THE RELATIONSHIPS BETWEEN SEVENTH AND TENTH GRADE STUDENTS' SELF-ESTIMATED INTELLIGENCE DIMENSIONS, AND THEIR SCIENCE OR PHYSICS ACHIVEMENT

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE
IN
THE DEPARTMENT OF SECONDARY SCIENCE AND MATHEMATICS EDUCATION

JANUARY 2004

Approval of the Graduate School of Natural and Applied Sciences.

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ABSTRACT

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January 2004, 119 pages

This study aimed to explore the self-estimated intelligence dimensions of seventh and tenth grade students, and the effect of grade level, gender, age, socio economic status (SES), physics/science achievement, and branch in school (science-math/literature-math/social sciences-literature) on these dimensions.

In this study a Multiple Intelligence Inventory was used as measuring instrument. The study was conducted in randomly selected 26 elementary and 7 high schools throughout Çankaya, Keçiören and Yenimahalle districts of Ankara with a total of 3721 seventh and tenth grade students in fall 2003-2004 semester.

The data obtained from the administration of the measuring instrument were analyzed by using multivariate analysis of variance (MANOVA) and bivariate correlations. Results indicated that most dominant intelligence of seventh, tenth, and all students was the interpersonal intelligence according to their self-perceptions. Results of the statistical analyses indicated that grade level of students had a significant effect on their self-estimated intelligence dimensions. Strengths and weakness of the students vary according to their grade level. Also, significant differences found in female and male students' self-estimated intelligence dimensions for both two different grade levels, and tenth grade students coming from three different branches. Bivariate correlations revealed low positive correlations between science achievement and interpersonal intelligence of seventh graders.

Keywords: Physics Education, Science Education, Physics Achievement, Science Achievement, Multiple Intelligence Theory

ÖZ

YEDİNCİ VE ONUNCU SINIF ÖĞRENCİLERİNİN KENDİLERİNİ DEĞERLENDİRMESİYLE BULUNAN ÇOKLU ZEKA BOYUTLARI VE FEN VEYA FİZİK BAŞARILARI ARASINDAKİ İLİŞKİLER

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Ocak 2004, 119 sayfa

Bu çalışmanın amacı; yedinci ve onuncu sınıf öğrencilerinin çoklu zeka boyutlarını öz-değerlendirme yoluyla belirlemek ve bu boyutlara sınıf seviyesi, cinsiyet, yaş, sosyo ekonomik durum, fizik/fen başarısı ve okuldaki branşın (fen-matematik, türkçe-matematik, türkçe-sosyal) etkisini araştırmaktır.

Çalışmada, ölçüm aracı olarak Çoklu Zeka Envanteri kullanılmıştır. Çalışma, 2003-2004 sonbahar döneminde, Çankaya, Keçiören ve Yenimahalle ilçelerinden rastgele seçilen 26 ilköğretim okulu ve 7 liseden toplam 3721 yedinci ve onuncu sınıf öğrencisi ile yapılmıştır.

Elde edilen veriler, çok yönlü varyans (MANOVA) istatistiksel tekniği ve basit ilişki analizi kullanılarak değerlendirilmiştir. İstatistiksel sonuçlar, yedinci sınıf, onuncu sınıf, ve tüm öğrencilerin en baskın zeka alanının bireylerarası zeka olduğunu göstermiştir. Sınıf seviyesinin öğrencilerin zeka alanları üzerinde anlamlı bir etkisi olduğu gözlenmiştir. Öğrencilerin zeka alanları sınıf seviyelerine göre değişkenlik göstermektedir. Ayrıca, her iki seviyedeki kız ve erkek öğrencilerin ve üç farklı branştan gelen onuncu sınıf öğrencilerinin zeka alanlarında anlamlı farkılık gözlenmiştir. Basit ilişki analizleri, öğrencilerin fen başarılarının bireylerarası zeka alanlarıyla düşük positif bir ilişki içerisinde olduğunu göstermiştir.

Anahtar Kelimeler: Fizik Eğitimi, Fen Eğitimi, Fizik Başarısı, Fen Başarısı, Çoklu Zeka Kuramı.

To My Parents

ACKNOWLEDGEMENT

I would like to thank my supervisor Assist. Prof. Dr. Ali Eryılmaz for his valuable guidance and help throughout the study.

I am grateful to my parents who provided valuable support throughout my life and this study. Thank you for your encouragement and patience.

Special thanks goes to my close friends Aslı, Ertuğrul, Pınar, Semra, Şule, and Yeşim for their valuable contributions and support to this study. I feel very fortunate that I have friends like you.

I also want to thank to administrators, teachers, and students who gave their time and helped by participating in the study.

I wish to thank the all people again who generously shared their time with me, and support to overcome the number of intellectual and psychological challenges during the completion of this thesis.

This thesis was financially supported by BAP-2003-05-01-03. I would like to emphasize my appreciation for this financial support.

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SYMBOLS

VLINT:	Verbal-Linguistic Intelligence
LMINT:	Logical-Mathematical Intelligence
VSINT:	Visual-Spatial Intelligence
MINT :	Musical Intelligence
BKINT:	Bodily-Kinesthetic Intelligence
INTRAINT:	Intrapersonal Intelligence
INTERINT:	Interpersonal Intelligence
PSSCORE:	Physics/Science Scores
MI:	Multiple Intelligences
IQ:	Intelligence Quotient
SES:	Socio Economic Status
DV:	Dependent Variable
IV:	Independent Variable
MANOVA:	Multivariate Analysis of Variance
df:	Degree of Freedom
N:	Sample Size
α:	Significance Level

CHAPTER 1

INTRODUCTION

In a changing world and society, students have to be prepared for the varying demands of the community. However, the task of providing an environment that fosters learning of diverse population of students is challenging, classrooms must meet students' individual needs (Chapman & Freeman, 1996). It requires educators' rethinking and reconceptualizing the abilities of students' skills and talents, because these are crucial to create learning environments where all students succeed and grow. Taken into account the learners' individual strengths and weaknesses can help educators to facilitate genuine and meaningful activities for all students. Recognizing students' diverse natures, besides encouraging self-awareness and metacognitive strategies within them, is important to train learners for the future (Franzen, 1999).

The idea of varying ways of learning for different individuals has been gathering momentum throughout the educators. It is believed that assessment methods, particularly standardized tests cannot measure certainly and fairly all students' knowledge or intellectual potential (Bouton, 1997). Throughout the history, psychologists have attempted to measure the human intelligence. Binet and Terman (as cited in Franzen, 1999) developed the first general intelligence test, which focuses on finding out an intelligence quotient (IQ) score. This single score has been used to categorize students within educational settings. Many intelligence tests, similar to Binet's, measure students' abilities in logical/mathematical and verbal/linguistic domains, and students are required to respond to verbal and written multiple-choice an short-answer questions within a determined frame (Wiseman, 1997). However, now educators all know that intelligence quotient is not enough to reflect students' individual talents and strengths.

As opposed to the limitations of unitary view of intelligence, Gardner (1993a) proposed his theory of Multiple Intelligences with the publication of Frames of Mind: The Theory in Practice. His theory suggests that there is a number of separate forms of intelligence and each individual possess these intelligences in varying degrees. The theory first comprised seven areas of intelligences: verbal-linguistic, logical-mathematical, musical-rhythmic, visual-spatial, bodily-kinesthetic, interpersonal, and intrapersonal. He later identified an eight intelligence referred to as the naturalistic intelligence (Checkley, 1997). Each individual possessing the eight intelligences has some strengths and weaknesses for those intelligences (Brualdi, 1998). This new understanding of intelligence assists teachers view students' learning differently (Harms, 1998).

According to Gardner, the implication of the theory is that teaching-learning process should focus on the particular intelligences of each person, and encourage individuals to use and develop their preferred intelligences. Therefore, teachers should recognize and emphasize the multiple intelligences and try to assess each student's intellectual profiles in order to facilitate learning (Brualdi, 1998). And, since possessing different profiles of intelligences changes students' preferences for learning (Gibson & Govendo, 1999), different forms of intelligences should be taken into account in planning instructional activities (Brualdi, 1998).

1.1 The Main Problem and Sub-problems

1.1.1 Main Problem

The purposes of this study were to determine the 7th and 10th grade regular state school students' self-estimated intelligence dimensions in Ankara and to investigate the effect of students' grade level, gender, age, socio economic status (SES), physics/science achievement, and branch in high school (science-math/literature-math/social sciences-literature) on students' self-estimated intelligence dimensions.

1.1.2 Sub-Problems

The following sub-problems were investigated based on the main problem.

1. What are the strongest and weakest self-estimated intelligence dimensions of 7th grade elementary school students in regular state schools in Ankara?
2. What are the strongest and weakest self-estimated intelligence dimensions of 10th grade high school students in regular state schools in Ankara?
3. Is there a significant difference between 7th and 10th grade regular state school students' self-estimated intelligence dimensions?
4. What is the effect of gender on 7th grade regular state school students' self-estimated intelligence dimensions?
5. What is the effect of gender on 10th grade regular state school students' self-estimated intelligence dimensions?
6. Are there significant relationships between age and self-estimated intelligence dimensions of 7th grade regular state school students?
7. Are there significant relationships between age and self-estimated intelligence dimensions of 10th grade regular state school students?

8. Are there significant relationships between socio economic status (SES) and self-estimated intelligence dimensions of 7th grade regular state school students?
9. Are there significant relationships between socio economic status (SES) and self-estimated intelligence dimensions of 10th grade regular state school students?
10. What is the effect of branch in school (science-math/literature-math/social sciences-literature) on 10th grade regular state school students' self-estimated intelligence dimensions?
11. Are there significant relationships between science achievement and self-estimated intelligence dimensions of 7th grade regular state school students?
12. Are there significant relationships between physics achievement and self-estimated intelligence dimensions of 10th grade regular state school students?

1.2 Null Hypothesis

The problems stated above were tested with the following hypothesis.

Null Hypothesis 1

There is no significant main effect of grade level on the population means of the collective dependent variables of scores on students' self-estimated intelligence dimensions.

Null Hypothesis 2

There is no significant main effect of gender on the population means of the collective dependent variables of scores on 7th grade regular state school students' self-estimated intelligence dimensions.

Null Hypothesis 3

There is no significant main effect of gender on the population means of the collective dependent variables of scores on 10th grade regular state school students' self-estimated intelligence dimensions.

Null Hypothesis 4

There are no significant relationships between age and self-estimated intelligence dimensions of 7th grade regular state school students.

Null Hypothesis 5

There are no significant relationships between age and self-estimated intelligence dimensions of 10th grade regular state school students.

Null Hypothesis 6

There are no significant relationships between socio economic status (SES) and self-estimated intelligence dimensions of 7th grade regular state school students.

Null Hypothesis 7

There are no significant relationships between socio economic status (SES) and self-estimated intelligence dimensions of 10th grade regular state school students.

Null Hypothesis 8

There is no significant main effect of branch in high school (science-math/literature-math/social sciences-literature) on the population means of the collective dependent variables of scores on 10th grade regular state school students' self-estimated intelligence dimensions.

Null Hypothesis 9

There are no significant relationships between science achievement and self-estimated intelligence dimensions of 7th grade regular state school students.

Null Hypothesis 10

There are no significant relationships between physics achievement and self-estimated intelligence dimensions of 10th grade regular state school students.

1.3 Definition of Important Terms

This section includes some important definitions related to the study.

Intelligence dimensions: Eight different intelligence areas that Gardner proposed. These dimensions are verbal-linguistic, logical-mathematical, visual-spatial, musical, bodily-kinesthetic, intrapersonal, interpersonal, and naturalistic intelligences. The seven of these dimensions were measured with the Multiple Intelligence Inventory, each dimension were measured by 10 items, naturalistic intelligence was not included in the study. Higher score for a dimension indicates strength in this dimension.

7th grade: Second year in junior high school.

10th grade: Second year in senior high school.

Gender: Students' self-reports of their gender were used to measure this variable.

Socio economic status (SES): Three items were used to measure this variable. These were education level of mother, education level of father, and number of books at home (G. Berberoğlu, personal communications, March10, 2003). These three items have 5 categories.

Branch in high school: There are three branches in Turkish high schools; science-math, literature-math, and social sciences-literature. After the first year in the senior high school, students have to choose the one of these three categories. In science-math branch, students attend heavily on science and math courses, in literature-math branch, students attend heavily on literature and math courses, and in the social sciences-literature branch, students attend heavily on social sciences and literature courses.

Science Achievement: Students' self-report of previous semester grades over 5 for science course at school were used to measure this variable.

Physics Achievement: Students' self-report of previous semester grades over 5 for physics course at school were used to measure this variable.

1.4 Significance of the Study

In order to be successful in educating all students, educators should be aware of the students' individual differences: individual learning styles and multiple intelligence profiles. In schools, while verbal-linguistic and logical-mathematical intelligences are emphasized and supported, students who are more developed in other intelligence dimensions are ignored. This situation makes science and physics lessons more complicated and incomprehensible for students (Gürçay & Eryılmaz, 2002). Identifying and knowing students' intelligence profiles have implications for instruction (Shalk, 2002). The theory claims that if a student can not be successful in school by using verbal and mathematical intelligences, this student can be successful by using other intelligence dimensions such as visual, musical, or kinesthetic (Oddleifson, 1994). Therefore, the MI theory has important implications for providing a more equitable approach to education (Eisner, 1994). If we plan science and physics lessons in multiple dimensions of intelligence, students not only like science and physics courses, but also they begin to reason, search, use and produce knowledge. Since intelligence strengths and weaknesses are not static, they may be improved with different educational experiences. For this reason, MI approach supports continuous assessment of intelligences starting at young age (Shalk, 2002).

A multiple intelligence inventory can be used to determine intelligence profiles of students and to guide them to compensate for their weaknesses especially in elementary and secondary grades. Also, the results of the inventory can be used to guide students to choose career areas before university entrance examination (Oral, 2001). Student completed surveys are accepted as effective tools by many educators to determine the challenging areas that the learner needs assistance, and also for the effective individualization of education. If used in this sense, MI surveys can function as early warning tools for educators to modify the instruction according to students' varying needs (Shalk, 2002).

The research results show that if teachers are given enough information about students' diverse profiles, they are not insensitive to their multiple intelligences. However, they have little opportunity to observe diverse accomplishments and talents of their students, because of the reality of large classes and constraints on curriculum, methods and time. Therefore, it seems important to provide clear information about the particular abilities and intelligences of their students (Guskin, Peng & Simon, 1992). Having information about the students' multiple intelligences can facilitate teachers, to support students more effectively, who have a difficulty with their schoolwork or with their behaviour (Gibson & Govendo, 1999).

Using inventories, also students recognize and discover their own strengths and weaknesses (Lambert, 1997), and they have the opportunity to employ their stronger intelligence areas, which gives motivation and self-confidence to them to be successful.

The results of this study will provide an insight into diverse population of learners in Turkish elementary and high schools, and their different learning of science, and the need for different learning environments according to students' varying profiles. It is hoped that this study will be useful for students for recognizing their own profiles, and make benefit from these profiles for more effective learning of science, for science teachers to being aware of these differences in their students and facilitating effective instructional practices that nurture students' growth, and for curriculum developers for taking into account the diverse population of learners in future curriculum plans. And it is also hoped that the results of this study will be a step and a guide for future studies for implementing the MI theory in science contexts.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 Intelligence Theories

From cognitive style researchers and practitioners we have known that the human being receives information from a variety of sources, such as from other persons, from the environment, and from itself, and processes this information in psychologically differentiated ways (Morgan, 1996). These ways constitutes the human intelligence. In the stereotype view, intelligence is accepted as a single quality that is manifested throughout a person's intellectual performances, measurable by a single quantifiable index called IQ score, presenting a potential early in life or not at all (Gardner, 1993a), inherited and static (Gardner, 1995).

In the history of psychology, there were many different intelligence views such as; Piaget's theory of developmental psychology which says; intelligence is developmentally constructed in the mind by the learner and moves from concrete and abstract stages of understanding, Vygotsky' theory of social mediation: intelligence is a function of activity mediated through material tools, psychological tools, and other human beings, Feuerstein's theory of structural cognitive modifiability: intelligence is a function of experience and can be changed through guided mediation, Sternberg's successful intelligence: intelligence is triarchic, with analytic, creative and practical components that required to be balanced, Perkins' theory of learnable intelligence:

intelligence is made up of neural, experiential, and reflective components that help us know our way around the good use of our minds, Costa's theory of intelligence behaviors: intelligence is composed of acquired habits or states of mind that are evident in such behaviors as persistence, flexibility, decreased impulsiveness, enjoyment of thinking, and reflectiveness, Goleman's theory of emotional intelligence: intelligence is both cognitive and emotional, with the motional (self-awareness, self-regulation, motivation, empathy, and social skill) ruling over the cognitive, Cole's theory of moral intelligence: intelligence is composed of cognitive, psychological or emotional, and moral realms, and Gardner's theory of Multiple Intelligences: intelligence is a biological and psychological potential that is the results of the experiential, cultural, and motivational factors (Gardner, 1995), and made up of eight realms of knowing (verbal, visual, mathematical, musical, bodily, interpersonal, intrapersonal, naturalistic) for solving problems and creating products valued in a culture (Gardner, 1993a).

The question of whether the intelligence is one thing or many were discussed among theorists such as Hernstein and Murray (as cited in Sternberg, 1996) who argued for the predominance of a general factor of intelligence; at the other extreme Guilford (as cited in, 1996) argued for as many as 150 factors of intelligence. Also the theorists, such as Gardner (1993a) who argue that intelligence is not one but many, Perkins (as cited in Sternberg, 1996) who argue that intelligence is not only manifold but also includes aspects of values and personality as well as cognitive skills, and Neisser (as cited in Sternberg, 1996) who argue that intelligence is only a cultural innovation, and it does not exists outside of our innovation of it as a prototype of what we value in a culture.

Although the intelligence was initially accepted as a unitary concept, which could be determined by a single number, later a debate arose about whether it can be divided into components (Gardner, 1998) and then, IQ scores were begun to recognized as a inadequate measures of intelligence (Ramos-Ford & Gardner; Renzulli; Sternberg; Tannenbaum; Winner as cited in Chan, 2001).

Thurstone (as cited in Morgan, 1996), was among the first theorists who says intellectual activity of human beings can not be determined only by a single human factor, thus, the intelligence can not be determined by measuring a single ability. He identified multiple factors such as verbal ability, deductive reasoning, spatial ability and perceptual speed, necessary to a fused theory of intelligence. Guilford (as cited in Gardner, 1998) also argued that intelligence is better conceived of a set of possibly independent factors. However, Gardner (1987) did not find these criticisms satisfying, according to him the entire concept of unitary view of intelligence had to be changed or replaced.

The early work of Thorndike and Guilford emerge in Gardner's interpersonal intelligence, which is stated as the capacity to notice and respond appropriately to the moods, temperaments, motivations, and desires of other people (Morgan, 1996).

Our view of intelligence has begun to change according to the new knowledge of the brain. Neurobiological research indicates that, different areas of brain are responsible for different types of learning (Brualdi, 1998). Lazear (as cited in Patterson, 2002) stated that the change in the view of the intelligence resulted in following acceptations of intelligence. First, we have a set of capabilities that are continually developing and changing during our lives, rather than having fixed or static intelligences. Therefore, intelligence can be learned and taught, and almost any intellectual ability can be enhanced at any age. Finally, intelligence is multidimensional and present at various levels of our brain, mind, and body system.

At the present time, evidences make clear that intelligence is multifold, and the full range of its dimensions is not captured fully by a single general ability (Fasko, 2001; Sternberg as cited in Sternberg, 1996). Also, instead of depending on just one criterion, such as the Stanford Binet IQ test, intelligence can be defined to include diverse abilities (Trent, 1997). In fact, human intelligence encompasses a richly textured mental landscape, which is easily trivialized by IQ scores and labels such as smart, average, or stupid (Gray & Viens, 1994).

Sternberg (1994) stated that, we have to move away from a notion of intelligence composed of a fixed set of abilities, regardless of the number, and to an approach of intelligence emphasizing on strengths and compensation and development of weaknesses.

Also, in most theories of intelligence, whether singular or multiple, intelligence was viewed as biological entities or potentials that exists in the head and brain and can be measured reliably free from the context (Gardner, 1998). However, Gardner’s multiple intelligence theory is made distinctive with the contextualization and distribution ideas, which are against the belief that the intelligence is only in the head (Schmidt, 1994). Contextualization states that intelligence can only be understood in terms of the context or environment in which the individual lives, and distribution states that intelligence can merely be appreciated in terms of the individual’s access to all other kinds of human and non-human resources (Schmidt, 1994). Gardner (1998) claims that intelligence is always in an interaction between biological proclivities and opportunities for learning in a specific cultural context.

