar eder?

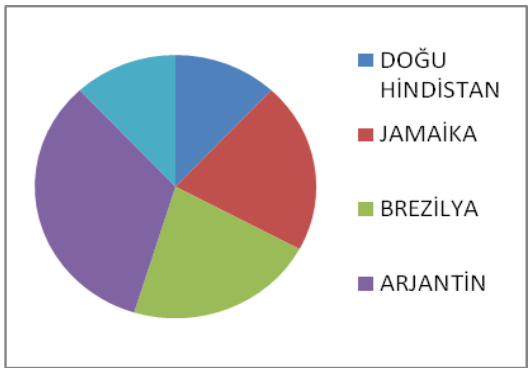
A) $ 10
B) $ 790
C) $ 1000
D) $ 7900

31. Şirkete yapılan başka bir siparişin maliyeti $ 273 550' dır. Aşağıdakilerden hangisi bu miktarın en yakın $ 1000'a yuvarlanmış halidir?

A) $ 274 000
B) $ 273 600
C) $ 273 000
D) $ 270 000

32. Aşağıdaki daire grafiği nakliyat şirketinin farklı bölgelerden aldığı sipariş miktarını göstermektedir.

Farklı bölgelerden alınan sipariş miktarları



Yukarıdaki daire grafiğine göre,

A) Doğu Hindistan ve Jamaika'dan gelen sipariş miktarları aynıdır.
B) Arjantin en az sipariş alınan ülkedir.
C) Tüm siparişlerin yaklaşık çeyreği Amerika'dan alınmaktadır.
D) Arjantin'den alınan sipariş miktarı Brezilya'dan alınandan daha yüksektir.

Şirket çalışanlarının çeyreği satış departmanında çalışmaktadırlar.
Çeyrek kavramı *yüzde* olarak nasıl ifade edilebilir?

A) 40%
B) 25%
C) 20%
D) 4%

ELEKTRİK FABRİKASINDA ÇALIŞAN İŞÇİLERİN SAATTE ALDIKLARI YEVMİYE		
UNVAN	ULAŞIMLARI SAĞLANDIĞI ZAMAN	ULAŞIMLARINI KENDİLERİ KARŞILADIKLARI ZAMAN
Teknisyen	11.00 TL	11.50 TL
Elektrik Ustası	9.00 TL	9.50 TL
Elektrikçi Kalfası	8.00 TL	8.50 TL
Elektrik İşçisi	7.00 TL	7.50 TL
Kıdemli Stajyer	8.00 TL	8.50 L
Stajyer (21 yaşınaltındaki)	5.50 TL	6.00 TL

34. sorudan 40. soruya kadar olan sorular bir elektrik fabrikasında çalışanlar ve onların ücretlendirilmeleri ile ilgilidir.

Aşağıdaki tablo elektrik fabrikasında çalışanların unvanlarına göre saatte aldıkları yevmiyeleri göstermektedir.

34. Yukarıdaki tabloya göre, tüm çalışanların ücret aralığı nedir?

A) 0.50 TL
B) 5.50 TL
C) 6.00 TL
D) 8.50 TL

. Şirkete ulaşımda kendi imkânlarını kullanan bir elektrikçi kalfasının saatlik kazancı ne kadardır?

A) 7.50 TL
B) 8.00 TL
C) 8.50 TL
D) 9.50 TL

36. Fabrika çalışanlarından biri almış olduğu bir elektrik işine giderken yolun mesafesini bulmak için bir harita kullanmaktadır. Kullandığı harita 10 mm: 1 km olarak ölçeklendirilmiştir ve gideceği yolun uzaklığı haritada 55 mm olarak gösterilmektedir. (mm: milimetre, km: kilometre)

Buna göre fabrika çalışanının gideceği yolun uzaklığı kaç km'dir?

A) 0.55 km
B) 5.5 km
C) 10 km
D) 55 km

37. Bir fabrika çalışanı ulaşımını kendisi karşılayarak saatte 9.50 TL para kazanmaktadır. Bu işçinin bir hafta süresince günlük çalışma saatleri aşağıdaki gibidir:

Pazartesi	9
Salı	8
Çarşamba	10
Perşembe	8
Cuma	7

Buna göre, aşağıdaki işlemlerden hangisi ile bu çalışana haftalık olarak ödenecek olan toplam ücret bulunabilir?

A) (9 + 8 + 10 + 8 + 7) x 9.50
B) (9 + 8 + 10 + 8 + 7) 9.50
C) (9 x 8 x 10 x 8 x 7) x 9.50
D) (9 x 8 x 10 x 8 x 7) 9.50

. Bir işçi, iş için fabrika dışına gönderildiği zaman ulaşım ücretini kendisi karşılıyor ve daha sonra bu parayı şirketten talep ediyor.
Bu işçinin geçen hafta kendi arabasıyla 6 farklı işe giderken yapmış olduğu harcama yandaki tabloda gösterilmektedir.Buna göre, işçinin ulaşım için şirketten talep edeceği ulaşım ücreti ortalama olarak ne kadardır?

A) 5.20 TL
B) 5.00 TL
C) 2.80 TL
D) 2.40 TL

İŞÇİNİN ULAŞIM HARCAMASI	
SEYEHAT	TL
A	2.40
B	2.80
C	5.20
D	2.80
E	8.00
F	8.00
TOPLAM	30.00

39. Şirkette çalışan bir stajyer saat başına 5.50 TL ücret almaktadır.

Bu stajyer bir haftada 40 saat çalışıyorsa, haftalık eline geçen para ne kadardır?

A) 200.50 TL
B) 202.00 TL
C) 220.00 TL
D) 238.00 TL

40. Şirkette çalışan bir teknisyen haftada 506 TL para kazanmaktadır. Bu hafta şirket tarafından şehir dışına gönderilen bu çalışan 111.50 TL ulaşım için para harcadığını beyan etmiştir. Ayrıca geceliği 26.50 TL olan bir otelde iki gece kaldığı için konaklama masrafı olmuştur.

Buna göre, bu teknisyenin bu hafta şirketten alması gereken toplam para ne kadardır?

A) 606.50 TL
B) 669.50 TL
C) 670.50 TL
D) 671.50 TL

APPENDIX F: COVER PAGE

Değerli Katılımcı,

Bir parçası olarak yer aldığınız bu çalışma, Boğaziçi Üniversitesi Eğitim Bilimleri Bölümü Yetişkin Eğitimi Yüksek Lisans Programında yer alacak olan bir tez çalışmasıdır. Çalışmada, yetişkinlerin matematik okuryazarlığı becerileri ile sahip oldukları eğitimsel (*kendilerinin ve ailelerinin eğitim seviyeleri)* ve eğitim dışı (*cinsiyet ve yaş)* faktörler arasında anlamlı bir ilişki olup olmadığı incelenmektedir. Bunun yanı sıra, yetişkinlerin matematik okuryazarlığı becerileri ile günlük yaşamlarında kullandıkları sayısal bilgiye karşı tutumları arasında anlamlı bir ilişkinin olup olmadığı araştırılmaktadır. Bu amaçla sizlere üç bölümden oluşan bir ölçek uygulanacaktır.

