THE EFFECT OF ENRICHED COURSE MATERIALS ABOUT MOTION ON NINETH GRADE SIGHTED AND TOTALLY BLIND STUDENTS' ACHIEVEMENT, MOTIVATION, ATTITUDE, PERCEPTION OF LEARNING ENVIRONMENT AND INTERACTION IN INCLUSIVE CLASSES

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

BY

MUSTAFA ŞAHIN BÜLBÜL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
SECONDARY SCIENCE AND MATHEMATICS EDUCATION

MAY 2014

Approval of the thesis:

THE EFFECT OF ENRICHED COURSE MATERIALS ABOUT MOTION ON NINETH GRADE SIGHTED AND TOTALLY BLIND STUDENTS' ACHIEVEMENT, MOTIVATION, ATTITUDE, PERCEPTION OF LEARNING ENVIRONMENT AND INTERACTION IN INCLUSIVE CLASSES

submitted by **MUSTAFA ŞAHİN BÜLBÜL** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Secondary Science and Mathematics Education Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Prof. Dr. Ömer Geban _____
Head of Department, **Secondary Science and Mathematics Education Dept.**

Assoc. Prof. Dr. Ali Eryılmaz _____
Supervisor, **Sec. Sci. and Math. Edu.Dept., METU**

Examining Committee Members:

Prof. Dr. Ayşegül ATAMAN _____
Special Education Dept., European University of Lefke

Assoc. Prof. Dr. Ali Eryılmaz _____
Sec. Sci. and Math. Edu.Dept., METU

Prof. Dr. Bilal GÜNEŞ _____
Sec. Sci. and Math. Edu.Dept., Gazi University

Assist. Prof. Dr. Ömer F. Özdemir _____
Sec. Sci. and Math. Edu.Dept., METU

Assist. Prof. Dr. Haki PEŞMAN _____
Elementary Education Dept., Fırat University

Date: 15.05.2014

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: Mustafa Şahin BÜLBÜL

Signature :

ABSTRACT

THE EFFECT OF ENRICHED COURSE MATERIALS ABOUT MOTION ON NINETH GRADE SIGHTED AND TOTALLY BLIND STUDENTS' ACHIEVEMENT, MOTIVATION, ATTITUDE, PERCEPTION OF LEARNING ENVIRONMENT AND INTERACTION IN INCLUSIVE CLASSES

Bülbül, Mustafa Şahin
Ph.D., Department of Secondary Science and Mathematics Education
Supervisor: Assoc. Prof. Dr. Ali Eryılmaz
May, 2014, 423 pages

The purpose of this study is to compensate the totally blind students' disadvantage position in physics courses by developing course materials which let them use different senses and investigate the effect of these materials on the totally blind and sighted students' achievement, motivation and attitude towards the physics course and perceptions about their learning environment. In accordance with this purpose, a quasi-experimental study was conducted in two independent cases. These cases are selected because there was no other school in Ankara which includes totally blind student in 9th grades. Student identification form, motion achievement test, and motivation and attitude questionnaire are given to both experimental and control groups. Both groups followed the formal textbook but the experimental group which the totally blind student is member of this group additionally used enriched course

materials. During the treatment, totally blind students are observed in terms of their interaction types and frequencies. At the end of the treatment additional to post-tests, a learning environment questionnaire and a form about the students' interaction are given to all groups.

Descriptive statistics and some effect size values indicated that the totally blind students and their friends in the experimental group have higher achievement than students in the control groups. Moreover, their motivation and attitude towards the physics course and perceptions about their learning environment increase positively. On the other hand, using only textbook change the all control group students' motivation and attitude towards the physics course and perceptions about learning environment negatively. It was observed that the totally blind students used course materials, asked questions, answered, commented, and gave examples during the treatment in motion unit. Based on the success of enrich course materials, this study suggest to develop more materials which support the disadvantaged students like blinds for inclusive classes.

Keywords: Physics Education, Blind students, Inclusive education, Motion, Material development, Achievement, Motivation, Attitude, Learning environment, and Interaction.

ÖZ

HAREKET KONUSUNDA ZENGİNLEŞTİRİLMİŞ DERS MATERYALLERİNİN DOKUZUNCU SINIF GÖREN VE TOTAL GÖREMEYEN ÖĞRENCİLERİN BAŞARILARINA MOTİVASYONLARINA, TUTUMLARINA ÖĞRENME ORTAMLARI HAKKINDAKİ ALGILARINA VE KAYNAŞTIRMALI SINIFLARDAKİ ETKİLEŞİMLERİNE OLAN ETKİSİ

Bülbül, Mustafa Şahin
Doktora, Ortaöğretim Fen ve Matematik Alanları Eğitimi Bölümü
Tez Yöneticisi: Doç. Dr. Ali Eryılmaz
Mayıs, 2014, 423 sayfa

Bu çalışmanın amacı, görme engelli öğrencilerin dezavantajlı konumunun kısmen de olsa telâfi etmek için onların farklı duyularını kullanmalarına izin veren ders materyallerini geliştirmek ve bu materyallerin total görme engelli ve gören öğrencilerin başarılarına, fizik dersine karşı tutum ve motivasyonlarına ve öğrenme ortamları hakkındaki algılarına etkisini araştırmaktır. Bu amaç doğrultusunda, iki bağımsız ortamda yarı deneysel bir çalışma yürütülmüştür. Bu ortamlar 9. sınıfta total görme engelli öğrenci içeren başka okul olmadığı için seçilmiştir. Öğrenci tanıma formu, hareket başarı testi, motivasyon ve tutum anketi gibi veri toplama araçları deney ve kontrol gruplarına birlikte verilmiştir. Her iki grupta resmi ders kitabını takip etmiştir ama total görme engelli olan öğrencinin mensubu olduğu deney grubu ilave olarak zenginleştirilmiş ders materyallerini kullanmıştır.

Uygulama süresince total görme engelli öğrenciler etkileşim türleri ve frekansları açısından gözlemlenmiştir. Uygulama sonunda son-testlere ek olarak; öğrenme ortamı anketi ve öğrencilerin etkileşimi hakkında bir form tüm gruplara verilmiştir.

Betimleyici istatistik ve bazı etki büyüklüğü değerleri göstermiştir ki deney grubundaki total görme engelli öğrenciler ve arkadaşları kontrol gruplarındaki öğrencilerden daha başarılı olmuştur. Üstelik fizik dersine karşı tutumları ve motivasyonları ve öğrenme ortamı hakkındaki algıları olumlu biçimde değişmiştir. Öte yandan sadece ders kitabı kullanmak tüm kontrol gruplarındaki öğrencilerin fizik dersine karşı motivasyon ve tutum ile öğrenme ortamı algılarını olumsuz biçimde etkilemiştir. Total görme engeli olan öğrencilerin hareket ünitesindeki uygulama boyunca daha fazla ders materyali kullandığı, soru sorduğu, cevap verdiği, yorumladığı ve örnek verdiği gözlemlenmiştir. Zenginleştirilmiş ders materyallerinin başarısına dayanarak bu tez, kaynaştırmalı ortamlar için görme engelli öğrenciler gibi dezavantajlı öğrencileri destekleyen daha fazla materyalin geliştirilmesini önermektedir.

Anahtar Kelimeler: Fizik Eğitimi, Görme engelli öğrenciler, Kaynaştırmalı eğitim, Hareket kavramı, Materyal geliştirme, Başarı, Motivasyon, Tutum, Öğrenme ortamı ve etkileşim.

To you as a reader.

ACKNOWLEDGEMENT

I would like to thank Ali Eryılmaz, Ayşegül Ataman, Ömer Faruk Özdemir, Haki Peşman, Bilal Güneş, Ömer Geban, Salih Ateş, Duygu Bülbül, Tarık Emre Bülbül, Mehmet Emin Bülbül, Şerife Bülbül, Claire Özel, Belkıs Garip, Mahmut Kertil, Ulaş Üstün, Demet Kırbulut, Kübra Eryurt, Özlem Oktay, Dilber Demirtaş, Ufuk Yıldırım, Giray Berberoğlu, Behiye Ubuz, Yezdan Boz, Ercan Kiraz, Safure Bulut, Bülent Çetinkaya, Ayhan Kürşat Erbaş, Esen Uzuntiryaki Kondakçı, Kürşat Çağıltay, Cezmi Ünal, Sevda Serdelen Damar, Cansel Kadıoğlu, Rıdvan Elmas, Zülal Şahin, Ümmülsüm Cansu Kurt, Nuran Ece Eren, Funda Arslan, Sabiha Sunar, Demet Yıldıran, Mustafa Tüysüz, Ayşegül Tarkın, Oktay Bektaş, Ali İhan Mut, Murat Kol, Savaş Pamuk, Himmet Korkmaz, Emine Hatun Diken, Tufan İnaltekin, Yasin Ünsal, Uygar Kanlı, Sevim Sevgi, Ayla Çetin Dindar, Harika Özge Arslan, Gülsüm Gül Cömert, Elif Selcan Kutucu, Betül Ekiz, Erkan Yeşiltaş, Beril Yılmaz, Şule Dönertaş, Eralp Bahçivan, Serkan Kapucu, Sevgi İpekçioğlu, Duygu Ören Vural, Fulya Kula, Emel Topbaş Tat, Fatma Nur Akın, Leyla Özdemir, Cendel Karaman, Ali Sağdıç, Semra Sungur, Jale Çakıroğlu, Erdinç Çakıroğlu, Sündüs Yerdelen, Ramazan Sak, Şule Alıcı, Aysun Öztuna Kaplan, Sinan Canan, Oktay Taşkın, Zeynep Gürel, Sevgi Aydın, Orhan Karamustafaoğlu, Vedat Bayraktar, Gökçe Kılıçoğlu, Eray Şentürk, Pervin Ünlü Yavaş, Esra Macaroğlu Akgül, Nejla Yürük, Nevzat Yiğit, Ahmet İlhan Şen, Gül Aktaş, Ahmet Kayıp, Mustafa Karadağ, and Dekant Kıran.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

AGFI : Adjusted Goodness of Fit Index

AT : After Treatment

BPre-ACHMO : Totally Blind Students' Pre Achievement Motivation

BPre-COOP : Totally Blind Students' Pre Cooperation

BPre-EQU : Totally Blind Students' Pre Equity

BPre-INN : Totally Blind Students' Pre Investigation

BPre-INT : Totally Blind Students' Pre Involvement

BPre-IMP : Totally Blind Students' Pre Importance of Physics

BPre-MAQ : Totally Blind Students' Pre Motivation and Attitude Questionnaire

BPre-MAT : Totally Blind Students' Pre Motion Achievement Test

BPre-SCON : Totally Blind Students' Pre Student-Concept

BPre-SEFF : Totally Blind Students' Pre Self-Efficacy

BPre-SINT : Totally Blind Students' Pre Situational Interest

BPre-STUMO : Totally Blind Students' Pre Student Motivation

BPre-SRCO : Totally Blind Students' Pre Student Cohesiveness

BPre-ANX : Totally Blind Students' Pre Test Anxiety

BPre-TAOR : Totally Blind Students' Pre Task Orientation

BPre-TESU : Totally Blind Students' Pre Teacher Support

BPre-WIHIC : Totally Blind Students' Pre What Is Happening In the Class

BPost-ACHMO : Totally Blind Students' Post Achievement Motivation

BPost-COOP : Totally Blind Students' Post Cooperation

BPost-EQU : Totally Blind Students' Post Equity

BPost-INN : Totally Blind Students' Post Investigation

BPost-INT : Totally Blind Students' Post Involvement

BPost-IMP : Totally Blind Students' Post Importance of Physics

BPost-MAQ : Totally Blind Students' Post Motivation and Attitude Questionnaire

BPost-MAT : Totally Blind Students' Post Motion Achievement Test

BPost-SCON : Totally Blind Students' Post Student-Concept

BPost-SEFF : Totally Blind Students' Post Self-Efficacy

BPost-SINT : Totally Blind Students' Post Situational Interest

BPost-STUMO : Totally Blind Students' Post Student Motivation

BPost-SRCO : Totally Blind Students' Post Student Cohesiveness

BPost-ANX : Totally Blind Students' Post Test Anxiety

BPost-TAOR : Totally Blind Students' Post Task Orientation

BPost-TESU : Totally Blind Students' Post Teacher Support

BPost-WIHIC : Totally Blind Students' Post What Is Happening In the Class

BT : Before Treatment

CM : Course Materials

CFA : Confirmatory Factor Analsis

CPre-ACHMO : Control Group Students' Pre Achievement Motivation

CPre- COOP : Control Group Students' Pre Cooperation

CPre-EQU : Control Group Students' Pre Equity

CPre-INN : Control Group Students' Pre Investigation

CPre-INT : Control Group Students' Pre Involvement

CPre-IMP : Control Group Students' Pre Importance of Physics

CPre-MAQ : Control Group Students' Pre Motivation and Attitude Questionnaire

CPre-MAT : Control Group Students' Pre Motion Achievement Test

CPre- SCON : Control Group Students' Pre Student-Concept

CPre- SEFF : Control Group Students' Pre Self-Efficacy

CPre-SINT : Control Group Students' Pre Situational Interest

CPre-STUMO : Control Group Students' Pre Student Motivation

CPre-SRCO : Control Group Students' Pre Student Cohesiveness

CPre-ANX : Control Group Students' Pre Test Anxiety

CPre-TAOR : Control Group Students' Pre Task Orientation

CPre-TESU : Control Group Students' Pre Teacher Support

CPre-WIHIC : Control Group Students' Pre What Is Happening In the Class

CPost-ACHMO : Control Group Students' Post Achievement Motivation

CPost-COOP : Control Group Students' Post Cooperation

CPost-EQU : Control Group Students' Post Equity

CPost-INN : Control Group Students' Post Investigation

CPost-INT : Control Group Students' Post Involvement

CPost-IMP : Control Group Students' Post Importance of Physics

CPost-MAQ : Control Group Students' Post Motivation and Attitude Questionnaire

CPost-MAT : Control Group Students' Post Motion Achievement Test

CPost-SCON : Control Group Students' Post Student-Concept

CPost-SEFF : Control Group Students' Post Self-Efficacy

CPost-SINT : Control Group Students' Post Situational Interest

CPost-STUMO : Control Group Students' Post Student Motivation

CPost-SRCO : Control Group Students' Post Student Cohesiveness

CPost-ANX : Control Group Students' Post Test Anxiety

CPost-TAOR : Control Group Students' Post Task Orientation

CPost-TESU : Control Students' Post Teacher Support

CPost-WIHIC : Control Group Students' Post What Is Happening In the Class

DT : During Treatment

ECM : Enriched Course Materials

EPre-ACHMO : Experimental Group Students' Pre Achievement Motivation

EPre-COOP : Experimental Group Students' Pre Cooperation

EPre-EQU : Experimental Group Students' Pre Equity

EPre-INN : Experimental Group Students' Pre Investigation

EPre-INT : Experimental Group Students' Pre Involvement

EPre-IMP : Experimental Group Students' Pre Importance of Physics

EPre-MAQ : Experimental Group Students' Pre Motivation and Attitude Questionnaire

EPre-MAT : Experimental Group Students' Pre Motion Achievement Test

EPre-SCON : Experimental Group Students' Pre Student-Concept

EPre-SEFF : Experimental Group Students' Pre Self-Efficacy

EPre-SINT : Experimental Group Students' Pre Situational Interest

EPre-STUMO : Experimental Group Students' Pre Student Motivation

EPre-SRCO : Experimental Group Students' Pre Student Cohesiveness

EPre-ANX : Experimental Group Students' Pre Test Anxiety

EPre-TAOR : Experimental Group Students' Pre Task Orientation

EPre-TESU : Experimental Group Students' Pre Teacher Support

EPre-WIHIC : Experimental Group Students' Pre What Is Happening In the Class

EPost-ACHMO : Experimental Group Students' Post Achievement Motivation

EPost-COOP : Experimental Group Students' Post Cooperation

EPost-EQU : Experimental Group Students' Post Equity

EPost-INN : Experimental Group Students' Post Investigation

EPost-INT : Experimental Group Students' Post Involvement

EPost-IMP : Experimental Group Students' Post Importance of Physics

EPost-MAQ : Experimental Group Students' Post Motivation and Attitude Questionnaire

EPost-MAT : Experimental Group Students' Post Motion Achievement Test

EPost-SCON : Experimental Group Students' Post Student-Concept

EPost-SEFF : Experimental Group Students' Post Self-Efficacy

EPost-SINT : Experimental Group Students' Post Situational Interest

EPost-STUMO : Experimental Group Students' Post Student Motivation

EPost-SRCO : Experimental Group Students' Post Student Cohesiveness

EPost-ANX : Experimental Group Students' Post Test Anxiety

EPost-TAOR : Experimental Group Students' Post Task Orientation

EPost-TESU : Experimental Students' Post Teacher Support

EPost-WIHIC : Experimental Group Students' Post What Is Happening In the Class

GPA : Grade Point Average

GFI : Goodness of Fit Index

HCI : Human-Computer Interactions

IBX : Individual Students' Interaction Scores of X^{th} Item Before Motion Unit

IDX : Individual Students' Interaction Scores of X^{th} Item During Motion Unit

MAGA : Minds-on Audio-Guided Activities)