2.2 The Multiple Intelligences (MI) Theory

In his book Frames of Mind: The Theory of Multiple Intelligences, using biological as well as cultural research and basis, Howard Gardner (1993a) proposed a revolutionary view about intelligence and formulated his list of multiple intelligences. This new outlook on intelligence differs greatly from the traditional unitary view, which usually emphasizes only two intelligences, verbal and computational (Brualdi, 1998). In another way, the Multiple Intelligences theory is an effort to rethink the theory of measurable intelligence embodied in intelligence testing (Silver, Strong & Perini, 1997).

Gardner proposes the theory that the human organism possesses seven distinct units of mental functioning, which he called "intelligences" (Blythe & Gardner, 1990; Teele, 1996; Willis, 2001). And these separate intelligences are based on multiple frames (Willis, 2001), and have their own specific sets of abilities, which can be observed and measured (Morgan, 1996).

Hence, the notion of multiple factors, which contribute to what is generally considered as intelligence, is not new. What is new about Gardner's proposal is that each factor described in his theory, constitutes a separate construct that would qualify as an intelligence (Morgan, 1996).

Gardner stretches the word intelligence beyond its customary application in educational psychology (Gardner & Hatch, 1989), and defines intelligence as biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are valued in one or more culture or community (Gray & Viens, 1994; Patterson, 2002). Rather than being limited to and determined by standardized test scores, it is argued to determine one's profile of intelligence in familiar and culturally valued contexts (Yekovich, 1994). Because, intelligences are potentials that may or may not be utilized and developed depending on the cultural values, opportunities, individual decisions (Patterson, 2002), biological endowment, and personal life history (Armstrong, 2000).

Besides biology, culture also plays an important role in the cultivation of the intelligences (Gardner, 1993a). All societies give importance to different types of intelligences. Since, accepted and valued behaviors increases motivation and orient individuals to enrich those behaviors, giving more importance to particular intelligence dimensions causes to develop those dimensions more and rapid than others. Thus, while certain intelligences might be highly developed in people of one culture, those same intelligences might not be as developed in the individuals of another culture (Brualdi, 1998), in spite of the fact that all individuals are born with potential in all seven intelligence areas (Gardner & Hatch, 1989). Kennedy (1994) indicated that as kids grow and change, different strengths emerge, and culture too plays a part in which strengths might flourish and which may go underground. Also, Gardner (1987) believes that people may born with different intelligence profiles, and they certainly differ in the profiles they end up with.

Gardner (1994) clarifies the effect of nature and nurture in the development of intelligences by given the example of Mozart and Einstein. He believes that both of them were born with different intellectual proclivities, and their respective genetic characteristics influenced their options and their ultimate achievements, but he adds it does not mean to ignore the importance of cultural or motivational factors.

Gardner (1987) and his colleagues surveyed a wide set of resources in order to find an answer to the question “What is an intelligence?” and has provided reasons to dismiss the single factor constructs of intellectual functioning (Morgan, 1996).

The theory combine insights from scientific research in fields; cognitive science (the study of the mind), neuroscience (the study of the brain) (Gardner, 1987), biology, anthropology, psychology, medical case studies and an examination of art and culture (Patterson, 2002; Silver, Strong & Perini, 1997).

One source of knowledge about the nature of intelligence is development of different kinds of abilities in normal children; another source is information on the ways that these abilities break down under conditions of brain damage (Gardner, 1987; Silver, Strong & Perini, 1997). In the case suffering from a stroke or some other kind of brain damage, several abilities can be destroyed, or spared, in isolation from other abilities. The research was conducted with brain-damaged patients and yields a very powerful kind of evidence (Gardner, 1987) to show that the intelligences are distinct from one another (Raeburn, 1999) and to answer the question whether abilities and potentials are different than intelligences (Hoerr, 1996). Also, forms of intellect that exist in different species; forms of intellect respected in different cultures; the evolution of cognition across the millennia; and as a psychological indication, the results of factor analytic studies of human cognitive capacities provides valuable information about the nature of intelligence (Gardner & Hatch, 1989).

Gardner (1987) and his research group looks at other special populations as well: prodigies, idiot savants, autistic children, children with learning disabilities: all of whom have very different cognitive profiles that cannot be explained by a unitary view of intelligence.

Ultimately, he created a list of criteria in which to judge what constituted each intelligence dimension. Eight criteria for determining what constitutes intelligence as follows: potential isolation of brain damage; existence of idiot savant, prodigies, and other exceptional individuals; an identifiable core set of operations-basic kinds of information processing operations or mechanisms that deal with one specific kind of output; a distinctive developmental history, along with a definite set of “end state” performances; an evolutionary history and evolutionary plausibility; support from experimental and psychological tasks; support from psychometric data; and susceptibility to encoding from a symbol system (Gardner, 1993a, 1996).

In his theory of the Multiple Intelligences initially Gardner (1998) argues that human beings have evolved to be able to perform at least seven distinct forms of analyses. These are linguistic intelligence as in a poet, logical-mathematical intelligence as in a scientist, musical intelligence as in a composer, spatial intelligence as in a sculptor or airplane pilot, bodily-kinesthetic intelligence as in an athlete or dancer, interpersonal intelligence as in a salesman or a teacher, and intrapersonal intelligence that exhibited individuals with precise views of themselves. Linguistic intelligence is described as the capacity to use the words effectively, orally or by writing (Armstrong, 2000), and sensitivity to the meaning and order of words (Gardner, 1987), to use language to communicate quickly (Brougher, 1997). Logical-mathematical intelligence is described as the capacity to use numbers effectively (Armstrong, 2000), analyze and engage in higher order thinking (Brougher, 1997), and ability to handle chains of reasoning and distinguish the patterns and order (Gardner, 1987). Musical intelligence is described as the capacity to recognize, discriminate, transform, and express musical forms (Armstrong, 2000), and sensitivity to pitch, melody, rhythm, and tone. Spatial intelligence is described as the ability to recognize the spatial world precisely and to reconstruct or transform aspects of that world (Gardner, 1987), and involves sensitivity to color, line, shape, and form (Armstrong, 2000). Bodily-kinesthetic intelligence is described as to control body movements and handle items skillfully, or to use whole body or parts of the body to solve problems or create products. Interpersonal intelligence is described as the ability to understand moods, intentions, motivations, feelings and relationships of people (Armstrong, 2000), and how to work cooperatively with them (Gardner, 1987), and intrapersonal intelligence is described as to access to one's emotional life as a means to understand oneself and others (Gardner, 1987), and includes awareness of inner moods, intentions, motivations, temperaments, and desires of oneself (Armstrong, 2000). Gardner stresses the importance of this intelligence regarding a person's decisions throughout his/her life. Intrapersonal intelligence helps the individuals understanding of his/her entire intelligence profiles (Patterson, 2002).

Campbell, Campbell and Dickinson (2001) suggest that although these eight intelligences are conceptually distinct, they can be associated and grouped in broad categories. Particularly, intelligences that are centered on the person, namely interpersonal and intrapersonal intelligences are personal or person-related intelligences,

intelligences that are dependent on interacting with objects, namely visual-spatial and bodily-kinesthetic intelligences are object related intelligences, and intelligences that are not so dependent, namely verbal-linguistic and musical intelligences are object-free intelligences. However, this classification needs further investigation to provide empirical basis.

Gardner's multiple intelligences are not abstract concepts; they are recognizable through common life experiences. We all intuitively understand the difference between musical and linguistic or spatial and mathematical intelligences (Silver, Strong & Perini, 1997).

The manifestation of any intelligence emerges within some type of symbol system and that symbol system itself has a purpose within some domain, for example linguistic forms of intelligence may operate in the domain of literature or in the domain of sociology. Also, the products of an individual's efforts are always assessed within some field, that is, by individuals working within some domain who evaluate the value of the work (Eisner, 1994).

Every individual possess the multiple intelligences in varying degrees (Checkley, 1997), and an individual's unique cognitive profiles based on the combination of these separate intelligences (Fasko, 2001), and use all these intelligences throughout their lives, but each person has a particular blend of intelligence strengths at any given time (Willis, 2001), because each intelligence has its own developmental sequence that emerges at different stages of life (Goodnough, 2001).

After proposing seven intelligences, Gardner added an eight, the naturalistic intelligence (Checkley, 1997). The naturalistic intelligence includes the ability to relate the natural world with clarity and sensitivity (Willis, 2001), and it is described as the ability to recognize and classify plants, minerals, and animals, including rocks and grass and all variety of fauna and flora (Checkley, 1997), and understand the relationship among species (Raeburn, 1999). Ecological and environmental perspectives are grounded in this type of intelligence (Willis, 2001). Fisherman, gardeners, biologists, farmers, and cooks possess a high naturalist intelligence (Patterson, 2002).

In Gardner's efforts to update the multiple intelligences theory in the light of new research, he is considering the possibility of adding existentialist intelligence to the eight intelligences. Existential intelligence involves the capacity to know about ultimate issues, mysteries, and meaning of life (Campbell & Campbell, 1999), and represents the human proclivity to ask fundamental questions about life, such as "Who are we?, Where do we come from?, Why do we die?" (Scherer, 1999).

Gardner's list of the multiple intelligences constitutes the preliminary list, since the MI theory is constantly being recognized in terms of new findings from the laboratory and the field (Gardner, 1995), each form of intelligence can be subdivided (Gardner, 1987), or in the light of the future work the number or nature of the intelligences can be revised (Gray & Viens, 1994; Armstrong, 2000).

Gardner (1995) indicated that the MI theory based completely on empirical evidence and can be revised on the support of new empirical findings. In his book Frames of Mind, hundreds of empirical studies were reviewed, and the intelligences were identified on the basis of empirical findings. Also, he claims that the theory represents his efforts to organize an enormous amount of data in a way that is sensible to both psychologists and educators, and it cannot be proved correct or incorrect by a study or a set of studies only from an experimental laboratory (Gardner, 1994).

Regardless of these potential changes, the real point is that the plurality of human intellect (Gardner, 1987), and understanding its role in educational settings requires a pluralistic perspective (Gray & Viens, 1994).

Gardner (1998) points out that, although the intelligences are anatomically separated from each other, they very seldom operate independently; instead they are used concurrently and complement each other. Performance in a domain requires an association of intelligences. And how these associations of intelligences manifest themselves depend on the tasks that the individual confronts in his/her life, and the situations in which he/she finds himself/herself (Sternberg, 1994). For example, a football player uses bodily-kinesthetic intelligence when he is running or kicking, he uses visual-spatial intelligence when he is recognizing the stadium, he uses verbal-linguistic intelligence when he is learning the rules, and discussing and sharing with his team, and he uses intrapersonal intelligence when he is evaluating himself after a match (Talu, 1999).

According to Armstrong (2000), the Multiple Intelligence theory has four main basis: (1) every individual possesses all areas of intelligence in varying degrees. (2) Every individual can develop each areas of intelligence to a sufficient level. (3) Different intelligence areas work together in a complex manner. (4) For an individual, there are many ways to be intelligent in all areas of intelligence.

Eisner (1994) says that although Gardner is not the first person to recognize the fact that individuals differ in their ability to solve problems in different areas of life and make contributions to cultures in different ways, he has been the person who heightening public and providing professional consciousness to this fact, and broadened our understanding of the multi-dimensional nature of intelligence (Shalk, 2002). Gardner seems to agree with laypeople's understanding of the notion of intelligence (Furnham, Reeves & Budhani, 2002). And his theory of the multiple intelligences has been largely influential in psychology, mainly in educational psychology (Raeburn, 1999).

2.3 Implications For Education

After Gardner (1993a) proposed the multiple intelligences theory in his book Frames of Mind, educators who seek a more comprehensive and individualized education system (Gardner, 1998), have been very interested in the theory to improve teaching and learning in a multiplicity of ways (Goodnough, 2001). And they have begun questioning “How are you smart?” instead of “How smart are you?” (Berkemeier, 2002). How intelligence is defined, then makes a philosophical statement about what is valued in education (Hoerr, 1992). According to Gardner (1993b), the important thing in education is to reveal students’ strengths and weaknesses rather than to determine their capabilities.

Since Gardner’s theory makes suggestions about educators’ major concerns such as student dispositions and diversity, curricular demands, and societal realities, which are the obstacles to achieving the goals of education, the most of the educators has accepted the theory (Patterson, 2002).

The theory also has been embraced by liberals and humanists who seems it as a guide for helping students who are not successful in standardized tests but who may shine in music, visual arts or any other areas (Raeburn, 1999).

Traditional education system values students’ success only in the mathematical and linguistic intelligence domains (Brualdi, 1998; Kennedy, 1994; Shalk, 2002; Smagorinsky, 1996) and in standardized test scores (Hoerr, 1992), and reinforce the development of these two intelligences. The kids who do not learn in a style that relies on language and logic are labeled deficient (Kennedy, 1994), and disadvantaged in school (Goodnough, 2001). However, with his theory, Gardner challenged educators to recognize the fact that high scores from mathematics and language tests were not the only evidence of human intelligence (Dunn, Denig & Lovelace, 2001). Although these two domains are clearly important in school, other domains of intelligence also play a significant role in human cognitive activity (Gardner & Hatch, 1989).

Supporters of the MI theory believe that emphasis on verbal and mathematical intelligences is unfair (Brualdi, 1998). The Multiple Intelligence theory claims that if a student cannot successful in school by using verbal or mathematical intelligences, this student can be successful by using other intelligence dimensions such as visual, musical, or kinesthetic (Oddleifson, 1994), that is, when his strengths are brought into play during the learning process (Emig, 1997). Therefore, the MI theory has important implications for providing a more equitable approach to education (Eisner, 1994).

The MI theory gives importance to how students learn according to their varying interests, skills and dominant intelligences. The theory acknowledges that all students may not have verbal or mathematical talents, but they may have an expertise in other areas (Brualdi, 1998). In general, it reflects a desire to support learning of students whose intelligence profiles includes dominant intelligences other than linguistic and logical-mathematical intelligences (Shalk, 2002). Approaching students' learning in this manner allows more students to actively engaged in classroom learning (Teele, 1996; Brualdi, 1998), and provides teachers being able to meet the needs of more students (Cantu, 2000).

Bellenca (1998) argues that the traditional method is not wrong and there are many high achieving students who prosper in the traditional teaching system. However, it is insufficient for providing achievement of all students. If all students are to learn the curriculum, then all need the chance to be taught in ways that improve their learning, and schools have a responsibility to the child and the society to match the curriculum to the child's needs and talents (Scarr, 1981), so educators need concise and efficient ways to learn more about their students' learning styles and the multiple intelligences (Synder, 2000), and need to step back and look at the classrooms to ensure that all students can succeed, regardless of their intelligence profiles (Hoerr, 2002).

Thus, teachers need to expand their instructional and assessment repertoires to include strategies including many intelligences (Goodnough, 2001). Although IQ scores is often successful in predicting achievement in school, it focuses on only on the two dimensions of human intelligence, namely logical and linguistic and it does not take into account whole potential or competence of individuals (Gardner, 1993a).

Gardner's design of ideal school of future is based upon an assumption that not all people have the same interests and abilities; not all of us learn in the same way. And he proposes a new set of roles for educators such as assessment specialist, student-curriculum broker, and school-community broker. The job of the assessment specialist is to try to understand the abilities and interests of students in a school as sensitively as possible. The important point is that these people should use intelligence fair instruments to be able to look specifically and directly at spatial abilities, at personal abilities, and the all other abilities of different intelligence dimensions, and not through the use of usual instruments of the linguistic and logical-mathematical intelligences. Student-curriculum broker assists students for matching their intelligence profiles and talents, proclivities, and specific style of learning. And the school-community broker tries to provide placements to students in the community, who are not successful in standardized tests (Gardner, 1987).

According to Teele (1996), a multiple intelligences school is a student-centered environment, and both internal and external players have roles in the educational process, where major internal players are students, teachers, principles, and staff members, and major external players are parents and community.

People all have different talents, skills, perspectives, and intelligences, and it is required to encourage children's abilities in two ways; first, we need to admit diversity; second, we need to focus on their commonalities (Pool, 1997).

The MI theory described as a powerful "catalyst" in education, and it is stated that the theory can be used to meet three visions. First, to match the students' way of learning and teaching (Kagan & Kagan, 1998; Sternberg, 1994), second, to help students to extent their abilities and to improve all of their intelligences as much as possible because intellectual profiles of students' have the potential to change over time (Gray &

Viens, 1994; Kagan & Kagan, 1998) using strategic pedagogical or facilitating techniques, and third, to honor and celebrate diversity (Gardner, 1998).

Since it provides a framework to differentiate individual intellectual profiles of students, the MI theory has a practical value to educators. The theory makes it easy to identify students' learning needs, and to program appropriate educational responses to them (Allix, 2000). The concept of personalizing education, which suggests understanding each child in depth regardless of the sex, ethnicity, cultural background and socioeconomic status (Teele, 1996), and determining his or her educational needs, is the basis of the MI theory (Schmidt, 1994).

The Multiple Intelligence theory accepts that all of the intelligences are required to productively function in a society. And in contrast to the traditional education systems, it suggests teachers to give equal importance to each intelligence. For this purpose, teachers should structure the instruction of a topic in a way that it engages most or all of the intelligences (Brualdi, 1998). By this way the topic is represented in various ways, and allows different individuals for learning and success (Beckman, 2002; Hoerr, 2002), and joining in the community (Gibson & Govendo, 1999). Also, when learning occurs in a variety of ways, children can translate these experiences into greater learning outcomes (Beckman, 2002). This individualized approach to education helps us to honor students' differences and celebrate all kinds of excellence (Ellison, 1992).

The MI theory provides teachers to examine their beliefs about students' abilities, and educational practices critically in order to make science teaching and learning more meaningful and individualized for all students. Since students need to learn in an environment that allows them to engage all of their intelligences and to explore their own intelligences, the theory is useful in assisting teachers to make decisions about structuring teaching and learning experiences more meaningful, personalized, and relevant for students (Goodnough, 2001). Encouraging students to be aware of the choices they make and the activities they enjoy is another point important in MI teaching (Hoerr, 2002). Also, as students learn in an environment acknowledging their strengths and interests, they are more probable to feel engaged and satisfied (Gray & Viens, 1994).

Many educators support individualized learning approaches that focus on students' exclusive strengths, weaknesses, and learning styles. Since, both the multicultural and individualized approaches underline that educators should supply meaningful learning experiences for all students, it have to be understood that there are many differences exist among students (Gray & Viens, 1994), and each child must be considered individually (Omdal, 2001).

When using the MI theory in classrooms, the essential point is being conscious about the different learning modes of the children, and the ways in which they exhibit their intelligence (Beckman, 2002). It must be acknowledged that all students cannot have a single identical intelligence profile, and a uniform approach to education can serve only a minority of students (Gardner, 1995). Being aware of the students' multiple intelligences can facilitate teachers, to support students more effectively, who have difficulty with their schoolwork or with their behavior (Gibson & Govendo, 1999). Teachers can help children by making them discover their own patterns of strengths and weaknesses (Sternberg, 1994), and providing opportunities to use their stronger intelligences to process information and to assist in understanding of a subject, which normally employs their weaker intelligences (Teele, 1996). And children should be tried to be their best, and thus to compete with themselves instead of competing with others (Sternberg, 1994).

The MI theory has implications for curricular design besides instruction. By using MI based assessments and observations, educators can determine questions, topics, activities, and materials that are particularly fitting to the students' intellectual profiles and interests (Gray & Viens, 1994). When planning curriculum, educators also should take into consideration students' learning style, disability, language, culture (Goodnough, 2000), and needs (Reiff, 1997). Sternberg (1994) adds that if teachers help children to learn in their natural interests and in their own way, even the most unmotivated children may become motivated.

In classrooms that incorporating the MI theory, all children are allowed to learn through their strengths and to share their expertise, and it is obviously observed in those classrooms that, among the students the appreciation and respect for each other's strengths were developed (Beckman, 2002). Ellison (1992) also observed that as students internalize many forms of intelligence, they expand their respect for the diversity of abilities within their classroom.

Gardner (as cited in Schmidt, 1994) said that the purpose of education should be to tell students how to go out and find out about things, instead of giving them a thousand of facts. Dunn et al. (2001) also indicated that rather than requiring to master extraneous academic information, children's potential or talent should be developed, and they should be provided with an environment to learn thinking instead of memorizing, through their natural talents and interests. School should help students to discover their talents or strengths (Campbell, 1997), develop their intelligences, and to assist individuals to reach vocational and avocational goals that are appropriate to their intelligence spectrum (Gardner, 1987).

Bellenca (1998) also indicated that, teaching is a strategic act of engagement, requiring active engagement of students' minds prerequisite to learning. This means that teacher should plan and design lessons and units to ensure that all students are engaged and get the content.