İlk bölümde, kişisel bilgilere yönelik açık ve kapalı uçlu olmak üzere 10 adet soru yer almaktadır. İkinci bölüm, sayısal bilgiyi kullanımınızdaki kişisel tercihlerinizi öğrenmeye yönelik 20 adet soruyu içermektedir. Burada ***kesinlikle katılıyorum (5))*** dan, ***kesinlikle katılmıyorum (1)*** a kadar derecelendirilmiş 5 tane seçenek bulunmaktadır. Son bölümde ise her biri farklı bir matematik okuryazarlığı becerisini ölçen 40 adet çoktan seçmeli soru yer almaktadır. Bu soruların cevaplandırılması için uygun görülen süre 1 saat 15 dakikadır.

Cevaplarınız sadece bu çalışma kapsamında değerlendirilecek olup, herhangi başka bir amaca hizmet etmemektedir. Bu nedenle ölçeklerin herhangi birine isim yazmanız gerekmemektedir**.** Çalışmada gizlilik sınırları esas alınmıştır. Soruları titizlikle cevaplandırmanız, çalışmanın sonucunda ortaya çıkacak bulguların doğruluğu açısından son derece önemlidir.

Katkılarınızda dolayı teşekkür ederim.

Pınar Albayrak Ataklı

Boğaziçi Üniversitesi Eğitim Bilimleri Bölümü

Yetişkin Eğitimi Programı

APPENDIX G: FACTOR ANALYSIS RESULTS OF SBKTC

Correlation Matrix

		SBKTC1	SBKTC2	SBKTC3	SBKTC4	SBKTC5	SBKTC6	SBKTC7	SBKTC8	SBKTC9	SBKTC10	SBKTC11	SBKTC12	SBKTC13	SBKTC14	SBKTC15	SBKTC16	SBKTC17	SBKTC18	SBKTC19	SBKTC20
Correlation	SBKTC1	1	0,306	0,163	0,493	0,271	0,144	0,45	0,375	0,406	0,522	0,362	0,385	0,141	0,295	0,189	0,042	0,203	0,284	0,351	0,372
	SBKTC2	0,306	1	0,412	0,064	0,402	0,13	0,432	0,28	0,413	0,541	0,201	0,334	0,025	0,25	0,145	-0,069	0,119	0,175	0,212	0,3
	SBKTC3	0,163	0,412	1	0,173	0,185	0,241	0,168	0,147	0,109	0,322	0,171	0,179	0,15	0,21	-0,046	-0,113	0,274	0,228	0,277	0,16
	SBKTC4	0,493	0,064	0,173	1	0,138	0,351	0,406	0,478	0,234	0,273	0,643	0,239	0,462	0,21	0,342	0,225	0,315	0,426	0,218	0,319
	SBKTC5	0,271	0,402	0,185	0,138	1	-0,037	0,376	0,21	0,408	0,204	0,107	0,21	0,095	0,149	0,067	0,036	0,096	0,029	0,137	0,173
	SBKTC6	0,144	0,13	0,241	0,351	-0,037	1	0,29	0,187	0,096	0,381	0,489	0,175	0,385	0,183	0,172	0,362	0,233	0,219	0,252	0,458
	SBKTC7	0,45	0,432	0,168	0,406	0,376	0,29	1	0,456	0,643	0,506	0,427	0,491	0,07	0,513	0,334	0,062	0,357	0,336	0,37	0,467
	SBKTC8	0,375	0,28	0,147	0,478	0,21	0,187	0,456	1	0,354	0,327	0,518	0,28	0,284	0,293	0,558	0,176	0,462	0,397	0,342	0,322
	SBKTC9	0,406	0,413	0,109	0,234	0,408	0,096	0,643	0,354	1	0,513	0,361	0,486	0,108	0,432	0,307	0,176	0,253	0,204	0,243	0,23
	SBKTC10	0,522	0,541	0,322	0,273	0,204	0,381	0,506	0,327	0,513	1	0,473	0,535	0,392	0,393	0,179	0,268	0,291	0,347	0,576	0,669
	SBKTC11	0,362	0,201	0,171	0,643	0,107	0,489	0,427	0,518	0,361	0,473	1	0,3	0,613	0,347	0,49	0,423	0,401	0,314	0,421	0,521
	SBKTC12	0,385	0,334	0,179	0,239	0,21	0,175	0,491	0,28	0,486	0,535	0,3	1	0,122	0,288	0,257	0,199	0,332	0,288	0,397	0,377
	SBKTC13	0,141	0,025	0,15	0,462	0,095	0,385	0,07	0,284	0,108	0,392	0,613	0,122	1	0,04	0,321	0,516	0,302	0,289	0,261	0,293
	SBKTC14	0,295	0,25	0,21	0,21	0,149	0,183	0,513	0,293	0,432	0,393	0,347	0,288	0,04	1	0,401	-0,019	0,25	0,094	0,38	0,251
	SBKTC15	0,189	0,145	-0,046	0,342	0,067	0,172	0,334	0,558	0,307	0,179	0,49	0,257	0,321	0,401	1	0,163	0,483	0,246	0,201	0,314
	SBKTC16	0,042	-0,069	-0,113	0,225	0,036	0,362	0,062	0,176	0,176	0,268	0,423	0,199	0,516	-0,019	0,163	1	0,324	0,195	0,27	0,246
	SBKTC17	0,203	0,119	0,274	0,315	0,096	0,233	0,357	0,462	0,253	0,291	0,401	0,332	0,302	0,25	0,483	0,324	1	0,612	0,391	0,318
	SBKTC18	0,284	0,175	0,228	0,426	0,029	0,219	0,336	0,397	0,204	0,347	0,314	0,288	0,289	0,094	0,246	0,195	0,612	1	0,383	0,362
	SBKTC19	0,351	0,212	0,277	0,218	0,137	0,252	0,37	0,342	0,243	0,576	0,421	0,397	0,261	0,38	0,201	0,27	0,391	0,383	1	0,623
	SBKTC20	0,372	0,3	0,16	0,319	0,173	0,458	0,467	0,322	0,23	0,669	0,521	0,377	0,293	0,251	0,314	0,246	0,318	0,362	0,623	1
Sig. (1-tailed)	SBKTC1		0,005	0,087	0	0,011	0,115	0	0,001	0	0	0,001	0	0,121	0,006	0,058	0,364	0,044	0,008	0,001	0,001
	SBKTC2	0,005		0	0,299	0	0,14	0	0,009	0	0	0,046	0,002	0,419	0,018	0,114	0,284	0,161	0,073	0,038	0,005
	SBKTC3	0,087	0		0,074	0,061	0,022	0,081	0,111	0,184	0,003	0,077	0,068	0,106	0,04	0,351	0,174	0,01	0,028	0,01	0,091
	SBKTC4	0	0,299	0,074		0,126	0,001	0	0	0,025	0,011	0	0,023	0	0,04	0,002	0,03	0,004	0	0,034	0,003
	SBKTC5	0,011	0	0,061	0,126		0,38	0,001	0,04	0	0,044	0,187	0,04	0,216	0,108	0,288	0,382	0,213	0,405	0,127	0,075
	SBKTC6	0,115	0,14	0,022	0,001	0,38		0,007	0,059	0,212	0,001	0	0,072	0	0,064	0,075	0,001	0,025	0,033	0,017	0
	SBKTC7	0	0	0,081	0	0,001	0,007		0	0	0	0	0	0,281	0	0,002	0,305	0,001	0,002	0,001	0
	SBKTC8	0,001	0,009	0,111	0	0,04	0,059	0		0,001	0,003	0	0,009	0,008	0,007	0	0,071	0	0	0,002	0,003
	SBKTC9	0	0	0,184	0,025	0	0,212	0	0,001		0	0,001	0	0,184	0	0,005	0,071	0,016	0,044	0,021	0,027
	SBKTC10	0	0	0,003	0,011	0,044	0,001	0	0,003	0		0	0	0	0	0,068	0,012	0,007	0,002	0	0
	SBKTC11	0,001	0,046	0,077	0	0,187	0	0	0	0,001	0		0,006	0	0,002	0	0	0	0,004	0	0
	SBKTC12	0	0,002	0,068	0,023	0,04	0,072	0	0,009	0	0	0,006		0,155	0,007	0,015	0,048	0,002	0,007	0	0,001
	SBKTC13	0,121	0,419	0,106	0	0,216	0	0,281	0,008	0,184	0	0	0,155		0,37	0,003	0	0,005	0,007	0,014	0,007
	SBKTC14	0,006	0,018	0,04	0,04	0,108	0,064	0	0,007	0	0	0,002	0,007	0,37		0	0,438	0,018	0,217	0,001	0,017
	SBKTC15	0,058	0,114	0,351	0,002	0,288	0,075	0,002	0	0,005	0,068	0	0,015	0,003	0		0,088	0	0,019	0,047	0,004
	SBKTC16	0,364	0,284	0,174	0,03	0,382	0,001	0,305	0,071	0,071	0,012	0	0,048	0	0,438	0,088		0,003	0,052	0,011	0,019
	SBKTC17	0,044	0,161	0,01	0,004	0,213	0,025	0,001	0	0,016	0,007	0	0,002	0,005	0,018	0	0,003		0	0	0,003
	SBKTC18	0,008	0,073	0,028	0	0,405	0,033	0,002	0	0,044	0,002	0,004	0,007	0,007	0,217	0,019	0,052	0		0	0,001
	SBKTC19	0,001	0,038	0,01	0,034	0,127	0,017	0,001	0,002	0,021	0	0	0	0,014	0,001	0,047	0,011	0	0		0
	SBKTC20	0,001	0,005	0,091	0,003	0,075	0	0	0,003	0,027	0	0	0,001	0,007	0,017	0,004	0,019	0,003	0,001	0	