MAT : Motion Achievement Test

MAQ : Motivation and Attitude Questionnaire

MBL : Micro-computer Based Laboratories

NCO : Number of Common Observations

NTO : Number of Total Observations

OCLI : Observation Check List of Interaction

PA : Being Physically Active

PGFI : Parsimony Goodness of Fit Index

PNFI : Parsimony Normed Fit Index

RMSEA : Root Mean Square Error of Approximation

SBX : Sighted Students' Interaction Scores of X^{th} Item Before Motion Unit

SDX : Sighted Students' Interaction Scores of X^{th} Item During Motion Unit

SIF : Student Identification Form

SMQ : Science Motivation Questionnaire

SQCI : Students Before and During the Motion Unit

SQET : Student Questionnaire about Efficiency of Treatment

SPre-ACHMO : Sighted Students' Pre Achievement Motivation

SPre-COOP : Sighted Students' Pre Cooperation

SPre-EQU : Sighted Students' Pre Equity

SPre-INN : Sighted Students' Pre Investigation

SPre-INT : Sighted Students' Pre Involvement

SPre-IMP : Sighted Students' Pre Importance of Physics

SPre-MAQ : Sighted Students' Pre Motivation and Attitude Questionnaire

SPre-MAT : Sighted Students' Pre Motion Achievement Test

SPre-SCON : Sighted Students' Pre Student-Concept

SPre-SEFF : Sighted Students' Pre Self-Efficacy

SPre-SINT : Sighted Students' Pre Situational Interest

SPre-STUMO : Sighted Students' Pre Student Motivation

SPre-SRCO : Sighted Students' Pre Student Cohesiveness

SPre-ANX : Sighted Students' Pre Test Anxiety

SPre-TAOR : Sighted Students' Pre Task Orientation

SPre-TESU : Sighted Students' Pre Teacher Support

SPre-WIHIC : Sighted Students' Pre What Is Happening In the Class

SPost-ACHMO : Sighted Students' Post Achievement Motivation

SPost-COOP : Sighted Students' Post Cooperation

SPost-EQU : Sighted Students' Post Equity

SPost-INN : Sighted Students' Post Investigation

SPost-INT : Sighted Students' Post Involvement

SPost-IMP : Sighted Students' Post Importance of Physics

SPost-MAQ : Sighted Students' Post Motivation and Attitude Questionnaire

SPost-MAT : Sighted Students' Post Motion Achievement Test

SPost-SCON : Sighted Students' Post Student-Concept

SPost-SEFF : Sighted Students' Post Self-Efficacy

SPost-SINT : Sighted Students' Post Situational Interest

SPost-STUMO : Sighted Students' Post Student Motivation

SPost-SRCO : Sighted Students' Post Student Cohesiveness

SPost-ANX : Sighted Students' Post Test Anxiety

SPost-TAOR : Sighted Students' Post Task Orientation

SPost-TESU : Sighted Students' Post Teacher Support

SPost-WIHIC : Sighted Students' Post What Is Happening In the Class

SRMR : Standardized Root Mean Square Residual

SSN : Students with Special Needs

WIHIC : What Is Happening In the Class

CHAPTER 1

INTRODUCTION

In 1948, the Universal Declaration of Human Rights, the full text of which includes every child has the right to education was adopted and proclaimed by the General Assembly of the United Nations (Engel, 1991). Until today, many countries signed the declaration and reflected to their own national constitution; however, it is hard to transform the rights to reality. In Turkey, the Council of Higher Education prepared a special law for the students with special needs in 2010. Before this constitutional arrangement, barriers for the students with special needs were overcome by the help of volunteers in the discipline. These students must be guided how to get the support by the unit in all universities; however, students still have problems and special needs. For example, in one Turkish University, a blind inborn physicist candidate had some problems during his laboratory work. Lecturers in that university supported the idea that a blind student can not follow physics course and never become adequate to do physics. Thus a discussion was started: whether a student totally blind in born should be a physicist. The most important reason why the possibility of a blind student in being able to become a physicist in Turkey is less than one in a three hundred billion (Bülbül, 2009a) is that those blind students don't have equal educational opportunities as their sighted classmates.

Attending physics courses at university level is dependent on the decision of a blind student. However, every blind student has to attend a physics course in 9^{th} grade level of high schools in Turkey (Meb, 2004). According to official reports, it seems

that there is no problem for blind students during physics courses at high schools due to tolerated approaches of the teachers. In fact, they prefer to prepare exam questions which require blind students to only memorize information rather than problem solving tasks. Moreover, these students are not even expected to participate in classes (Bülbül, 2011a). However, it is every blind student's right that they should have a chance to learn physics subjects in equal conditions with his or her class mates.

To reach the equal conditions, current academic studies don't offer adequate amount of effective solutions to authority and policy makers. There should be more studies in two main areas; what kind of materials should be designed for blinds, and how to improve learning climate in equivalent conditions for both the sighted and blind students. Although materials designed for blinds help them understand the concept individually, learning has a social dimension which human needs to share, discuss and compare his own experience. That is, without sharing, discussing and comparing individual experiences with others, mere understanding of concepts does not mean learning itself. The same effect may be observed for sighted students whether a teacher is interested in blind students rather than others. In other words, the material or the learning atmosphere designed for blinds should also be effective for his sighted friends so that anyone should not be left behind.

In daily life, this strategy is known as "universal design". Generally, products are designed for the average users. In contrast, materials and/or environments designed with universal design are available to use for all people without the need for an adaptation or a specialist design (Burgstahler, 2002). For example; a standard door is not accessible for all. If a large switch is installed to the door, the door becomes more accessible. Doors with sensors to signal it to open may be an example for universal design (Burgstahler, 2002). Universal or inclusive design is architecture based term which has meaning about accessible environments (Imrie & Hall, 2001). In education, universal design is analogous to the notion "science for all" (Scott, Loewen & Funckes, 2003). Because it is hard to claim a course which appropriate to all types of learners, educators prefer to focus on a case and define how the disadvantaged learners overcome the problems about science learning in an existing case. In this dissertation, the focus is on blind students as disadvantaged learners

without ignoring the sighted students. In an educational perspective, analog scale of ammeter without a screen may be an example of how to adapt materials for blinds (Bülbül & Eryılmaz, 2012; Bülbül & Eryılmaz, 2010a). A blind student may understand whether there is a current by touching the needle of the ammeter.

Being aware of the described issues, equivalent learning conditions for sighted and blind students are tried to be constructed in this study. This study aims to support blind students' educational rights to be able learn physics and be a participant of the physics course which is compulsory for all 9^{th} grades without ignoring the rights of their sighted friends. There is no doubt that it would be great if an approach used for blind and sighted students make a positive difference in learning physics with respect to an approach used for only sighted students. To clarify this suggestion, why Finnish students in large scale examinations are always at the top of the list may be given as example. When Turkish and Finnish successes different science scale results in PISA are compared, teacher support seems to be one of the main factors (Ustun, 2010). A student who is behind other students is claimed to be supported by teachers in Finnish educational system (Eraslan, 2009) and all classes includes different level of students; for instance, gifted students may be classmate with slow learners (Tanrıverdi, 2012). It seems that Finnish Government has achieved their success by supporting the students with special needs by both their teachers and different-level-classmates.

In some studies, blind students are named as "handicapped students" or "exceptional learners"; however, who wants to be an exceptional, not average? Due to the ethical concerns, "students with special needs (SSN)" is preferred for them in this study. The aim of this study is to convert physics courses into equivalent environments in favour of blind students by satisfying the needs of blind students without ignoring the needs of sighted students.

Recording the physics courses is not always tolerated by teachers. When the reasons are asked personal conservations, they say that they are afraid of the possibility that the course records may be in broadcast and none of them have digital forms of lecture notes. They complain about having too much course hours and having no

time to prepare something for blinds. From the perspective of blind students, they spent huge time of their day with inappropriate courses and their intensive schedule does not let them focus on the issues discussed in the course. When they sit to study the course, how should they revise the course material and with whom they study? In primary school years everything were designed for them and all staff in their school worked for them. However, in their first year of the secondary school (9^{th} grade), they face an adaptation problem. Just as passing from special education in special schools to the inclusive courses, blind students may most probably face some problems with environment and teachers, and also with friends. They start to attend in an inclusive class which there is no any other blind friends. Establishment of friendships between blinds and sighted students generally takes much time. Moreover, this problem is also valid for the physics teacher and the school administrators. To overcome the problem, it is obvious that these educational actors need educational support.

Students may differ in achievement, gender or socio-economic status. If the school administration chooses students according to these kinds of differences, that discrimination is be a barrier for being an inclusive school (Nichols, 2008). In inclusive schools, every student may attend and receive the instruction in the same class whether they have special needs to attendance (Reid, 2005). For inclusive schools sitting together is not enough; for instance blind students should also interact with sighted students.

Inclusive learning environment is a learning atmosphere which occurs in inclusive schools. It does not mean that legally every inclusive school has an inclusive learning environment. This term sometimes express ideal conditions and sometimes is used to identify the level of interaction, collaboration or other features of inclusive classes. In this environment, learning occurs towards integration of SSN and others together.

There are some misconceptions about learners with blindness and low vision (Hallahan & Kauffman, 2006). For instance; the perception that people who are legally blind have no sight at all is a misconception because only a small percentage of people have absolutely no vision; many have a useful amount of functional vision.

The blind student who has no vision and whether this situation is continuous from the birth we call them “blind in born students”. Generally this kind of blind students have no sight; totally blind.

1.1 Purpose of the study

The main aims of this study are to prepare appropriate materials for blinds and sighted students for their 9^{th} grade physics course for providing equivalent educational opportunities, and then analyze the effects of these materials in terms of sighted and blind students. As weel as supporting physics teachers by useful materials for sighted and blind students, this study also gives an example about how to prepare a course material for inclusive classes. Being a frontier study in physics education about SSN for teachers and researchers is our primer purpose and it seems more important than the aim of investigating the effect of special course materials for inclusive learning environments. It is not easy to reach these purposes with only this study but for one unit and for a few schools, to apply these materials and analyze the effect of using the materials are not impossible targets. It may be a great target for an ordinary study to develop and adapt course materials for inclusive classes in a meaningful structure in terms of students’ achievement and affective variables; moreever, a frontier study should include these essential goals to be consistent in theoretical and practical ways for further studies.

1.2 The Main Research Problems and its sub questions

There are five main research problems in this dissertation. First problem is about the effect of enriched course materials on the sighted and totally blind 9^{th} grade students’ achievement, motivation and attitude towards physics course. With the second problem, students’ perceptions about enriched course materials are investigated. The third research problem is about the perceptions of experimental and control groups’ learning environment. The fourth research problem is about the all students’ perceptions about their physical and cognitive interactions. The last problem is about the physical and cognitive interactions of sighted and totally blind students.

1.2.1 The first research problem and its sub questions

What is the effect of using enriched course materials on the sighted and totally blind 9th grade students' physics achievement, and motivation and attitude towards physics course in Ankara?

a. What is the effect size of the mean difference due to the use of enriched course materials in the post-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores of the sighted and totally blind students?

b. What is the effect size of the mean difference in the pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores of the sighted and totally blind students?

c. What is the effect size of the mean differences due to the use of enriched course materials between the sighted students' post and pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores?

d. What is the effect size of the mean differences due to the use of enriched course materials between the totally blind students' post and pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores?

e. What is the effect size of the mean differences in control group students' post and pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores?

f. What is the effect size of the mean differences due to the use of enriched course materials between the experimental group students' post and pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores?

g. What is the effect size of the mean differences due to the use of enriched course materials in the pre-test achievement, and sub dimensions of pre-test motivation

and attitude towards the physics course scores of the experimental and control group students?

h. What is the effect size of the mean differences due the use of enriched course materials in the post-test achievement, and sub dimensions of post-test motivation and attitude towards the physics course scores of the experimental and control group students?

1.2.2 The second research problem

What are the sighted and totally blind 9th grade students' perceptions and perception differences about the enriched course materials in terms of contribution in their learning, and to what extent they like the materials?

1.2.3 The third research problem

What are the sighted and totally blind 9th grade students' perceptions and perception differences between the control or experimental groups in what is happening in the class before and during the instruction about the motion topic?

1.2.4 The forth research problem

What are the sighted and totally blind 9th grade students' perceptions and perception differences between the control or experimental groups in physical and cognitive interactions in the class before and during the instruction about the motion topic?

1.2.5 The fifth research problem and its sub questions

How do the totally blind 9th grade students interact with the enriched course materials, with their teachers and friends in the physics classes.

a. How does the treatment change the totally blind 9th grade students' relevant and irrelevant behaviors?

b. What are the frequency rates of physical and cognitive interactions during the courses?

c. What are the totally blind students' frequency rates of sitting and standing during the courses?

d. What are the totally blind students' frequency rates of cognitive interaction with the teachers and friends during the courses?

e. What is the frequency rate of totally blind students' using the enriched course materials, during the course?

f. What kind of and how many conversations do the totally blind 9th grade students make with each other during the courses?

1.3 Definition of Important Terms

In this part, the terms which were used in research problems would be explained with their constitutive and operational definitions. Others from these essential terms are defined in the necessary parts. The important terms used in research problems can be defined as follows;

Enriched course materials are prepared materials for this study according to the process written in the methodology chapter. These materials are enriched with the sense of touch and hearing. They are useable with both sighted and blind students. Apart from enriched course materials, "course materials" are ordinary materials which students use during the course.

Sighted students are the member of experimental or control group classes who do not have any visual problem during the courses. To decide whether a student is sighted or totally blind, their expression and formal records are used.

Totally blind students are who do not see anything from their birth. They cannot go alone to somewhere without their walking stick or a friend. They are identified as totally blind by the Ministry of National Education.

Students' physics achievement, and motivation and attitude towards physics course are some variables of this study which is used to decide about students' cognitive and

affective domains during the physics course according to the scores of relevant instruments written in the methodology chapter.

Physical and cognitive interactions are two types of interactions when the blind students and others do during the course by asking, answering, talking, standing or using is some course materials.

1.4 Significant of the Study

After elementary school years in specialized schools for blind students, the first semester of secondary school in inclusive environment may be difficult to adapt. This first semester problem occurs not only for the students with special needs, but also for the others. In this period, if an inclusive learning environment was not constructed, the adaptation problem would go on during other years. This reason makes the inclusive studies more important in the first semester. Therefore, this study is meaningful due to the support for inclusive classes which are compulsory for all students.

From all units in 9^{th} grade, motion concept is chosen for several reasons. One of the reasons is related with the importance of motion concept in physics. The physics course generally focuses on the motion of electrons, photons or bodies and the motion unit includes basic principles of other units. Secondly, the motion concept in 9^{th} grade includes graphs and blind students are exempt from the graphs in all examinations. However; understanding the motion without graphs is hard to construct the concept. Additionally, this concept is the most explained one which 9^{th} grade physics teachers needed to learn how to teach when they are working with a blind student (Bülbül, Oktay, Cansu, Garip & Demirtaş, 2012) and which was explained as hard to learn by blind students who passed 9^{th} grade successfully (Garip, Eryılmaz & Bülbül, 2012). Physics teachers think that this concept is difficult to work with blind students and they need a support for this concept if they have a chance to choose a unit in 9^{th} grade. The other reason is about the sequence of units. Being as a guest in a class for the first time may affect the students, so the motion concept which is the part of third unit is more appropriate.

There are some other issues about the justification of the study such as educational rights and ethics in education. In student role and during the teenage years, the educational rights may not be seen clearly; however this is educators' duty and to develop the awareness is our responsibility as an educator. Almost never blind students choose physics course after 9^{th} grade. With the help of this study and further studies blind students may take courage to take other physics courses and want to be physicist. It is not obvious that blind physicist gives the best attribution to the physics world but it is obvious that their perception is different from others. To learn the current information about totally blind students in 9^{th} grades a formal request is submitted. According to the official responses, there are two totally blind inborn students in Ankara. This study is completed with these two blind students. Therefore conclusions are valid for all totally 9^{th} grade blind students in Ankara. Morevover, parents of blind students from neighbor cities around Ankara generally prefer to settle in the capital of Turkey due to the educational opportunities, this may make the study's effects valid on a wider area.

This dissertation contributes to physics education by providing evidences for the blind students' interactions and effectiveness of the enriched course materials. Among SSN, blind students have a special position. Students who use a wheelchair have an accessibility problem but can follow the course like other students. Although the blind students may walk and ascend stairs, they have some problems during the courses. For instance, teacher may show something without describing and assume that all the students understand clearly, however; words without a name like "this, that or these" are meaningless for the blind student. These kinds of learning barriers force the special education researchers to give priority to the blinds. Among the blinds, totally blind students seem to have more disadvantaged position according to the blinds who have sighted backgrounds. Therefore this is the first dissertation about physics education focused on totally blind students who are in the most disadvantaged position. Although being totally blind was enough to be selected for this study, all two totally blind students explained that their blindness has been since their birth.

The main significance of the study appeared in the blind students' motivation to participation in the class. Generally, they came to the class and sit on a desk with closing the receivers to the sighted centered course. In contrast to the real social environments like streets, according to our experiences, educational actors do not believe that physics can be learned by a blind student in an inclusive learning environment. It is an unbelievable suggestion that blind students may play soccer with bill installed balls but they cannot understand the force concept which affects the ball's motion.

CHAPTER 2

LITERATURE REVIEW OF RELATED STUDIES

Among special education studies, to find a useful and meaningful study about how to construct an inclusive education in physics courses is very difficult because the percentage of SSN is small to be ignored (Batu, 2008) and most of the studies are related with SSN's general education. In other words, the number of studies focused on physics education with blind students is not adequate to make clear decisions. This limited literature was organized under important terms like inclusive education, characteristics of totally blind students, physics education with blind students, studies about kinematics, interaction in education, motivation and attitude towards physics course, and enriched course materials. This chapter starts with the literature about inclusive education and characteristics of totally blind students. These studies help the reader understand the problem and make these important terms clear. To evaluate the study, additional to students' achievement there should be some other parameters like interaction, motivation and attitude levels; therefore, following sections are needed. The last section is about enriched course materials which is the presented solution in this dissertation about totally blind students in inclusive education.