There are multiple styles of learning, multiple intelligences, that students bring them to the task of learning. To learn most readily, students naturally tend to draw upon one or more of their stronger intelligences. All of the intelligences are equally important, and to ignore them is to risk the students end up working against their own intelligences rather than with it. Therefore, the main question for teachers is this: How do we match student's learning styles to what is being taught? (Kennedy, 1994).

When planning lessons, teachers should target multiple dimensions of intelligence, but it is not necessary to include all eight intelligences in every lesson, rather teaching and learning should be structured in naturally integrated ways that call upon various intelligences (Fogarty, 1998).

According to Gardner's eight intelligences, students' preferences for learning vary in classroom. Students having bodily-kinesthetic intelligence strongly, enjoy and learn best from activities that use body, and involve movement, such as dance, crafts, mime, sports, acting and using manipulatives (Gibson & Govendo, 1999), and hands-on learning experiences (Brougher, 1997; Teele, 1996). They use their bodies in highly differentiated ways to develop and express concepts. Instructional approaches using manipulatives allows to express both bodily-kinesthetic and visual intelligences (Willis, 2001). Students having visual-spatial intelligence strongly understand and learn simply through spatial media. They enjoy learning and communicating visually, and like creating puzzles, maps, three-dimensional models, graphic representations (Gibson & Govendo, 1999), art activities (Teele, 1996). Students having strong spatial intelligences perceive the visual world accurately, and create images in their minds in the lack of physical stimuli (Willis, 2001). Students having interpersonal intelligence strongly, learn well through interacting and communicating with others, and prefer to learn in teams, and cooperative activities (Teele, 1996; Gibson & Govendo, 1999). Students having intrapersonal intelligence strongly, enjoy individual, introspective, and metacognitive tasks. They like to study at their own pace and setting personal goals (Gibson & Govendo, 1999), and they do well in independent study projects (Teele, 1996). All students can get advantage from their introspection and developing personal strategies

(Willis, 2001). Students having logical-mathematical intelligence strongly, learn easily through logical and mathematical activities, such as experiments, problem solving, logical games, puzzles, using numbers and patterns (Gibson & Govendo, 1999). Students having musical intelligence strongly understand through the use of rhythm, melody, tapping, rapping, singing, and listening music (Gibson & Govendo, 1999). Musical notation system is based on fractions and numerical patterns (Willis, 2001), and Gardner (1993b) indicated that many mathematicians and scientists are interested in music, and many composers were sensitive to mathematical patterns. Students having naturalistic intelligence strongly understand the patterns in nature, and they learn well through activities involving interacting with natural and environmental materials (Gibson & Govendo, 1999). Students having verbal-linguistic intelligence strongly, have a wide range of language skills (Willis, 2001), and learn well through language and words. They like reading, writing, speaking, and using language in creative activities (Gibson & Govendo, 1999).

Campbell (1990) conducted an action research project to explore students' reactions to a multiple intelligence-based model. The information related to the students' attitudes, behavior, and abilities were obtained by using a daily journal with specific entries, from a classroom climate survey, which was administered nine times during a year, and from observations. At the end, following hypothesis were validated. The students displayed increased independence, responsibility, and self-direction through the year. Students previously having behavioral problems, made significant development in their behavior, cooperative skills developed in all students, leadership skills emerged in several students, more positive attitudes about school were observed, and attendance rate of students was increased. Campbell and Campbell (1999) also add that since everyone is talented in some areas and weak in others, in multiple intelligence based models students experience greater self-acceptance.

Goodnough (2001) made a qualitative case study of an action research group to explore the MI theory in the context of the science education. The study was focused on how one teacher interpreted and adopted the MI theory in his science teaching and learning. The researcher made semi-structured and informal conversational interviews with the participant teachers, made visits to the classrooms, and took fieldnotes during the study. At the end of the study, it was reported that students liked working together when studying on assignments, also the class displayed a high level of participation during the science classes, and enjoyed learning science more in comparison to the past.

Patterson (2002) and Willis (2001) argue that an MI based approach provides deeper and richer understanding of concepts. By understanding topics deeply, students can make use of the knowledge in new situations, especially situations that encountered in outside classroom, in daily life (Patterson, 2002).

Goodnough (2001) states that science teachers can help students for learning science, learning about science, and learning to do science through the use of the MI theory, and by this way they improve students' conceptual understanding in science, foster positive attitudes toward science, increase their enjoyment of science, participation in science lessons, create more reliable learning experiences in science, and make all students scientifically literate.

Gardner's theory of the Multiple Intelligences give chance to all students to be valued for their particular qualities, and to be successful in their own way, and teachers role is important to guide young people to use their intelligences effectively (Lambert, 1997).

2.4 Applications of the Multiple Intelligences Theory

Since the multiple intelligence theory is not a strict educational methodology, it can be applied in various ways depending on the teacher, particular students, and the contexts (Campbell, Campbell & Dickinson, 1999; Willis, 2001). Each school's implementation of MI will be culture-specific, context-specific, and school-specific (Hoerr, 1996). The theory does not dictate how and what to teach, rather it gives educators a mental model to construct curriculum and improve themselves (Campbell, 1997; Campbell & Campbell, 1999).

Teachers' adaptations of the theory into the classrooms may vary from direct instruction using different methods to setting multiple intelligences centers or stations that students visit throughout the day (Armstrong, 2000; Willis, 2001). And in fact, the success of the theory lies in its flexibility for allowing individual interpretation, design, and implementation to create an approach to teaching and learning (Cantu, 2000).

Before implementing the theory into the classroom, students should be given with an overview of the eight intelligences. They should also have the opportunity of understanding their own intelligence profiles. Then the teacher should stress that everyone possesses all eight intelligences, some of them are strong and some of them are weak in every person, and they need to be exercised rather ignored (Patterson, 2002).

Just as there are certain characteristics related to each of the intelligences identified by Gardner, so are there specific teaching strategies that can be used for students' learning (Cantu, 2000). To accommodate all of the intelligences, particular classroom activities can be redesigned (Hoerr, 2002). For example for logical/mathematical intelligence teaching activities such as problem solving, investigation, experimentation, and questioning can be used, for verbal/linguistic intelligence discussion, narration, advanced organizers, and writing activities can be used, for visual/spatial intelligence imaginary, map analysis, observation activities, construction of dioramas or posters can be used, for musical/rhythmic intelligence simulations, song analysis, creative song writing, performances can be used, for bodily/kinesthetic intelligence simulations, modeling, role playing, analyzing manipulatives can be used

(Cantu, 2000). Willis (2001) gives examples that to teach multiplication in mathematics education by suggesting teachers to group students to dramatize facts by asking them to act out various problems by make them use their bodily-kinesthetic intelligence. For naturalist intelligence recognizing and classifying cultural and natural artifacts, data gathering in natural settings can be used, for interpersonal intelligence cooperative learning, peer teaching, brainstorming, shared inquiry can be used (Cantu, 2000). Willis (2001) adds that even when students study individually on problems or on given assignments, they can be asked to validate their methods and results with one another to operationalize their interpersonal intelligence. Finally, to use intrapersonal intelligence decision-making, journal writing, self-discovery, independent learning projects can be used (Cantu, 2000).

When designing the lessons and units according to the MI approach, Patterson (2002) states that teachers need to ensure that the lesson or unit covers all eight intelligences. On the other hand, Campbell (1997) and Campbell, Campbell and Dickinson (1999) suggested that when teachers start to plan lesson, they should identify the most appropriate intelligences for communicating the content, and adds that instructional methods should be appropriate to the content being taught. In another point of view Hatch (1997) suggests to organize the curriculum around the child instead of organizing around the intelligences.

Collins (1998) stated that the key point for implementing the MI theory into the classrooms is first deciding on the facts and procedures that wanted to be understood by the students, and then designing the lesson to present this information according to the students' strengths and weaknesses. Dunn et al. (2001) also suggests changing instruction to capitalize on students' talents.

Armstrong (2000) suggests a seven-step procedure to create lesson plans or curriculum units based on the MI theory. The first step is focusing on a specific objective or topic, the second is asking the key MI questions. He created a checklist to test existence of intelligences when developing plans. For linguistic intelligence, teachers may ask themselves "How can I use spoken or written language?" for logical-mathematical intelligence, they may ask "How can I include numbers, logic, classification, and critical thinking?" for visual-spatial intelligence "How can I use videos, visualization, visual organizers, color, and art?" for musical intelligence "How can I include musical sounds, environmental sounds, and rhythm?" for bodily-kinesthetic intelligence "How can I include movement, hands-on experience, and eye-hand coordination?", for interpersonal intelligence "How can I involve students in cooperative groups, peer or cross-age tutoring, and large group role playing?", for intrapersonal intelligence "How can I elicit memories, personal feelings, or present options?". The naturalistic intelligence is not included in this checklist, to test the involvement of this intelligence; teachers may ask themselves, "How can I include classifying, pattern recognition, or environmental appreciation?" The third step is considering the possibilities; most appropriate methods and materials to the selected topic. The fourth step is brainstorming. The teacher should list everything that comes to her mind. The fifth step is selecting the appropriate activities. The next step is setting up a sequential plan, and the final step is implementing the plan.

Teachers can use several models for applying the MI theory in the classroom. The first model is problem-based learning that can be applied to the whole curriculum or to a unit for a brief period for time. The second model may be an MI model that involves case studies. The project learning can be another effective learning. The thematic learning model is taking and connecting subject matter from different disciplines and different intelligences to learn and comprehend the theme. In the fifth model, with performance learning model, students show their understandings through action (Fogarty as cited in Patterson, 2002).

Gardner (as cited in Patterson, 2002) discusses a three-step model, which involves providing entry points, telling analogies, and approaching the core, to present a topic to the students. The purpose of providing entry points is to connect students to the topic being taught. Analogies are drawn from a topic or a concept that the students already know to transfer important aspects of the less familiar topic. For example if a teacher want to present the topic evolution, he or she can analogized the topic evolution to character development in a novel, or changes in society over time. In fact, these multiple representations are necessary to provide in depth understanding of the concept. The key ideas of a topic can be approached in various different symbol systems, such as language, poetry, static graphs, dynamic flowcharts, and so on (Scherer, 1999).

In multiple intelligence classrooms, it is possible to approach topics from a variety of ways after deciding on the time that will be dedicated to specific items (Gardner, 1995). It is not necessary to approach each item from eight ways (Gardner, 1993b, 1994, 1995), but in a number of ways that are pedagogically appropriate to the topic. Almost every topic can be approached in a multiplicity of ways from telling a story to a formal argument or to an artistic exploration or to hands-on experiment (Gardner, 1995). The important point regarding MI implementation is that it should be a whole approach including planning, instruction, and assessment (Patterson, 2002).

Teachers implement the MI theory into their classrooms in a way that they think most suitable for their students, school, and society (Campbell, 1997; Campbell, Campbell & Dickinson, 1999). Some of them interpret the theory as an approach to instruct lesson content from several entry points, some of them suggests to improve students' skills early in life, on the other hand others devote equal time to the arts each day. Many teachers apply the theory as integrating curriculum, organizing multiple intelligence stations in classroom, establishing apprenticeship programs (Campbell, 1997).

Guided by the students' talents, strengths, and interests, there are five curricular formats being used. These are multiple intelligence based lesson designs, interdisciplinary curriculums, student projects, assessments, and apprenticeship (Campbell, 1997). Gardner (as cited in Levin, 1994) gives a significant importance to student projects for recognizing and constructing the multiple intelligences. By completing projects of their choice, students acquired independent learning skills, and they naturally engage various intelligences. Apprenticeship programs are also suggested for students as a part of their regular school programs, or as an extracurricular activity (Campbell, 1997).

One MI approach implemented in a class may not meet the needs of other class. It is the teacher who can decide the best model for his or her class, for a particular group of students. Even the teacher determines the best model for his or her class; this particular model may not be suitable for every subject matter. For example, when starting a unit that focuses on a complex and unfamiliar material, the students may be allowed to select any of their intelligences to demonstrate their learning. On the other hand, if a unit is less complex and familiar to the students, the teacher may limit the choice of intelligences to the students' weaker intelligences (Patterson, 2002). Also, environmental and instructional factors should be taken into account (Chapman & Freeman, 1996).

When the MI theory implemented in a classroom, the content is approached from different perspectives, and because all students do not learn in the same way, more of them understand and learn the subject (Gardner, 1995), more of them have a chance to participate in class (Gibson & Govendo, 1999), and this pluralistic approach gives them the possibility to show their understandings in different ways (Gardner, 1995).

According to Bellenca, Chapman and Swartz (1997), there are many strategies for structuring authentic, active learning opportunities to develop each of the multiple intelligences, such as exhibits, performances, journals, demonstrations, products, problem-solving processes, graphic organizers, and projects.

Greenhawk (1997) states that research confirmed that there were many good reasons for applying the MI theory in classrooms. As a summary, these are; to help students understand their abilities and those of others, to show students how to use their strengths both to learn and to work on their weakness, to build students' confidence so they would be willing to take educational risks, and to help students learn more by engaging all the senses, and to more accurately assess students' mastery of basic skills and higher level content.

2.5 Gender and the Multiple Intelligences Theory

The researchers stated that significant sex differences in intelligence have not been supported by consistent evidence, or most textbooks related to the subject argue that there is a little difference (Brody; Halpern as cited in Furnham, Reeves & Budhani, 2002). However, Halpern (1997) claimed that there is a little, constant, and significant difference between males and females. Males typically score higher than females on tasks involving visual-spatial working memory, motor skills, spatio-temporal reasoning, and especially abstract mathematical and scientific tasks.

Research provides evidence for sex differences in intelligence in terms of particular skills. Males are good at mathematical reasoning tasks, and naturally spatial tasks such as maze performance, mental rotation, and picture assembly. On the other hand, females are generally good at tasks requiring the use of language such as, verbal fluency, speed of articulation and grammar, arithmetic calculation, and manual precision (Coltheart, Hull & Slater; Halpern; Springer & Deutsch as cited in Furnham, Reeves & Budhani, 2002) Landshell, Springer and Deutsch, and Witelson (as cited in Furnham, Reeves & Budhani, 2002) attributed these differences hemisphere specialization in brain.

According to the research, generally males tend to overestimate their own intelligence, in contrast females tend to underestimate theirs (Furnham & Gasson, 1998;

Furnham & Rawles, 1999; Hogan, 1978; Beloff; Campion; Reilly & Mulhern as cited in Furnham, Reeves & Budhani, 2002).

Chan (2001) conducted a study to explore whether there were gender differences according to the students' multiple intelligences. The students' responses on a self-report checklist were examined in the study. The checklist covered items related to the seven of the multiple intelligences, naturalistic intelligence was not included. The sample of the study includes 73 boys and 118 girls, a total of 191 grade 7 to 12 students, nominated by their schools to join the gifted program at the university. To explore gender and age group differences on the seven intelligences multivariate analysis of variance (MANOVA) was performed, and it was found that overall main effect of gender was significant, Wilk's λ = 0.82, F(7.181) = 5.81, p<.001. On the other hand, the overall main effect of age group and the interaction effect of gender by age group were non-significant. As a follow up test to the MANOVA, univariate ANOVA on each of intelligence scores was performed. Because of multiple tests, Bonferroni procedure was used and each ANOVA was evaluated at the .05/7 or .007 level. The results obtained indicated that boys rated themselves higher than girls in logical-mathematical intelligence, whereas girls rated themselves higher than boys in interpersonal intelligence. There was no significant gender difference observed in the remaining five dimensions of intelligence.

Furnham, Clarke and Bailey (as cited in Rammstedt & Rammsayer, 2000) and Furnham, Fong and Martin (1999) conducted two studies to determine the sex differences in self-estimates of intelligence. In the first study, they only found a significant sex difference for the mathematical-logical intelligence. In the second study significantly higher self-estimated mathematical, spatial, and bodily-kinesthetic intelligences were shown for males as compared to females.

Rammstedt and Rammsayer (2000) investigated sex differences in various dimensions of self-estimated intelligence. For this purpose, 54 male and 51 female psychology students, ranging in age from 20 to 41 years, estimated their own multiple intelligence dimensions namely musical, bodily-kinesthetic, interpersonal and intrapersonal intelligences. T-tests revealed that males' self-estimates of mathematical intelligence ($p<.01$) and spatial intelligence ($p<.01$) were significantly higher as compared to female students. On the other hand, female students' self-estimates of musical ($p<.05$) and interpersonal ($p<.05$) intelligences were higher than male students' estimates.

Gürçay and Eryılmaz (2002) made a survey with 395 ninth grade students in order to determine the distribution of multiple intelligence dimensions (except naturalistic intelligence) of these students, and it is found that all of the seven intelligence dimensions distributed nearly in equal proportions in this sample of students.

Synder (2000) constructed an instrument to determine the multiple intelligences, namely linguistic, logical, spatial, bodily-kinesthetic, musical, interpersonal, and intrapersonal intelligences and learning styles of high school students. The results of the study indicated significant gender differences in the categories of the instrument. The female students were stronger on intrapersonal, linguistic, musical, interpersonal intelligences, whereas male students were stronger on bodily-kinesthetic, logical and spatial intelligences. And she suggested repeating this study with college seniors and graduate students in order to see whether these differences between males and females are stable or not according to the age.

2.6 Achievement and the Multiple Intelligences Theory

Dunn and DeBello (as cited in Dunn, Denig & Lovelace, 2001) indicated that when a new and difficult content was taught to academically unsuccessful students, they achieved statistically higher test scores when instructed through approaches that are appropriate to their learning style strengths.

Patterson (2002) stated that enthusiasm have been continued for Gardner's multiple intelligence theory, because the teachers who implemented the MI theory in their classrooms have experienced positive results. In Campbell and Campbell's (1999) book, it is reported that many teachers and students from six different schools which have varying economic, social, and cultural background, experienced positive results by implementing the MI theory into their classrooms. In these schools, students self-esteem and enthusiasm significantly improved, daily attendance rates and students' responsibility for their learning significantly increased, a high number of graduates continue on to attend colleges, and students' achievement in standardized, state-mandated, and informal tests significantly improved.

One year after implementing the MI theory in Greenhawk's school, students' scores on the School Performance Assessment test rose by 20 percent. The students remembered the information they get more accurately. They did well at completing graphs and worked easily with manipulatives, worked well in groups engaging hands on activities, demonstrated a flexible approach to problem solving (Greenhawk, 1997).

SUMIT (Schools Using Multiple Intelligence Theory) project, which is a study investigating the effect of the Multiple Intelligence theory in schools, also reported positive results. The project includes 41 schools throughout the United States, and 78% of these schools reported significant increase in standardized test scores, 78% reported improvement in performances of students who have learning difficulties, and 81% reported improvement in students' discipline (Patterson, 2002).

In two middle schools implementing MI programs; Skyview Junior High School in Washington and Key Learning Community in Indiana, there has been observed a growth in student achievement. On a national standardized test, 8th graders of the first school score 20% points higher than their state and national peers in reading, language, and mathematics, and the second school's students got scores above their grade level. In another MI school, Mountlake Terrace High School in Washington students outperform their state peers on a state mandated test in English, mathematics, and social studies, and on SAT (Scholastic Aptitude Test) they again outperform their state and national peers in mathematics (Campbell & Campbell, 1999).

Synder (2000) conducted a study in order to investigate the relationship between students' multiple intelligences/learning styles and academic achievement. To determine students' multiple intelligences an instrument was constructed including items related to the Gardner's seven intelligences. And the academic achievement data was obtained from standardized achievement test scores and GPA (Grade Point Averages). By observing the correlations between GPA and the categories of the instrument, there is a positive correlation between the male students' GPA and spatial and logical intelligence dimensions. For the female students' there is a positive correlation between students' GPA and bodily-kinesthetic intelligence. By observing the students' standardized achievement test total score and the categories of the instrument, there is positive correlation between the students' total score and the categories of logical intelligence and linguistic intelligence. For the standardized achievement test math score, there is a positive correlation between math score and logical intelligence and negative correlation between the math score and musical intelligence. And for the standardized test reading score, there is positive correlation between the students' reading score and linguistic intelligence. It would seem obvious that the students' performing higher on the reading test would be strong on linguistic intelligence and students higher on the math tests would be strong on logical intelligence.

Özdemir, Korkmaz and Kaptan (2002) made an experimental study with a class of fourth graders (n=32). The design of the study was a single group pretest-posttest design, and they obtained data with a fourth grade science test including 20 questions. The results of the paired samples t-test showed that multiple intelligence based instruction caused a significant difference ($p<.05$) in students' knowledge, comprehension, application, and scientific processing skills.