a. Determinant = 7,57E-005

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,754
Bartlett's Test of Sphericity	Approx. Chi-Square	670,617
	df	190
	Sig.	,000

KMO and Bartlett's Test for the factor analysis of the items in the SBKTC

APPENDIX H: ITEM DISCRIMINATION AND ITEM DIFFICULTY TABLE

Item	Item Discrimination (D)	Item Difficulty (p)
YMTOB 1	0.26- Fair D	0.87-Very Easy
YMTOB 2	0.38- Good D	0.78- Easy
YMTOB 3	0.62- Excellent D	0.69- Easy
YMTOB 4	0.39- Good D	0.65- Easy
YMTOB 5	0.65- Excellent D	0.59- Medium
YMTOB 6	0.58- Excellent D	0.59- Medium
YMTOB 7	0.38- Good D	0.68- Easy
YMTOB 8	0.49- Excellent D	0.64- Easy
YMTOB 9	0.51- Excellent D	0.66- Easy
YMTOB 10	0.59- Excellent D	0.68- Easy
YMTOB 11	0.66- Excellent D	0.67- Easy
YMTOB 12	0.46- Excellent D	0.77- Easy
YMTOB 13	0.50- Excellent D	0.34- Difficult
YMTOB 14	0.69- Excellent D	0.56- Medium
YMTOB 15	0.66- Excellent D	0.61- Easy
YMTOB 16	0.57- Excellent D	0.69- Easy
YMTOB 17	0.49- Excellent D	0.76- Easy
YMTOB 18	0.39- Good D	0.81-Very Easy
YMTOB 19	0.72- Excellent D	0.52- Medium
YMTOB 20	0.59- Excellent D	0.67- Easy
YMTOB 21	0.75- Excellent D	0.60- Easy
YMTOB 22	0.64- Excellent D	0.64- Easy
YMTOB 23	0.47- Excellent D	0.71- Easy
YMTOB 24	0.66- Excellent D	0.45- Medium
YMTOB 25	0.64- Excellent D	0.59- Easy
YMTOB 26	0.76- Excellent D	0.59- Easy
YMTOB 27	0.47- Excellent D	0.52- Medium
YMTOB 28	0.66- Excellent D	0.67- Easy
YMTOB 29	0.60- Excellent D	0.71- Easy
YMTOB 30	0.76- Excellent D	0.50- Medium
YMTOB 31	0.73- Excellent D	0.52- Medium
YMTOB 32	0.62- Excellent D	0.57- Medium
YMTOB 33	0.68- Excellent D	0.66- Easy
YMTOB 34	0.02- Poor D	0.12-V.Difficult
YMTOB 35	0.66- Excellent D	0.55- Medium
YMTOB 36	0.42- Excellent D	0.61- Easy
YMTOB 37	0.78- Excellent D	0.61- Easy
YMTOB 38	0.69- Excellent D	0.63- Easy
YMTOB 39	0.66- Excellent D	0.67- Easy
YMTOB 40	0.74- Excellent D	0.57- Medium
N=40		

APPENDIX I: TESTS OF NORMALITIES

Tests of Normality for Age

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
AGE	,078	694	,000	,969	694	,000

a. Lilliefors Significance Correction

Tests of Normality for Basic Numeracy Skills Distribution

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SCORE	,121	678	,000	,932	678	,000

a. Lilliefors Significance Correction

Tests of Normality for Numeracy Attiude

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MEANSKBTC	,049	657	,001	,983	657	,000

a. Lilliefors Significance Correction

APPENDIX J: ANOVA TABLE

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19711,592	9	2190,177	35,439	,000[a]
	Residual	37019,108	599	61,802		
	Total	56730,700	608			

a. Predictors: (Constant), MEANSKBTC, MOTHEREDUCTION, SEX, DUMMYORTA, AGE, DUMMYMAS, DUMMYLISE, FATHEREDUCATION, DUMMYUNIV

b. Dependent Variable: SCORE

APPENDIX K: PERMISSION FOR ADAPTING SBKTC

Dear Pinar, Please move forward with your research to translate this instrument. The items are available in the paper and the response scales are presented after that. There is no unique format. As you have acknowledged me, there is no issue of plagiarism and you should feel free to use as you wish. I do appreciate your consideration and honesty. I believe the paper has the generic instructions if any (it has been a long time). Please let me know if you have any further questions.

Good luck.