2.1 Inclusive Education

With different problems, cultural and economic status, learning styles, and gender, all students generally go to school. Inclusive schools ignore these differences and let their students and teachers follow inclusive education (Sands, Kozleski & French,

2000). If a student could not attend a school owing to these differences; for instance, there may be a gender difference, the school may be categorized into discriminative school. To call a school as "inclusive", mixed student characteristics may be enough formally but inclusive education is something more than sitting together (Bülbül, 2011a). To evaluate any schools' inclusiveness, one characteristic of that school may be enough. For example, there may be no gender discrimination but SSN have some registering problem for that school. This situation makes the school discriminative in terms of disability.

From a narrowed perspective, this dissertation focuses on inclusive schools in terms of blind students. Although all of the schools have to let blind students register and attend, some of school administers abstain from blind students because of an idea that they are not ready and suggest other schools to parents of the blind student. After registering the blind student, inclusive school could not be occurred. There should be some special adaptations which most of teachers don't know. Due to the fact that most of the teachers have lack of knowledge about these adaptations with inadequate materials, and the blind students are ignored during the courses, some parents against the inclusion (Sands, Kozleski & French, 2000). There are three the types of inclusion (Beukelman & Mirenda, 2005); full, selective and no inclusion. Full inclusion is more realistic setting which involves learning to accept peers with differences (Morris, 2000). Selective integration is partial inclusion and there are no students which attends the class selectively out of the students with special needs. Sometimes, policy makers decide not to perform inclusive education; however, there is no end separating the students and in inclusive classes, students have a chance to use their talents and needs together (Bülbül, 2010c). Instead of complaining about full inclusion, every actor of inclusive schools should focus on how to take full inclusion to take place (Keefe & Davis, 1998). Therefore, to make decision about how to integrate school with blind student is more related with the awareness of the characteristics of the blind students brought to school.

In Turkey, for secondary schools full inclusion model was chosen (Döke, Garip, Bülbül & Özel, 2012). Blind students attend a class where there are sighted students.

It is a rule that there should be only one blind student in a class. Guidance service and other teachers help blinds when they claim.

2.1.1 Characteristics of totally blind students

It is obvious that all blind students are not same, and they feel, behave and act in different ways like other students. The common point of blind students is about their visual ability. Some of them have low vision and they may read with materials which make the writing bigger like telescopic glasses or putting the paper closer to eyes which were written in large print. In a formal way, it is called "blind" if central visual acuity of the student's better eye is less than 20/200 (Tuncer, 2009). Other students are categorized in terms of visual capacity as students with low vision or sighted students who have no visual problem. Some blind students are sensitive to light. However there are some totally blind students who have no idea about light. If these total blind students have some visual experience in their childhood not before five years old, they are known as advantaged totally blind students according to totally blind inborn students (Enç, 2005).

Table 2.1 Charcterisitics of totally blind students.

Characteristics	Reference
Limitations about learning style, mobilization, and interaction.	(Gürsel, 2009)
Generally prefer listening to use braille.	(Sucuoğlu & Kargın, 2006)
Generally blinds from birth may have poor idea about light or some other well known objects like trees.	(Enç, 2005)

Repeatedly every blind student has individual differences but in terms of observation about surroundings, blind students have three main limitations about learning style, mobilization, and interaction (Gürsel, 2009). First, they have no chance to use their

eyes. This limitation directs them to use other senses. Blind students generally use braille alphabet and reading this kind of haptic materials which takes more time, so blind students prefer to listen more (Sucuoğlu & Kargın, 2006). Additionally, they need different experiences; for instance without touching branches or listenning a good description about trees a totally blind inborn student may perceive a tree like a vertical pipe (Enç, 2005).

Second, walking independently is also limited according to sighted students. For most of blind students, going to a library and finding the related book means spending a day. Although some blind students may have more experiences to have books from a library than some sighted students, it is obvious that the blind students have limitations about moving from somewhere to another place.

Third, they generally have interaction problem during courses. For instance, a sighted student may wait appropriate time to turn back and ask a question to friends without teachers permission but blind students never be sure what the teacher or behind students do while listening the course, therefore, they cannot easily react on every act. To sum up the characteristics of totally blind students, Table 2.1 is prepared. As it seen in Table 2.1, there are not a lot of characteristics and these are not certain characteristics which all the totally blind students have. However, these are the most common characteristics and the study is orgized according to these. For instance, the study tries to improve the totally blind students' interaction and let some audio materials to use.

2.2 Physics Education with Blind Students

Generally physics teachers consider these limitations of blind students and do nothing to activate them and they believe that they help blinds by asking easy exams (Bülbül, 2010a). Blind students don't be participant of discussions, answering questions and pass the course with a little effort. Bülbül (2011a) interviewed with four physics teachers with their three blind students, school administers, guidance and families of the blind students about a collaboration example from physics courses. Although all sides emphasized that there is no problem, some of their

explanations includes lack of equality, awareness, support, participation, and collaboration. Also teachers don't prepare any special material or method to take blinds into the course and got rid of making an effort for blind students. This relationship may be called as incorrect mutual ignorance. In spite of this mutual ignorance, there are some good examples in the national and international literature.

There are two important studies which were prepared in Turkey. First one is an article and second one is a master dissertation. In the article, high school students who are blind and live in Ankara expressed that physics is difficult discipline and the most easy subject is features of matter, the most difficult subject is optic (Ünlü, Pehlivan & Tarhan, 2010). However, the number of blind students who thing that every topic of physics as difficult is nearly same to the number of blind students who explain that optics are difficult. The blind students prefer clear explanations with face to face support and some applications about the subject. Braille documents and examples from daily life are two which blind students use to answer the physics questions. According to the study, properties of matter, force, pressure and equilibrium are respectively easy to learn.

Ünlü, Pehlivan and Tarhan (2010) gathered 24 blind students' view about physics courses; however, the structure of physics course in terms of concepts in compulsory courses is changed. There were only some titles as a curriculum and teachers were very flexible to prepare a course when the researchers completed the study. Due to the fact that there is no detail about the content of units, it is not clear what do they mean when the students explain their opion. Then the new curriculum defined some objectives for each unit. Garip, Eryılmaz, and Bülbül (2012) asked objectives of this national curriculum to eight students whether they can reach that objective or not. Some of objectives which include "observation or design" expressions are defined as difficult to learn. These eight blind students explained that if the objective is about electricity, force and motion units or about graphics, they may have some problems to reach the objective. After discussing on the verbs of objective deeply, they all changed their view positively that they can learn with some educational support.

The master dissertation prepared in Turkey (Kandaz, 2004) focused on "pressure concept" and some activities were tested in terms of blind students' usage. He studied with three blind students with 21 simple experiments about pressure. All experiment was successful and students explain that they enjoyed and learnt throught the experiments.

These two studies may be a starting point to understand blind's world in Turkey; however, the survey study lost its currency with new Turkish Physics Programme and the dissertation is not appropriate for needs of blind students' inclusive learning environment because they studied in a special course. Both the most difficult concept "electricity" according to the survey and "pressure" concept worked on the dissertation are out of 9th grade students' Physics Programme. Only force and motion concepts is appropriate to study with blind students because they explained that they may have some difficulties while learning force and motion and they have to learn this unit although they select other fields after 9th grade. Force and motion unit also includes graph which blind student think that they may have difficulties to learn.

Nature of physics is one of the other compulsory topics in 9th grade classes. Although Bülbül (2013a) adapted most well-known nature of science activities into tactual form and tested with both sighted and blind students, some scientists have still some misconceptions that science is not appropriate for blinds (Bülbül, 2010b). About a tottaly blind student who attends courses in a university to be a physicist, committee from the university decelerated that he cannot be a physicist. Although lots of following study confutes this view, mentioned blind student gave in being a physicist. This is an important event to compare some other cases when they face to a blind student because in most of the conditions, researchers prefer to support the SSN and present the outputs.

For instance, Weems (1977) highlighted that in primary schools blind students have some special facilities and support for their learning process but in college level blind students abstain from physical science course due to incompatible structure of the course with their needs. He adapted his course for four blinds by transforming course

notes to Braille and providing special apparatus like the Optacon with associated reading aids. He observed increasing on number of blind students attending physical science course in the following semester. The course is not only about mechanics but also about waves, electricity, and nuclear sciences. He noticed that all four blind students were successful but they needed an extra time to be familiar to the apparatus.

Similarly Parry, Brazier, and Fischbach (1997) shared their experience with a blind student during the standard pre-med physics course. Their support was consisted of note-takers, a specialist in the lab, and a tutor for both labs and courses. They had some difficulties about transforming some equations in braille format and demonstrating graphs or figures. They overcome these problems by writing equation in linear type and using Play-Doh and pencil. They indicated that the bind student received an A in both semesters without any special treatment except giving more time in the exams.

When Baughman and Zollman (1977) faced a blind student in their physics laboratory, they wished to provide an appropriate learning environment in terms of four principles. First, lab equipment should be built from equipment readily available in an introductory physics lab. Second, it should be used in a number of experiments. Third, it should be inexpensive to construct. Finally, it should take small amount of adaptation or construction time. For instance, they used ceiling tile to draw graphs and adapted the timer for the blind students. Figure 2.1 is reprinted from Baughman and Zollman (1977). They construct a photocell system to be used for timing the period of a pendulum. There were two totally blind students from birth, one sighted and one partial sighted student who had taken theoretical information before experiments. There were positive results about their usage of materials with a small difference; blind students get the values later than sighted students. Finally they emphasized how easy and cheap did the adaptation taken to encourage physics teachers about their blind students.

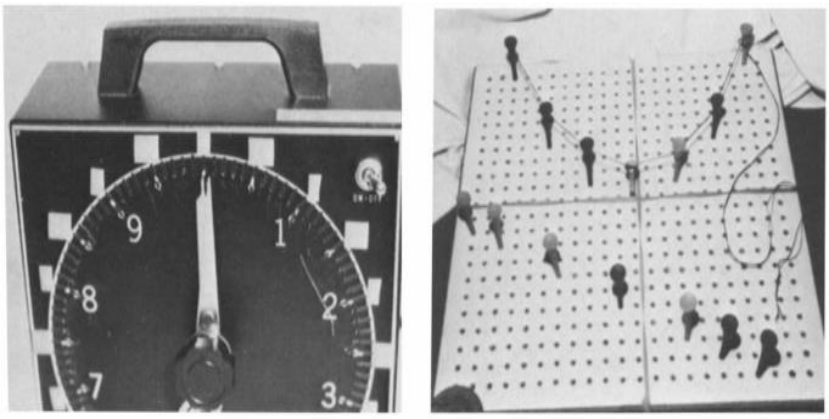


Figure 2.1 Used timer and ceiling tile

Windelborn (1999) reported his laboratory experience with totally blind student. The problem was to design lab for the blind students to measure three major units. He used a common slotted set of masses, a meter stick showing spacing of grooves for distance (Figure 2.2) and Braillen speak device with stop-watch function for time measurement. To make graphs a sheet of acrylic plastic which has holes drilled about 1 inch was used with some pegs. For similar purpose Bülbül and Eryılmaz (2010b) suggested more devices like electronic meter stick or counting the constant falling small balls and used with a visually impaired student to do an experiment about friction on inclined plane. The student was successful on following the guides and analyzed correctly the data she gathered.

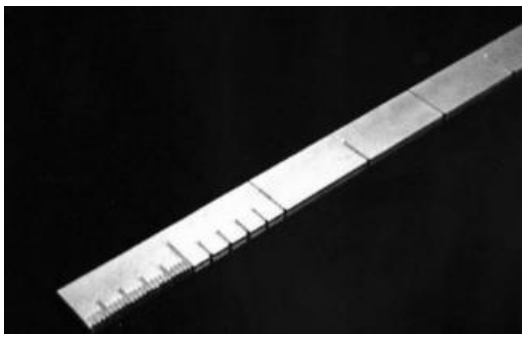


Figure 2.2 A meter stick reprinted from Windelborn (1999)

A study conducted by Sevilla, Ortega, Blanco, and Sanchez (1991) shows that blind students can be successful in a general physics course with the aids developed for them. Physics courses require mental representations of physical concepts and doing

it by only verbal transmission is not enough for sufficient understanding. Blind students experience hardship to understand three dimensional visualizations. The study focuses on especially to this aspect, and the models/aids are developed to support accordingly. They asked ten question before and after courses and there were two groups with 12 members. All first group members were blind and other group members were sighted. Post-test scores of blind students increased from 3.04 to 5.30. Sighted students' post-test scores were decreased from 5.25 to 4.6. According to these average scores from ten points, 58 percentage of blind and 40 percentage of sighted students were passed the course successfully. The result of the study shows that if needed time is given to these students, they are able to follow a general physics course.

Bülbül and Garip (2012) repeated one of equilibrium experiment with a blind student. Used materials were very simple. A piece of paper, a ruler, a pencil, a soft ground and a toothpick used in four main steps; preparation, application, finalization, and promotion. In preparation phase, blind student put toothpick into the soft ground and make a hole on the paper. In the second step, she had hanged paper on toothpick with that hole and drew a line with the ruler. Intersecting lines show the center of paper. Finding this point was the finalization step and she tested the center of mass by putting the paper horizontally on the toothpick.

Although there are some other various studies about branches of physics like astronomy (Grice, 2007; Winchatz & Ostro, 2004), modern physics (Camargo & Nardi, 2006), electricity (Bülbül, 2012a), magnetism (Bülbül, 2012b; Bryan, 1951), energy and heat (Bülbül, 2012b; Bryan, 1951), and opticts (Capra, Logiurato, Danese & Gratton, 2006; Bülbül, 2009b; Bülbül, 2011b; Bülbül, 2012c), only the studies related with motion and mechanics are presented. Generally, all studies about branches of physics with blind students include tactual materials and state the positive interactions between material and blind students. This becomes a tradition that authors explain how they support the blind student and how the blind students' success is increased. The conclusion of all these studies is about materials or methods designed to support blind students' educational needs and positive

differences after the support. There is no study which presents negative results although they give importance to support the blind students' educational needs.

Bülbül and Eryılmaz (2012) combined all of these materials designed for blind students and added some new suggestions. They started their book with a questionnaire which indicates the level of readiness of teachers to work with blind students. They summarized all the reachable literature to make the teachers familiar about how to work with blind students. After explaining the previous studies, totally 42 physics materials from 9^{th} to 12^{th} grades are given with critics from blind students who had an experience with the material.

2.3 Studies about Kinematics

The selected unit for this study is about motion. In motion concept, teachers need to work with grapghs. In this section, the explanation of kinematics, the importance of event and graph relationship, the common difficulties, types of graphs and types of how to draw graphs are given respectively.

Kinematics is one of the most studied fields in physics education literature. Information of Kinematics includes some definitions like position, velocity and acceleration with graphical understanding. Although graphics is one of data representing types and helps students to understand the event deeply, reading and writing graphics is not the most preferred method to representing the data. Some students may like numbers more than visual graph, or it is possible for the situation vice versa. Therefore, teachers should be careful using both type of representation.

Some graph includes an event and the reader comment the event through the data on the graph. This kind of graphs is called as qualitative graphs and help student understand the data and the context together by predicting before and discussing after the event (Connery, 2007). Out of context related graphics; visual properties of graphs, the level of students' information about reading the graphs and the content information which the student has effect on students' understanding and commenting (Shah & Hoeffner, 2002).

Although some university students think that kinematics is relatively easy (Turgut, Karaman, Sönmez, Dilber, Şimşek & Altun, 2006) or medium difficult (Aycan & Yumuşak, 2003) acoording to other physics topics, they are not good at interpreting and writing graphs. Sometimes they read the graph with mistakes and get wrong results (Hale, 2000), sometimes their errors base on their erroneous methods (Chiu, Kessel, Moschkovich, Munoz-Nunez, 2001), and sometimes they independently have graphic reading skill but they have a problem with relating mathematics world into physics world (Woolnough, 2000). Duval (2006) indicated that under the most of student mistakes in mathematics, there is a misunderstood symbols and presentations. This is the explanation why understanding and drawing graphs is complex process and it is hard to be measured with multiple choice tests (Taşar, İngeç & Güneş, 2002). In general matter, students perceive graphs as pictures or have an area, slope and height confusion (Beichner, 1994; McDermott, Rosenquist & Zee, 1987; Wemyss & Kampen, 2013).

To endeavor the understanding difficulties, using micro-computer based laboratories (MBL) is a common method. There are some sensors which collect the data and the other computer technology transforms the data into graphs. It is not only save time to get the real time events' graphs (Lapp & Cyrus, 2000) and with new technologies it let the user be mobile (Mattias, 2013) but also MBL helps the students increase their conceptual understanding (Thornton & Sokoloff, 1998). However, most of the schools in Ankara like the schools this research done do not have MBL technologies.

There is one more computer technology that let the students use their auditory skills; it is auditory graphs. The user hears different type of rhythm for different axis together for each data on the graph. To use auditory graphs you only need computer software and a speaker. This makes the auditory graphs more useful for every kinematic course. Sahyun (1999) studied these types of graphs via internet and reported that with a little using information 70% of visual graph users are successful at auditory graphs. Additionally, he mentioned some blind students' success who attends the study with similar percentage.