Goodnough (2001) made a qualitative case study in order to explore the MI theory in the context of the science education. He obtained results as a result of the experiences of four high school science teachers. One of the participant teachers implemented the MI theory into his ninth grade science classroom, during the study he worked with 13 students. The study was descriptive, focusing on this teacher's interpretation and adaptation the MI theory in his science teaching and learning. At the end the study he concluded that there was not a significant increase in students achievement levels, the class average on a teacher made unit test was 64% before implementing the theory, on the other hand the average became 68% after implementing the theory into the class. Seven students increased their scores after implementing the theory, four got lower scores, and two maintained the same scores. However, when he compared students' performances on the other forms of assessment, namely performance based assessments, for both units, he obtained 71% class average for the first unit, and 84% class average for the second unit. The teacher concluded that, although students' performance did not increase significantly on traditional teacher made tests, the understanding in science was quite high for the majority of the students. When students were asked whether or not applying the multiple intelligence theory into their lessons had made them better learners, 85% of the students gave positive response. And again 85% of the students stated that they learned easily using a variety of multiple intelligences.

To explore the relationship between students' profiles of seven intelligences and academic achievement, Chan (2001) made a research with 191 (73 boys and 118 girls), grade 7 to 12 Chinese secondary school students who nominated by their schools to join the gifted program at the university. To determine students' intelligence profiles a self-report checklist was used. For the academic achievement, the data from the HKAT (Hong

Kong Attainment Test) scores were accepted as indicator. For the students' achievement in Chinese language HKAT- C, for English language HKAT-E, and for the mathematics HKAT-M scores were used. To examine the relationship among the seven intelligences and different aspects of academic achievement, a series of multiple linear regression analysis were performed using HKAT-C, HKAT-E, and HKAT-M scores separately as the criterion and the seven intelligences scores as predictors. Among the different aspects of academic achievement only academic achievement in Chinese language as assessed by the HKAT-C was most predictable from the verbal-linguistic intelligence at the $p<.05$ significance level. Since there were gender differences in the seven intelligences, the regression analysis was repeated separately for the two genders, but similar results were obtained as for the total sample.

In another study, Shalk (2002) investigated the relationship between the multiple intelligence profiles which were determined by using MIDAS (Multiple Intelligences Developmental Assessment Survey) and standardized reading, mathematics, and writing achievement test results of 132 high school sophomores. The data was analyzed using backward removal stepwise multiple regression analysis using the MI variables from MIDAS as the predictor variables and each state test score (reading, mathematics, writing) as criterion measures. The results indicated that for reading scale test score, linguistic and interpersonal intelligences, for mathematics scale score, logical-mathematical, linguistic and interpersonal, and for the writing raw score, linguistic and interpersonal intelligences are appeared as the key profile variables. However, since the percentage of the explained variable is low, the results suggested that the relationship between the multiple intelligences and achievement in standardized tests is present but weak within the parameters of this study. Therefore, the convenience of the multiple intelligence profiles to predict the achievement in standardized tests is limited.

2.7 Teacher Development and the Multiple Intelligences Theory

Bellenca (1998) states that, beliefs about learning influence teaching practices. Recent research results provides new insights about how human mind works, and shows us that teaching for intelligence is a everlasting challenge, and also an endless chance to help students become active, engaged, and successful learners.

Campbell and Campbell (1999) claim that the MI theory has a positive effect on teachers' beliefs. Teachers' expectations from students significantly influence the students' performance. In classrooms using the MI theory as a teaching and learning approach, teachers believe that all students have giftedness, and design the instruction accordingly to enrich students' giftedness, and they recognized extensive differences among their students using MI as a guide.

Guskin, Peng and Simon (1992) suggested that if teachers are given information about students' multiple intelligences and accomplishments, they will not be insensitive to the students' multiple intelligences and different talents. Therefore, it would seem significant to provide clear information about the particular abilities of their students in order to ensure teachers' recognition of diverse abilities of the students.

Vialle (1997) claims that, although good teachers always recognize the diverse nature of abilities in their students, the MI theory provides an environment to help teachers to look for the distinct strengths of students. And teachers acknowledge that the dual observation of themselves and their students in the MI framework makes them better teachers. The theory also improved teachers in terms of assessment and evaluation perspective. By using the MI theory, teachers change their assessment and evaluation process, from a narrowly based end of unit process to an extended presentation of understanding. Also, it is added that by the MI theory teachers' teaching repertoire extends and includes broader range of methods, materials, and techniques to reach more diverse range of learners (Armstrong, 2000; Bellenca, Chapman & Swartz, 1997).

Campbell (1990) conducted an action research project to explore students' and teachers' reactions to the multiple intelligences based instruction. The information was obtained by keeping a daily journal and applying a classroom survey several times during the study. He reported that during the year as the study progressed, the participant teacher became less directive, and more facilitative and diversified. And he behaves like a resource person and a guide instead of a taskmaster.

In another study, which is a qualitative case study of an action research group in the context of science education, Goodnough (2001) investigated a teacher's interpretation and adaptation of the MI theory in the context of the science teaching and learning. He obtained information by observing the lessons of four science teachers, by making interviews with these teachers, and by taking fieldnotes in the classrooms. At the end of the study, it was observed that the participant teacher's approach to science teaching and learning changed notably, he improved his knowledge in pedagogical content, and developed instructional approaches for representing the content understandable to others and for facilitating the students' learning. He became more sensitive to the students' diverse learning needs, and he concluded that any positive outcomes experienced by his students during the study, could be attributed to the variety of learning opportunities.

2.8 Assessment and the Multiple Intelligences Theory

Any educational reform must be accompanied with a reform in the assessment procedure, and it should be focused on the students' growth and the progress (Jordan, 1996; Teele, 1996). According to the Multiple Intelligence theory, since all students do not learn in the same way, they cannot be assessed uniformly. Thus, teachers have to assess their students' diverse learning ways, varying strengths and weaknesses first

(Brualdi, 1998) by this way they can appropriately assess each child's progress (Lazear as cited in Brualdi, 1998).

Krechevsky and Seidel (as cited in Fasko, 2001) suggested four principles to make assessments according to the MI Theory: to be intelligence-fair, assessments have to be contextualized, assessments should provide multiple ways to demonstrate students' understanding, it should monitor the growth in students, it should be accompanied with reflections and self-assessment to allow students understanding their own progress.

According to the MI theory, assessing giftedness in a student starts with identifying the nature and quality of the intelligences that the student possesses. However, by using psychometric and standardized tests, only a limited part of the students' qualities can be assessed (Chan, 2001). In contrast, Gardner (1993b) firmly supports to use alternative assessment techniques, such as performance-based assessment in order to determine students' strengths in multiple intelligence view. Student self-reports and checklists may also provide valuable information about the students' multiple intelligence profiles (Armstrong, 2000).

Bellenca, Chapman and Swartz (1997) stated that to assess authentic learning tasks observation checklists, observation note-cards, Likert scales, open-ended and guided responses, and teacher made tests, quizzes can be used.

Gardner (1987) also indicated that early identification of students' intelligence profiles is important for attending the students' weaknesses early in alternative ways to cover an important skill area, and to take advantage from assessing the students' intelligence profiles, this identification should be reliable (Gardner & Hatch, 1989).

There are many ways to determine intelligence profiles of students. The first way, may be the most important way is teachers' observations in classrooms. The second is asking students some questions in order to reveal their proclivities. And the third one is using multiple intelligence inventories to assess students' intelligences (Saban as cited in

Oral, 2001). However, if possible it is suggested to assess intelligences in intelligence fair ways, that is, examining the intelligences directly rather than through the lens of linguistic and logical intelligences. For example, to examine musical intelligence, the individual should be exposed to a new melody, to observe how he or she recognize it, transform it, and sing it. Another important point in assessing intelligences is providing comfortable setting with materials that are appropriate and familiar to the individual (Gardner & Hatch, 1989; Gardner, 1995). Sternberg (1994) also indicated that to maximize students' potential, educators should focus on the real performances in natural settings.

For the assessments of students' multiple intelligences, Armstrong (2000) suggests using videotapes, photographs, samples of schoolwork, grades of different courses, other teachers' opinions, parents' opinions, students' own opinions, special activities, and checklists to collect data about students.

Traditional paper and pencil tests are limited to assess individuals' potential (Walters as cited in Shalk, 2002), and these tests favor students who have strong linguistic and logical-mathematical intelligences (Gardner, 1993a). Advocates of the MI theory claims that in order to assess students better, they should be allowed to explain the task in their own way using variety of intelligences, as in the case of student portfolios, independent projects, students journals, video and/or musical productions, exhibitions, classroom demonstrations, peer reviews, debates, panel discussions, simulations, sculptures (Teele, 1996).

In the Multiple Intelligence context students can be assessed in different ways: Teacher may assign a performance task appropriate to the students' strengths, or students themselves may choose the way they would like to be assessed (Armstrong, 2000).

Lazear (as cited in Patterson, 2002) pointed out the problems related to the traditional assessment. He states that assessment should be a way to qualify, improve, and celebrate students' learning and to provide the opportunity for students to make connections between classroom and other aspects of discipline, other subjects and life, instead of indicating students' failures. And he adds that he is not opposed to the traditional forms of assessments, but he is opposed to the use of traditional tests to identifying the whole student learning.

In the MI theory, it is important to determine clear criteria of assessment, and rubrics can be helpful for this purpose, and also the students should be involved in this procedure. Assessment should be a collaborative process between the students and the teacher. It should be a chance for students' further learning (Patterson, 2002).

Teachers and researchers working with Harvard Project Zero's Project Spectrum, which is a curriculum and assessment project for young children, have assessed early childhood and elementary students' multiple intelligences since 1984. The project was initially designed to determine whether young children exhibit distinctive profiles of intelligence (Gardner, 1998). Throughout the years the researchers in the project developed fifteen activities and by using these activities, they found that children exhibit variety of intellectual profiles across the multiple intelligences. In contrast to the standardized assessments, which stress on the linguistic and logical-mathematical intelligences, Spectrum investigates the diverse nature of abilities in the light of the MI theory. Researchers in the spectrum examine these cognitive abilities when children are exposed to different activities in different domains, such as music, science, and art. The activities are conducted in daily classroom context in order to provide children with comfortable materials and procedures. The activities are designed as hands-on and game, for making them relevant to children. Thus, because the MI theory suggests activities from real life and in familiar contexts, Project Spectrum offers more reliable and meaningful assessment of children's intelligence (Gray & Viens, 1994).

Gardner and Hatch (1989) states that the multiple intelligence theory has been inspired several research and development projects that are conducted in a variety of grade levels, from preschool to high school. For a long time, these projects have focused mainly on development of intelligence fair assessment instruments The process of development of such instruments has been time consuming and costly, since there are few examples for developing scoring systems that exceed linguistic and logical criteria for this kind of assessment, and also materials suitable for one age, gender, and social group may not be appropriate for the other groups. The assessments made by these instruments demonstrate that, when developing this kind of instruments, three factors must be considered; the developmental appropriateness of the materials, the social class background of the children, which may influence the child's talent and enthusiasm for using the diverse materials, and the correct employment of the materials and assessment measures in the classroom environment.

2.9 Multiple Intelligence Projects

Gardner's research group named Harvard Project Zero, has been examining the questions about the curriculum content such as what would be taught and why, through the lens of the multiple intelligences (Blythe & Gardner, 1990).

To identify variety of intellectual strengths of preschool children, another MI research project, Project Spectrum, a laboratory pre-school, developed intelligence-fair assessment techniques, which are natural, familiar, and in non-threatening contexts. In Project Spectrum classrooms, to stimulate students' particular intelligences, classroom environment is enriched with variety of materials (Blythe & Gardner, 1990; Campbell, Campbell & Dickinson, 1999).

Key Learning Community is a kindergarten to high school program, in which educators use videotapes extensively to assess the learning progress of students. Students are videotaped during they present their projects, and these records are used with the grades as a valuable assessment information to parents, teachers, administrators, and to the students themselves (Armstrong, 2000).

Arts PROPEL assesses middle and high school students' progress in several art areas such as music, creative writing, and visual arts (Armstrong, 2000; Blythe & Gardner, 1990).

At Yale University, another project called PIFS (Practical Intelligence For Schools) project has developed meta-curricular units to be embedded in middle school curriculums (Armstrong, 2000; Blythe & Gardner, 1990).

2.10 Cautions About the Multiple Intelligences Theory

As in the implementation of any educational approach, there are some precautions and considerations regarding the MI theory (Gardner as cited in Patterson, 2002).

- Do not try to teach all subjects by using all of the intelligences; it is unnecessary and insensible (Emig, 1997). The important point in the MI theory is realizing that any subject can be taught more than one ways (Checkley, 1997).
- Avoid trivial using of intelligences; be sure that intelligences are applied in meaningful contexts (Gardner as cited in Patterson, 2002).
- Gardner (1995) do not support the beliefs, such as it suffices in and of itself, just go through the motions of exercising a certain intelligence or to use of materials associated with an intelligence as a background. For example, giving time to students for moving around the classroom, do not improve the bodily-kinesthetic intelligence. Random muscular movements do not cultivate the mind or even the body.
- Do not label students according to their intelligences. A student who labeled as linguistic or kinesthetic learner may think that he or she can only learn in these

predetermined ways (Gardner, 1996), and it should be kept in mind that intelligences shift, grow, or vary over time (Hatch, 1997).

- Avoid focusing on the students' one intelligence, and ignoring their full intellectual spectrum, categorizing students as high or low in a specific intelligence area is the one of the misapplications of the MI theory (Gray & Viens, 1994).
- Teachers should avoid giving an unequal emphasis on particular intelligences. They should equally stress on each of the intelligences, and should try to employ materials to improve all of the intelligence dimensions (Demirel as cited in Oral, 2001).
- To determine students' intelligence profiles, multiple intelligence inventories can be used. However, it is not recommended to describe students possessing and not possessing a specific dimension of intelligence by looking only at the inventory results (Arı & Saban as cited in Oral, 2001).

MI theory is not a strict plan, it is a framework, and when teachers decide on implementation, they must be aware of the rationale behind their decisions (Patterson, 2002).

2.11 Criticisms About the Multiple Intelligences Theory

The theory of multiple intelligences has been criticized in terms of its content and structure. And basically it is stated that the methodological resources for defending the multiple intelligences themselves are inadequate (Allix, 2000). Sternberg (1994) claims that there has been no evidence stated regarding the validity of the MI theory. And Allix (2000) adds that the overall support in cognitive science research for the MI theory is questionable.

Allix (2000) claims that Gardner's multiple intelligences were reached as a result of a kind of subjective factor analysis, and he adds that Gardner himself is unable to explain the operation of intelligences in an integrative manner.

Levin (1994) questions the theory in terms of its educational implications, and asks that how a school based on the MI theory, which builds on diversity of intelligences, maintains the common focus of schools. Sternberg (1994) believes that Gardner's theory may help educators to produce better dancers, athletes, or musicians, but it focuses away from the traditional academic abilities.

Silver, Strong, and Perini (1997) state that the Multiple Intelligences Theory focuses on the content of learning and its relation to the disciplines, and it means that the theory does not deal with the process of learning itself. And they claim that, it becomes clear if we look at a particular intelligence, for example musical intelligence. Are conductors, performers, composers, and musical critics all are using the same musical intelligence?

2.12 Summary of the Literature Review

1. In the stereotype view, intelligence is accepted as a single quality that is manifested throughout a person's intellectual performances, measurable by a single quantifiable index called IQ score, and present a potential early in life or not at all (Gardner, 1993a).
2. Gardner stretches the word intelligence beyond its customary application in educational psychology (Gardner & Hatch, 1989), and defines intelligence as biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are valued in one or more culture or community (Gardner, 1993a).

3. The theory combine insights from scientific research in fields, cognitive science (the study of the mind), neuroscience (the study of the brain) (Gardner, 1987), biology, anthropology, psychology, medical case studies and an examination of art and culture (Patterson, 2002; Silver, Strong & Perini, 1997).
4. In his theory of the Multiple Intelligences initially Gardner (1998) argues that human beings have evolved to be able to perform at least seven distinct forms of analysis. These are linguistic intelligence, logical-mathematical intelligence, musical intelligence, bodily-kinesthetic intelligence, visual-spatial intelligence, interpersonal intelligence, and intrapersonal intelligence. Then, he added an eight, the naturalistic intelligence (Checkley, 1997).
5. Research provides evidence for sex differences in intelligence in terms of particular skills (Chan, 2001; Furnham as cited in Rammstedt & Rammsayer, 2000; Rammstedt & Rammsayer, 2000; Synder, 2000).
6. MI based approaches improve students' academic achievement (Campbell & Campbell, 1999; Dunn & DeBello as cited in Dunn, Denig & Lovelace, 2001; Greenhawk, 1997; Patterson, 2002). However, the studies, which concluded this claim, were qualitative studies, and their generalizability is very limited.
7. The MI theory has positive effects on teachers' beliefs, and develops their teaching practices (Campbell & Campbell, 1999; Goodnough, 2001; Vialle, 1997).

Since Gardner proposed the MI theory, many schools and teachers attempted to implement the theory in a variety of ways in all around the world, but little attention has been given in science education. In fact, in Turkey a few studies have been conducted to introduce the theory in Turkish educational system. The first step in implementing the theory into teaching and learning process is identifying the students MI profiles and proclivities. For this purpose student completed surveys can be used as effective tools to initiate individualized education.

The review of the literature indicates that there is a need for identifying students' intelligence profiles according to the MI theory, and recognize the potential benefits for science education in order to have more individualized, more effective teaching and learning environment in Turkish schools.

CHAPTER 3

METHOD

In the previous chapters, problems and hypotheses of the study were presented, related literature was reviewed and the essence of the study was justified. In this chapter population and sampling, description of variables, development of measuring tools, procedure, methods that were used to analyze data, and assumptions and limitations are explained briefly.

3.1 Population and Sample

All seventh and tenth grade regular state schools' students in Turkey were identified as the target population of this study. However, it is appropriate to define an accessible population, since it is not feasible to study with this target population. The accessible population was determined as all seventh and tenth grade students in regular state schools in Çankaya, Keçiören, and Yenimahalle districts of Ankara. This is the population for which the results of this study will be generalized. Since the relationships between students' science/physics achievement and self-estimated intelligence dimensions were investigated, the sample of the students had to take science/physics lesson before. For this reason 7th and 10th grade students selected for the study. The population of 7th grade students sampled in this study was approximately 31295 students according to the results of 2001-2002 census. In this population, approximately 53% are males and 47% are females. The desired sample size was determined as 2850 students, which is approximately 9% of the whole population of 7th grade students. The population of 10th grade students sampled in this study was approximately 18205 students according to 2001-2002 census. In this population, approximately 49% are males and 51% are females. The desired sample size was determined as 1650 students, which is approximately 9% of the whole population of 10th grade students. Stratified cluster random sampling and convenience sampling were used to obtain a representative sample of the population. First, the three districts in Ankara from which the sample of study was chosen, were selected by the convenience sampling method, and the schools in these districts were determined from the web site of Ministry of National Education, and then schools were selected randomly from these districts in similar proportions with the population. From the selected schools, classes to which the instrument was administered was selected by taking into consideration the convenience of teachers and administration.

Due to some unexpected situations, sample was restricted to 1580 tenth grade and 2146 seventh grade students at the end. Of this sample of tenth grade students %49.7 were female and %50.3 were male, and of the sample of seventh grade students %50.9 were female and %49.1 were male. These were approximately the same proportions in the population of seventh and tenth grade students.

Table 3.1 presents number of elementary schools throughout the districts, number of selected elementary schools throughout these districts and number of students from each of the districts. An average of 80-85 students for per each elementary school corresponding to 2 or 3 classes were participated in the study.

Table 3.1 Numbers of Elementary Schools, Selected Elementary Schools, and Selected Students Throughout the Districts

District	Number of Elementary Schools	Number of Selected Elementary Schools	Number of Selected Students
Çankaya	103	10	748
Keçiören	89	8	686
Yenimahalle	85	8	712
Total	277	26	2146

Table 3.2 presents number of high schools throughout the districts, number of selected high schools throughout these districts and number of students from each of the districts. An average of 200-250 students for per each high school corresponding to 5 or 6 classes were participated in the study.

Table 3.2 Numbers of High Schools, Selected High Schools, and Selected Students Throughout the Districts

District	Number of High Schools	Number of Selected High Schools	Number of Selected Students
Çankaya	17	3	550
Keçiören	14	1	341
Yenimahalle	15	3	689
Total	46	7	1580

Most of the students' socio-economic status including the educational level of their mother, the educational level of their father, and the number of books at their home and middle and low. The ages of seventh grade students range from 10 to 17, and ages of tenth grade students range from 13 to 19. The distribution of ages students with respect to grade level was given in Table 3.3.

Table 3.3 Distribution of Ages of Students with respect to Grade Level

Grade 7	Age	Frequency	Percent (%)
	10	5	.1
	11	32	1.5
	12	1671	78
	13	374	17.5
	14	49	2.2
	15	6	.3
	16	2	.1
	17	17	1
Grade 10	Age	Frequency	Percent
	13	1	.1
	14	44	2.8
	15	1091	69.1
	16	359	22.7
	17	72	4.6
	18	12	.8
	19	1	.1

3.2 Variables

There are thirteen variables involved in this study, which were categorized as dependent and independent.