Madhu

From: pinar atakli [mailto:pinaratakli@gmail.com]

Sent: Wednesday, May 13, 2009 2:56 AM

To: mviswana@illinois.edu; mviswana@uiuc.edu

Subject: Permission Request

- Alıntılanan metni göster -

Dear Mr. Viswanathan

I am a master student in Adult Education Program in Educational Science Department at Bogazici University, Istanbul, Turkey. I am currently doing my master thesis study; and the purpose of the study is to investigate whether there is a significant relationship between the basic numeracy skills of adults in Turkey and their individual differences in preference for using numeracy.

I would like to ask your permission for translation your ‘‘PNI Measuring Instrument’’ in Turkish. The instrument will be applied nearly five hundred adult students in two People Education Centers, Istanbul. I will be very pleased if you send whole of the instrument with the 7th point-scaled response format. Avoiding any plagiarism, I will add the original copy of the instrument and your permission form in my thesis in the appendix part; and the test paper will not be used in any other way than for this study.

I am looking forward to hearing from you soon,

Thank you very much for your help

Sincerely,

Pinar Albayrak Atakli

Bogazici University Master Student

Yanıtla Yönlendir

Yanıtla |pinar atakli Kime: Madhu

ayrıntıları görüntüle 14 May

Dear Mr. Viswanathan,

Thank you very much for your helpfulness.

Sincerely

Pinar

- Alıntılanan metni göster -

Dear Pinar, Please move forward with your research to translate this instrument. The items are available in the paper and the response scales are presented after that. There is no unique format. As you have acknowledged me, there is no issue of plagiarism and you should feel free to use as you wish. I do appreciate your consideration and honesty. I believe the paper has the generic instructions if any (it has been a long time). Please let me know if you have any further questions.

Good luck.

Madhu

APPENDIX L: PERMISSION FOR TRANSLATING YTMOB

RE: Permission Request 090513-000081

Gelen KutusuX

Yanıtla |Johnson, Shernet Kime: bana, Francesca, Haidee

ayrıntıları görüntüle 09 Haz

Dear Pinar

Permission to reproduce and translate the Key skills application of number (Adult numeracy Level 1–C) test paper in your thesis as requested is granted. Please note that permission is only for use within your thesis and QCA must be fully acknowledged as the copyright owner of the test.

If you require any further assistance please contact us.

Regards

Shernet

From: scottf@qca.org.uk [mailto:scottf@qca.org.uk]

Sent: 08 June 2009 09:26

To: Johnson, Shernet

Subject: FWD: Permission Request

The following incident has been forwarded to you by:

Francesca Scott (scottf@qca.org.uk)

Sender's Comment

Reference #090604-000453

Summary: Permission Request

Rule State: Updated

Date Created: 04/06/2009 06.56 PM

Last Updated: 04/06/2009 06.56 PM

Status: Unresolved

Assigned:

Discussion thread

Customer (pinar atakli)04/06/2009 06.56 PM

Dear Mr. / Mrs.

I am a master student in Adult Education Program in Educational Science Department at Bogazici University, Istanbul, Turkey. I am currently doing my master thesis study; and the purpose of the study is to investigate whether there is a significant relationship between the basic numeracy skills of adults in Turkey and their individual differences in preference for numerical information.

I would like to ask your permission for adaptation your ‘‘*Key skills application of number **Adult numeracy Level 1–C Test Paper’’*. The test paper has the reference number: AoN-L1-SQ1_A-P1-v7.0-URN:487 and is available on your web page. Avoiding any plagiarism, I will add the original copy of the instrument and your permission form in my thesis in the appendix part; and the test paper will not be used in any other way than for this study.

The schools will be closed in short time in Turkey and I have to do my pilot study before the closing of schools. Because of this, I need an urgent reply from your support team. In addition to this, I will apply for phd programs and before applying, I have to finish my thesis as soon as possible. If necessary my advisor can call you and give information about the urgency of the response.

I am looking forward to hearing from you soon,

Thank you very much for your help

Sincerely,

Pinar Albayrak Atakli

Bogazici University Master Student

REFERENCES

AAMT (1998). Policy on Numeracy Education in Schools. Adelaide: AAMT, from www.aamt.edu.au/content/download/724/19518/file/numpol.pdf retrieved 12/12/2007.

Aiken, L. R. (1974). Two scales of attitude toward mathematics. *Journal for Research in Mathematics Education, 9,* 67-71.

Atakli, P. (2008). Basic Numeracy Skills for Adults. In O. Demirel & A., M., Sunbul (Eds.) Further Education in the Balkan Countries. *Education and Pedagogy in Balkan Countires, Vol: 9, II,* pp: 1163-1173.

Baykal, A. (2006). Hem Okudum Hem Yazdım., *UNESCO, Turkiye, Milli Komisyonu.* http://www.unesco.org.tr/index.php?gitid=4&gncl=58

Benn, R. (1997). *Adults count too: Mathematics for empowerment*. Leicester, England: National Institute of Adult Continuing Education.

Berberoğlu, G., Çelebi. O., Özdemir, E., Uysal, E., & Yayan, B. (2003). Factors affecting achievement levels of Turkish students in the Third International Mathematics and Science Study (TIMMS). *Educational Sciences and Practice*, 2 (3), 3-14.

Berberoğlu, G. ve Kalender, İ. (2005). Öğrenci başarısının yıllara, okul türlerine, bölgelere göre incelenmesi: ÖSS ve PISA analizi. *Eğitim Bilimleri ve Uygulama, 4* (7), 21-35.

Bernard, R. (2000). *Social research methods: Qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Billett, S. (1996). Towards a model of workplace learning: The learning curriculum. *Studies in Continuing Education*, *18* (1), 43-58

Brew, C. R. (2001). Implications for women and children when mothers return to tackle mathematics. In M. J. Schmitt & K. Safford-Ramus (Eds.), A Conversation between Researchers and Practitioners. Adults Learning Mathematics - 7. Proceedings of ALM-7 the Seventh International Conference of Adults Learning Mathematics - A Research Forum (pp. 167-172). Cambridge, MA: National Center for the Study of Adult Learning and Literacy (NCSALL), Harvard University Graduate School of Education, in association with Adults Learning Mathematics - A Research Forum (ALM).

BSA. (1995). Older and Younger: The basic skills of different age groups. London: The Basic Skills Agency.

BSA. (2001). Adult Numeracy Core Curriculum. London: Cambridge Training and Development on behalf of The Basic Skills Agency.

Bonett, Douglas G. and Wright, Thomas A (2000). Sample size requirements for estimating Pearson, Spearman and Kendall correlations. *Psychometrica, Vol:65.* 23–28.

Boudard, E. (2001), *Literacy Proficiency, Earnings and Recurrent Training: A Ten Country Comparative Study,* Institute of International Education, Stockholm University, Stockholm.

Bruce E. Landon (2004). Quantitative Research Methods. *Career Satisfaction Among Physicians,* MD, MDA. *JAMA*, February 4, 2004, 295(5), 634.

Burton, L. (Ed.). (1990). Gender and Mathematics: An international perspective. London: Cassell.

Bynner, J. and Steedman, J. (1995). Difficulties with Basic Skills: Findings from the 1970 British Cohort study. London: The Basic Skills Agency.