2.4 Interaction in Education

Although interaction is board concept in education, researchers only deal with the characteristics of subjects and results of test scores. However, types and frequencies of interactions among teachers, students, and course materials give additional and important information about what had happened. In contrast to the importance of interaction, there is a lack of reporting the interaction in educational studies.

Yoshikawa (2002) discussed the model of human environment interaction which explains the interactions through messages. According to the model, a message is necessary to interact, so all the interaction can be separated to relevant and irrelevant interactions in terms of message. This message can be about the course or other social behaviors like justice, belonging or supporting. Additionally, Yoshikawa suggest "physical and mental workload" concepts to analyze the interactions between human and computers. In educational field, studies about Human-Computer Interactions (HCI) are like lodestar to understand the interactions. Therefore, physical and mental interactions with relevant and irrelevant messages should be analyzed through interactions with human and materials.

2.4.1 Interaction with people

There are two kinds of role in a class; student or instructor. Therefore a student may interact with the teacher or the friends. Interaction with peers about relevant issues of courses is known as "cooperation" and effective of the methods is averred many times (Heller, Keith & Anderson, 1992; Johnson, Johnson & Smith, 1998). Moreover, peer interactions contribute to the socialization of values, attitudes and it is necessary to reduce the social isolation; discrimination (Johnson, 1981).

About the teacher and student interaction, Thompson, White and Morgan (1982) observed 12 third-grade mainstreamed classrooms and analyzed non-handicapped high achievers, non-handicapped low achievers, learning disabled, and behavioral handicapped students' interactions with their teachers in terms of academic and nonacademic initiations. The researchers regarded the frequency and the quality of feedbacks and questions. This methodology is reflected to the observation form of

this dissertation as asking questions, answering, and related with the course or irrlevent with the course.

Swing and Peterson (1982) focused on student-student interactions in small groups. They worked with 47 fifth-grade students. They selected small group participants according to the math ability level and recorded that student with low ability benefits from small group interaction. The researchers observed high, medium and low ability students during division, fractions and retention concepts with regards to number of works, explanations, directions, answers, off-task situations and task related interactions. Addition to this study, Jordan and Stanovich (2001) studied in inclusive elementary classes and observed teacher student interaction whether it is academic or non-academic. They categorized academic interactions as comprehension monitoring, partial extensions, and full extensions.For instance, questions are designed to check a student's understanding of a particular concept, if the interaction is coded as as comprehension monitoring. On the other hand, there were four types of non-academic interactions: organisational questions and statements concerned with classroom procedures management statements and questions concerned with student behaviours, status questions and statements, and personal interactions. While preparing the observation form about interaction for this dissertation, similar categories like these are used.

2.4.2 Interaction with materials

This section is about the interaction between students and their course materials. It is unexpected thing that teacher and student interact in an endless way. Sometimes, students write, cut, clean something during the course. This action should be without teacher but related with the course. Therefore, interaction with materials which are relaevant or irrelevant to the course is important as the interaction between people.

Although it is a well-known debate that using computers as a course material is meaningfulness on students' learning without a method (Clark, 1983), special prepared course materials may increase the interaction among students and the instructor. The activity theory Nardi (1996) depends on socio-cultural learning theory

that explains the learning though interactions among rules, community, tools, division of labor, subject and object. For instance, Bullock, LaBella, Clingan, Stewart and Thibado (2002) used technology to follow students' answer to enhance the student-instructor interaction frequency. Student logged in the instruction web page and answered the question when the instructor shows a question. The researchers reported that all the students participate to the instruction and their performance is increased.

Students do not have to learn the concept all the time. Sometimes they need to learn how to use the material. In other word, learning and interacting with material depends on the user's experience with it. Bülbül (2009b) tested the material about curved mirrors with a blind student. Before explaining the features of material, a short time was given to the totally blind student without any explanation. She touched and tried to understand the material. The explanation about how to use the material was started after a question from her.

2.5 Learning Environment

The 'inclusive learning environment' term was firstly used to emphasize enriched places like museums and natural parks (Ramey, 1999) or virtually enriched places like learning technologies and multimedia applications (Lage, Platt &Treglia, 2000). Contemporary meaning of inclusive learning environment is more related with the atmosphere of inclusive environments instead of physical conditions. In other words, inclusive learning environment is something more than furniture used in the class; it involves type of interaction or climate of class (Clough & Corbett, 2006).

About the relationship between students' achievement and the quality of the classroom learning environment, teachers should not feel that it is a waste of time and energy to improving their classroom environment (Fraser, 2007). However, there is a meta-analysis study involving 823 classes and 17,805 students. According to this study, better achievement on a variety of outcome measures was found consistently in classes perceived as having greater "satisfaction, cohesiveness and goal direction" and less "disorganization and friction" (Fraser, 1998). The last two features of

classroom climate are also not adequate for inclusive learning environment. Equality in instruction method, material and assessment, awareness of friends/student's special needs and support in each other are other important factors (Kugelmass, 2004). All these factors may combine in one observable dimension; it is collaboration!

With collaboration, all students may feel active participate and with the help of defined role on the work may let a meaningful learning due to the goal directed approach (McNary, Glasgow & Hicks, 2005). This collaboration makes more connections and increases the communication in class, so after finishing the work together sense of belonging improves (Rayner, 2007). All members of team are evaluated according to the team work.

Brekelmans, Eeden, Terwel and Wubbels (1997) analyzed student characteristics and learning environment from a resource perspective which was developed by Foa (1993) for economic and social interactions. They support that student characteristics with which they enter the classroom, individual perceptions of the learning environment and class-level characteristics of the learning environment are three important resources for students' math and physics achievement.

The research studies also consider the curriculum and instruction topics for special education. Some advocates that students with disabilities should be integrated into general education. Therefore, content and instruction method should be adapted for these children, in a way. Generally, teachers are not aware of how to make adaptations for these students. So, it seems to be problematic issue. Collaboration of teachers can enhance the learning facilities for these students (McGinnis & Stefanich, 2007). An alternative model is suggested in Cooper, Baum and Neu's (2004) research study. Their target was the students who have learning and attention difficulties. The idea behind the project was promoting a learning environment for students where they can actively engage with the discipline directly different than a typical classroom instruction. However, there is no chance to change the content or curriculum in Turkey. Therefore, needed adaptations should be done for teachers and treatment should improve their awareness.

Fraser, Fisher, and McRobbie (1996) developed a cross-cultural tested, widely used learning environment questionnaire which is known as What Is Happening In the Class (WIHIC). Relatively to the other learning environment questionnaires, WIHIC is currently developed and tested in terms of the validity and the reliability with lots of times in different contexts. WIHIC is adapted to Turkish and used in Turkey with huge number of high school students (Brok, Telli, Cakiroglu, Taconis & Tekkaya, 2010; Telli, Brok, Tekkaya & Cakiroglu, 2009). This questionnaire covers most of other learning environment questionnaires' dimensions with fewer items. There are seven dimensions as known student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, and equity with 56 items. These dimensions seem most related ones with inclusive learning environment. For instance, involvement presents how the students' happeness due to being a member of that class. The other dimension of WIHIC is equity and it is a must for inclusive classes.

There are some environmental properties which blind students need. For instance, in a laboratory, there should not be pointed corners or the brittle materials should be collect in one place where the blind students are informed about (Bülbül & Eryılmaz, 2010c; Henderson, 1965; Maddox & Morgan, 2002). These are necessary for security and there should be some other facilities like text to braille printers, software programs like LaTeX2Tri (Thompson, 2005).

2.6 Motivation and Attitude towards Physics Course

Motivation is generally defined as the internal state that arouses, directs, and sustains human behavior (Brophy, 2004). In other words, it is a theoretical construct used to explain the outputs, behavior and/or achievement, of students (Sideridis, 2009). The components of this structure change according to the theoretical background of the motivation approach. For instance; in Bandura's social learning theory, the concept of self-efficacy plays an important role. It is defined as ones sense of capability to perform a skill and refers to a more global evaluation of the self. Learned helplessness is other theoretical approach about motivation. It represents the inability to learn when one perceives that there is no relationship between his/her behavior

and reinforcement. Sadness and dejection are two well-known dimensions of emotional engagement about the motivational theory.

Sometimes SSN may be low achievers and there are some strategies (Brophy, 2004) like individualizing the course activities, providing the directions, tutoring and motivation. These strategies collected and named as mastery learning which allows slow learners more time to reach their friends. This type of strategy is more usable in where some standards are decided in curriculum because to make a decision about how mastery the students is more related with whether he or she reached the 80 percent of all standards (Brophy, 2004).

The majority of studies about SSN's motivation is descriptive and correlational and explains the role and function of the several motivational structures with enough deal of information (Sideridis, 2009). According to Sideridis (2009) further studies should focus on motivation with aim of enhancing achievement and learning environments. Among blind students, there is a general conviction which was realized by the end of face to face interviews that the most important factor for their course achievement is motivation.

Accordingly success and motivation are two concepts which are nested, achievement motivation is the most correlated affective characteristic among students' situational interest in physics, personal interest in physics, aspiring extra activities related to physics, importance of physics, importance of electricity, physics course anxiety, physics test anxiety, physics achievement motivation, student motivation in physics, self-efficacy in physics, self-concept in physics, and locus of control (Gungor & Eryılmaz, 2007).

Self-efficacy is other important dimension of motivation that depends on student characteristics and prior experiences with also affect and is affected by variables related with the task like content difficulty, instructional strategy, models and performance feedbacks (Pintrich & Schunk, 2002). In this perspective, experiences about physics should influence on student's self-efficacy. Similarly, the learning environment with little experiences may affect student's self-efficacy negatively. Furthermore, making the course fun and keeping the students involve is well worked

strategies to be proud of and affect students' self-concept positively (Blackburn, 2006; McLean, 2003). With respect to Zimmerman (2000) self-concept and self-efficacy are two closest constructs both are about the own capability of the student, self-efficacy is related more with the context; than self-concept and the self-concept reflects the student's general view.

According to Koballa and Glynn (2007), attitude is a kind of inclination in a positive or negative way to things, person, thoughts or places. In addition to attitude, they explained the motivation as states of human which attend on personal behavior. In their perspective, attitude impress motivation and motivation influence on understanding. This relationship between attitude and motivation is essential to understand the case with a holistic way and is the reason why the researchers should measure the both.

To state the motivation of students, Glynn, Taasoobshirazi, and Brickman (2009) prepared a Science Motivation Questionnaire (SMQ) to examine how non-science majors, enrolled in a core-curriculum science course, conceptualized their motivation to learn science. There were five factors constructed for the questionnaire; intrinsic motivation and personal relevance, self-efficacy and assessment anxiety, self-determination, career motivation, and grade motivation. These factors are arranged according to the percentage of variance in the questionnaire from the bigger to the lower one. The last factor, grade motivation, explained 3.49% of the total amount of variation in students' responses to the test. It seems that although there is a high correlated finding with achievement, and achievement motivation, students' motivation includes being interested in and enjoyed science. Additionally, being anxious reduce the motivation score, however, in a moderate anxiety may affect students' achievement positively. However, there is no version of SMQ which adapted to Turkish and Physics course.

The attitude and motivation questionnaire which was developed by Abak (2003) is in Turkish language for physics courses. It is well-known and tested for many times. Peşman (2012) used the last version of the questionnaire with a personal contact and indicated the validity of his results in terms of confirmatory factor analysis. He got a

good fit model with the post data of 30 items which predicts seven sub-dimensions; situational interest, importance of physics, physics self-efficacy, achievement motivation, student motivation, self-concept and test anxiety.

2.7 Enriched Course Materials

In this section, enriched course materials are discussed. The importance of enriched course materials with an example about how to prepare and use is explained in terms of literature. The term of "enriched course materials" is used firstly for computer based instructions. The instructor using enriched course materials wanted to highlight to improve the quality of computer software by adding more features like broadcasting or gaming (Kassop, 2003; Rose, 2009).

Enriched course material term is used to refer the needed materials which enriched with senses and can be used by both sighted and blind students. Bülbül (2012b) explain that using materials in inclusive classes should be appropriate for all students. The way described in the study starts with defining groups in the class; for instance, blind and sighted students. Then the teacher should put all the materials for same purpose in to a graph. Horizontal axis indicates how many groups in the class may use the material. Vertical axis indicates how many sense students in the inclusive class use with that material. According to the study a closed compass is appropriate for only sighted students. Open compass also not appropriate for blinds due to its sensitive structure but let students touch and appeal to more senses. The most suggested material in that study was gyroscope because it is user-friendly for both groups and appeals to both watching and touching senses.

Özmen and Karakoç (2010) recommended including the blind students' peers, adapting course materials, communicating with parents and reviewing course book in terms of the blind students to make classroom more inclusive. About how to develop a material for blinds, Franks (1975) gave an outline including three main parts; identification objectives, prototype development and evaluation. In identification part, there are five sub-dimensions; observations in the class, investigation with researchers and teachers, examination of educational goals, thought concepts, review

instructional materials, and recommendations of educational specialists. In prototype development, classifying apparatus and setting specifications for design are two main sub-dimensions. Lastly, formative testing, formal testing and recommendation for production are three main sub-dimensions of evaluation part. Bülbül and Eryılmaz (2012) categorized materials for blinds as adapted, worked with, sold and designed for the study. Adapted materials are present in all laboratories like ammeter but you should adapt it for blinds like putting the glasses out. Materials worked with represents the materials in the physics education literature. Sold materials are used to address some companies which produce special materials for costumers. Out of these, they designed special materials for specific objectives like haptic H-R diagram and tasting the pressure.

Gardner (2006) is a blind physics professor who lost his vision after an operation and investigates the technologies to continue the research. He suggests IVEO tactile-audio system which let blind student understand what ever in the computer screen. The system also is useful for sighted students because colorful print is possible and computer talks about the touched part. This technology is very useful to understand the graphs but not available for Turkish blind students in common schools.

Hancock and Fornari (2012) suggest a good enriched course material called MAGA (Minds-on Audio-Guided Activities). There is a record which directs the student on what to do and the students follow the directions with group members to finish the activities. They use several coupled channels like auditory stimuli, visual input, and kinesthetic experimentation. Researchers and teachers suggested MAGA as supplement activity both before and after course.

In chemistry education to illustrate chemical bonds, some tactual materials are used (Boyd-Kimball, 2012). These materials let both sighted and blind students learn together because numbers and symbols are not prepared according to Braille alphabet (Bülbül, Garip, Cansu and Demirtaş, 2012) prepared needle page as an enriched mathematics course material. The user put some numbers and symbols on needles and blind students use the material like sighted students' lined notebooks. Out of these two enriched course materials about chemistry and mathematics education,

Tanrıkulu (2011) prepared sphere to demonstrate world and used some haptic maps with 6 female and 5 male totally blind students. Pre-test and post-test results to 45 multiple choice questions are represented that the students answered eight questions correctly and averagely more than pre-test.

2.8 Summary of the Literature Review

To sum up the literature related to this dissertation, a concept map about related literature is prepared (Figure 2.3). According to this map, to make the study more understandable, there are eight main issues; Inclusive education, Physics education with blind students, studies about kinematics, interaction in education, learning environment, motivation and attitude towards physics course, and enriched course materials.

Blind students have some participation problems in inclusive classes (Bülbül, 2011a). Due to these problems some parents don't support the full inclusion model (Sands, Kozleski & French, 2000). However, full inclusive education has some social and educational benefits (Bülbül, 2010c). Therefore, the awareness of educational actors should be increased (Keefe & Davis, 1998). This study is designed to construct the mentioned awareness by enriched course materials.

The main educational actor in inclusive classes is blind students, so their characteristics are important. Totally blind students don't see anything and if they are tottaly blind since their birth, they may need some extra information (Enç, 2005), audio-materials (Sucuoğlu & Kargın, 2006), and interaction (Gürsel, 2009). Additional to the tactual textbook, an audio material is prepared for totally blind students and out of the most other dissertations, this dissertation is placed emphasis on interaction.

Students' activity or interaction is as important as their achievement according to socio-cultural learning theory (Nardi, 1996). Yoshikawa (2002) explained interaction with two components; mental and physical. In this dissertation, interactions of blind students are observed according to cognitive and physical indications.

Althought among physics education literature studies about blind students are rare, there are some studies about force and motion (Kandaz, 2004; Weems, 1977; Parry, Brazler & Fischbach, 1997; Baughman & Zollman, 1977; Windelborn, 1999; Sevilla, Ortega, Blanco & Sanchez, 1991; Bülbül & Garip, 2012), nature of science (Bülbül, 2013a), and all other concepts out of force and motion (Grice, 2007; Winchatz & Ostro, 2004; Camargo & Nardi, 2006;Bülbül, 2012a; Bülbül, 2012b; Bryan, 1951; Capra, Logiurato, Danese & Gratton, 2006; Bülbül, 2009b; Bülbül, 2011b; Bülbül, 2012c).There are also some survey studies about students' needs while they are learning physics (Garip, Eryılmaz & Bülbül, 2012; Ünlü, Pehlivan & Tarhan, 2010). According to these servay studies, the most important concept in physics education in terms of blind students' needs and requests is kinematics.

Kinematics is one of the fields of physics which is related with reading, commenting, and drawing graphs in motion. When the students try to understand the kinematics, they may have some problems (Beichner, 1994; McDermott, Rosenquist & Zee, 1987; Wemyss & Kampen, 2013) due to graphs or/and students' level of knowledge about kinematics (Shah & Hoeffner, 2002). There are audio-graphs for blinds to understand and draw a graph (Sahyun, 1999). These graphs transform the numeric values to melodic form and used by the totally blind students in this dissertation.