3.2.1 Dependent Variables

The dependent variables (DV) were students' self-estimated multiple intelligence dimensions, namely verbal-linguistic intelligence (VLINT), logical-mathematical intelligence (LMINT), visual-spatial intelligence (VSINT), musical intelligence (MINT), bodily-kinesthetic intelligence (BKINT), intrapersonal intelligence (INTRAINT), and interpersonal intelligence (INTERINT), as measured by the Multiple Intelligence Inventory. They are continuous and in interval scale of measurement.

3.2.2 Independent Variables

The independent variables (IV) included in this study were students' gender (SEX), age (AGE), grade level (GRADE), socio economic status (SES), science/physics achievement score (PSSCORE), and branch in high school (BRANCH). Among these variables SEX and BRANCH are discrete and in nominal scale of measurement, GRADE and PSSCORE are discrete and in ordinal scale of measurement, AGE and SES are continuous and in interval scale of measurement.

3.3 Measuring Tools

In this study, for the assessment of students' characteristics only the Multiple Intelligence Inventory was used.

3.3.1 The Multiple Intelligence Inventory

The Multiple Intelligence (MI) Inventory used in this study is based on Howard Gardner's theory of multiple intelligences from his book Frames of Mind. It is adapted in Renaissance Project with the permission of Sue Teele and Anne Biro. The inventory ("Multiple Intelligences Inventory," n.d) includes total 105 items; 15 statements for each of the seven intelligence dimensions, these dimensions are verbal-linguistic, logical-mathematical, intrapersonal, visual-spatial, musical, bodily-kinesthetic, and interpersonal. Participant checks each statement if it describes him most, then the score of the participant on each intelligence dimension will be found by adding the checked items on the specific intelligence dimension. There is also a description paragraph at the end of the each intelligence dimension, and the participant rate himself according to how well this paragraph describes him on a 5 point Likert scale from "not like me" to "just like me". The total score for each of the intelligence dimensions is obtained by adding the score on the description paragraph to the total number of checked items on the related intelligence dimension.

The inventory was adapted and translated into Turkish by Gürçay and Eryılmaz (2002). After translation, the inventory was controlled and retranslated into English by an assistant at the Department of the Foreign Languages Education at Hacettepe University. Then, a Turkish instructor at Hacettepe University controlled the translation of the inventory in terms of its appropriateness to Turkish and retranslated some of the statements. The inventory was also given to one ninth grade student and two research assistants, and the incomprehensible items were retranslated and adapted into Turkish and one item ("I am an accurate speller") was excluded from the inventory because of its unsuitability to Turkish language. After this process, experts; one professor, one associate professor, one instructor, and three research assistants, examined the inventory, and by taken into consideration the suggestions of these experts, some of the items were revised and the inventory took its final format.

After taken the translated format of the inventory from Gürçay and Eryılmaz (2002), experts; two assisted professors and one research assistant from the Department of Secondary Science and Mathematics Education of METU and two research assistants from the Department of Elementary Education of METU examined the inventory for the clarity of items and their appropriateness to the specific intelligence dimensions. The experts were given the inventory, and they were asked to determine the each item's intelligence dimension, and also the confusing items. Experts thought that some of the items might be placed under more than one dimension, some of them could not be placed under any of the dimensions, and some of the items were found to be confusing. Then, principle component analysis and reliability analysis were performed separately for each intelligence dimension with the data of 395 ninth grade students. Items that were found to be problematic by the experts, which were also supported by the statistical analysis, were taken out from the inventory. The final version of the MI inventory includes 70 items, 10 items for each of the seven intelligence dimensions (see Appendix A). Item numbers with respect to the intelligence dimensions were given in Table 3.4 below.

Table 3.4 Representations of the MI Inventory Items

Intelligence Dimensions	Inventory Items
Verbal-linguistic intelligence	1, 5, 10, 11, 37, 43, 48, 63, 68, 70
Logical-mathematical intelligence	9, 18, 24, 26, 27, 28, 45, 46, 47, 57
Visual-spatial intelligence	7, 12, 15, 17, 21, 23, 34, 54, 56, 69
Musical intelligence	6, 14, 29, 49, 50, 51, 52, 58, 59, 62
Bodily-kinesthetic intelligence	4, 8, 13, 16, 19, 30, 38, 44, 53, 66
Intrapersonal intelligence	20, 22, 25, 31, 39, 40, 42, 55, 65, 67
Interpersonal intelligence	2, 3, 32, 33, 35, 36, 41, 60, 61, 64

3.3.2 Reliability and Validity of the MI Inventory

A study was conducted by using the MI inventory with 395 ninth grade students, and Cronbach Alpha internal consistency coefficient of the inventory was reported as .86 by Gürçay and Eryılmaz (2002). She also reported Cronbach Alpha internal consistency coefficients for the seven sub-dimensions of the inventory. For the verbal-linguistic sub-dimension, the coefficient was found as .63, for logical-mathematical sub-dimension, it was found as .54, for visual-spatial sub-dimension, it was found as .61, for interpersonal sub-dimension, it was found as .63, for intrapersonal sub-dimension, it was found as .48, for musical-rhythmic sub-dimension, it was found as .76, and for bodily-kinesthetic sub-dimension, it was found as .55. She conducted the study with 9th grade students, but in this study the inventory will be administered to 7th and 10th grade students. For this reason the reliability of the inventory were calculated separately for both results of 7th and 10th grade participants of this study. In verbal-linguistic dimension, the reliability coefficient was calculated as .54 for seventh graders, and .61 for tenth graders. In logical-mathematical dimension, it was calculated as .59 for seventh graders, and .57 for tenth graders. In visual-spatial dimension, it was calculated as .45 for seventh graders, and .50 for tenth graders. In musical dimension, it was calculated as .69 for seventh graders, and .74 for tenth graders. In bodily-kinesthetic dimension, it was calculated as .45 for seventh graders, and .51 for tenth graders. In intrapersonal dimension, it was calculated as .46 for both seventh and tenth graders. And in interpersonal dimension, it was calculated as .53 for seventh graders, and .55 for tenth graders. When we compared the reliability coefficients of this study with the previous study, only the reliability of the logical-mathematical intelligence dimension was higher, the remaining dimensions' reliabilities were slightly lower. The reliability coefficients of this study were ranging between .45 and .74, but according to Fraenkel and Wallen (1996), the coefficients should be .70 and preferably higher. When the results of the Oral's (2001) study were examined, the reliability of the sub-dimensions again found as low, although he used a different inventory to determine the multiple intelligence dimensions of 615 university students. In his study also, the musical intelligence sub-dimension has the highest reliability coefficient, its reliability was found as .79. The other dimension's reliability coefficients were reported as around .60. The reason for having low internal consistencies for the both of the MI inventories may be explained as follows: Each intelligence dimension may have sub-categories in it also. For example, in the musical intelligence, there may be items that measure different sub-categories of the musical intelligence: one related to being able to play a musical instrument, and another related to liking listening to music and so on. A student, who likes listening to music, may not be talented to play a musical instrument. Therefore, this student's responses will not be consistent throughout this dimension. When factor analysis was conducted for each intelligence dimension, the results confirmed this claim. According to the rotated component matrix, for the verbal-linguistic and interpersonal intelligences, 3 factors, for the logical-mathematical and musical intelligences, 2 factors, for the visual-spatial, bodily-kinesthetic, and intrapersonal intelligences, 4 factors obtained. When the reliability coefficients of the intelligence dimensions were compared, it was seen that dimensions constituting more factors or sub-categories had lower coefficients.

In the previous study, for the content and face validity, the inventory was checked by experts; one professor, one associate professor, one instructor and three research assistants. Also the translation of the inventory was controlled by an assistant at the Department of Foreign Languages Education at Hacettepe University and by a Turkish language instructor at Hacettepe University (Gürçay & Eryılmaz, 2002).

For the validity of the inventory, Gürçay and Eryılmaz (2002) also prepared a Parent Inventory and a Teacher Inventory. In the parent inventory, first a brief introduction was given about the theory of multiple intelligences, and then parents were required to determine their children's position in each of the seven intelligence dimensions according to a five point Likert scale. At the end of the study 241 parent responded and gave back the inventories. In the Teacher Inventory, again a brief introductory information was given about the theory of multiple intelligences, and teachers were asked to evaluate their well-known students in each of the seven intelligence dimensions according to a three point Likert scale.

In order to determine how well the students' responses in the inventory reflect their real status in each intelligence sub-dimension, simple correlation analysis were conducted between the responses to the inventory and the responses to the parent inventory and between the responses to the inventory and the responses to the teacher inventory. It was found that there were significant correlations between parent responses and student responses in each of the seven intelligence sub-dimensions at .05 significance level. This was a positive evidence for the validity of the instrument and it was indicated that the responses of parents and responses of students were parallel to each other. On the other hand, there was no significant correlation found between the responses of teachers and responses of students at .05 significance level (Gürçay and Eryılmaz, 2002). This might be due to the fact of large classes in Turkey. Since, generally the population of classes in state schools is over 40, this might minimize the interaction between the teacher and the students. Therefore, the teacher had not enough information about each of his/her students.

In this study, to establish face and content validity, the MI Inventory was checked by experts (two instructors from the department of Secondary School Science and Mathematics Education at METU, two research assistants from the department of Elementary Education at METU, and one research assistant from the department of Secondary School Science and Mathematics Education at METU). The experts were asked to determine each statement's dimension in the inventory. They were explained about the instrument, and then they evaluated the appropriateness of the items to the students' characteristics, representativeness of the each item for the related intelligence dimension, clarity of wordings, language, format and directions of the instrument, and suggestions were taken into consideration. To provide construct validity, factor analysis was conducted to check whether the expected seven constructs of intelligence were confirmed or not with the results of the study. When the factor number was set to 7, according to the rotated factor matrix, except the visual-spatial dimension's items, majority of the items in each intelligence dimension of the inventory were fit into their components.

3.4 Procedure

Since both students multiple intelligence dimensions and the effect of gender, age, grade level, socio economic status, science/physics achievement, and branch in school on these dimensions were investigated, the design of this study was both cross-sectional survey, and casual-comparative study. The study began with a detailed review of the literature. For this purpose, first a keyword list was determined. After that, Educational Resources Information Center (ERIC), International Dissertations Abstracts, Social Science Citation Index (SSCI), Ebscohost, Science Direct, Kluwer Online databases, Internet (e.g., Google), and studies done in Turkey (from YÖK, Hacettepe Eğitim Dergisi, Eğitim ve Bilim Dergisi (TED), Çağdaş Eğitim Dergisi, MEB Dergisi, and studies presented in Fen Bilimleri Eğitimi Kongresi) were searched systematically. The photocopies of the available documents were obtained from METU library, Hacettepe University Library, Tübitak-Ulakbim library, and Internet. The documents were read, and the results of the studies were compared.

After completing the literature review, the participant schools and subjects of the study were determined, and permission was granted for the study from the Ministry of Education. The correspondence was given in Appendix C. Afterwards, the MI Inventory was prepared, the detailed information about the preparation of the inventory was given in section 3.3.1.

For the ease of administration and data entry, an optical form was designed. The data was collected with these optical forms.

Then pilot and main studies were conducted by administering the inventory to the selected seventh and tenth grade students. Before the administration, the directions and the necessary information was explained to both the participants and the teacher. Also, the participants of the study were informed that the results of the study would not affect any of their grades in school. The data collection procedure took 8 weeks.

In order to eliminate potentially confounding variables, data related to the subject characteristics, such as gender, age and socio economic status (SES) were also obtained with the inventory, and taken into consideration. This was help to control for a subject characteristics threat to the internal validity and for a possible loss of subjects. Also, the attitude of the subjects and instrumentation might affect the results of this study, to prevent this factor same directions and necessary explanations about the instrument were given to all of the participants, and the instrumentation process was standardized.

After the data collection procedure, data entry was made by the firm who prepared the optical forms. The data was given to the researcher as an Excel file. Then the researcher coded all the categories of the variables in the data. Female students were coded as 1, and male students were coded as 2. Elementary school students were coded as 7, and high school students were coded as 10. Students' science and physics achievement scores were remained the same as what the students coded in the optical form, it ranged from 1 to 5. "Science-math branch" was coded as 1, "literature-math branch" was coded as 2, and "literature-social sciences" branch was coded as 3. For the number of books at home item, "0-25" books were coded as 0, "26-60" books were coded as 1, "61-100" books were coded as 2, "101-200" books were coded as 3, and "more than 200" books were coded as 4. For the mother's and father's education level items, "primary school" was coded as 1, "elementary school" was coded as 2, "high school" was coded as 3, "university" was coded as 4, and "other" was coded as 0. For the responses to the Inventory, "yes" was coded as 2, "not sure" was coded as 1, and "no" was coded as 0.

Possibility of harm to the participants was not appeared to be a problem for this study. Deception was not required.

3.5 Analysis of Data

Data list, consisting of gender, age, grade level, number of books at home, education level of mother, education level of father, science/physics achievement, branch in school, and responses of participant students to the inventory were prepared by using Excel in which columns show variables and rows show students participating in the study and given to the researcher. Then the researcher coded the data, and prepared for the statistical analysis. The data obtained from the study was analyzed statistically by using both Excel and statistical package for the social sciences program (SPSS). The data was analyzed in two parts, descriptive statistics and inferential statistics.

3.5.1 Descriptive Statistics

The mean, mode, standard deviation, skewness, kurtosis, and histograms of the variables were presented.

3.5.2 Inferential Statistics

In order to test the null hypothesis, statistical techniques named multivariate analysis of variance (MANOVA) and bivariate correlations were used. The reason for using MANOVA was incorporating two or more DVs in the same analysis and control experimentwise Type I error (Fraenkel & Wallen, 1996). To determine the effect of grade level on the intelligence dimensions, MANOVA was conducted with all students' data, to determine effect of gender on the intelligence dimensions of 7th grade students, MANOVA was conducted with 7th grade students' data, to determine the effect of gender and branch on the intelligence dimensions of 10th grade students, MANOVA was conducted with 10th grade students' data. To determine the relationship between age, science/physics scores and intelligence dimensions, bivariate correlations were conducted with all students, 7th grade students, and 10th grade students' data separately. The statistical analysis of the study was performed by using (SPSS). The significance level was set to .05, since it is the mostly used value in educational studies. Therefore, the probability of rejecting the true null hypothesis (probability of making Type I error) was set to .05 a priori to hypothesis testing. Power of the study was set to 0.99. In other words, the probability of failing to reject the false null hypothesis (probability of making Type II error) was .01 (i.e., 1-.99). The effect size was set as medium for all variables, since there is no effect size indicated in the literature related to the variables of this study.

3.6 Assumptions and Limitations

The assumptions and the limitations of this study considered by the researcher given below.

3.6.1 Assumptions

1. The administrations of the MI Inventory were under standard conditions.
2. The participant students of the study responded to the items of the instrument sincerely.

3.6.2 Limitations

1. Since the data for the study was obtained by the participants' self-reporting to the inventory, they might not represent the complete objectivity.
2. Using an inventory instead of performance-based or objective criterion measures was a limitation for the study.

CHAPTER 4

RESULTS

The results of the study are explained in five different sections. The first section presents missing data analysis. The second section deals with outlier analysis. The third section is descriptive statistics in which dependent variables of the study are explored. The fourth section presents the inferential statistical results produced from testing the null hypothesis. Finally, the last section summarizes the findings of the study.

4.1 Missing Data Analysis

The first step is related with missing data analysis. It was carried out before descriptive and inferential statistics. The inventory was applied to 3726 students. One of these students was completely excluded from the study, since his all MI inventory sub scores were missing, and four of the students again completely excluded from the study, since 20% or more of the answers to sub scale items of one or more of their MI inventory sub scales were missing. It was thought that leaving an item without indicating an answer most closely meant being not sure about the item. For this reason, missing data of students which were less than or equal to 20% of the answers of any of the MI inventory sub scale items were replaced with 1 (not sure). These students who did not answer some of the items of sub scales of the inventory constituted less than 5% of the whole subjects.

At the end of the missing data analysis, 2141 seventh and 1580 tenth grade, total number of 3721 students left for the statistical analysis.

Missing data in students' age (AGE) and physics/science scores (PSSCORE) constituted a range smaller than 5% of the whole data, so they easily replaced with the series mean of the entire subjects. Also, some students did not answer the items related to the number of books at home, mother's education level and father's education level, which constitute the independent variable socio economic status (SES). The missing data in these three independent variables (IVs) constituted a range again less than 5% of the whole subjects, and each of them were replaced with the mode instead of the mean of the related variable, since they are categorical variables.

Table 4.1 Missing Data versus Variables

Resultant Variable	Missing Values Replaced	Valid Cases	Missing Percentage	Creating Functions
AGE	20	3721	0.5	SMEAN(AGE)
PSSCORE	106	3721	2.8	SMEAN(PSSCORE)

4.2 Outlier Analysis

For measuring outliers on dependent variables (DVs), the standardized residuals were used. Stevens (2002) indicated that any standardized residual greater than 3, in absolute value, is unusual and should be examined carefully. For measuring outliers on independent variables (IVs), the hat elements (leverage values) were used. The leverage values lie between 0 and 1, and values greater than 3p/n, where "p" is the number of independent variables and "n" is the sample size, were accepted as unusual (Stevens, 2002). According to these standardized residual and leverage values, some outliers were detected in the data. To determine which outliers were influential, Cook's distances were examined. A Cook's distance greater than 1 would generally be considered as large (Stevens, 2002). None of the points in the data were found to be influential; all Cook's distance values were less than 1. Therefore, all cases were kept for the analysis.

4.3 Descriptive Statistics

Descriptive statistics related to the students' each MI Inventory sub scale scores, namely verbal-linguistic intelligence scores (VLINT), logical-mathematical intelligence scores (LMINT), visual-spatial scores (VSINT), musical intelligence scores (MINT), bodily-kinesthetic intelligence scores (BKINT), intrapersonal intelligence scores (INTRAINT), and interpersonal intelligence scores (INTERINT) are presented in Table 4.2.

Students' each intelligence score could range from 0 to 20 with higher scores meaning strength in the related intelligence dimension. As Table 4.2 indicated, among the seven intelligence scores, the INTERINT had the highest mean score for all students, 7th grade students and 10th grade students. Then the MINT came for all students and 10th grade students. For 7th grade students the second strong intelligence was the LMINT. The LMINT and VSINT had nearly the same mean score for all students' data, and they came after the MINT. Lastly the INTRAINT, the BKINT and the VLINT came with the lowest mean score for all students data. For 7th grade students the MINT had the third highest mean score, then the VSINT and the VLINT intelligences came, and it followed by the BKINT, the lowest mean score was the INTRAINT score. For the 10th grade students, the VSINT had the third highest mean score, it followed by the INTRAINT and the LMINT. Then, the BKINT came, and the lowest mean score was the VLINT mean score. For each intelligence dimension the means of 7th and 10th grade students were close to each other. All means ranged between 13.3 and 16.3. When it is thought that the possible maximum score for each dimension was 20, both 7th and 10th grade students did not tend to rate themselves as weak in any of the intelligence dimensions. When the standard deviations were examined, it was also seen that variation among students was low. Since, in this sample of the study, all students came from the regular state schools, this low variation may be explained by standardized curriculum and instruction methods implemented in schools. Standardization of education does not allow students to be more developed in different areas of strengths.

When we look at the skewness and kurtosis values, all the seven intelligences lie between –1 and +1 for all students, for 7th grade students and for 10th grade students, accepted as excellent for most psychometric purposes (George & Mallery, 2003). Only for 10th grade data, interpersonal intelligence's skewness and kurtosis values are higher than 1 in absolute value, but they are in approximately acceptable range for a normal distribution as given in Table 4.2.

Table 4.2 Basic Descriptive Statistics Related to the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT Scores of Students

	Mean	Standard Deviation	Skewness	Kurtosis	Minimum	Maximum
			Scores on VLINT			
All students	13.614	3.410	-.587	.297	0	20
7th grade	13.809	3.253	-.514	.200	1	20
10th grade	13.351	3.596	-.624	.259	0	20
			Scores on LMINT			
All students	14.974	3.141	-.608	.130	0	20
7th grade	15.452	3.042	-.780	.614	0	20
10th grade	14.327	3.156	-.418	-.193	3	20

Table 4.2 (continued)

			Scores on VSINT			
All students	14.489	3.134	-.577	.131	3	20
7th grade	14.295	3.175	-.524	.057	4	20
10th grade	14.751	3.059	-.650	.268	3	20
			Scores on MINT			
All students	15.366	3.674	-.939	.613	0	20
7th grade	15.086	3.681	-.872	.512	1	20
10th grade	15.744	3.631	-1.053	.847	0	20
			Scores on BKINT			
All students	13.777	2.908	-.421	.096	1	20
7th grade	13.682	2.877	-.385	.035	3	20
10th grade	13.906	2.946	-.476	.193	1	20
			Scores on INTRAINT			
All students	13.816	3.096	-.338	-.117	1	20
7th grade	13.307	3.133	-.261	-.143	1	20
10th grade	14.505	2.907	-.410	-.034	3	20
			Scores on INTERINT			
All students	15.861	2.913	-.886	.897	0	20
7th grade	15.45	2.965	-.750	.575	0	20
10th grade	16.370	2.762	-1.110	-1.695	3	20

Note: n=3721 for all students, n=2141 for 7th grade, n=1580 for 10th grade

Figures 4.1, 4.2, and 4.3 show the histograms with normal curves related to the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of all students, 7th grade students, and 10th grade students. Although all of the histograms were left-skewed, they can be accepted as evidences for the normal distribution of the dependent variables (DVs).