Casey, J., Purcell, C., & Whitlock, T. (2006). *Factors affecting success in community based literacy: Final report*. Windsor, Ontario: University of Windsor.

Civil, M. (2001). Adult learners of mathematics: Working with parents. In G. E. FitzSimons, J. O'Donoghue & D. Coben (Eds.), Adult and Lifelong Education in Mathematics Papers from Working Group for Action (WGA) 6, 9th International Congress on Mathematics Education, ICME9 (pp. 201-210). Melbourne: Language Australia in association with ALM.

Chettri, N., & Baker, D. P. (2005). "The Environment for Literacy among Nations: Concepts, Past Research, and Preliminary Analysis." Background paper for *EFA Global Monitoring Report 2006.*

Coben, D. (2000). Numeracy, Mathematics and Adult Learning. In I. Gal (Eds), *Adult Numeracy Development: Theory, Research, Practice.* Hampton Press: New Jersey. pp.34-40.

Coben, D. (2001). Fact, fiction and moral panic: The changing adult numeracy curriculum in England. In G. E. FitzSimons, J. O'Donoghue & D. Coben (Eds.), Adult and Life-long Education in Mathematics: Papers from Working Group for Action 6, 9th International Congress on Mathematical Education, ICME 9 (pp. 125-153). Melbourne: Language Australia in association with Adults Learning Mathematics – A Research Forum (ALM).

Coben, D. (Ed.). (2003). *Adult numeracy: Review of research and related literature*. Retrieved November 21, 2005, from the National Research and Development Centre for Adult Literacy and Numeracy Web site: http://www.nrdc.org.uk/uploads/ documents/doc_2802.pdf.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). Applied multiple regression/correlation for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrewnce Erbaum Associates.

Communities Scotland (2003). *National Training Project for Adult Literacies Newsletter* (March 2003, Issue 13). Retrieved June 23, 2003, from http://www.communitiesscotland.gov.uk/communities/upload/23a14.doc.

Coombs, P.A. and Ahmed, M. (1974), *Attacking Rural Poverty: How Nonformal Education Can Help,* John Hopkins University, Baltimore.

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed method approaches.* Thousand Oaks, CA. Sage.

Crockroft, W. H., 1986. Mathematics Counts: A Report into the Teaching of Mathematics in Schools. HMSO.

Curry, D. (2000). Journey . Into Journal Jottings: Mathematics As Communication. In I. Gal (Eds), *Adult Numeracy Development: Theory, Research, Practice.* Hampton Press: New Jersey. pp.239-255.

Curry, D., Schmitt, M.J., & Waldron, S. (1996). *A framework for adult numeracy standards: The mathematical skills and abilities adults need to be equipped for the future.* Retrieved October 1, 2003, from Adult Numeracy Network Web site:http://shell04.TheWorld.com/std/anpn//framewk.html.

DeCoster, J. (1998). *Overview of Factor Analysis.* Retrieved 2009, 28, December from http://www.stat-help.com/notes.html

DeCoster, J. & Claypool, H. (2004). *Data Analysis in SPSS.* Retrived 2011, 22, March from http://www.stat-help.com/notes.html

Demir, E. & Paykoç, F. (2006). Challenges of Primary Education in Turkey: Priorities of Parents and Professionals. *International Journal of Educational Development*, *Vol:26, n:6* ,pp: 640-654.

Desjardins R. (2003). "Determinants of Literacy Proficiency: a Lifelong-Lifewide Learning Perspective." *International Journal of Educational Research, 39,* 205-245.

Desjardins, R. (2004), *Learning for Well Being: Studies Using the International Adult Literacy Survey,* Institute of International Education, Stockholm University, Stockholm.

DfEE. (1999). Framework for Teaching Mathematics from Reception to Year 6. London: DfEE.

DfEE. (2001). *Skills for Life: The national strategy for improving adult literacy and numeracy skills.* London: Department for Education and Employment (UK).

DfES. (2003). Skills for Life: The national strategy for improving adult literacy and numeracy skills. Annual Review 2002-2003. Achievements so far (No. SFL AR2). London: Department for Education and Skills.

Dingwall, J. (2000). Improving numeracy in Canada. Retrieved June 12, 2010, from http://www.nald.ca/nls/inpub/numeracy/improve/improve.PDF.

Division of Adult Education and Literacy, Office of Vocational and Adult Education, U.S.Department of Education (2001). *The National Reporting System for Adult Education: Implementation guidelines*.

Durgunoglu, A.Y., & Oney, B. (2000). Numeracy needs of adult literac participants. *Focus on Basics, 4,* 18-20.

Edwards, A. 1988. ‘‘ Computational Estimation for Numeracy’’. Educational Studies in Mathematics. 18: 281-298.

Ellerton, N. F., Clarkson, P. C., & Clements, M. A. (2000). Language factors in Mathematics teaching and learning. In K. Owens & J. Mousley (Eds.), *Research in mathematics education in Australasia 1996-1999* (pp. 29-95). Sydney: MERGA.

English Ministry of Education (1959). *15 to 18: A report of the Central Advisory Committee forEducation (England).* London: Department of Education and Science.

Epstein, J.L. and Dauber, S.L. (1991), “School Programs and Teacher Practices of Parent Involvement in Inner-City Elementary and Middle Schools”, *Elementary School Journal*, Vol. 91, pp. 291-305.

Ernest, P. (1994). *Constructing mathematical knowledge: Epistomology and mathematical education.* Bristol, PA: Falmer Press.

Ersoy, Y. (2002). Matematik Okuryazarlığı-II: Hedefler, Gelitirilecek Yetiler ve Beceriler.,*Matematikçiler Derneği*. Retrieved 9, May, 2009 from: http://www.matder okur-yazarligi-iihedefler-gelistirilecek-yetiler-ve-beceriler-&catid=8:matematik kosesi-makaleleri&Itemid=172

European Commission. (2005). *White paper on education and training: Teaching and learning towards the learning society*. Luxembourg: Office for Official Publications the European Commission.

Evans, J. 1987.The Politics OF Numeracy. In P.Ernest (Ed.) Mathematics Teaching The State of The Art. Falmer Press. 203-220.

Evans, C. (1989a). Breaking Through Barriers To Adult Learning.Equity & Excellence, 24(3), p.28.

Evans, J. (1989b). The politics of numeracy. In Paul Ernest (Ed.), *Mathematics teaching: The state of the art* (pp. 203-220). New York: Falmer Press.

Evans, J. (2000). Adults' Mathematical Thinking and Emotions: A Study of Numerate Practices. Norwich: Curran Publishing Services, Ltd.

Fennema, E. & Sherman, J. (1976). 'Fennema-Sherman Mathematics Attitude Scales'*Catalogue of Selected Documents in Psychology 6.*

Fennema, E. (1979). 'Women and Girls in Mathematics-Equity in Mathematics Education', *Educational Studies in Mathematics* 10:389-401.

Fennema, E. (1995). Mathematics, gender and research. In B. Grevholm & G. Hanna (Eds.), Gender and Mathematics Education: An ICMI Study in Stiftsgarden, Akersberg, Hoor, Sweden, 1993 (pp. 21-38). Lund: Lund University Press.