Additional to achievement test for kinematics, students should be evaluated with their motivation and attitude towards physics course and perceptions about learning environments. About motivation and attitude, the questionnaire prepared by Abak (2003) and develop by Peşman (2013) seems more appropriate for blinds and schools in Turkish conditions than Glynn, Taasoobshirazi and Brickman's (2009) study. In this dissertation, learning environment is not used only for the physical conditions for blinds (Bülbül & Eryılmaz, 2010c; Henderson, 1965; Maddox & Morgan, 2002) but also used to emphasize the learning climate (Fraser, 1998). Therefore, adaptated version of Fraser, Fisher and McRobbie's (1996) instrument, WIHIC, seems more usefull inclusive classes.

Due to the fact that every kind of positive interactions related with the course bring blind students into inclusive learning environment, providing enriched course

materials seemed one of the best ways to improve students' achievement, motivation and attitude towards physics course. Bülbül and Eryılmaz (2012) are collected all the physics tools for blind students and Bülbül (2012b) suggested physics tools which include more senses and appropriate all groups in a class. To make the students' senses more active and provide the totally blind students' needs, an increased version of Franks' (1975) model is used.

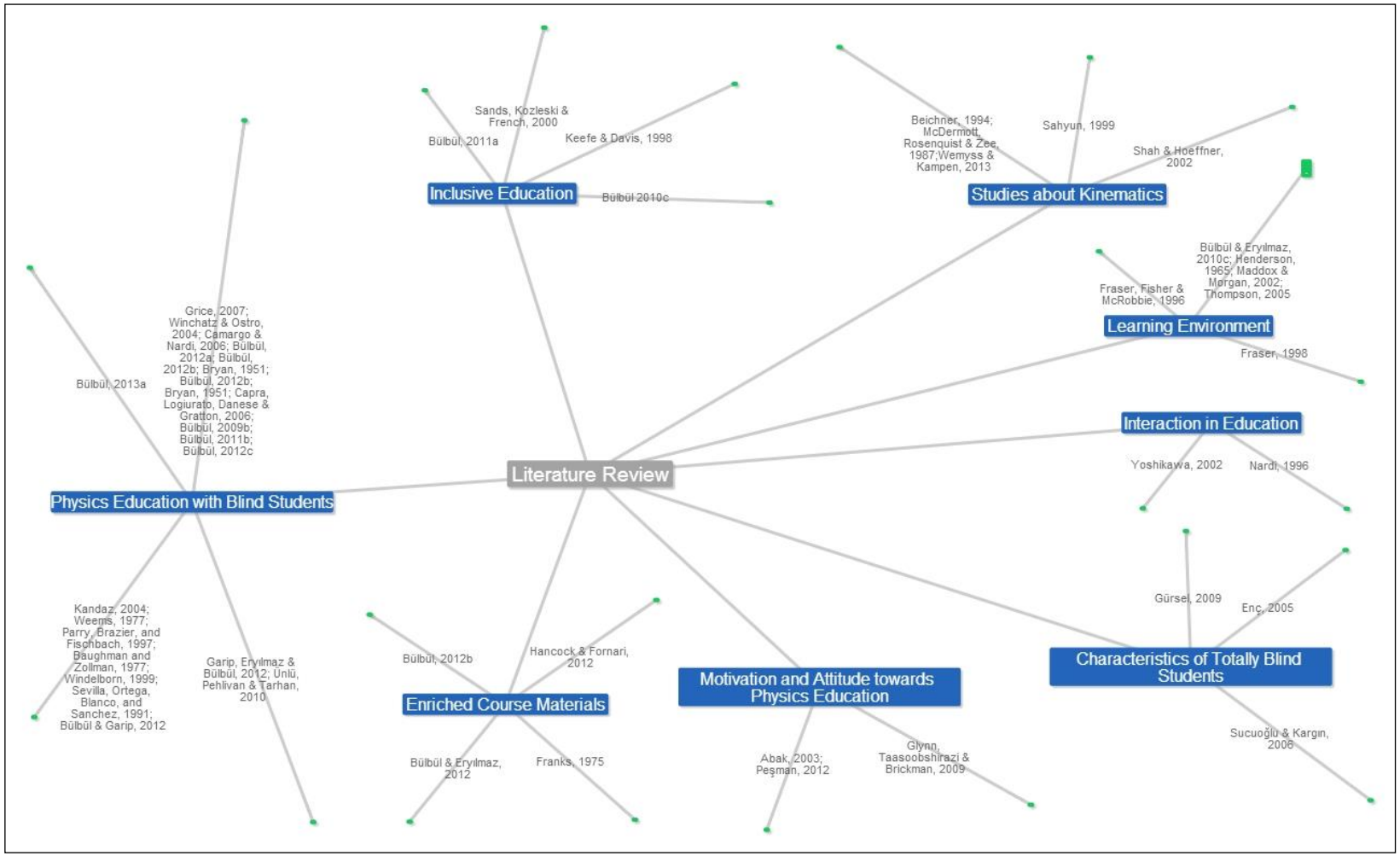


Figure 2.3 An overview to the related literature

CHAPTER 3

METHOD

Cases studied in this dissertation are introduced firstly. The next section is about the enriched course materials' designing process. In the third section, all used instruments are described. Research design and procedure are the following sections of the method chapter. At the end of the chapter, details of the implementations of the treatment and analysis of data are explained.

3.1. Describing the Cases

In this study, there were only two inclusive classes which includes totally blind student in Ankara. Therefore, these schools were selected to work on. In other words, selecting method of this study is purposive sampling and assignment of sampling is nonrandom sampling.

To understand these two cases Figure 3.1 is demonstrated. In each case there are three different classes. Every case includes one formal inclusive class which is set as an experimental group and the other two are all sighted students shown as control groups. Each case includes only one totally blind student and these students try to understand the course with their sighted friends. In Figure 3.1, every student presented with a circle but totally blind students' circle is marked with black. Similarly, experimental groups have filled with gray to make different from control groups.

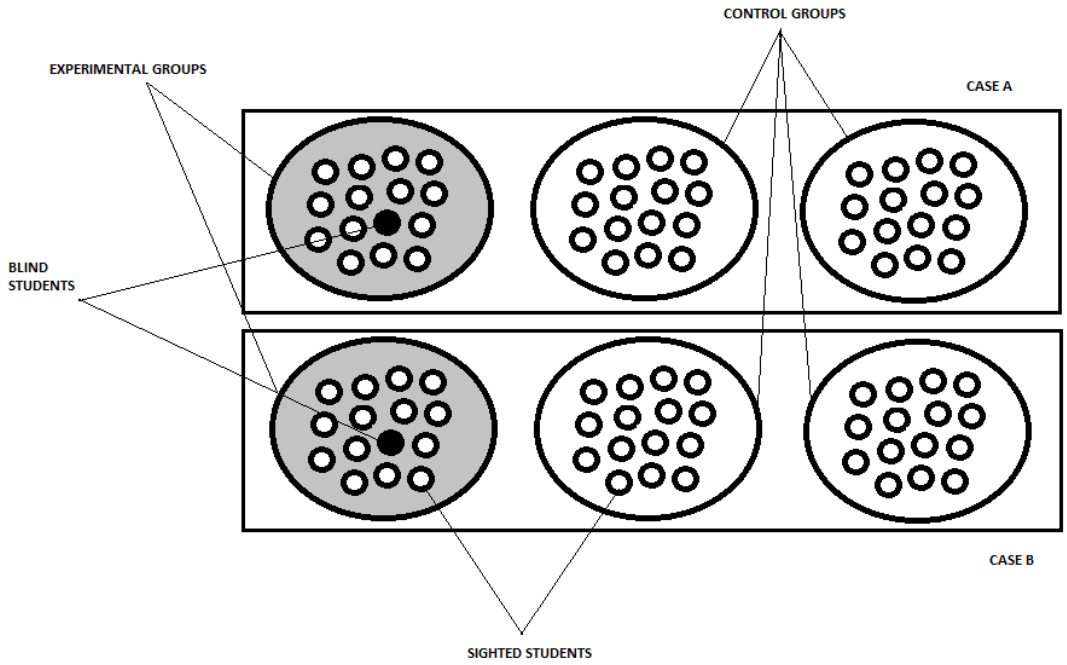


Figure 3.1 A simple presentation of two cases in the study

In case A, there are 30 students defined as experimental and 59 students as control group member. In Case B, the number of control group members is 67 and the number of experimental group members is 35. Both physics teachers in case A and B are male. They have teaching experience more than ten years but neither of them works with totally blind students before.

The cases studied in within the scope of this dissertation are described by using two methods; survey and interview. Firstly, a student identification form (SIF) is prepared about some demographic characteristics of students and their strategies about understanding physics (Appendix A). This questionnaire includes totally 20 questions, some of which include categorized answers and some of them are open ended. Secondly, interviews with school administration, physics teachers and blind students in both cases were carried out. During the interviews, they were asked their personal observations and a comparison of their school with other schools. In addition to this, the blind students, the school administrations and the physics teachers were asked to compare their own school with other schools, as well as 9^{th} grade classes and blind students with their peers with respect to outstanding features (Figure 3.2).

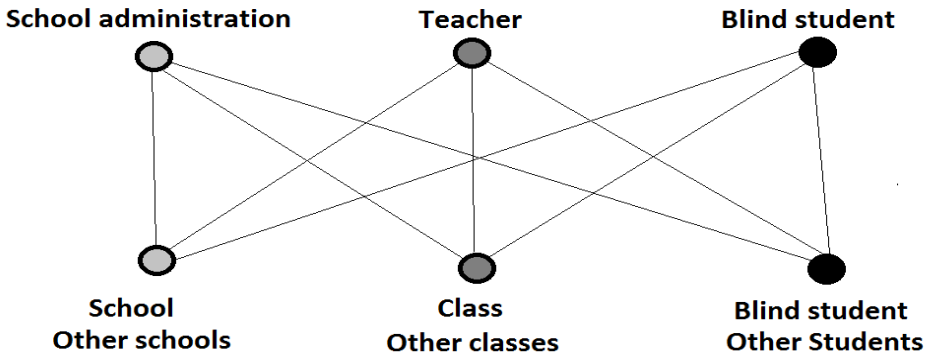


Figure 3.2 A demonstration of cross-interview of major components in the cases

Descriptions of any interview results aren't shared with other talkers to save the original data. Thus the cases introduced themselves independently in terms of major components; administers, teachers and students. Gathered data through two methods are organized in terms of experimental and control groups in two cases with tables and written text.

The principal of Case A compared their school with others as follows; “In terms of economic level, cultural background and academic achievement, our school is very homogeneous. The average performance score of our school is equal to that of Turkey. Additionally, our teacher team is complete”. While talking about the 9th grade classes, the principal of Case A said that “all classes are equivalent in achievement, the number of students, and the number of students who failed the previous year”. Lastly, the principal shared his observation about the relationship of the one blind student in the 9th grade with her friends by stating that “She is alone. She generally walks and talks with the other blind student in the 10th grade”.

The physics teacher of Case A compared their school with others as follows; “Although its name includes Anatolia (the Anatolian high schools in Turkey accept students who get a high score in the entrance examination) this year the school accepted students with very low scores. Students are from this location and they are very polite and respectful. Our school is perhaps the school with the least problems in Ankara”. For the 9th grade classes, the physics teacher described the class which the blind student attends as “the best in terms of behaviors but achievement is at

moderate level". To compare blind students and his friends in the class, the physics teacher said that he has not got enough information to compare because he is never interested in her.

During the interview, the blind student in Case A compared her school with others by saying "I like my teachers' approach and I never have any problems". About other classes, she represented her satisfaction too and added that her friends kind and easy going. According to her teachers her class is spoilt, however, there are students she doesn't like in other classes. Lastly, she compared her friends and herself saying "I generally try to participate in all courses but in mathematics and physics it seems impossible. Other than that my first scores are very high".

The Principal of Case B compared their school with others as follows; "Our students are members of conservative families. Days in this school go by usually without any trouble but levels of students are generally low. There is no curriculum difference with other schools but additionally there are more religious courses". While talking about the 9th grade classes, the principal of Case B said that "the level in all classes is approximately the same. Generally, their score is not adequate to attend any other school". Lastly, the principal shared his observation about the relationship of the one blind student in the 9^{th} grade with his friends by stating that "His friends care about him. When they see him and his mother coming to school, they take the student by the arm and walk along with him".

The physics teacher of Case B compared their school with others as follows; "I was expecting that this school would be better but it is approximately the same as others". For the 9^{th} grade classes, the physics teacher described the class which the blind student attends as "moderate; neither good nor bad". To compare blind students and his friends in the class, the physics teacher said that although his attendance is very low and he is very shy, his listening skills are very good.

During the interview, the blind student in Case B compared his school with others by saying "in contrast to my previous school, earlier on, I had some adaptation problems in this school. The reason why I chose this school was not the special structure of the school but its proximity to my home". When comparing his class with others, he

expressed his satisfaction and added that his friends are always helpful. Lastly, he compared his friends and himself saying "I think I participate in the courses and I am successful".

All the students in case A and B responced the SIF as it seen from Table 3.1. All the answers are given with the frequency of students of chosen answer. Frequencies of the answers can be seen in the brakets. Unanswered questions presented with "U". Beyond the demographic information about the cases, Table 3.1 reflects the perceptions of students about physics course. This information about each classes is given together to compare easily what do they do during the course or how do they learn the physics course. The reality should be different from their responces. For instance, according to the students in two of the case A's control groups; their course materials are not adequate. However, the students in case B's control group do not have the same idea. In fact, both schools have the same smartboard but only the teacher in case B used it.

Table 3.1 Some demographic and educational findings about both cases.

	Case A		Case B	
Questions	Experimental group Answer (Frequency)	Control groups Answer (Frequency)	Experimental group Answer (Frequency)	Control groups Answer (Frequency)
Gender	Girl (15), Boy (15)	Girl (27), Boy (32)	Boy (35)	Boy (67)
Age	14 (12), 15 (18)	14 (21), 15 (37), 16 (1)	14 (4), 15 (27), 16 (4)	14 (15), 15 (39), 16 (8), 17 (4), 18 (1)
Number of family members	4 (15), 5 (12), 6 (2), 7 (1)	2 (2), 3 (5), 4 (26), 5 (19), 6 (6), 8 (1)	U (1), 3 (3), 4 (14), 5 (13), 6 (2), 7 (1), 8 (1)	U (1), 4 (20), 5 (20), 6 (14), 7 (6), 8 (1), 10 (1)
Number of sibling	0 (2), 1 (1), 2 (14), 3 (10), 4 (2), 5 (1)	0 (8), 1 (1), 2 (27), 3 (15), 4 (7), 5 (1)	1(5), 2 (14), 3 (11), 4 (4), 5 (1)	2 (16), 3 (24), 4 (16) 5 (5), 7 (2)
Answers to "Do you have your own room?"	Yes (21), No (9)	Yes (47), No (12)	Yes (25), No (10)	Yes (43), No (24)

Table 3.1 (cont.)

	Case A		Case B	
	Experimental group Answer (Frequency)	Control groups Answer (Frequency)	Experimental group Answer (Frequency)	Control groups Answer (Frequency)
Answers to "Does your mother and father alive?"	Mother (1), Father (1), Both (28)	Father (2), Both (57)	U (2), Father (1), Both (32)	Mother (4), Father (1), Both (62)
Answers to "Does your parents live together?"	Yes (25), No (5)	Yes (55), No (4)	U (1), Yes (33), No (1)	Yes (62), No (5)
Answers to "Do you live with your parents?"	Yes (30)	Yes (29) Yes (30)	Yes (32), No (3)	Yes (32), No (3) Yes (31), No (1)
Answers to "Do you have any economic problem that affect your education?"	Yes (1), No (29)	Yes (3), No (56)	Yes (35)	Yes (7), No (60)
Answers to "Do you have any transportation problem that affect your education?"	Yes (2), No (28)	Yes (11), No (48)	Yes (6), No (29)	U (1), Yes (12), No (56)
Answers to "Do you have enough materials to understand physics?"	Yes (11), No (19)	Yes (18), No (41)	Yes (20), No (15)	Yes (31), No (26)
Answers to "Do you have any support about physics out of school?"	Yes (1), No (29)	Yes (3), No (57)	U (2), Yes (3), No (30)	U (5), Yes (6), No (56)
Answers to "What do you do during 45 minutes physics courses?"	Take notes (15), Follow textbook (22), Ask (1), Listen (3)	Take notes (34), Follow textbook (25), Sleep (3), Listen (6), Participate (2), Write (3)	Take notes (18), Follow textbook (17), Listen (4)	Take notes (46), Follow textbook (33), Listen (6), Repeat (2), Write (1)

Apart from general information about cases, the response of blind students to the form is one of the focuses of this study. According to their explanations, both blind students are totally blind inborn students. The blind student at case A is 14 years old and has three siblings. Her father and mother are alive and live together. She has no transportation or economic problem. She has a special room in her house. However, she things that there are not enough materials for her and there is no support for physics course. Generally she listen the course and study the exams through the course book. She explained that she may learn better with discussions. Other blind student is in case B. He is 16 years old, has one older brother and lives with parents. He has a special room and has no economic problem. He explained that there is a transportation problem but most of the time after courses his brother or mother takes him with their car. Similar to the blind student in case A, he only listen the course and things that there are not enough materials for him and there is no support for physics course. He studies the course through the course book. According to their explanations both of them are good at in verbal courses but they have some difficulties in numeric courses such as physics.