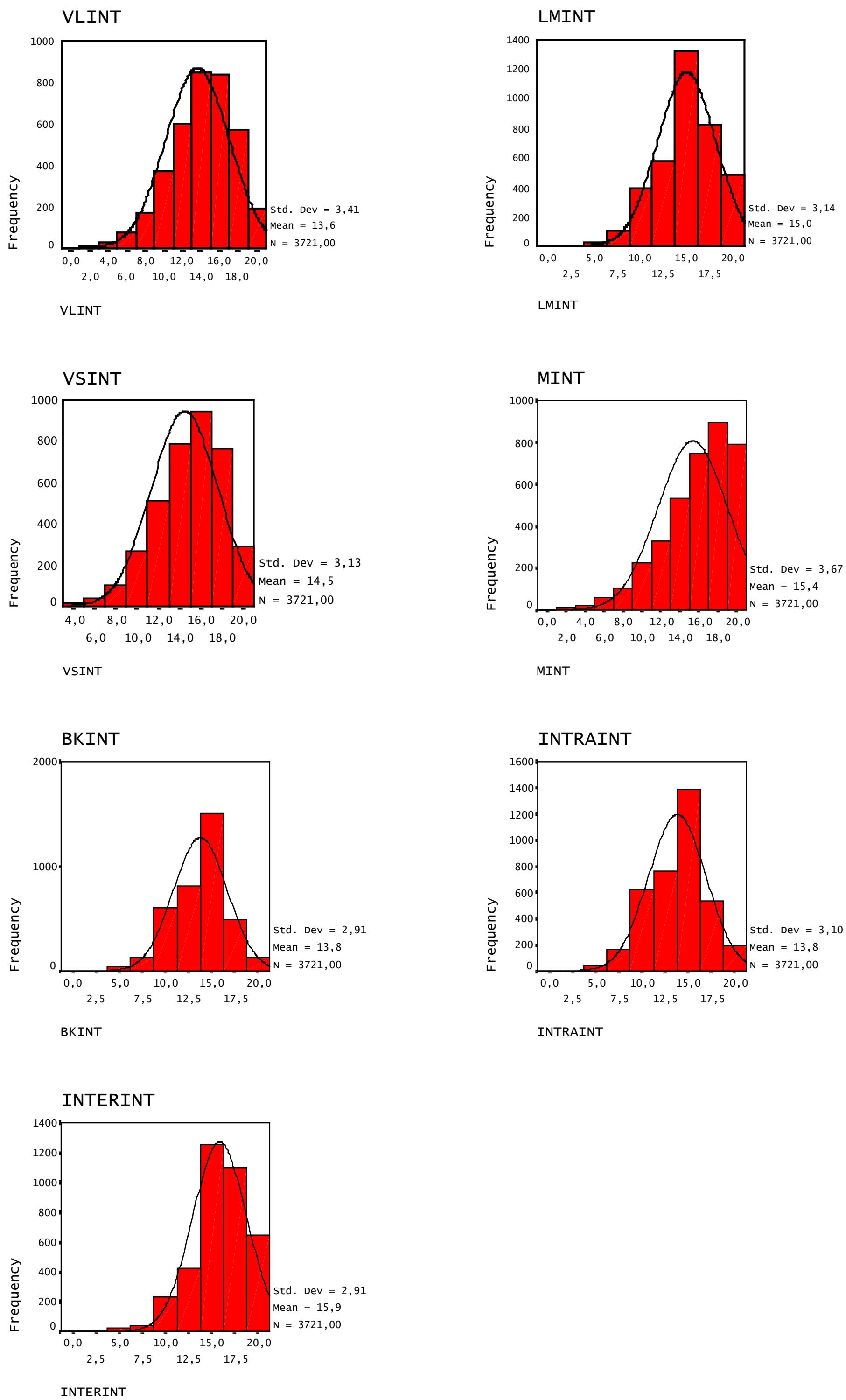

Figure 4.1 Histograms with normal curves for the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of all students.

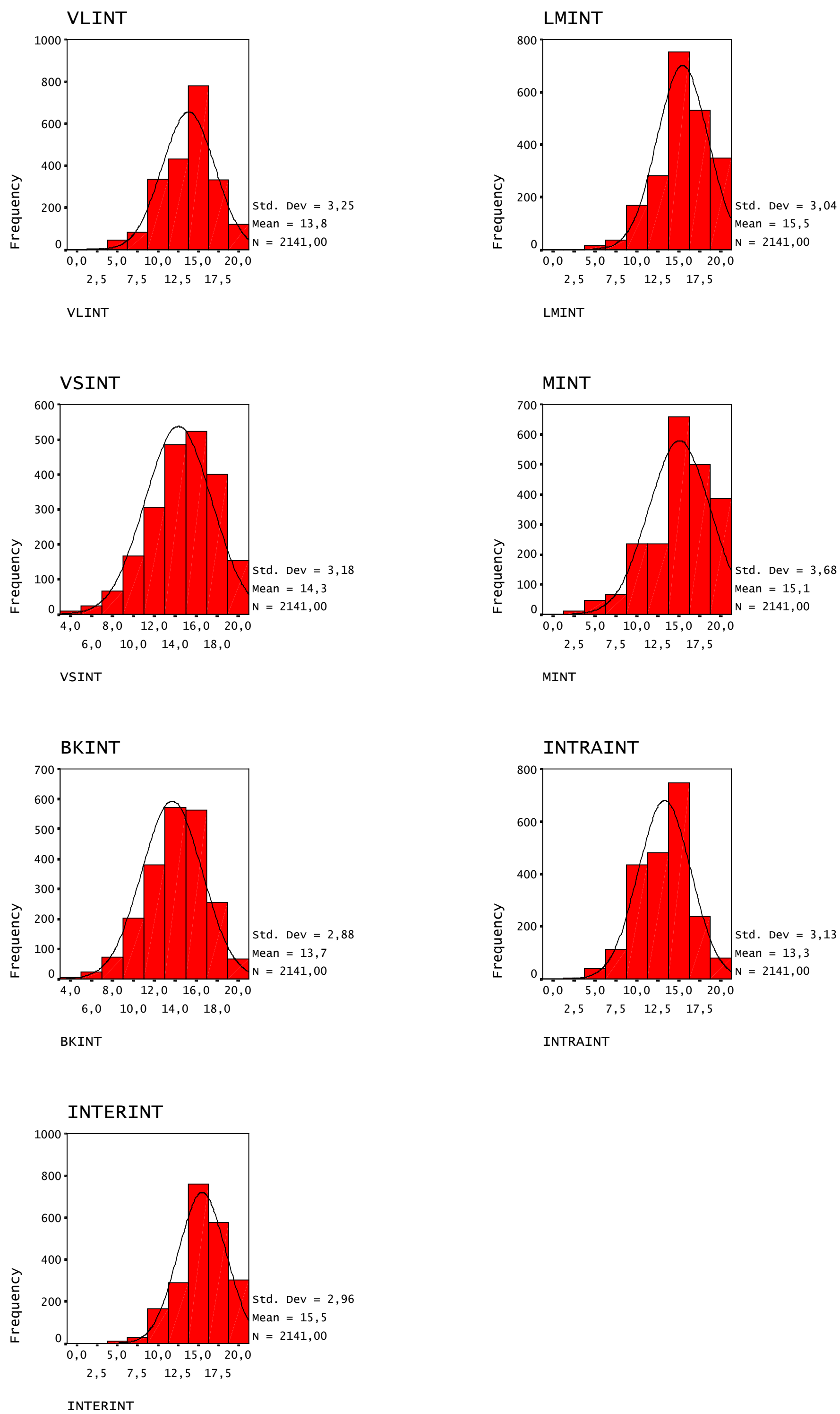

Figure 4.2 Histograms with normal curves for the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 7th grade students.

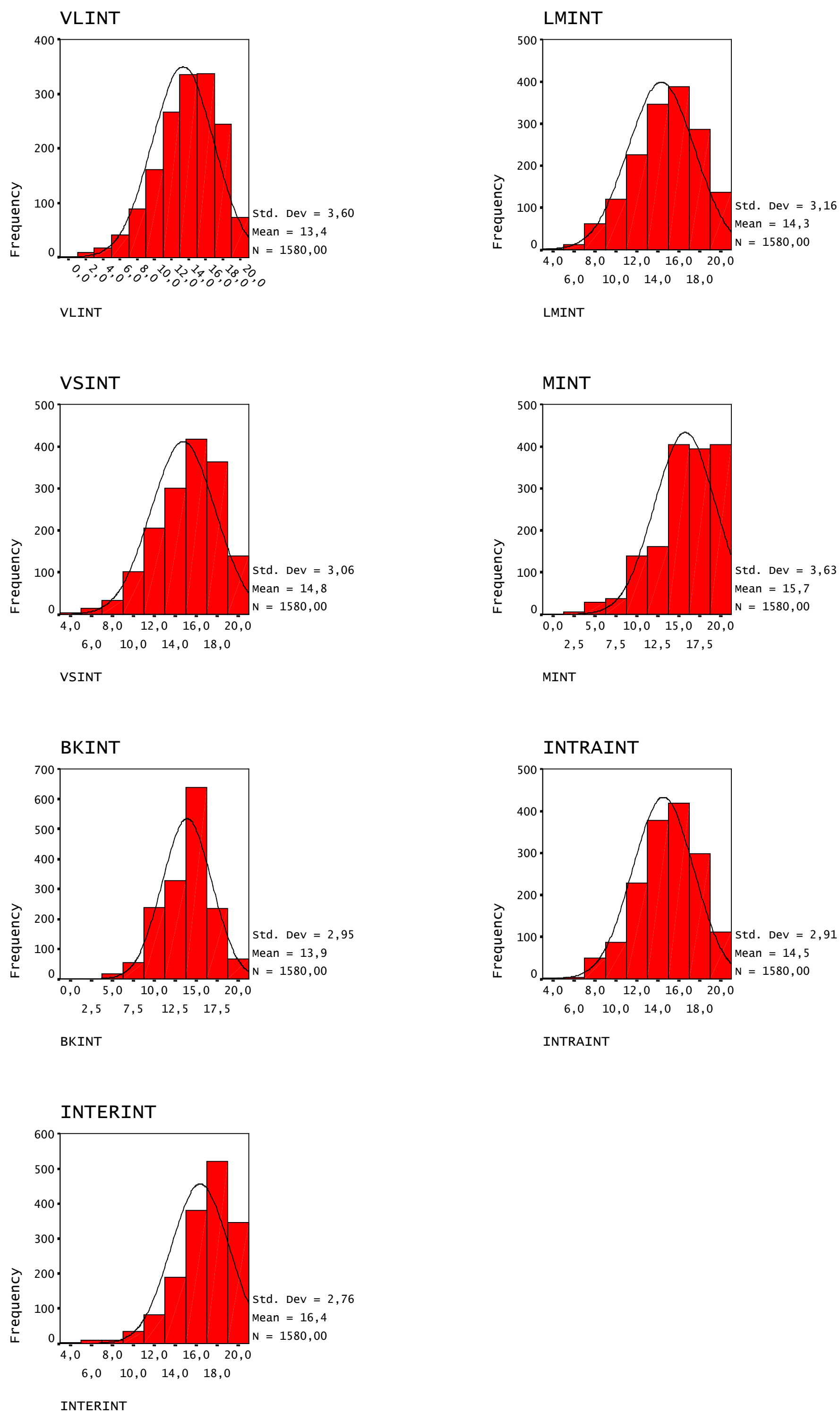

Figure 4.3 Histograms with normal curves for the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students.

4.4 Inferential Statistics

This section deals with the verification of multivariate analysis of variance (MANOVA) assumptions, the statistical model of MANOVA, bivariate correlations and the analysis of the hypotheses.

4.4.1 Assumptions of Multivariate Analysis of Variance

MANOVA has the assumptions of multivariate normality, equality of covariance matrices, equality of variances and independence of observations assumptions. All the variables were tested for all the assumptions. Since three separate MANOVAs were conducted with all students' data, 7th grade students' data, and 10th grade students' data, the assumptions were tested for three different groups of data.

Since there is no statistical analysis available for multivariate normality, univariate normalities were checked for each of the dependent variables (DVs) by using skewness and kurtosis values given in section 4.3. The skewness and kurtosis of the scores on the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT for all data, for 7th grade student's data, and for 10th grade student's data, were in acceptable range for a normal distribution.

For the equality of covariance matrices assumption, Box's test of equality of covariance matrices was conducted for all data, for 7th grade student's data, and 10th grade student's data. As seen from the Table 4.3 the observed covariance matrices of the dependent variables are not equal across groups for none of the data.

Table 4.3 Box's Test of Equality of Covariance Matrices

	All Data	7th grade	10th grade
Box's M	219.631	176.768	388.268
F	7.828	6.291	2.737
df1	28	28	140
df2	4.0E+07	1.6E+07	1769401
Sig.	.000	.000	.000

For the equality of variances assumption, Levene's Test of Equality was used. As indicated in Table 4.4, only the error variances of the VSINT, MINT, and BKINT across grade were equal. For the 7th grade students data, only the error variances of the INTRAINT were equal across gender, and for the 10th grade students data only the error variances of INTRAINT were equal across gender and branch.

Table 4.4 Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
		All Students across Grade		
VLINT	17.915	1	3719	.000
LMINT	4.525	1	3719	.033
VSINT	2.141	1	3719	.144
MINT	.214	1	3719	.644
BKINT	.046	1	3719	.829
INTRAINT	11.622	1	3719	.001
INTERINT	15.925	1	3719	.000
		7th Grade Students across Gender		
VLINT	37.676	1	2139	.000
LMINT	4.844	1	2139	.028
VSINT	36.245	1	2139	.000
MINT	79.987	1	2139	.000
BKINT	4.700	1	2139	.030

Table 4.4 (continued)

INTRAINT	.006	1	2139	.938
INTERINT	27.239	1	2139	.000
10th Grade Students across Gender and Branch				
VLINT	9.559	5	1574	.000
LMINT	4.000	5	1574	.001
VSINT	8.998	5	1574	.000
MINT	16.371	5	1574	.000
BKINT	3.627	5	1574	.003
INTRAINT	2.066	5	1574	.067
INTERINT	9.583	5	1574	.000

The last assumption states that observations should be independent of one another. The administration of the inventory did not involve interactions among subjects; therefore they did not influence each other. It was observed that all participants did their test by themselves.

The normality and independence of observations assumptions are the assumptions of bivariate correlation also. These two assumptions were verified as discussed above for MANOVA.

Except the equality of covariance matrices and equality of variances assumptions, other assumptions of MANOVA were met. MANOVA is robust to the violation of equality of covariance matrices and equality of variances assumptions when the group sizes are equal (Stevens, 2002). Since the group sizes were equal across dependent variables, the analyses were conducted with three different groups of data. In addition, to compare the results non-parametric Mann Whitney U test was conducted, the same results were obtained with the MANOVA results.

4.4.2.Null Hypothesis 1

The first null hypothesis was; 'There is no significant main effect of grade level on the population means of the collective dependent variables of scores on all students' self-estimated intelligence dimensions.'

MANOVA was conducted to determine the effect of grade level (GRADE) on the seven dependent variables of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT. The results are given in Table 4.5.

Table 4.5 MANOVA results for null hypothesis 1

Effect	Wilk's Lambda	F	Hypothesis df	Error df	Sig.	Eta Squared	Observed power
Grade	.870	79.240	7.0	3713.0	.000	.130	1.000

Significant differences were found among 7th and 10th grade students on the collective dependent measures of self-estimated intelligence dimensions as indicated in Table 4.4 ($F(7, 3713) = 79.240$, $p < .05$). The multivariate η^2 based on Wilk's λ was high. In order to test the effect of GRADE on each DV, an analysis of variance (ANOVA) was conducted as follow-up tests to the MANOVA. The results are given in Table 4.6.

Table 4.6 Follow-up results for null hypothesis 1

DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Observed Power
			Source: GRADE				
VLINT	190.976	1	190.976	16.496	.000	.004	.982
LMINT	1149.447	1	1149.447	120.254	.000	.031	1.000
VSINT	189.099	1	189.099	19.347	.000	.005	.993
MINT	394.044	1	394.044	29.412	.000	.008	1.000
BKINT	45.522	1	45.522	5.390	.000	.001	.641
INTRAINT	1305.181	1	1305.181	141.308	.000	.037	1.000
INTERINT	711.979	1	711.979	85.810	.000	.023	1.000

Using the Bonferroni procedure because of multiple tests, each ANOVA was evaluated at .007 (.05/7) level. The ANOVA on the all dependent variables were significant ($p<.007$), but η^2 values for all of them were low.

As indicated in Table 4.2, seventh grade students perceived themselves stronger than 10th grade students on the VLINT and the LMINT, on the other hand, 10th grade students perceived themselves stronger than 7th grade students on the VSINT, the MINT, the BKINT, the INTRAINT, and the INTERINT.

4.4.3 Null Hypothesis 2

The second null hypothesis was ‘There is no significant main effect of gender on the population means of the collective dependent variables of scores on 7th grade regular state school students’ self-estimated intelligence dimensions.’

MANOVA was conducted to determine the effect of gender on the seven dependent variables of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 7th grade students. The results are given in Table 4.7.

Table 4.7 MANOVA results for null hypothesis 2

Effect	Wilk's Lambda	F	Hypothesis df	Error df	Sig.	Eta Squared	Observed power
Gender	.892	36.739	7.000	2133.0	.000	.108	1.000

Significant differences were found among 7th grade male and female students on the collective dependent measures of self-estimated intelligence dimensions as indicated in Table 4.7 ($F(7, 2133) = 36.739$, $p < .05$). The multivariate η^2 based on Wilk's λ was medium. In order to test the effect of gender on each DV, ANOVA was conducted as follow-up tests to the MANOVA. The results are given in Table 4.8.

Table 4.8 Follow-up results for null hypothesis 2

DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Observed Power
			Source: GENDER				
VLINT	567.453	1	567.543	54.993	.000	.025	1.000
LMINT	64.554	1	64.554	6.998	.008	.003	.753
VSINT	983.772	1	983.772	102.191	.000	.046	1.000
MINT	1659.789	1	1659.789	129.846	.000	.057	1.000
BKINT	134.613	1	134.613	16.386	.000	.008	.982
INTRAINT	50.770	1	50.770	5.183	.023	.023	.624
INTERINT	399.796	1	399.796	46.443	.000	.021	1.000

Using the Bonferroni procedure because of multiple tests, each ANOVA was evaluated at .007 (.05/7) level. The ANOVA on the VLINT, VSINT, MINT, BKINT, and INTERINT were significant. ($p<.007$), but η^2 values for the VLINT, BKINT, and INTERINT were low, for VSINT and MINT were medium. In order to see who perceived himself/herself stronger, means were given in Table 4.9 for variables on which ANOVA was found significant. As seen from the table, 7th grade female students perceived themselves stronger than male students in all five dimensions of self-estimated intelligence dimensions.

Table 4.9 Means for variables related to null hypothesis 2

Dependent Variable	SEX	Mean
VLINT	Female	14.315
	Male	13.285
VSINT	Female	14.961
	Male	13.606
MINT	Female	15.951
	Male	14.190
BKINT	Female	13.928
	Male	13.427
INTERINT	Female	15.910
	Male	15.046

4.4.4 Null Hypothesis 3

The third null hypothesis was, ‘There is no significant main effect of gender on the population means of the collective dependent variables of scores on 10th grade regular state school students’ self-estimated intelligence dimensions.’

MANOVA was conducted to determine the effect of gender on the seven dependent variables of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students. The results are given in Table 4.10.

Table 4.10 MANOVA results for null hypothesis 3

Effect	Wilk's Lambda	F	Hypothesis df	Error df	Sig.	Eta Squared	Observed power
Gender	.841	42.500	7.0	1568.0	.000	.159	1.000

Significant differences were found among 10th grade female and male students on the collective dependent measures of self-estimated intelligence dimensions as indicated in Table 4.10 ($F(7, 1568) = 42.500$, $p<.05$). The multivariate η^2 based on Wilk's λ was high. In order to test the effect of gender on each dependent variable, ANOVA was conducted as follow-up tests to the MANOVA. The results are given in Table 4.11.