Field, A. P. (2005). Is the meta-analysis of correlation coefficients accurate when population effect sizes vary? *Psychological Methods*, *10 (4)*, 444-467.

Field, A. P. (2005b). Discovering statistics using spss (2nd ed.) pp.153-205. London: SAGE.

FitzSimons, G. E., & Coben, D. (2004). Adult numeracy for work and life: Curriculum and teaching implications of recent research. In R. Mclean & D. Wilson (Eds.), *International handbook of technical and vocational education and training*. Dordrecht, The Netherlands:

FitzSimons, G. E. (2005). Can adult numeracy be taught? A Bernsteinian analysis. In M. Goos, C. Kanes, & R. Brown (Eds.), *Mathematics education and society* (Proceedings of the 4th International Mathematics Education and Society Conference pp. 155-165). Brisbane: Griffith University, Centre for Learning Research.

FitzSimons, G. E. (2006). *Towards a definition of numeracy: A work in progress*. Retrieved 9 August,2007 from: http://www.statvoks.no/emma/index_numeracy_gail_middle.html.

Forman, S. and Arthur-Steen, L. 1995. ''How School Mathematics Can Prepare Students for Work, Not Just for Collage''. The Harward Education Letter 11: 6-8.

Forman, S. L. & Steen, L. A. (1999). *Beyond eighth grade: Functional mathematics for life and work.* University of California, Berkeley: National Center for Research in Vocational Education.

Frey, R. (2000).*Risk-Minimization with Incomplete Information in a Model for High Frequency Data,* Mathematical Finance, vol 10, no 2 (2000).

Gabony & Traxler, 1982; Derrick, 1984; Edwards, 1988; Sowder, 1990 cited in O' Donoghue, 1998

Galbraith, P.L., 1992. ''Towards Numeracy for the Third Millenium: A Study of the Future of Mathematics and Mathematics Education''. Educational Studies in Mathematics.23: 569-593.

Gal, I. (2000). The Numeracy Challenge.. In I. Gal (Eds), *Adult Numeracy Development: Theory, Research, Practice.* Hampton Press: New Jersey. p.9-31.

Gal, I. (2002). Systemic needs in adult numeracy education. *Adult Basic Education*, *12*(1), 20-33

Gal, I. and Stoudt, A. (1997). Numeracy: becoming literate with numbers. *Adult Learning*. 9(2), 13-15. [Online] Available: ProQuest [2005, April 11].

Gal, I., van Groenestijn, M., Manly, M., Schmitt, M. J., & Tout, D. (2005). Adult numeracy and its assessment in the ALL survey: A conceptual framework and pilot results. In T. S. Murray, Y. Clermont & M. Binkley (Eds.), *Measuring Adult Literacy and Life Skills: New frameworks for assessment* (pp. 137-191). Ottawa: Statistics Canada

Galligan, L. & Taylor, J.A. (2008). Adults Returning to Study Mathematics. in "*Research in Mathematics Education in Australasia 2004-2007*" (Eds. H. Forgasz, A. Barkatsas, A. Bishop, B, Clarke, S. Keast, W. Seah & P. Sullivan), Sense Publishers Rotterdam. pp. 87-118.

Gronlund, N. E. (1985). *Measurement and evaluation in teaching.* New *York:* Macmillan.

Halliday, M. A. K. .(1979). *Language as social semiotic: The social interpretation of language and meaning.* London: Edward Arnold Publishers.

Hara, K. (1995). Quantitative and Qualitative Research Approaches in Education.*Education,*Vol. 115, p.78.

Harris, M. (1997). Common Threads: Women, mathematics and work. Stoke on Trent:Trentham Books.

Hartley, R., & Horne, J. (2005). Support document. Mapping benefits and costs: Literature review. In R.Hartley and J. Horne. *Social and economic benefits of improved adult literacy: Towards a better understanding*. Adelaide: NCVER. Retrieved 17 December 2007 from http://www.ncver.edu.au/research/proj/nr4L06s.doc.

Henningsen, I. (2002). Gender in ALM - Women and men learning mathematics. In L. Ø.Johansen & T. Wedege (Eds.), Numeracy for Empowerment and Democracy? Proceedings of the 8th International Conference of Adult Learning Mathematics – A Research Forum (ALM8) (pp. 223-233). Roskilde, Denmark: Centre for Research in Learning Mathematics, Roskilde University, in association with Adults Learning Mathematics - A Research Forum.

Ho, E. and Willms, J.D. (1996), "The Effects of Parental Involvement on Eighth Grade Achievement", *Sociology of Education*, Vol. 69, pp. 126-141.

Hopkins, K. D. (1998). *Educational and psychological measurement and evaluation.* Boston: Allyn & Bacon.

Horn, J.L. and Hofer, S.M. (1992), "Major Abilities and Development in the Adult Period", in R.J. Sternberg and C.A. Berg (eds.), *Intellectual Development,* Cambridge University Press, New York, pp. 44-49.

Hyde, J. S., Fennema, E., & S. J. Lamon (1990). "Gender differences in mathematics performance: A meta-analysis." Psychological Bulletin, 107(2), 139-155.

Johnston, B. (1998). Maths and gender: Given or made? In P. Gates (Ed.), Mathematics Education and Society. Proceedings of the First International Mathematics Education and Society (MEAS1), 6-11 September 1998 (pp. 207-213). Nottingham: Centre for the Study of Mathematics Education, University of Nottingham.

Johnston, B. (2002). Numeracy in the Making: Twenty years of Australian adult Numeracy. An investigation by the New South Wales Centre, Adult Literacy and Numeracy Australian Research Consortium (No. 0868039446). Sydney: University of Technology, Sydney.

Johnston, B., & Maguire, T. (2005). Adult numeracy: policy and practice in global contexts of lifelong learning. Unpublished manuscript. Retrieved 26 June 2006 from: http://www.staff.vu.edu.au/alnarc/revamp/publications/05bettyjohns.pdf.

Kapsalis, C. (1999). *Literacy Profile of Ontario's Youth*, Toronto, Ontario: Ministry of Training, Colleges and Universities.

Kaiser, H.F. (1974) An index of factorial simplicity. *Psychometrika*, 39, 31-36.

Kell, P. 1998. *From the billabong to the mainstream? A teacher's guide to Australian training and literacy policy developments 1974-1998.* ALRN/ Language Australia, Melbourne.

Kemp, M. (2005). *Developing critical numeracy at the tertiary level.* Unpublished PhD Thesis, Murdoch University, Australia, 2005. Retrieved 22 June 2006 from: http://wwwlib.murdoch.edu.au/adt/browse/view/adt-MU20060831.171947.

Kieran, C. (1994). Doing and seeing things differently: A 25-year retrospective of mathematics education research on learning. *Journal for Research in Mathematics Education*, *25*(6), 583-607.

Kirsch, I. S., Jungeblut, A., Jenkins, L. and Kolstad, A. (1993), *Adult Literacy in America: A First Look at the Results of the National Adult Literacy Survey,* Educational Testing Service, Princeton, NJ.

Laborde, C. (1990). Language and Mathematics. In P. Nesher & J. Kilpatrick (Eds.) *Mathematic and Cognition (pp.53-69).* New York: Cambridge University Pres.