On the other hand, grade points of control and experimental groups given in Table 3.2 indicate that number of unsuccessful students is more than the half of population in an unexpected way.

Table 3.2. Control and experimental groups' GPA scores

Physics GPA				
Grade Points	Control Group		Experimental Group	
	Frequency	Percent	Frequency	Percent
0	15	11.9	2	3.1
1	52	41.3	14	21.5
2	22	17.5	17	26.2
3	31	24.6	14	21.5
4	6	4.8	14	21.5
5	0	0	4	6.2

3.2. Process of Preparing Enriched Course Materials

Enriched course materials used in this dissertation is passed through some processes. These processes are important to improve the level of enrichment of the materials. Improvement in education needs an ongoing evaluation after too many practices; every improvement needs retesting and additional comments and this makes the process spiral (Zuber-Skerritt, 2001). For the materials used in this dissertation, all versions of designs are revised after an expert or student interaction. These steps of developing enriched course materials cover the Franks' methodology (1975) which is the only and obvious suggestion in science education literature about designing materials for blind students.

The process of preparing enriched course materials includes four levels with eight types of suggestions and revised versions of course materials (Figure 3.3). Third version of the enriched course materials are used in this dissertation because the last level includes the brought experiences from the cases. Physics teachers (E1) who studied with blind students before, academicians from physics education (E2), special educators (E3) and students who experienced the materials during the courses (E4) are defined as an expert and combined on the line according to the model.

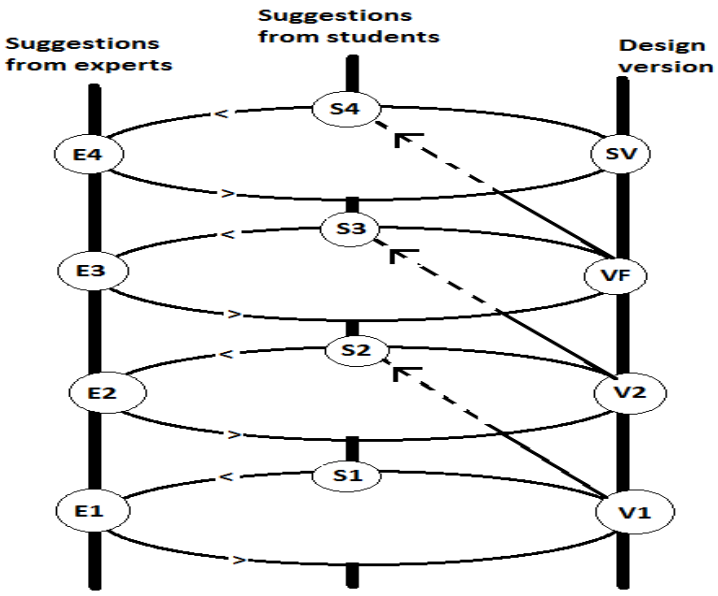


Figure 3.3 Symbolic representations of preparing enriched course materials

In this model, blind students who listened the motion unit before (S1), a totally blind inborn student (S2), sighted students (S3) and the students who are investigated in this dissertation (S4) are four types of students whose reflections about materials are used to improve the version of enriched course materials. Lastly, the letter "V" symbolizes the word "version" and the number near the letter defines the alignment of versions. Detailed information of these steps is given in the following sections.

3.2.1. First version of the enriched course materials

To construct the first version of the materials, experienced blind students and teachers are selected in Ankara. Two 10^{th} grade visually impaired students from two different schools are selected as a convenience sampling. These two students are easily accessible subjects according the researcher and suggested from a special educator. Both are not totally blind but using baton to move independently. The teachers as an expert in this level are selected from the two visually impaired students' schools.

With two visually impaired students, an interview guide approach (non-standardized open-ended interview) is conducted. The issue of interview was focused on their situation in the class and needs during the physics courses. Their explanations were almost same; they are not active in physics course and they need attractive, enjoyable materials and methods which are appropriate to them. They both explained that course should be constructed on their daily life experiences and every component of the course should be revised whether it is appropriate for blinds. For example, they cannot follow the explanation if teacher uses words like "this and that". They have some difficulties to understand the motion graphs although they were evaluated by the memorization of definitions and were successful. One of the student explained that she had learned the general graphs (not used in the physics) by the help of writing in her hands. Additionally they have no information about written on the black-board and physics teachers like to write and pass. Lastly, they wanted to touch some of the examples in the textbook. The formal textbooks may include a well-defined texts or tactual figures.

Before the first version of enriched course materials, a research is done and presented in an international conference (Bülbül, Demirtaş, Cansu, Oktay & Garip, 2012). This research is about five physics teachers' views. The common point of these teachers is that they worked with blind students before. According to the research, teachers think that visually impaired students mostly have difficulties in force and motion unit and they need some extra materials or educational supports. In Appendix B1, there are some questions about how to teach for each objective. They suggested some materials, teaching techniques and evaluation method; however, only their suggested materials are given in Table 3.3 to indicate how first version of enriched course materials are prepared.

Table 3.3 Teachers' suggestions for each objective about motion

Objectives (Students should be able to…)	Suggested Materials
Realize that motion is relative event.	Discussions about car/travel experiences, toy cars, travelling with vehicle
Explain position, distance and velocity concepts.	Any object that can be moved, map, ruler, string, watch, embossed figures
Interpret by drawing position- time, and velocity- time graphs for uniform linear motion.	String
Calculate velocity in motion by using position-time graphs for uniform linear motion.	Embossing graphics, simple velocity-time formula
Calculate distance in motion by using velocity-time graphs for uniform linear motion.	Map, ruler, string, watch
Define acceleration by giving daily-life examples.	Car and watch, inclined plane car, masses, string, ruler, stop-watch, pointing to changes in pulse beat, sonorous vehicles while moving inclined plane.

Suggestions from teachers are not seem as adequate to provide blind students to reach the course objectives; besides, they may cause discrimination among students. It is obvious from the suggestions that there should be more creative and effective proposals about material. The materials should be adaptive to curriculum and curriculum includes context based approach which teachers should connect the concepts to real life. Therefore materials should also be context based (Bülbül & Eryılmaz, 2012).

Although suggestions include ordinary materials and they should be context based, first version of enriched course materials are produced after some additional investigations on formal textbook. First version was a model of play-ground. All the necessary concepts can be talked though play-ground context in a funny way. Every student probably has an experience with play-ground toys. Especially, most of these toys can be an example for acceleration concept. The context in textbook was about a journey but some mentioned observations are not appropriate for blind students. First version of enriched course materials is made by styropor to form easily.

3.2.2. Second version of the enriched course materials

Redesigning the first version of the enriched course materials is stared with a totally blind students' testing. Additional to her suggestions, physics educators' recommendations and suggestions were collected. Both experiences were combined to prepare the second version of enriched course materials.

The blind subject in this step was a university student. She helped analyzing the strengths and weaknesses of the materials (Figure 3.4). She explained that materials should be more stable; beside, teacher needs more directions and time. Play-ground models seem enough to explain basic definitions but blind student still need some tools to understand motion graphs. She suggested some haptic graphs with simple materials like strings, sticker or magnets.

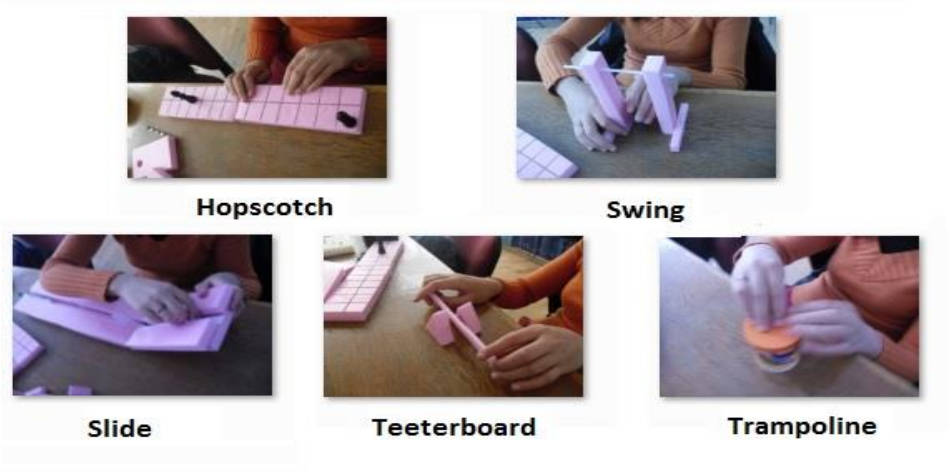


Figure 3.4 Some parts of enriched course materials' first version

Additional suggestions independently to the first version were collected from experts. All the experts in this process have PhD degree or are PhD candidates in physics education field. One of them is a physics teacher and others are academicians in different universities in Ankara. One of the experts has experiences on blind students and others have teaching experience on both physics and material development with sighted students. Although a written document (Appendix B2) was expected from all experts, some of them preferred to talk; therefore video records were used to gather their suggestions (Table 3.4).

In Table 3.4, all views from experts are given with a capital letters such as "A, B, C, D, and E". Each letter temsil represented on of these experts. Numers in the parentheses explained how many expert suggested and numbers in the square brackets explained how data collected; by a written document or video records.

Table 3.4 Suggestions from physics education experts and decisions about the second version of enriched course materials

Objectives from Turkish physics curriculum	Suggested Materials for blind students	Suggested Materials for sighted students	Decision
-Realize that motion is relative event.	A-(2) There should be a role-play which one student stay and other two students walk arm in arm through him and explain their motion in terms of different reference points [2]. B-(1) Voice of different motions should be used. For example; you make sound by touching a rail with a stick while you are moving and you may get same sound by touching a rail with a stick while rail is moving. Listening same sound is similar like observing same motion, therefore motion is relative [3]	C-(1) There should be some videos about relative motion and some observation homework [1].	A new course material (CM) is not developed according to (AT) suggestion A because 1st activity about motion given in the course book is very similar. 1st CM is a video and taken from Youtube and adapted for blind students AT suggestion C. 2nd CM is developed AT suggestion B.

Table 3.4 (Cont.)

Objectives from Turkish physics curriculum	Suggested Materials for blind students	Suggested Materials for sighted students	Decision
-Explain position, distance and velocity concepts.	A(1)There should be some basic materials used like stick and bead to demonstrate graphics [2]. B-(1)There should be some play dough, rope and tactual maps of Turkey [1]. C-(2) A student can walk in the class and students talk about his motion, distance and replacement with a material makes sounds [2]. D-(1) Putting same objects in different positions on linear platform and make relationship between those objects and the motion [4]. E-(1) Student may use a rope and safety pin while walking in the class. The length of rope will be changed with safety pins and without them between start and finish points [5]. F-(1) Student may use tactual materials for vector concept because velocity and position are vectorial concepts [6].	G-(1)There should be some maps of Turkey [1]. H-(1) There should be a metronome used to compare different velocity of walking students [2].	2nd CM is developed AT suggestion C, D, and H. 3rd CM is developed AT suggestion A and F. 4th CM is developed AT suggestion B and G. 5th CM is developed AT suggestion E.

Table 3.4 (Cont.)

Objectives from Turkish physics curriculum	Suggested Materials for blind students	Suggested Materials for sighted students	Decision
-Interpret position-time, and velocity-time graphs for uniform linear motion by drawing.	A-(1)Different kind of sticks should be used to demonstrate velocity and position time graphs with pegboard [2] B-(1) Graphics may be drawn by the help of accessible office programs, some special graphic creators for blinds. Additionally, there may be used some basic materials like rope, play dough and needles for graphic demonstrations[1] C-(1) Teacher may prepare some haptic accelerate [5].	D-(1)Graphics may be drown by the help of computers or paper-pencil method [1]	6th CM is developed AT suggestion A. Additional to the suggestions, due to the importance of the objective, researcher prepared 7th CM. 8th CM is developed AT suggestion B and D. Additional to the suggestions, due to the importance of the objective, researcher prepared 9th and 10th CM. A new CM is not developed AT suggestion C but it was used for material equivalence of the course for sighted and blind students.

Table 3.4 (Cont.)

Objectives from Turkish physics curriculum	Suggested Materials for blind students	Suggested Materials for sighted students	Decision
-Calculate velocity in motion by using position-time graphs for uniform linear motion.	A-(1) Graphics may be drawn by the help of accessible office programs, some special graphic creators for blinds. Additionally, there may be used some basic materials like rope, play dough and needles for graphic demonstrations[1] B-(1) Teacher may prepare some haptic acetate [5].	C-(1)Graphics may be drown by the help of computers or paper-pencil method [1]	Additional to the suggestions, due to the importance of the objective, researcher prepared 7th CM. 8th CM is developed AT suggestion A and C. Additional to the suggestions, due to the importance of the objective, researcher prepared 9th and 10th CM. A new CM is not developed AT suggestion B but it was used for material equivalence of the course for sighted and blind students.

Table 3.4 (Cont.)

Objectives from Turkish physics curriculum	Suggested Materials for blind students	Suggested Materials for sighted students	Decision
-Calculate distance in motion by using velocity-time graphs for uniform linear motion.	A-(1) Graphics may be drawn by the help of accessible office programs, some special graphic creators for blinds. Additionally, there may be used some basic materials like rope, play dough and needles for graphic demonstrations[1] B-(1) Teacher may prepare some haptic acetate [5].	C-(1)Graphics may be drown by the help of computers or paper-pencil method [1].	Additional to the suggestions, due to the importance of the objective, the researcher prepared 7th CM. 8th CM is developed AT suggestion A and C. Additional to the suggestions, due to the importance of the objective, researcher prepared 9th and 10th CM. A new CM is not developed AT suggestion B but it was used for material equivalence of the course for sighted and blind students.
-Define acceleration by giving daily-life examples.	A-(4) Several examples can be given orally [3,4,5,6].	B-(4)Several examples can be given orally [3,4,5,6].	11th CM is developed AT suggestion A and B.

(Number): Explains how many expert suggested, [Source Number]: Explains how data collected.

Second version of enriched course materials includes selected expert suggestions and some magnetic graphic boards from blind student's suggestions. Play-ground model is reproduced from a wood by a master joiner. Additionally, there is a toy in Arvind Gupta's web page (arvindguptatoys.com) named "slate for the blind" which inspired the researcher to use as a graphic drawer. User put the wool on velcro board and draw figures. Preparing the guide about how to use is postponed after taking sighted students' responses. The other suggestion is about graphs with sound (audio graph). For this suggestion, open source software called sonification sandbox 6.1 is decided to use. Therefore, at the end of the second level, materials without guide were ready to re-evaluate.

3.2.3. Final version of enriched course materials

To get the final version (FV) of enriched course materials, a science fair and a national conference were used. Additionally, the guide is completed at the same time. First, all the produced materials were exhibited during a science fair. Participants from different ages and districts of Ankara listened the developers' explanation about how to use the materials and some of volunteers filled the form. There are eight necessary dimensions (Bülbül, 2013b) about materials for blind students in the form. Durableness, instructiveness, inclusiveness, user friendly and easy preparing structure, holding a security, scale or economic problems are the dimensions from the form which asked to participants and analyzed in terms of their "low, medium and high" responses (Appendix B3). Although during the day more than 1000 participants joined the fair and some of them listened the explanations about the materials, only 44 of them filled the form (Figure 3.5).

Figure 3.5 Exhibiting the second version of enriched course materials to sighted students

Recommendations from sighted learners were necessary to improve the enriched course materials for both sighted and blind students. After the science fair experience, magnetic board found unusable and most of visitors liked the board with nail. With the help of context every children got the success on solving the problem. Problem was about a sequence of pulleys failed down from the hole of basket in the bicycle. Most of the participant decision was right about the bicycle's motion; whether it slow down or speed up.

During the national conference about the educational problems of blind learners, an oral presentation (Bülbül, 2012d) about all suggested and tested enriched course materials is shared with special educators. They expressed that blind students need similar materials in inclusive classes and there should be more studies in different fields. Some of them stated their concern that telling the motion graphs with too many materials may recoil on students' understanding.

To ask the experts whether their suggestions are produced in an expected way, a form is constructed (Appendix B4). In Appendix B4, it was asked whether the material, guide, and objectives are appropriate each other. According to their feedbacks, the last version of guide is prepared (Appendix B5). Two physics teachers in case A and B are also informed about the experts' opinion form and their suggestions were collected with the same method.

Guide of enriched course materials include page numbers according to sighted and blind students' textbooks for physics teachers because teachers don't know braille alphabet and may have some difficulties to direct blind students. This part in the guide prepared after analyzing sighted and blind students' physics course books. Sighted students use the formal 9^{th} grade physics textbook which is appropriate to the Turkish physics curriculum. Appendix B6 indicates the analysis of textbook about the appropriateness in terms of objectives. This analyze showed that there is no missing objective in the formal textbook.

The blind student mentioned in the first version of enriched course material helped analyzing the blind students' physics books. She read the texts and the researcher decided whether everything is same and descriptions of all figures are included in the

textbook. She read loudly and the researcher recorded the reading to give blind students as an extra supplementary material.