Table 4.11 Follow-up results for null hypothesis 3

DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Observed Power
			Source: GENDER				
VLINT	1784.481	1	1784.481	158.584	.000	.092	1.000
LMINT	172.022	1	172.022	17.146	.000	.012	.992
VSINT	667.445	1	667.445	74.975	.000	.045	1.000
MINT	716.913	1	716.913	57.093	.000	.035	1.000
BKINT	84.605	1	84.605	9.790	.002	.006	.878
INTRAINT	99.956	1	99.956	11.921	.001	.008	.932
INTERINT	355.088	1	355.088	48.659	.000	.030	1.000

Using the Bonferroni procedure because of multiple tests, each ANOVA was evaluated at .007 (.05/7) level. The ANOVA on all dependent variables were significant ($p<.007$), but η^2 values for all of them were low except for the VLINT and VSINT. Their η^2 values were medium. In order to see who perceived himself/herself stronger, means were given in Table 4.12 for variables on which ANOVA was found significant.

Table 4.12 Means for variables related to null hypothesis 3

Dependent Variable	SEX	Mean
VLINT	Female	14.482
	Male	12.184
LMINT	Female	13.959
	Male	14.673
VSINT	Female	15.442
	Male	14.036
MINT	Female	16.462
	Male	15.006
BKINT	Female	14.151
	Male	13.651
INTRAINT	Female	14.787
	Male	14.244
INTERINT	Female	16.920
	Male	15.895

Tenth grade female students perceived themselves stronger than male students on all of the self-estimated intelligence dimensions except the LMINT. In this dimension male students' score was higher than female students.

4.4.5 Null Hypothesis 4

The fourth null hypothesis was; 'There is no significant relationship between age and self-estimated intelligence dimensions of 7th grade regular state school students.'

Bivariate correlations were computed to determine the relationships among AGE and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 7th grade students. The results are given in Table 4.13.

Table 4.13 Correlations for null hypothesis 4

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
AGE	-.039	-.024	-.034	-.018	-.042*	-.016	-.033

* $p < .05$

The results of the correlational analysis presented in Table 4.13 show that only the correlation between the AGE and the BKINT of 7th grade students was significant ($p<.05$), but its effect size was very low. The correlations among age and the other intelligence dimensions tended to be lower and not significant. In general, the results suggest that older 7th grade students tended to perceive themselves weaker in the BKINT.

4.4.6 Null Hypothesis 5

The fifth null hypothesis was; 'There is no significant relationship between age and self-estimated intelligence dimensions of 10th grade regular state school students.'

Bivariate correlations were computed to determine the relationships among the AGE and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students. The results are given in Table 4.14.

Table 4.14 Correlations for null hypothesis 5

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
AGE	-.071*	-.031	-.032	-.023	-.052*	.029	-.065*

* p < .05

The results of the correlational analysis presented in Table 4.14 show that the correlations among the AGE and the VLINT, BKINT, and INTERINT of 10th grade students were statistically significant ($p<.05$), but the all effect sizes were very low. In general, the results suggest that older 10th grade students tended to perceive themselves weaker in the VLINT, BKINT, and INTERINT.

4.4.7 Null Hypothesis 6

The sixth null hypothesis was; ‘There is no significant relationship between socio economic status (SES) and self-estimated intelligence dimensions of 7th grade regular state school students.’

Bivariate correlations were computed to determine the relationships between SES and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 7th grade students. The results are given in Table 4.15.

Table 4.15 Correlations for null hypothesis 6

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
SES	.089*	.043*	.071*	.076*	.197*	.134*	.193*

*p < .05

The results of the correlational analysis presented in Table 4.15 show that all of the correlations among SES and the intelligence dimensions of 7th grade students were significant ($p<.05$), but the effect sizes were low. In general, the results suggest that among the 7th grade students as the SES increases, the students' perceptions of their strength in the BKINT, INTRAINT, and INTERINT tend to increase.

4.4.8 Null Hypothesis 7

The seventh null hypothesis was; 'There is no significant relationship between socio economic status (SES) and self-estimated intelligence dimensions of 10th grade regular state school students.'

Bivariate correlations were computed to determine the relationships between SES and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students. The results are given in Table 4.16.

Table 4.16 Correlations for null hypothesis 7

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
SES	.009	.039	.048	.048	.094*	.119*	.036

*p < .05

The results of the correlational analysis presented in Table 4.16 show that only the correlations among SES and the BKINT and INTRAINT were significant (p<.05), but the effect sizes were low. In general, the results suggest that among the 10th grade students as the SES increases, the students' perceptions of their strength in the BKINT and INTRAINT dimensions tends to increase.

4.4.9 Null Hypothesis 8

The eighth null hypothesis was; 'There is no significant main effect of branch in high school (science-math/literature-math/social sciences-literature) on the population means of the collective dependent variables of scores on 10th grade regular state school students' self-estimated intelligence dimensions.'

MANOVA was conducted to determine the effect of BRANCH on the seven dependent variables of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students. The results are given in Table 4.17.

Table 4.17 MANOVA results for null hypothesis 8

Effect	Wilk's Lambda	F	Hypothesis df	Error df	Sig.	Eta Squared	Observed power
Branch	.868	16.367	14.0	3134.0	.000	.068	1.000

Significant differences were found among students from three different branches namely science-math., literature-math., and social sciences-literature on the collective dependent measures of self-estimated intelligence dimensions as indicated in Table 4.17 ($F(14, 3134) = 16.367$, $p < .05$). The multivariate η^2 based on Wilk's λ was medium. In order to test the effect of BRANCH on each DV, ANOVA was conducted as follow-up tests to the MANOVA. The results are given in Table 4.18.

Table 4.18 Follow-up results for null hypothesis 8

DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Observed Power
Source: BRANCH							
VLINT	354.410	2	177.205	15.747	.000	.020	1.000
LMINT	1156.763	2	578.831	64.375	.000	.076	1.000
VSINT	7.997	2	3.999	.449	.638	.001	.124
MINT	73.729	2	36.864	2.936	.053	.004	.573
BKINT	8.315	2	4.158	.481	.618	.001	.129
INTRAINT	52.786	2	26.393	3.148	.043	.004	.605
INTERINT	27.608	2	13.804	1.892	.151	.002	.395

Using the Bonferroni procedure because of multiple tests, each ANOVA was evaluated at .007 (.05/7) level. The ANOVA only on the VLINT and LMINT were significant (p<.007), but the η^2 value for the VLINT was low and for the LMINT was medium.

In order to determine which branches were significantly different from the other branches on the VLINT and LMINT post-hoc analysis were conducted. Since equal variances were not assumed, as a post-hoc test, Tamhane's test was used. The results are given in Table 4.19.

Table 4.19 Post-hoc results for null hypothesis 8

		BRANCH		sig.
VLINT	Tamhane	scien.-math	lit.-math.	.000
			lit.-social scien.	.000
		lit.-math.	scien.-math.	.000
			lit.-social scien.	.655
		lit.-social scien.	scien.-math.	.000
			lit.-math.	.655
LMINT	Tamhane	scien.-math	lit.-math.	.000
			lit.-social scien.	.000
		lit.-math.	scien.-math.	.000
			lit.-social scien.	.004
		lit.-social scien.	scien.-math.	.000
			lit.-math.	.004

Post-hoc results showed that there were significant mean differences (p<.05) between the VLINT scores of students from science-math. and lit.-math., from science-math. and lit.-social scien. branches. There were significant mean differences (p<.05) between the LMINT scores of students from scien.-math. and lit.-math., from scien.-

math. and lit.-social scien., from lit.-math. and lit.-social scien. branches. Table 4.20 gives the means of students' from each branch on the VLINT and LMINT.

Table 4.20 Means for variables related to null hypothesis 8

Dependent Variable	BRANCH	Mean
VLINT	scien.-math	12.278
	lit.-math.	13.728
	lit.-social scien.	13.953
LMINT	scien.-math	15.746
	lit.-math.	13.936
	lit.-social scien.	13.285

Tenth grade students from literature-social sciences branch perceived themselves stronger than students both from literature-math and science-math branches, and students from literature-math branch perceived themselves stronger than students from science-math branch on the VLINT. Tenth grade students from science-math branch perceived themselves stronger than students from both literature-math and literature-social sciences students, and students from literature-math branch perceived themselves stronger than students from literature-social sciences branch on the LMINT.

4.4.10 Null Hypothesis 9

The ninth null hypothesis was; 'There is no significant relationship between science achievement and self-estimated intelligence dimensions of 7th grade regular state school students.'

Bivariate correlations were computed to determine the relationships between the PSSCORE and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 7th grade students. The results are given in Table 4.21.

Table 4.21 Correlations for null hypothesis 9

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
SMEAN(PSSCORE)	.177*	.172*	.035	.050*	.203*	.147*	.231*

*p < .05

The results of the correlational analysis presented in Table 4.20 show that all of the correlations among the PSSCORE and the intelligence dimensions of 7th grade students were significant (p<.05), except the correlation between the PSSCORE and the VSINT, but the effect sizes were low, only for the INTERINT, it was medium. In general, the results suggest that among the 7th grade students as the perceptions of strength in the VLINT, LMINT, BKINT, and INTERINT increase the PSSCORE tends to increase.

4.4.11 Null Hypothesis 10

The last null hypothesis was; 'There is no significant relationship between physics achievement and self-estimated intelligence dimensions of 10th grade regular state school students.'

Bivariate correlations were computed to determine the relationships between PSSCORE and the seven intelligence dimensions of the VLINT, LMINT, VSINT, MINT, BKINT, INTRAINT, and INTERINT of 10th grade students. The results are given in Table 4.22.

Table 4.22 Correlations for null hypothesis 10

	VLINT	LMINT	VSINT	MINT	BKINT	INTRAINT	INTERINT
PSSCORE	-.084*	.196*	.020	.075*	.033	.049	.038

*p < .05

The results of the correlational analysis presented in Table 4.21 show that only the correlations among the PSSCORE and the VLINT, LMINT, and MINT of 10th grade students were significant, but the effect sizes were low. In general, the results suggest that as the students' perceptions of strength in the LMINT increase, PSSCORE increases.

4.5 Summary of the Results

- The strongest intelligence of all students, of 7th grade students, and of 10th grade students is the interpersonal intelligence.
- Significant grade level differences were observed between 7th and 10th grade students on the collective dependent variables of scores on self-estimated intelligence dimensions. When the follow-up results were examined, it was seen that 7th grade students perceived themselves stronger on the verbal-linguistic and logical-mathematical intelligences. Whereas, 10th grade students perceived themselves stronger on the visual-spatial, musical, bodily-kinesthetic, intrapersonal, and interpersonal intelligences.
- Significant gender differences were observed 7th grade female and male students on the verbal-linguistic, visual-spatial, musical, bodily-kinesthetic, and interpersonal intelligences. When the follow-up results were examined, it was seen that female students perceived themselves stronger than male students on all of these five intelligence dimensions.
- Significant gender differences were observed 10th grade female and male students on all seven intelligence dimensions. When the follow-up results were examined, it was seen that 10th grade female students perceived themselves stronger than male students on all the seven intelligence dimensions except the logical-mathematical intelligence.
- There is a significant negative correlation between 7th grade students' age and the bodily-kinesthetic intelligence. Older 7th grade students perceived themselves

weaker on the bodily-kinesthetic intelligence. The correlations among 7th grade students' age and the other intelligence dimensions were non-significant.

- There is a significant negative correlation among 10th grade students' age and the verbal-linguistic, bodily-kinesthetic, and interpersonal intelligences. Older 10th grade students perceived themselves weaker on the verbal-linguistic, bodily-kinesthetic, and interpersonal intelligences. The correlations among 7th grade students' age and the other intelligence dimensions were non-significant.
- There is a significant positive correlation among the 7th grade students' socio economic status and the seven intelligence dimensions. As the socio economic status increases, the students' perceptions of strength in the bodily-kinesthetic, intrapersonal, and interpersonal intelligence dimensions increase.
- There is a positive correlation between the 10th grade students' socio economic status and the bodily-kinesthetic and intrapersonal intelligences. As the socio economic status increases, the students' perceptions of strength in the bodily-kinesthetic and intrapersonal intelligences increase. The correlations among the 7th grade students' socio economic status and the other intelligence dimensions were non-significant.
- Significant branch differences were observed among 10th grade students on the collective dependent variables of scores on self-estimated intelligence dimensions of the verbal-linguistic and logical-mathematical. Students from literature-social sciences branch perceived themselves stronger than students both from literature-math and literature-social sciences branches, and students from literature-math branch perceived themselves stronger than students from science-math branch on the verbal-linguistic intelligence. Tenth grade students from science-math branch perceived themselves stronger than students from both literature-math and

literature-social sciences, and students from literature-math branch perceived themselves stronger than students from literature-social sciences on the logical-mathematical intelligence.

- There is a significant positive correlation between 7th grade students' science achievement and the verbal-linguistic, logical-mathematical, bodily-kinesthetic, and interpersonal intelligence dimensions. As the 7th grade students' science achievement increase, their perceptions' of strength in these dimensions increase.
- There is a significant positive correlation between 10th grade students' physics achievement and the logical-mathematical intelligence. As the students' perceptions of strength in the logical-mathematical intelligence increases, the physics achievement of 10th grade students increases.

CHAPTER 5

CONCLUSIONS, DISCUSSION AND IMPLICATIONS

This chapter consists of six sections. First section presents the summary of the research study. The second one is the conclusions based on the results. The third section is the discussion of the results. Internal and external validities of the study are given in the fourth and fifth sections, respectively. The sixth section points out implications of the study, and the last section presents recommendations for further studies.

5.1 Summary of the Research Study

In order to investigate the specified purposes of the study, 3721 seventh and tenth grade students were administered the MI Inventory during the first eight weeks of the fall 2003-2004 semester. To obtain the representative sample, stratified cluster random sampling integrated with convenience sampling was used. Both cross-sectional survey and casual-comparative studies were utilized during the course of this study.

5.2 Conclusions

Since the accessible population of the study was a large, randomized and stratified one, there is no limitation about the generalizability of the study to the accessible population. Hence, the conclusions presented below were selected from the results with medium and high effect sizes, and can easily be applied to the accessible population.

Findings of this study showed that there was a significant effect of grade level on students' self-estimated intelligence dimensions. Strengths and weakness of the students vary according to their grade level. Seventh grade students perceived themselves higher on verbal-linguistic and logical-mathematical intelligences, and tenth graders perceived themselves higher on the remaining five dimensions of intelligences. Also, significant differences found in female and male students' self-estimated intelligence dimensions for both two different grade levels. Seventh grade females perceived themselves to be higher than males in verbal-linguistic, visual-spatial, musical, bodily-kinesthetic, and interpersonal intelligences. Similarly, 10th grade females perceived themselves to be higher than males in all of the intelligence dimensions except the logical-mathematical intelligence.

The result of the study indicated significance differences on verbal-linguistic intelligence of 10th grade students coming from different branches, namely science-math, literature-math, and literature-social sciences branches. Students from literature-social science branch perceived themselves to be higher than the students from other two branches on verbal-linguistic intelligence, and students from science-math branch perceived themselves to be higher than students from other two branches on logical-mathematical intelligence.

The study also revealed significance positive correlation between science achievement and interpersonal intelligence of 7th graders, but when we look at the intelligence dimensions and physics achievement of 10th grade students, there were no significant correlations, when we considered only the correlations with medium and high effect sizes.

5.3 Discussion of the Results

Results of the data analysis indicated that students having different characteristics possess different combinations of the seven intelligences. This results support Gardner's argument that there is a need to recognize the students' multiple intelligences in order to view their learning differently. Meeting individual needs and offering variety of learning opportunities are the major goals of the MI theory. Being aware of the students' diverse profiles can help educators shape science curriculum and instruction to develop students' potential. Results of this study showed that not only there are significant differences in perceptions of intelligences among grade levels, but also there are significant differences in perceptions between females and males, students from different branches, different socio economic status, and ages.

When the results of this research were compared those of the previous ones, this research supports some of the findings, and differs from some of the others. Franzen (2000) made a survey about 407 fifth, sixth, and seventh grade students' self-perceptions of eight multiple intelligences, and the interpersonal and naturalistic intelligences yielded the highest mean score and verbal-linguistic intelligence yielded the lowest mean score among all grades of students. Similarly, Harms (1998) conducted a research with 644 third, seventh, and eleventh grade students, and he found that, of the eight intelligences, interpersonal and naturalistic intelligences yielded the highest mean scores, whereas verbal-linguistic and intrapersonal intelligences yielded the lowest mean scores among the entire student sample. In Özdemir's study (2002), the interpersonal intelligence was also found as the dominant intelligence of fourth graders. Interpersonal intelligence together with the intrapersonal intelligence scored highest also in the study of Chan (2001), who conducted a research with 192 grade seven to twelve students nominated by their schools to join the gifted program at the Chinese University of Hong Kong. Similar results obtained also in this study, the strongest intelligence was the interpersonal intelligence, and the weakest intelligence was the verbal-linguistic intelligence among the entire students' sample.

Franzen (2000) and Harms (1998) found that, seventh grade students' perceptions of most predominant intelligences were the interpersonal and naturalistic intelligences. Parallel to this findings, in this study seventh graders' most predominant intelligence was the interpersonal intelligence. However, different results were obtained about students' least dominant intelligences when compared with Franzen's (2000) study. In this study and Harm's (1998) study seventh grade students' least dominant intelligence was the intrapersonal intelligence. In Franzen's (2000) study, it was the verbal-linguistic intelligence.

Harms (1998) reported that students' perceptions of all eight intelligences by grade were significantly different. The findings of this study are in agreement with Harms' study, significant differences were found among seventh and tenth grade students self-estimated intelligence dimensions.

Chan (2001), Franzen (2000), Harms (1998), Rammstedt and Rammsayer (2000), and Synder (2000) found significant differences between females and males in multiple intelligence dimensions in different grade levels. The result of the first study indicated that in high school students, males rated themselves significantly higher than females in logical mathematical intelligence, whereas females rated themselves significantly higher than males in interpersonal intelligence. In the second study, significant differences were found in verbal-linguistic, musical, bodily-kinesthetic, intrapersonal, and interpersonal intelligences of fifth, sixth, and seventh grade female and male students, female students perceived themselves to be higher than males in all these five dimensions of intelligence, except the bodily-kinesthetic intelligence. Harms (1998) reported significant differences in verbal-linguistic, visual-spatial, musical, interpersonal, intrapersonal, and naturalistic intelligence of seventh grade female and male students. In his study, females perceived six of their intelligences to be significantly stronger than male classmates. According to Rammstedt and Rammsayer's (2000) study, males' self-estimates of logical-mathematical and visual-spatial intelligences were significantly higher as compared to the female sample of university students. On the other hand, self-estimates of musical and interpersonal intelligences of females were higher than males. Synder's (2000) study indicated that females perceived themselves stronger on intrapersonal, verbal-linguistic, musical, and interpersonal intelligences, whereas the male students perceived themselves stronger on bodily-kinesthetic, mathematical-logical, and visual-spatial intelligences. Significant gender differences found also in this study both for seventh and tenth grade students. Both seventh and tenth grade females rated themselves higher than males in all seven dimensions except the logical-mathematical intelligence, in this dimension males rated themselves to be higher than females.

There is no studies found in the literature examining the relationships between socio economic status, age, science/physics achievement and branch in school and the multiple intelligence dimensions, to compare the results with this study.

The most interesting finding in this and also in past studies is that the dominant intelligences varied from those to which both curriculum and assessment procedures are oriented; verbal-linguistic and logical-mathematical intelligences. Although schools emphasize these two dimensions of intelligences, students' perceptions of strength areas were different from these dimensions.

This study provided data that supported the practicability of the use of a self-report questionnaire to assesses the intelligence profiles of students in terms of the seven multiple intelligences. However, the MI theory suggests using intelligence-fair instruments for assessing relative strengths and weaknesses of students, but the development process of these instruments proved time consuming and costly. Moreover, there is little precedents to score performances resulted from using these instruments, and materials appropriate for one age group, gender, and social class may not be appropriate for the others (Gardner & Hatch, 1989). For this reasons instead of developing such intelligence fair instruments, an inventory was used to assess students' intelligence profiles. Using such a paper and pencil measure allowed only a narrow range of response of students, and limited the exploration of full spectrum of the multiple intelligences. Also, it might test interest rather than the ability as assessed through an actual performance.

5.4 Internal Validity of the Study

Internal validity of the study refers to the degree to which the observed differences on the dependent variables are directly related to the independent variables, not to extraneous variables that may affect the results of the research (Fraenkel & Wallen, 1996). Possible threats to internal validity and methods to cope with them were discussed in this section.