Lakatos, I. (1976). *Proofs and Refutations: The logic of mathematical discovery.* Cambridge: Cambridge University Press.

Le Roux, A. A. 1979. ‘‘Numeracy: an alternative definition’’. International Journal of Mathematical Education in Science and Technology 10: 343-354.

Levinger, B.1996. Critical Transitions: Human Capacity Development Across The Lifespan. Education Development Center, INC. MA.

Linacre, J. M. (1999). *A user’s guide to Facets: Rasch measurement computer program*.Chicago: MESA Press.

Lindenskov, L. and Wedege, T. (2001). *Numeracy as an Analytical Tool in Adult Education and Research.* Centre for Research in Learning Mathematics, Publication no.31, Roskilde University.

Literacy and Basic Skills Section (1998). *Working with learning outcomes: Validation draft.*Toronto: Queen’s Printer for Ontario.

Literacy and Basic Skills Section (2000). *Common assessment in the Literacy and Basic Skill Program*. Toronto: Queen’s Printer for Ontario.

Llorente, J. C. (1996). Problem solving and constitution of knowledge at work. *Research Bulletin 92.* Helsinki, Finland: University of Helsinki, Department of Education.

Leonelli, E. D. & Schmitt, M. J. (2001). Bringing reform to adult numeracy instruction. *Field Notes*, 11(2), 226-246.

Maguire, T. and J. O'Donoghue (2002). A grounded approach to practitioner training in Ireland: Some findings from a national survey of practitioners in Adult Basic Education. In L. Ø. Johansen and T. Wedege (Eds.), *Numeracy for Empowerment and Democracy? Proceedings of the 8th International Conference of Adult Learning Mathematics - A Research Forum (ALM8)* (pp.120-132). Roskilde, Denmark: Centre for Research in Learning Mathematics, Roskilde University, in association with ALM.

Marks, G.N., Fleming, N., Long, M. & McMillan, J. (2000). *Patterns of participation in Year 12 and higher education in Australia: Trends and issues.* LSAY Research Report Number 17. Melbourne: Australian Council for Educational Research.

Marsiske, M. and Smith, J. (1998), "Development of Competence: Toward a taxonomy", in T. Husén and T.N. Postlethwaite (eds.), *International Encyclopedia of Education* (Electronic edition), Pergamon Press, Oxford.

Martelly, D. I. (1998). Effects of using manipulative materials to teach remedial algebra to community college students on achievement and attitudes towards mathematics. *Dissertation Abstracts International, 59* (03), 0706A. (UMI No. 9826062).

Mayta, F. E. (1990). The relationship of mathematics computation with concrete ability, math attitude and four demographic variables of English and Spanish-speaking incarcerated males.*Dissertation Abstracts International, 51* (08), 2604A. (UMI No. 9032058).

Merriam, S.B.& Cunningham, P.M. (Eds.). (1989). Handbook of Adult and Continuing Education. San Francisco: Jossey Bass.

Merrifield, J., Coleman, U., & McDonogh, O. (2001). *Issues and Opoprtunities in Assessement*.Report prepared for Ireland's National Adult Literacy Agency. London: Learning from Experience Trust.

Meyers, L. S., Garnst, G. & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation.* Thousand Oaks, CA: Sage.

National Adult Literacy Agency (2003). *Tutor Bulletin*, Summer 2003. Cork: NALA.

National Research Council (2002). *Performance assessments for adult education: Exploring the measurement issues, Report of a workshop.* Committee for the Workshop on Alternatives for Assessing Adult Education and Literacy Programs, R. J. Mislevy and K. T. Knowles (Eds.), Board on Testing and Assessment, Centre for Education, Division of Behavioral and Social Sciences and Education. Washington, D.C.: National Academy Press.

NCVER 2001, 'A glossary of Australian vocational education and training terms' compiled by Anne Knight and Marianne Nestor, National Centre for Vocational Education Research Ltd., Adelaide. Retrived August, 28, 2009, from http://www.ncver.edu.au/research/core/cp9812.pdf.

Neill, W. A. (2001). The essentials of numeracy. Paper presented at the *New Zealand association of researchers in education conferenc*e 6th – 9th December. Christchurch. Retrieved 12 January 2007 from http://www.nzcer.org.nz/pdfs/10604.pdf.

OECD,2000. *Literacy in the information age: final report of the International Adult Literacy Survey.,* Organisation for Economic Cooperation and Development. Paris.

OECD. 2007. *Literacy skills for the knowledge society: further results from the InternationalAdult Literacy Survey*. OECD.

OECD and HRDC (1997), *Literacy Skills for the Knowledge Society: Further Results from the International Adult Literacy Survey,* Paris and Hull.

Organization for Economic Co-operation and Development & Statistics Canada. (2000). *Literacy in the information age: Final report of the international adult literacy survey*.Paris, France, and Ottawa, Canada: Author.

Orrill, C. H. (April, 2001). Supporting online PBL: Design considerations for collaborative problem-solving communication tools. In T. Koschmann (chair), *Studying collaboration in distributed PBL environments*. Structured Poster Symposium to be presented at American Educational Research Association Annual Meeting: Seattle WA.

O'Rourke, U. & O'Donoghue, J. (1998). Guidelines for the development of adult numeracy materials. In D. Coben & J. O'Donoghue (Eds .), *Adults Learning Mathematics-4: Proceedings of ALM 4: The fourth international conference at the University of Limerick, Ireland*. July 4-6, 1997. London, UK: Goldsmiths College.

Parsons, S and Bynner, J (2000) Impact of Poor Numeracy on Employment and Career Progression, in Tikly, C and Woolf, A F, eds, *The Maths We Need Now: Demands, deficits and remedies*, Institute of Education, Bedford Way Papers, London, Chap 2 pp 26-51.

Paulos, J. A. 1988. Innumeracy-Mathematical illiteracy and its Consequences. Penguin Books

Payne, D. A. (1992). *Measuring and evaluating educational outcomes.* New York: Macmillan.

Perkins, D.N., and Salomon, G. (1988). Teaching for transfer. Educational Leadership, 46(1), 22-32.

Pilling, D. (1990). Escape from Disadvantage. London: The Falmer Press.

Popham, W., J. (2007). Classroom Assessment: What Teachers Need To Know. Edition:5, Publisher: Allyn & Bacon.

QCA (Qualifications and Curriculum Authority) (2000) *Curriculum Guidance for the Foundation Stage*. London: QCA.

Reed, R. H., & Miller, H. P. (1970). Some determinants of the variation in earnings for college men. *Journal of Human Resources, 5,* 177–190.

Rogers, P., & G. Kaiser (Eds.). (1995). Equity in Mathematics Education: Influences of feminism and culture. London: Falmer Press.

Ross, K.(2005). Educational Research: Some Basic Concepts and Terminology. *Quantitative Research Mehods in Educational Planning.* Retrived October 02, 2009 from http://www.sacmeq.org and http://www.unesco.org/iiep.

Rothman, S. & McMillan, J. (2003). *Influences on Achievement in Literacy and Numeracy.* LSAY Research Report Number 36. Melbourne: ACER.