3.2.4. Suggested version of enriched course materials

Although the version which used in this dissertation is the final version, suggested version (SV) of enriched course materials include some suggestions for further usage. Suggestions were gathered from the case A and B. Before the treatment they explained how they want to learn motion concept with student identification form (Appendix A) and after the treatment as a user of enriched course materials they highlighted their views about enriched course materials (Appendix B7). Both forms let the researcher know about what kind of suggestions the students have. All suggestions are gathered, analized, and categorized. Most of them repeated the same suggestions or left blanks. Table 3.5 is combined all usable suggestions from sighted and blind students' before and after treatment experiences. This suggested version is the last version from this dissertation; in other words, other studies may use the suggested version.

Table 3.5 Some suggestions from applied cases about enriched course materials

Suggestions from case A and B before treatment	Suggestions from case A and B after treatment
More daily life examples	There should be more silence while listening audio-graphs.
Doing experiments with different materials	There should be more materials to use
Well organized writing, reading and listening activities	Some materials should be more colorful
With content oriented discussions	Graphic cards should be bigger

3.3. Instruments

In this section, there is a detailed information about all used instruments; Motion achievement test, Motivation and attitude questionnaire, Student questionnaire about efficiency of treatment, Student questionnaire for comparing learning environment before and during the motion unit, Observation check list of interaction, and Student questionnaire for comparing interaction among students before and during the motion unit.

The totally blind students take the exams by the help of staff from guidance office. The staff of guidance office in each case reading the text, give the special tactual papers which used for figures and graphics. Tactual papers were used only for MAT because other instrument do not include any figures or graphics. All instruments were applied during the guidance hours at guidance office but due to the number of instruments, sometimes following course hours were taked.

3.3.1. Motion achievement test

The focus concept of this dissertation is motion; therefore an achievement test is needed to compare the students. The test should be appropriate with course objectives which include information and skill parts. In general matter, test developers focus on the information; however, National Physics Curriculum has some expectations like skill and information orientated instructions and measurements. Additionally curriculum developers defined the physics programme as context based. This approach force teachers to organize their course through real life and to measure students' success with real life based questions. A new motion achievement test is needed due to the fact that there is no real life context based test which combined information and skills together about motion. Four main criteria were used while developing a real life context based achievement test; appropriateness for students' cognitive level, appropriateness for students' interests, appropriateness for real values, and appropriateness for students who are unfamiliar to the context. The focus of this dissertation is not to develop a real life context based test; however, the curriculum forced the educators to use real life context based

questions. These four criteria are produced to make the ordinary questions more real life context based.

Before the final version of Motion Achievement Test (MAT), there are five other versions (Figure 3.6). The developing process started with the corrections of supervisor of this dissertation. Before the corrections of supervisor, all the questions in draft version are produced by the researcher; however, the supervisor commented some questions and question writing principles during the test construction.

Agreed version of MAT (Version 1), given in Appendix C1, is sent to the experts. Their comments are collected with an expert opinion form (Appendix C2). Additional to the expert opinion form, a comparing form (Appendix C3) of question numbers and objectives with its both skill and information dimensions is given. Experts analyzed the appropriateness of questions in terms of mistakes, principles of real life context based questions. They answered the questions and wrote the correct alternative into the related part.

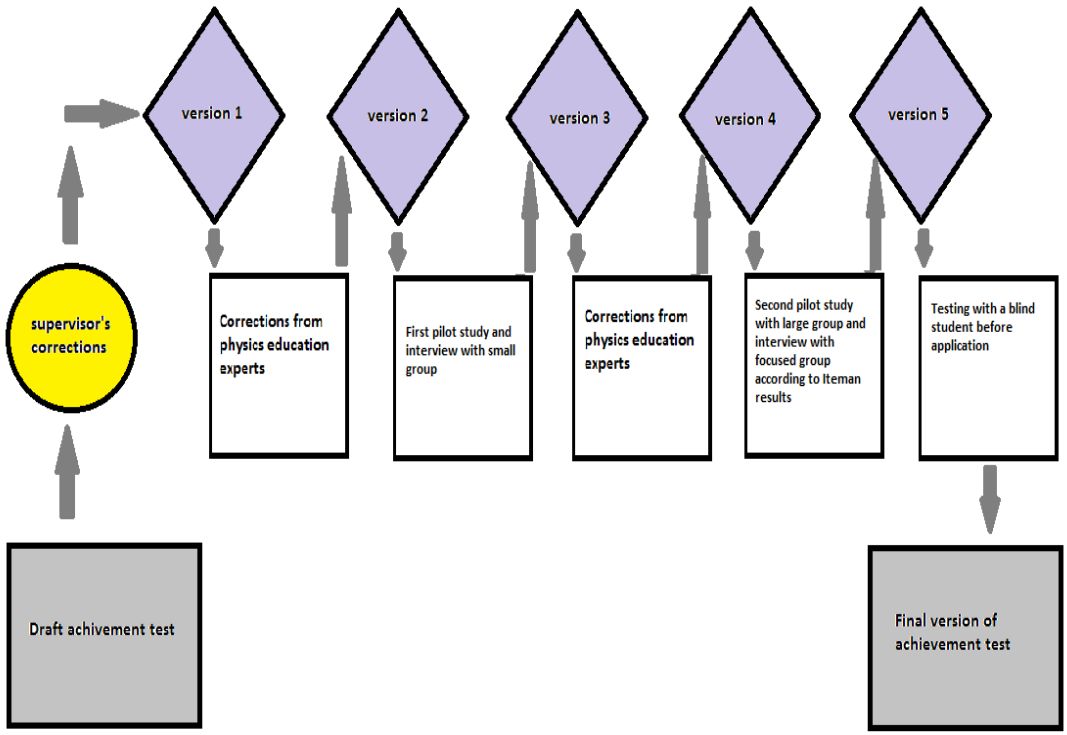


Figure 3.6 Process of developing motion achievement test

Corrected test (Version 2) developed by the help of six 10th grade students. Their mistakes and misunderstood parts are written again. Three of these students are female and all of them were from the same class which selected according to the physics teacher's suggestion. The school of these students was the only school in Ankara where female blind students generally regester due to the dormitory. The physics teacher in this school suggested the researcher these six students from different level of physics succsess; low, medium and high. Students solve the questions loudly one by one and Version 2 is constructed into Version 3 after this pilot study (Appendix C4).

Again experts controlled the changed version and Version 4 is constructed after the experts' additional corrections to version 3. Repeated controls by the help of physics education experts are important for validity of the results. Totally ten experts responded the invitation. Almost half of them make some contribution to Version 2 and the others suggestions were used for Version 4. Two of the experts are out of physics education field but both are prepared real life context based questions for their dissertations. Two of the physics education experts were the instructor of measurement course and one of the other has PhD about context based approach. Experts from four different universities in Turkey analyzed the objectives, filled the answer key, and evaluated the appropriateness of the MAT to the real life context based structure.

The results of second pilot study of the MAT are taken from another school's 10th grade students. There were 163 students who solved the MAT. In Appendix C5, there is an ITEMAN output of second pilot study. According to the output, some of alternatives should be revised. These alternatives asked to a focused group from these 163 students. This focused group members had choosen the common tendency of their frends. It was asked why did they choose that alternative. Focused group interviews are used to develope version 5 (Appendix C6).

At the last step of test constructing, a blind student tried to solve the MAT problems (Figure 3.7). Although he attends a university, he had many difficulties with MAT questions because he didn't take physics course during his high school years.

However, there was no understanding problem with the test. The researcher had read the text and he tried to answer with touching the special papers. These papers were tactual and also can be used by sighted users. After testing the MAT with a blind student, it was noticed that the size of figures shouldn't be as same as the original one. He suggested using bigger tactual figures and figures should be centered.

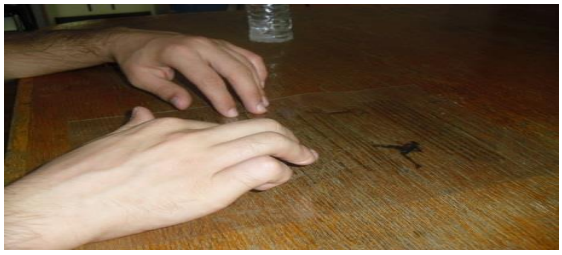


Figure 3.7 MAT's testing process with a blind student

All the questions in MAT are multiple choice questions. After the pilot studies, it was decided that 45 minute-time is enough for both sighted and blind students. Sighted students generally finish in 30 minutes; however, blind students need additional 15 minutes. It is parallel to the general tendency that half of the time for sighted students should be added to the blinds' exam.

To compare the two application of the MAT, pilot and main study, the alpha level of MAT results increased from 0.730 to 0.763 (Table 3.6 and Table 3.7). The results in Table 3.7 are taken from the case A nad B. The ITEMAN output of main study can be seen in Appendix C7. All these analysis is made with the missing values.

Table 3.6 Some statistical values from ITEMAN analysis of MAT's version 4

N of Items	16
N of Examinees	163
Mean	7.933
Std. Dev.	3.342
Skew	0.488
Kurtosis	-0.331
Alpha	0.730
Mean P	0.496
Mean Biserial	0.580

In this study, according to the ITEMAN results, 14th question in MAT worked as accepted with the students, however; the information about the length of the streets are not given. In the question, the expresstion "length of the streets are approximately

same" is not enough to compare. Anothor usage of this MAT should be applied with more clear information.

Table 3.7 Some statistical values from ITEMAN analysis of MAT's final version

N of Items	16
N of Examinees	191
Mean	5.120
Std. Dev.	3.449
Skew	0.755
Kurtosis	-0.132
Alpha	0.763
Mean P	0.320
Mean Biserial	0.619

Moreover, parallel-forms method for reliability of MAT results should be applied with alternate test forms that are equivalent in terms of content. There is a medium correlation between MAT scores of students in cases and their second written exam results (Appendix C8). The correlation between MAT and second exam results in case A is 0.597. In case B, this correlation is 0.404. Totally the correlation of all students' MAT and second exam results is 0.472.

3.3.2. Motivation and attitude questionnaire

The motivation and attitude questionnaire (MAQ) is used as the same form (Appendix D1) from a dissertation prepared by Peşman (2012) with his permission. Primarily MAQ is developed and validated by Abak (2003), and then Peşman got the revised version with his personal contact and applied in his dissertation. The Cronbach alpha coefficients were estimated as .86 for pre-test and .89 for post-test in this dissertation. These values are higher values than Peşman (2012) presented; .74 and .80 for pre-test and post-test scores. The confirmatory factor analysis is given to present seven dimensions could be measured through the results of MAQ as expected. These dimensions are situational interest (SINT), importance of physics (IMP), self-efficacy (SEFF), achievement motivation (ACHMO), student motivation (STUMO), student-concept (SCON), and test anxiety (ANX). Seven items in MAQ

are written negative and for analysis all were transform like opposite view is coded. Transformed numbers are 4, 7, 9, 27, 28, 29, and 30. Last four items are about students' physics course anxiety, fourth item is about students' situational interest and other two items are about importance of physics.

3.3.2.1 Confirmatory factor analysis

A Confirmatory Factor Analysis (CFA) is conducted in order to present evidence about whether results of MAQ dimensions are compatible with theoretical model. Before the analysis, descriptive statistics of MAQ results and assumptions of CFA are discussed in the following sections.

3.3.2.1.1 Descriptive statistics for confirmatory factor analysis

Descriptive statistics from pre and post scores of MAQ is analyzed by version 20 of Statistic Package for Social Studies (SPSS) and given in Table 3.8.

Table 3.8 Descriptive statistics and alpha coefficients for pre and post scores of MAQ

	N	Min	Max	Mean	SD	Skew.	Kurt.	Alpha
Pre-SINT	191	1.00	5.00	3.11	1.01	-.33	-.55	.82
Pre-IMP	191	1.00	5.00	3.39	.82	-.179	.74	.82
Pre-SEFF	191	1.00	5.00	3.23	1.08	-.32	-.61	.81
Pre-ACHMO	191	1.00	5.00	3.69	1.02	-1.00	.48	.82
Pre-STUMO	191	1.00	5.00	3.13	1.13	-.32	-.72	.81
Pre-SCON	191	1.00	5.00	3.26	1.12	-.30	-.65	.81
Pre-ANX	191	1.00	5.00	3.24	1.23	-.29	-.90	.84
Post-SONT	191	1.00	5.00	2.73	.90	-.24	-.59	.81
Post-IMP	191	1.00	5.00	2.99	.68	-.27	1.71	.82
Post-SEFF	191	1.00	5.00	3.07	1.23	-.02	-1.14	.81
Post-ACHMO	191	1.00	5.00	3.15	1.18	-.05	-1.23	.82
Post-STUMO	191	1.00	5.00	2.97	1.28	-.16	-1.22	.81
Post-SCON	191	1.00	5.00	3.03	1.16	-.04	-.98	.81
Post-ANX	191	1.00	5.00	3.31	1.17	-.25	-.68	.83

According to these values, all alpha scores in Table 3.7 are more than .800 where the expectable value is above .700 (Gliem & Gliem, 2003) and all minimum and maksimum values are at extreme values as expected. In Table 3.7, mean values are around the midpoint.

3.3.2.1.2 Assumptions for confirmatory factor analysis

In this section sample size of the study, distribution of variables, and correlations among dimensions are given in order to set the assumptions of confirmatory factor analysis. Altough Kelloway (1998) reported that minimum sample size should be 200 at least, 191 students are very close to the limit and Kim (2005) manifested that minimum sample size has a strong relationship among choice of fit index, number of variables/degrees of freedom, relation among the variables, and value of the fit index. Therefore, reliable variables tolorate the missing numbers. Secondly, negative skewness values indicate that all dimensions are in the same direction and there is a normal distribution. There is an enough correlation among pre (Table 3.9) and post (Table 3.10) results of the MAQ. Additionally, a few univariate and multivariate outliers were ignored not to decrease the sample size. To sum up, there is no lack of important assumtions in terms of the CFA.

Table 3.9. Correlations among the pre-results of the MAQ

	Pre-SINT	Pre-IMP	Pre-SEFF	Pre-ACHMO	Pre-STUMO	Pre-SCON
Pre-IMP	.448*					
Pre-SEFF	.589*	.478*				
Pre-ACHMO	.487*	.443*	.707*			
Pre-STUMO	.693*	.416*	.718*	.712*		
Pre-SCON	.558*	.341*	.666*	.666*	.706*	
Pre-ANX	.297*	.387*	.243*	.274*	.185	.192*

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

Table 3.10 Correlations among the post-results of MAQ

	Post-SINT	Post-IMP	Post-SEFF	Post-ACHMO	Post-STUMO	Post-SCON
Post-IMP	,595*					
Post-SEFF	,652*	,602*				
Post-ACHMO	,486*	,496*	,762*			
Post-STUMO	,550*	,510*	,775*	,784*		
Post-SCON	,590*	,458*	,697*	,725*	,702*	
POST-ANX	,367*	,306*	,351*	,270*	,371*	,261*

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

3.3.2.1.3 Results of the confirmatory factor analysis

Latent variable (motatt) and its predictors are given in a good fit for the pre-test results after three steps (Appendix D2) in Figure 3.8 with two covariances and for the post-test results after five steps (Appendix D3) in Figure 3.9 with two covariances.

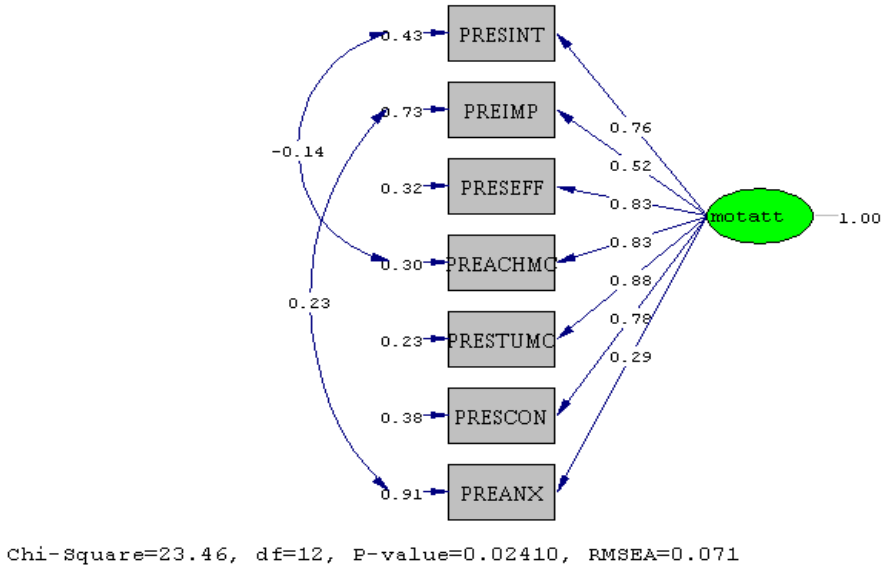


Figure 3.8 A good fit of the model with pre-MAQ's standardized regression coefficients

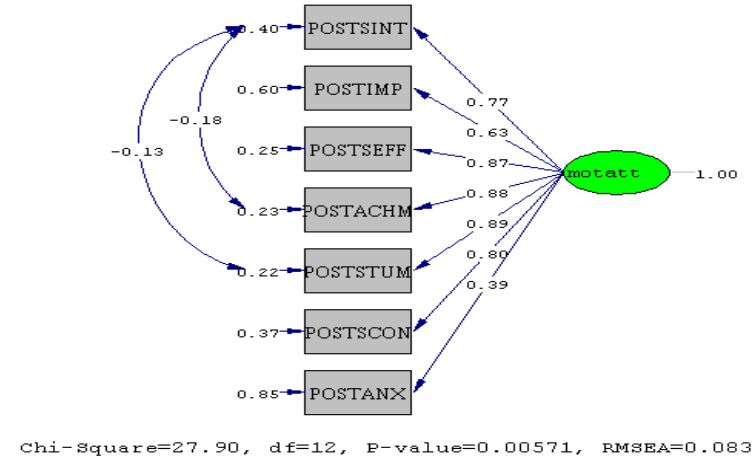


Figure 3.9 A good fit of the model with post-MAQ's standardized regression coefficients

There are some important values of CFA like Chi-Square, *p*, GFI, AGFI, RMSEA, and SRMR (Yılmaz & Çelik, 2009). Values of MAQ's results from previous study (Peşman, 2012) are compared with the MAQ's results studied in this dissertasion (Table 3.11). Additionally, In Table 3.11, possible ranges of good fit values are given Hooper, Coughlan & Mullen, 2008). It is obvious that results are similar in order to discuss the students' motivation and attitude towards physics.