Lack of randomization and inability to manipulate the independent variable are the two major weaknesses of the casual comparative research. Since the groups are already formed, random assignments of subjects to groups is not possible. Manipulation of the independent variable is not possible also, as the groups have already been exposed to the independent variable.

The major threat to the internal validity of casual-comparative study is the subject characteristics threat. In this study the groups were randomly selected instead of individuals, hence many subject characteristics such as age, gender, socio economic status might affect the results of the study. Age, gender, and socio economic status (as measured by education level of mother, education level of father, and number of books at home) of students were also assessed together with the inventory, and included in the study as independent variables. Since the effect of theses variables on the dependent variables were investigated in the study, they were not controlled as threats.

Maturation could not be a threat to this study, since the data collection procedure lasts in eight weeks. It might be a threat if the study spanned a number of years. Since the tests were administered to all groups in similar conditions by the researcher, location and instrumentation cannot be threats to the study also.

Mortality could be a threat to the internal validity of this study. To control this threat, missing data analysis was made for all of the variables included in the analysis.

Furthermore, confidentiality was not a problem in the study. The names of the participants were taken for the statistical analysis but they were not used anywhere else, only the researcher knows them.

5.5 External Validity

The external validity is the extent to which the results of the study can be generalized. There are two types of external validity: population generalizability and ecological generalizability. Population generalizability refers to the degree to which a sample represents the population of interest, and ecological generalizability refers to the degree to which the results of a study can be extended to other settings or conditions (Fraenkel & Wallen, 1996).

Subjects of this study were randomly selected from the accessible population and also the sample size was large enough, so there is no limitation to generalize the findings of the study. The results and conclusions of the study can easily be applied to the accessible population.

All the administration procedure of this study took place in ordinary classrooms during regular class hours, and there were possibly no remarkable differences among the environmental conditions. Hence, it was believed that external effects were sufficiently controlled by the settings used in the study.

5.6 Implications of the Study

According to the findings of the study and the previous studies done, following suggestions can be offered:

1. The results of the study together with the past studies showed that students possess different combinations of the multiple intelligences, and process information in many different ways. Educators should recognize these different profiles of students in order to view learning differently.

2. The findings indicated that students feel generally competence in interpersonal intelligence, but struggle within the verbal-linguistic intelligence. Also, there was a significant positive correlation found between students' interpersonal intelligence and science achievement; as the students' perceptions of interpersonal intelligence strengthens, their achievement in science increases. This information calls educators to encourage students to using strengths in the learning process, and to assist them strengthen and develop areas of weaknesses. Hence, facilitating meaningful activities that respond to the students' self-perceptions is imperative. For this purpose, cooperative, collaborative, and peer activities can be used to operate the interpersonal intelligence for more effective learning of science of students.

3. Students' awareness about strengths and weaknesses of themselves is as important as the teachers' recognition of students' profiles. Therefore, teachers should provide students being aware of their own intelligence profiles. Apprenticeship programs can be made at schools for this purpose with community experts to teach students real world skills.

4. School administrators and teachers should provide continuous staff development opportunities to be more informed about the multiple intelligences.

5. The general approach of how teachers teach should shift to how students learn. Therefore, considerable change should be made to change current practices in education, which emphasizes verbal-linguistic and logical-mathematical intelligences, and instruction should no longer be assumed to reach the majority of students by using these two dimensions.

6. Besides instruction, classroom assignments and tests should include multiple dimensions of intelligence and provide for all students to succeed.

7. In order to provide more accurate representations of students' abilities and to reveal deficiencies that predict difficulties learners may encounter, alternative assessments should be made.

8. Since the females and males perceived themselves differently, teachers should provide activities that assist in meeting specific gender needs. And teachers together with administrators should also seek to find out why female and male students perceive themselves differently in different intelligence dimensions.

9. Results showed that high school students from literature-social sciences branch perceived themselves higher on verbal-linguistic intelligence as compared to the students from other two branches. And students from science-math branch perceived themselves higher on logical-mathematical intelligence as compared to the students from other two branches. It can be simply seen that literature-social sciences branch includes courses depending on using mostly verbal-linguistic abilities. Similarly, science-math branch includes courses depending on using mostly logical-mathematical abilities when we compared with the other two branches. Therefore, we can conclude that by providing opportunities and activities to use all of the multiple intelligences, students' competence in all of these areas can be developed.

5.7 Recommendations for Further Research

This study has suggested a variety of topics for further studies. These are briefly as follows:

1. It would be beneficial to repeat this study with different grade levels to see if some of the differences in the perceptions of the intelligence dimensions of females and males change.

2. It would be beneficial to repeat this study including students from different types of schools to see whether perceptions change.

3. There is a need for longitudinal studies in MI to see whether or not intellectual tendencies shift over different phases of one's life or not.

4. Further studies are needed regarding the impact of the multiple intelligences theory on curriculum, course design, and instructional practices of science/physics education.

5. Future studies could investigate the effect of the MI theory on students' learning, and also search for the evidences for effectiveness of the theory on science/physics education.

6. Future studies could be made about teachers' attitude toward the MI theory, and studies should be done to train teachers about the MI theory and implementation of the theory in science contexts.

7. Besides a self-report survey, future studies could include a parent inventory to assess parent perceptions of their children's multiple intelligences, and the relationships between the two could be investigated.

8. Future studies could administer the MI inventory many times throughout the school year and it could be supported with the student interview to obtain more accurate intelligence profiles of students.

9. Future studies could assess the students MI profiles with performance based measures besides MI inventory, and could investigate the relationship between self-perceptions and performances in different intelligence dimensions.

10. Future studies could examine the effect of MI based lessons to the attitude of students toward science/physics lessons.

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APPENDIX A

MI INVENTORY

Sevgili Öğrenci,

Son yıllarda yapılan bilimsel çalışmalar zekanın bir çok alandan oluştuğunu ortaya çıkarmıştır. Çoklu Zeka Kuramına göre zeka, mantıksal-matematiksel, sözel-dilsel, görsel-uzaysal, bedensel-kinestetik, müziksel-ritmik, sosyal, öze-dönük ve doğacı zeka olmak üzere sekiz ayrı alandan oluşmaktadır. Herbirimiz bu alanların bazılarında güçlü iken bazılarında daha zayıf olabiliriz, fakat hepimiz bu alanların herbirinde az ya da cok yeteneğe sahibiz.

Bu anketle Ankara ilinde öğrenim gören ilköğretim 7. ve lise 10. sınıf öğrencilerinin güçlü ve zayıf oldukları zeka alanları belirlenecek ve çalışmanın sonuçları ileride Fen Bilimleri ile ilgili derslerin sizlerin yetenek alanlarına göre verilmesi için kullanılacaktır. Bu nedenle anket sorularını düşünerek ve içtenlikle cevaplamanız son derece önemlidir.

Anketin verileri Orta Doğu Teknik Üniversitesinde yürütülmekte olan bir yüksek lisans çalışmasında kullanılacak ve ankete katılanların isimleri kesinlikle gizli tutulacaktır.

Katılımınız için teşekkürler.

Emel Uysal
ODTÜ Fizik Eğitimi Yüksek Lisans Öğrencisi
ODTÜ İlköğretim Bölümü Araştırma Görevlisi

Lütfen ankete başlamadan önce size dağıtılan optik formların üzerindeki sorulara cevap veriniz. Daha sonra ankette numaralandırılan her cümlenin sizin sahip oldugunuz bir davranış şekli olup olmadığını düşününüz ve her bir soru için optik form üzerinde verilen

Evet Kararsızım Hayır

şıklarından birini işaretleyiniz.

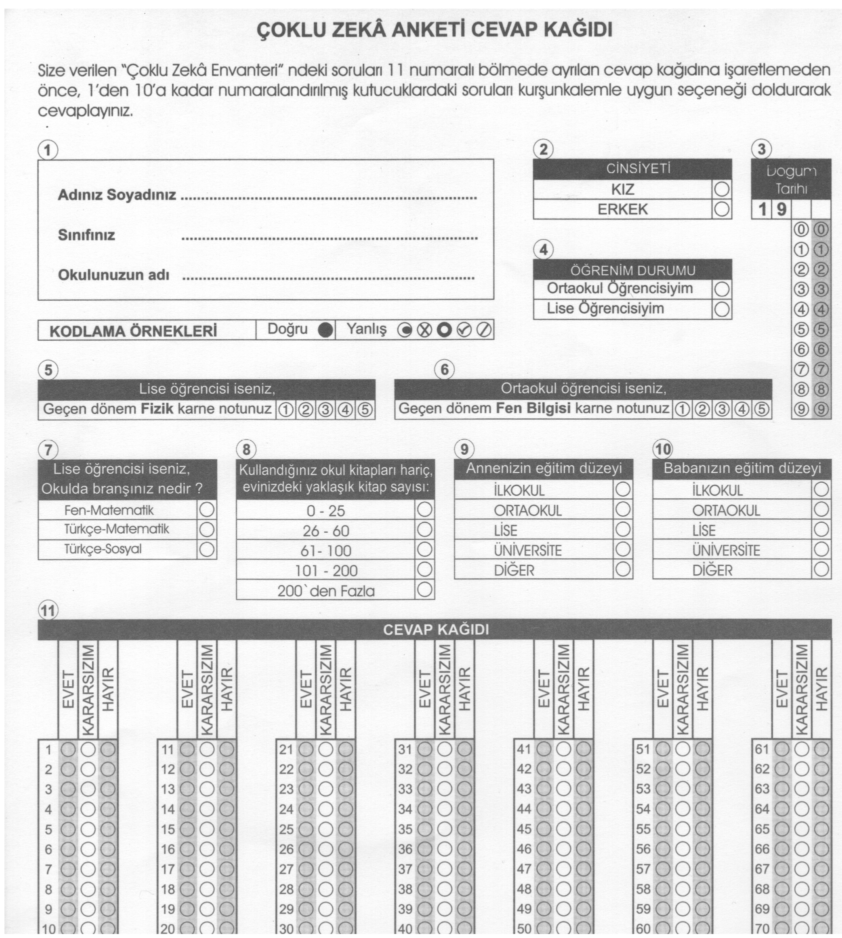
ÇOKLU ZEKA ANKETİ

1. Adam asmaca vs. gibi kelime oyunlarından hoşlanırım.
2. Başkalarına bir beceri veya aktivite öğretmekten zevk alırım.
3. Başkalarının ruh hali ve mizaçlarına göre davranırım.
4. Bir beceriyi yaparak öğrenirim.
5. Bir kelimeden başka bir kelime türetme gibi sözcük oyunları oynamayı severim.
6. Bir müzik aleti çalmak/çalabilmek bana zevk verir.
7. Bir odanın nasıl düzenlendiği her zaman dikkatimi çeker.
8. Bir şey öğrenirken etrafta yürümek hoşuma gider.
9. Çoğunlukla birçok şey ya doğrudur ya da yanlıştır.
10. Çok gelişmiş bir kelime hazinem vardır.
11. Daha önce bana söylenmiş şeyleri harfi harfine hatırlarım.
12. Duvardaki resmin düzgün asılıp asılmadığı dikkatimi çeker.
13. Ellerimle bir yapıt ortaya çıkarmaktan zevk alırım.
14. Etrafımdaki seslere duyarlıyım (Örn. Seslerdeki ritmi hemen algılarım).
15. Film seyretmek, fotoğraf ve slaytlara bakmaktan hoşlanırım.
16. Fiziksel aktivite gerektiren şeylerden zevk alırım.
17. Fotoğraf makinesi kullanmaktan hoşlanırım.
18. Gelir ve giderlerimi dengeli tutarım.
19. Genelde birileriyle konuşurken onlara dokunurum.
20. Genelde kendime güvenirim.
21. Genellikle kağıt üzerine resimler çizer ya da karalamalar yaparım.
22. Grupla değil tek başıma en iyi öğrenirim.
23. Harita ve grafikleri çok kolay okurum.
24. Her işimde planlı ve programlıyım.
25. Her konuda kendime has tavır sergilerim.
26. Her şeyde mantığa dayalı bir düzen olması hoşuma gider.
27. Her şeyin düzenli, açık ve anlaşılır olmasından hoşlanırım.
28. Her zaman mantıklı davranırım.
29. İçimden şarkılar mırıldanırım.
30. İçinde hareket olan aktivitelerden zevk alırım.
31. İlişkilerimde bağımsız kişilik sergilerim.
32. İnsancıl bir kişiyim.
33. İnsanları organize etmekten hoşlanırım.
34. İnsanların ya da nesnelerin benzerlerini çizebilirim.
35. İnsanlarla bir arada olmaktan zevk alırım.
36. İnsanlarla iletişim kurmayı severim.
37. İsimler, tarihler ve kimi önemsiz bilgileri hatırlarım.
38. İyi bir vücut koordinasyonum vardır.
39. Kendi düşünce ve hislerimi tahlil edebilirim.

40. Kendi kendimi motive ederim.
41. Kendimi başkalarının yerine koyarak onların duygularını anlayabilirim.
42. Kişisel problemlerim için nadiren yardım isterim.
43. Kitaplardan hoşlanırım.
44. Konuşurken canlı ve hareketliyim.
45. Mantık yürütmeyi gerektiren bilmecelerden hoşlanırım.
46. Mantıklı tahminler yürütebilirim.
47. Matematik ve/veya fen bilimlerinden hoşlanırım.
48. Mektup vb. şeyleri yazmaktan zevk alırım.
49. Müziğin temposunu takip etmek benim için çok kolaydır.
50. Müzik dinlemekten hoşlanırım.
51. Müzik duyduğumda ben de söylerim.
52. Müzikteki yanlış notayı fark edebilirim.
53. Nesnelere dokunmaktan hoşlanırım.
54. Nesneleri görerek hatırlarım.
55. Özel bir insanım ve bu iç dünyam da benim hoşuma gidiyor.
56. Renklere karşı duyarlıyım.
57. Satranç gibi taktik oyunlarından hoşlanırım.
58. Ses titreşimlerine duyarlıyım.
59. Sık sık radyo veya TV de müzik dinlerim.
60. Sosyal durumları iyi algılarım.
61. Sosyal olaylardan hoşlanırım.
62. Şarkı söylemekten hoşlanırım.
63. Tarih ve/veya edebiyattan zevk alırım.
64. Tek başıma bir etkinlikte bulunmaktansa grup etkinliklerini tercih ederim.
65. Tek başıma yaptığım aktivitelerden hoşlanıyorum.
66. Uzun süre sakince oturamam.
67. Yalnız başıma zaman geçirmekten hoşlanırım.
68. Yazarken ya da konuşurken yaratıcı gücüm ortaya çıkar.
69. Yönümü kolaylıkla bulabilirim.
70. Zevk için okumaktan hoşlanırım.

APPENDIX B

OPTICAL FORM



ÇOKLU ZEKÂ ANKETİ CEVAP KAĞIDI

Size verilen "Çoklu Zekâ Envanteri" ndeki soruları 11 numaralı bölmede ayrılan cevap kağıdına işaretlemeden önce, 1'den 10'a kadar numaralandırılmış kutucuklardaki soruları kurşunkalemle uygun seçeneği doldurarak cevaplayınız.

(1)

Adınız Soyadınız ....

Sınıfınız ....

Okulunuzun adı ....

KODLAMA ÖRNEKLERİ | Doğru | Yanlış

(2) CİNSİYETİ

- KIZ
- ERKEK

(3) Doğum Tarihi

1 9

0 1 2 3 4 5 6 7 8 9 | 0 1 2 3 4 5 6 7 8 9

(4) ÖĞRENİM DURUMU

- Ortaokul Öğrencisiyim
- Lise Öğrencisiyim

(5) Lise öğrencisi iseniz,
Geçen dönem **Fizik** karne notunuz 1 2 3 4 5

(6) Ortaokul öğrencisi iseniz,
Geçen dönem **Fen Bilgisi** karne notunuz 1 2 3 4 5

(7) Lise öğrencisi iseniz, Okulda branşınız nedir ?

- Fen-Matematik
- Türkçe-Matematik
- Türkçe-Sosyal

(8) Kullandığınız okul kitapları hariç, evinizdeki yaklaşık kitap sayısı:

- 0 - 25
- 26 - 60
- 61- 100
- 101 - 200
- 200`den Fazla

(9) Annenizin eğitim düzeyi

- İLKOKUL
- ORTAOKUL
- LİSE
- ÜNİVERSİTE
- DİĞER

(10) Babanızın eğitim düzeyi

- İLKOKUL
- ORTAOKUL
- LİSE
- ÜNİVERSİTE
- DİĞER

(11) CEVAP KAĞIDI

EVET | KARARSIZIM | HAYIR

1	11	21	31	41	51	61
2	12	22	32	42	52	62
3	13	23	33	43	53	63
4	14	24	34	44	54	64
5	15	25	35	45	55	65
6	16	26	36	46	56	66
7	17	27	37	47	57	67
8	18	28	38	48	58	68
9	19	29	39	49	59	69
10	20	30	40	50	60	70

APPENDIX C

CORRESPONDENCE

ORTAÖĞRETİM FEN VE MATEMATİK ALANLARI EĞİTİMİ BÖLÜM BAŞKANLIĞINA,

Orta Doğu Teknik Üniversitesi Eğitim Fakültesi, Orta Öğretim Fen ve Matematik Alanları Eğitimi Bölümünde yüksek lisans öğrencisiyim. 'Öğrencilerin Çoklu Zeka Boyutlarını Belirlemeye Yönelik Bir Tarama, ve Bu Boyutlarla Fizik Başarısı Arasındaki İlişkiler' konulu, özeti **Ek 1'**de verilen bir yüksek lisans tezi hazırlamaktayım. Tezim gereği yapmayı planladığım araştırma, Çankaya, Yenimahalle ve Keçiören ilçelerinden rastgele seçilen19 devlet lisesi ve 32 devlet ilköğretim okulunun 7. ve 10. sınıflarında uygulama yapmayı gerektirmektedir. Araştırma kapsamına alınan tüm öğrencilere bir Çoklu Zeka Envanteri **(Ek 2)** uygulanacaktır.

Çoklu Zeka Anketi kullanılarak öğrencilerin zeka alanlarının belirlenebilmesi için 1 saatlik uygulama izni gerekmektedir. Bu çalışmada yer alacak okulların ve öğrencilerin isimleri hiçbir şekilde açıklanmayacak, kesinlikle gizli tutulacaktır. Çalışma kapsamında bulunacak okulların düzeninin bozulmaması için gerekli titizlik gösterilecektir.

2002-2003 Eğitim ve Öğretim yılı 2. dönemi ve 2003-2004 Eğitim ve Öğretim yılı 1. Döneminde **Ek 3**'de adları verilen okullarda araştırma uygulamasının yapılabilmesi için gereğinin yapılmasını saygılarımla arz ederim.

Emel Uysal

ODTÜ Eğitim Fakültesi
Orta Öğretim Fen ve Mtematik Alanları Eğitimi Yüksek Lisans Öğrencisi
İlköğretim Bölümü Araştırma Görevlisi
Oda No: 121 Tel: 210 40 66 ANKARA

Ek 3: UYGULAMA İÇİN İZİN ALINMASI İSTENEN OKULLAR

Çankaya İlçesi Okul Listesi
7 Lise
12 İlköğretim Okulu

Keçiören İlçesi Okul Listesi
6 Lise
10 İlköğretim Okulu

Yenimahalle İlçesi Okul Listesi
6 Lise
10 İlköğretim Okulu

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : Kültür
SAYI : B.08.4.MEM.4.06.00.11-070/ 754
KONU : Tez Çalışması

05/03/2003

VALİLİK MAKAMINA
ANKARA

İLGİ: Orta Doğu Teknik Üniversitesi, Öğrenci İşleri Dairesi Başkanlığı'nın 17.02.2003 tarih ve 887/2371 sayılı yazısı.

Orta Doğu Teknik Üniversitesi; Fen ve Matematik Alanları Eğitimi EABD Yüksek Lisans öğrencisi Emel UYSAL, "Öğrencilerin Çoklu Zeka Boyutlarını Belirlemeye Yönelik bir Tarama ve bu Boyutlarla Fizik Başarısı Arasındaki İlişkiler" başlıklı yüksek lisans tez çalışması ile ilgili ekte sunulan anketi; İlimiz Çankaya, Yenimahalle ve Keçiören İlçelerine bağlı ekli listede isimleri belirtilen okullarda uygulayabilmeleri için ilgi yazı ile izin istenmektedir.

Kamu kurum ve kuruluşlarında uygulanan Devlet Memurları Kılık Kıyafet Yönetmeliği ve Okullarda uyulması gereken usul ve esaslara özen gösterilmesi, sonucundan Müdürlüğümüze bilgi verilmesi kaydıyla söz konusu istek uygun görülmektedir.

Makamlarınızca da uygun görüldüğü takdirde, Olurlarınıza arz ederim.

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OLUR
05/03/2003

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