Satherly, P. Lawes, E. and Sok, S. (2008). The Adult Literacy and Life Skills Survey (ALL) Retrieved September 28, 2009 from http://www. educationcounts.govt.nz/. publications/assessment/19491

Saxe, G. (1991). *Culture and cognitive development: Studies in mathematical understanding.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Schaie, K.W. (1994), "The Course of Adult Intellectual Development", *American Psychologist*, Vol. 49(4), pp. 304-313.

Schliemann, A. D., & Acioly, N. M. (1989). Mathematical knowledge developed at work: The contribution of practice versus the contribution of schooling. *Cognition and Instruction, 6*, 185-221.

Scottish Executive (2001). *Adult Literacy and Numeracy in Scotland*. Edinburgh. Retrieved June 23, 2009 from http://www.scotland.gov.uk/library3/lifelong/alan-00.asp.

Scottish Qualifications Authority (2003). *Core Skills Framework: An introduction (Numeracy)*. Glasgow. Retrieved June 23, 2003, from http://www.sqa.org.uk/ sqa/sqa_pageView.jsp?p_service=Content.show&pContentID=322&p_ap plic=CCC&.

Secretary's Commission on Achieving Necessary Skills (SCANS). *What Work Requires of Schools: A SCANS Report for America 2000.* Washington, DC: U.S. Department of Labor, 1991.

Seddon, T., 2002. Re-imagining VET: a response to Kaye Schofield, *Education Links*, 63, 27-29.

Sewell, W. H., & Hauser, H. M. (1975). *Education, occupation, and earnings: Achievement in the early career.* New York: Academic Press.

Shapiro, S. S., and M. B. Wilk. 1965. "An Analysis of Variance Test for Normality (Complete Samples)." *Biometrika*, 52(3/4) (December):591-611.

Shepherd, P. (1984). Literacy and numeracy and their implications for survey research evidence from the National Child Development Study. *Journal of the Market Research Society, 26,* 147-158.

Shonkoff, J. P and D. A. Phillips, eds, (2000), *From Neurons to Neighborhoods: The Science of Early Childhood Development*, National Academy Press, Washington DC.

Smart, T., & Z. Isaacson (1989). 'It was nice being able to share ideas': Women learning mathematics. In C. Keitel (Ed.), Mathematics Education and Society. Paris: UNESCO.

Smith, J. and Marsiske, M. (1997), "Abilities and Competencies in Adulthood: Lifespan perspectives on workplace skills", in A.C. Tuijnman, I.S. Kirsch and D.A. Wagner (eds.), *Adult Basic Skills: Innovations in Measurement and Policy Analysis,* Hampton Press, Inc., Cresskill, NJ, pp. 73-114.

Sowder, J.T. 1990. ''Mental Computation and Number Sense'' Arithmetic Teacher, 4: 258- 260.

Statistics Canada & OECD (2005). *Learning a living: First results of the Adult Literacy and Life Skills Survey*. Ottawa and Paris: Statistics Canada and Organisation forEconomicCooperation and Development. Retrieved April, 09, 2011, www.statcan.ca/english/freepub/89-603-XIE/89-603XIE2005001.htm

Steen, L.A. (Ed.). (2001). *Mathematics and Democracy: The Case for Quantitative Literacy*. Princeton, NJ: National Council on Education and the Disciplines.

Sterrett, A. (Ed.) (1990). *Using writing to teach mathematics* (MAA Notes No. 16). Washington, DC: The Mathematical Association of America.

Stevenson, D.L. and Baker, D.P. (1987), "The Family-school Relation and the Child's Schools Performance", *Child Development*, Vol. 58, pp. 1348-1357.

Sticht, T. (2001). *Reforming Adult Literacy Education: Transforming local programs into national systems in Canada, the United Kingdom and the United States.* www.nald.ca/fulltext/sticht/reformin.

Stigler, J. W. and Baranes, R. 1988. Culture and Mathematics Learning. In E.Z. Rothkopf, (Ed.) Review of Research in Education 1988/89. America Educational Research Association.

The Daily, 2005. Wednesday, November 9. *International Adult Literacy and Skills Survey*.Retrieved January 18, 2010, from http://www.statcan.gc.ca/daily quotidien/051109/dq051109a-eng.htm

Tamassia C., Lennon M., Yamamoto, K., & Kirsch I., (2007). *Adult Education in America: A First Look at Results from the Adult Education Program and Learner Surveys.*Princeton, NJ: ETS. Retrieved April, 09, 2011, www.ets.org/Media/Research/pdf/ETSL ITERACY_AEPS_Report.pdf

Toutkoushian, R. K. (2005). Chapter 3: Regression analysis for institutional research. In M. Coughlin (Ed*.), Applications of Intermediate / Advanced Statistics in Institutional Research (No. 16).* (pp.89-95). Tallahassee: Florida State University, Association for Institutional Research.

Treffers, A. (1987). *Three dimensions. A model of goal and theory description in mathematics instruction –the Wiskobas project*. Dordrecht: Reidel Publishing Company.

Tuijnman, A.C. (1989), "Recurrent Education, Earnings and Well-being: A 45-year longitudinal study of a cohort of Swedish men", *Acta Universitatis Stockholmiensis,* Almqvist and Wiksell International, Stockholm.

Vygotsky, L.S. (1978). Mind in society. Cambridge, MA: Harvard University Press.

White, S. (1981). *The New Liberal Arts.* New York, NY: Alfred P. Sloan Foundation.

Wickert, R., & McGuick, J. (2005). *Integrating literacies: Using partnerships to build literacy capabilities in communities*. Adelaide: NCVER.

Williams, T. (1987), *Participation in Education*, Australian Council for Educational Research, Hawthorn.

Willms, J. D. (1999). *Inequalities in literacy skills among youth in Canada and the United States.* (International Adult Literacy Survey No. 6). Ottawa, Ontario: Human Resources Development Canada and National Literacy Secretariat.

Wise, S. L. (1985). The development and validation of a scale measuring attitudes toward statistics. *Educational and Psychological Measurement, 45,* 401-405.

Wiswanathan, M. (1993).Measurement of Individual Differences in Preference for Numerical Information., *Journal of Applied Psychology. Vol:78, No:5,* 741-752.

Withnall, A., Osborn, M., & A. Charnley (1981). Numeracy and Mathematics for Adults (Vol.VII). Leicester: National Institute of Adult Education (England and Wales) (now NIACE).

Withnall, A. (1995). Older adults' needs and usage of numerical skills in everyday life (No.EDRS No. ED 383 879). Lancaster: Lancaster University.

Yasukawa, K., & B. Johnston (1994). A numeracy manifesto for engineers, primary teachers, historians…A civil society-Can we call it theory? In *Proceedings of the Australian Bridging Mathematics Network Conference* (pp.191-199). University of Sdney, 10-12 July.

Yelland, N.J & Kilderry, A. (2005) Becoming a mathematical thinker in new times. Hong Kong Journal of Early Childhood, 4 (1) 37-42.

Zevenbergen, R. (2004). Technologizing numeracy: Intergenerational differences in working mathematically in new times. *Educational Studies in Mathematics 56*(1), 97-117.