Table 3.11 Comparing some important values of good fit models of MAQ

	Current values (N=191)		Peşman (2012) (N=194)		Hooper, Coughlan & Mullen (2008)
	Pre-test	Post-test	Pre-test	Post-test	Good Fit Value
Chi-Square	24.32	27.45	16.09	20.26	
p	0.018	0.0066	0.19	0.06	
GFI	0.97	0.96	0.98	0.97	0.95-1.00
AGFI	0.92	0.91	0.95	0.93	0.90-1.00
RMSEA	0.071	0.043	0.042	0.060	0.00-0.08
SRMR	0.033	0.038	0.034	0.040	0.00-0.05

3.3.3. Student questionnaire about efficiency of the treatment

The treatment of this dissertation is using enriched course materials through the guide. To check the efficiency of treatment a questionnaire is prepared and asked to the students. It was expected that the students reflect their perceptions on this questionnaire, Student Questionnaire about Efficiency of Treatment (SQET). The content of SQET is about the level of students' enjoyment and how the materials were contributed into their understanding (Appendix B7). For each material, student reflected their perceptions about materials. Additionally, there were some empty parts in SQET to let the students write about unwritten materials, if there is.

All the materials' names are given with a small picture of the material in order to help students reminding. There were five degres of responces from "nothing" to "very much". If a student filled the "nothing" that item is recorded as one and some descriptive statistics of collected data are given in Table 3.12, 3.13, 3.14, and 3.15 according to the case name (A or B) and part of the questionnaire like views about materials effect on learning (L) and enjoyment with the alpha values of items.

According to the analysis with SPSS, Cronbach's alpha values about enjoyment are .769 case A and .798 for case B results. About materials' efficiency on learning, alpha values are .758 for case A and .808 from case b results.

Table 3.12 Statistics of SQET results from case A about materials enjoyment

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
N	30	30	30	30	30	30	30	30	30	30	30
Mean	4.40	4.00	3.83	4.23	3.83	3.86	4.06	4.23	4.06	3.76	4.66
SD	.77	.78	.83	.77	1.20	1.00	1.08	.93	1.01	1.40	.60
Skew.	-1.33	-.45	-.05	-.92	-.67	-.36	-1.19	-1.04	-1.41	-.90	-1.69
Kurto.	1.87	-.03	-.78	.92	-.63	-.97	1.01	.22	2.09	-.60	1.95
Mini	2.00	2.00	2.00	2.00	1.00	2.00	1.00	2.00	1.00	1.00	3.00
Maxi	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Sum	132.0	120.0	115.0	127.0	115.0	116.0	122.0	127.0	122.0	113.0	140.0
Alpha	.72	.72	.72	.72	.73	.73	.73	.71	.72	.74	.72

Table 3.13 Statistics of SQET results from case B about materials enjoyment

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
N	35	35	35	35	35	35	34	35	35	34	34
Mean	4.00	3.45	3.00	3.51	3.17	2.77	3.32	3.85	2.54	3.17	3.94
SD	1.18	1.40	1.39	1.44	1.31	1.59	1.38	1.21	1.35	1.46	1.45
Skew.	-.89	-.48	.06	-.56	-.00	.35	-.40	-.85	.54	-.140	-1.14
Kurto.	-.32	-.92	-1.21	-1.01	-1.02	-1.47	-1.06	-.12	-.71	-1.33	-.02
Mini	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maxi	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Sum	140.0	121.0	105.0	123.0	111.0	97.00	113.0	135.0	89.00	108.0	134.0
Alpha	.71	.71	.70	.71	.73	.72	.70	.72	.72	.70	.73

Table 3.14 Statistics of SQET results from case A about materials' efficiency on learning

	LA1	LA2	LA3	LA4	LA5	LA6	LA7	LA8	LA9	LA10	LA11
N	30	30	30	30	30	30	30	30	30	30	30
Mean	4.25	3.96	4.19	4.06	4.09	4.19	4.16	4.32	4.22	4.22	4.70
SD	.92	.87	1.07	.96	1.01	.87	1.00	1.35	1.30	1.49	1.32
Skew.	-1.8	-1.5	-1.2	-1.3	-.8	-.0	-.3	-.5	.9	1.4	3.6
Kurto.	4.60	3.84	1.10	2.33	-.42	-1.07	3.77	2.39	5.89	7.01	17.85
Mini	1.00	1.00	1.00	1.00	2.00	3.00	1.00	1.00	1.00	1.00	3.00
Maxi	5.00	5.00	5.00	5.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00
Sum	132.0	123.0	130.0	126.0	127.0	130.0	129.0	134.0	131.0	131.0	146.0
Alpha	.796	.780	.757	.780	.779	.766	.766	.767	.766	.777	.777

Table 3.15 Statistics of SQET results from case B about materials' efficiency on learning

	LB1	LB2	LB3	LB4	LB5	LB6	LB7	LB8	LB9	LB10	LB11
N	35	35	35	35	35	34	35	35	35	35	33
Mean	4.02	3.60	2.94	3.28	3.08	3.14	3.28	3.60	2.74	3.17	3.81
SD	1.12	1.35	1.51	1.31	1.54	1.47	1.50	1.41	1.40	1.58	1.46
Skew.	-.981	-.563	.102	-.075	-.049	-.209	-.520	-.543	.352	-.204	-.992
Kurto.	.141	-.957	-1.47	-1.16	-1.45	-1.35	-1.25	-.1,00	-1.07	-1.44	-.38
Mini	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maxi	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Sum	141.0	126.0	103.0	115.0	108.0	107.0	115.0	126.0	96.00	111.0	126.0
Alpha	.758	.754	.775	.780	.756	.768	.766	.760	.769	.761	.788

According to Table 3.12, 3.13, 3.14, and 3.15, minimum and maximum values are as expected, most of the Skewness and Kurtosis values are on the same direction, and the SQET are responced by the most of the experimental group members.

3.3.4. Student questionnaire for comparing learning environment before and during the motion unit

This form is prepared from What Is Happining In the Class (WIHIC)'s Turkish version (Brok, Telli, Cakiroglu, Taconis & Tekkaya, 2010). All the 56 items were conserved with the original order. However, response columns divided into two parts, one is for before and the other is for during motion.

There are three main reasons why WIHIC is chosen to apply to identify the learning environment. First, this questionnaire is adapted into Turkish and applied with 1474 high school students in Turkey under supervision of learning environment experts. Second, Cronbach's α from the results of WIHIC's Turkish version was 0.82. Third, the sub dimensions of WIHIC (Table 3.16) are important and most related with inclusive learning environment. There are seven sub dimensions in WIHIC, namely, student cohesiveness, teacher support, involvement, investigation, task orientation, cooperation, and equity. Generally, teacher support and equity sub dimensions are about teacher behaviors towards students and others about classroom rules and behaviors of students towards each others.

Table.3.16 Scale and item distribution of WIHIC questionnaire

Scale	Item Distrubution
Student cohesiveness (SRCO)	1-8
Teacher support (TESU)	9-16
Involvement (INT)	17-24
Investigation (INN)	25-32
Task oreintation (TAOR)	33-40
Cooperation (COOP)	41-48
Equity (EQU)	49-56

Although in this section there are some "pre-test and post-test" explanations, there was only one used test which was splitted the paper into two colums and asked the

previous decisions of students with their current decisions together (Appendix E1). This construct allow the students to compare the learning environments before and during motion concepts at the same time.

This method is necessary to present the difference between learning environments. Therefore, the effect of enriched course materials should be explained with regards to learning environment. If the enriched course materials increase the affective domains, achievement and interactions, it means that there is an inclusive learning environment in those cases and the results of WIHIC are an explanation of the characteristics of inclusive environment.

3.3.4.1 Confirmatory factor analysis

In order to confirm whether constructs in WIHIC work as questionnaire developers' explanations, Conformatory Factor Analysis (CFA) is applied with results of WIHIC. At the beginning of CFA, some descriptive statistics of WIHIC are discussed in terms of the CFA's assumptions.

3.3.4.1.1 Descriptive statistics for confirmatory factor analysis

To gather main important descriptive values, version 20 of SPSS is used and given in Table 3.17 and Table 3.18. According to Table 3.17 and 3.18; number of WIHIC participants (N=191) is equal to the totally number of students, most of the Skewness and Kurtosis values are on the same directions; all of them are negative or positive, there is no extreme value among mean, minimum and maximum values, and all alpha values are over .800 for sub dimensions of the WIHIC.

Table 3.17 Descriptive statistics of WIHIC's Pre results

	Pre-SRCO	*Pre-TESU*	*Pre-INT*	*Pre-INN*	*Pre-TAOR*	*Pre-COOP*	*Pre-EQU*
N	191	191	191	191	191	191	191
Mean	3.63	2.99	3.32	3.2	3.46	3.25	3.35
Std. Deviation	.94	1.22	1.07	1.08	1.05	1.17	1.10
Skewness	-.522	-.093	-.001	-.185	-.311	-.119	-.251
Kurtosis	.149	-.881	-.773	-.606	-.440	-.817	-.591
Minimum	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Alpha	.871	.869	.843	.842	.849	.845	.856

Table 3.18 Descriptive statistics of WIHIC's Post results

	P0-SRCO	*P0-TESU*	*P0-INT*	*P0-INN*	*P0-TAOR*	*P0-COOP*	*P0-EQU*
N	191	191	191	191	191	191	191
Mean	3.57	2.95	3.28	3.31	3.56	3.24	3.39
Std. Deviation	1.02	1.24	1.13	1.14	1.13	1.18	1.13
Skewness	-.476	.007	.059	-.194	-.327	-.152	-.253
Kurtosis	-.274	-.928	-.877	-.674	-.771	-.796	-.755
Minimum	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Alpha	.913	.914	.894	.895	.899	.898	.904

Due to the fact that there is no alpha value under .80, the standart deviation values around 1.0 could be tolarated. Most of the Kurtosis values are negative which explains why the std. deviation is around 1.0.

3.3.4.1.2 Assumptions for confirmatory factor analysis

Normally distributed values with 191 sample size are acceptable for a questionnaire with seven dimensions. Additionally, consistant results cause meaningful models and Cronbach's alpha value about pre test results is .87 and alpha value of post test results is .92. There is no correlation value under 3.0 among dimensions of WIHIC in pre-test results (Table 3.19) and in post-test results (Table 3.20). This moderate correlation is enough in terms of assumptions for confirmatory factor analysis with

pre and post test results of WIHIC. Tu sum up, assumptions of CFA were not violated.

Table 3.19 Correlations among WIHIC constructs from pre-test results

	Pre-SRCO	*Pre-TESU*	*Pre-INT*	*Pre-INN*	*Pre-TAOR*	*Pre-COOP*
Pre-TESU	.306**					
Pre-INT	.517**	.646**				
Pre-INN	.350**	.508**	.563**			
Pre-TAOR	.342**	.333**	.498**	.675**		
Pre-COOP	.454**	.442**	.569**	.648**	.627**	
Pre-EQU	.405**	.333**	.478**	.568**	.648**	.487**

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

Table 3.20 Correlations among WIHIC constructs from post-test results

	Po-SRCO	*Po-TESU*	*Po-INT*	*Po-INN*	*Po-TAOR*	*Po-COOP*
Po-TESU	.461**					
Po-INT	.612**	.690**				
Po-INN	.514**	.592**	.709**			
Po-TAOR	.530**	.454**	.655**	.717**		
Po-COOP	.580**	.523**	.696**	.762**	.680**	
Po-EQU	.470**	.483**	.631**	.653**	.757**	.609**

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

3.3.4.1.3 Results of the confirmatory factor analysis

Latent variable (WIHIC) and its predictors are given in a good fit for the pretest results after five steps (Appendix E2) in Figure 3.10 with four covariances and for the posttest results after four steps (Appendix E3) in Figure 3.11 with three covariances.

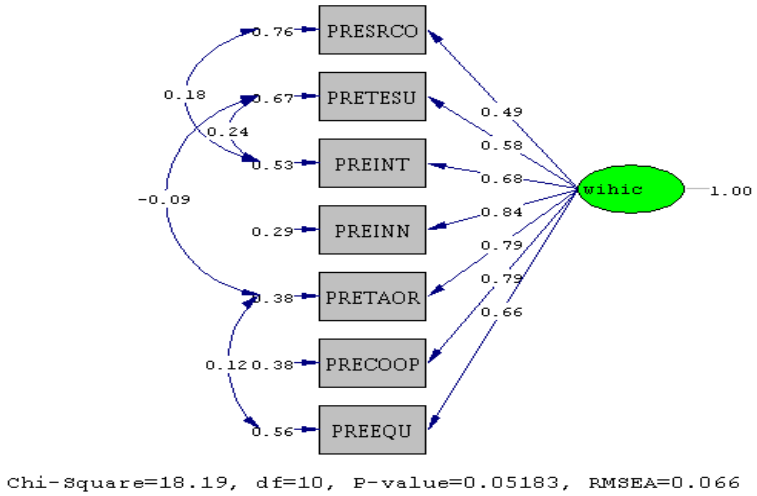


Figure 3.10 A good fit of the model with pre-WIHIC's standardized regression coefficients

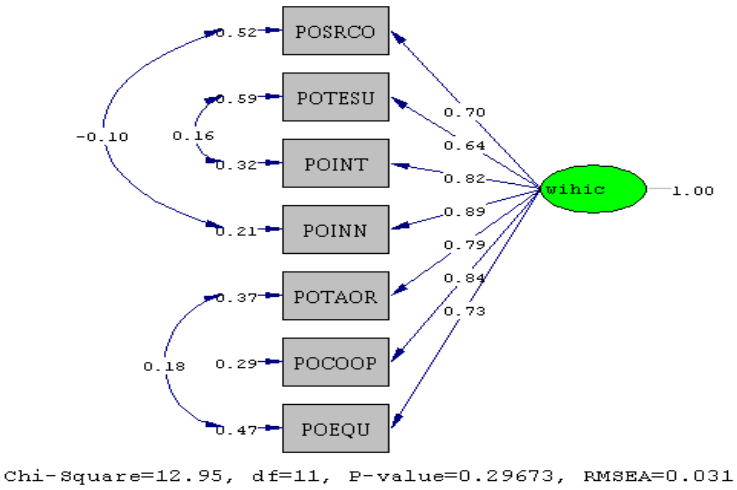


Figure 3.11 A good fit of the model with post-WIHIC's standardized regression coefficients

Dorman (2003) compared some Model fit (GFI and RMSEA) and model parsimony (PGFI and PNFI) values of WIHIC used in three different countries in order to present the cross-national validation of the questionnaire. As it seen in Table 3.21, model parsimony values are less than the other applications of WIHIC. However, there is a serious sample size difference and model fit values are as good as other applications of WIHIC in Table 3.21.

Table 3.21 Comparing some important values of good fit models of WIHIC

		Current values		*Dorman (2003)*		
		Pre-test (N=191)	*Post-test (N=191)*	*Australia (N=1433)*	*UK (N=1596)*	*Canada (N=951)*
Model fit	GFI	.98	.97	.99	.91	.99
	RMSEA	.03	.06	.08	.08	.08
Model	PGFI	.39	.35	.87	.80	.88
parsimony	PNFI	.52	.47	.90	.82	.93

PNFI and PGFI values should be ranged from 0 to 1 and expected values should be around 0.5 (Dorman, 2003). These are the some reasons why test results gathered with this study should be used (Yılmaz & Çelik, 2009).

3.3.5. Observation check list of interaction

The focus of the study is blind students; therefore an observation of their interactions during the physics course is necessary. In order to follow the blind students' interactions during the course an Observation Check List of Interaction (OCLI) (Appendix F) is adapted from Sands, Kozleski and French's (2000) observation form about student behaviors. The interaction among blind students, teacher, friends and course materials are divided into two as cognitive and physical interactions. Indicators of these kinds of interactions are defined as asking, answering, giving example, sitting, standing, etc. From 58 observed lesson in two different cases, 12 observations were compared with the other observer, and 8 observations were compared with the records (Table 3.22).

The data from observations is needed to analyze interms of the reliability. The reliability of observations could be tested with other observer and re-observasion from records (Table 3.23). Inter reliability is calculated by deviding the number of common observations (NCO) with the number of total observations (NTO).

Two teachers didn't allow recording the whole lesson but they accepted whether records would be cleaned; therefore the researcher re-observed the blind students one

hour later and cleaned the record in front of the teacher. The other observer is a doctoral candidate in science education and tries to prepare a qualitative dissertation which includes observations.

Table 3.22 Distribution of observation types

WEEK	A	B
1	O1, O2	O1, O2
2	O1	O1
3	O1,C	O1,C
4	O1	O1
5*	O1	O1
6*	O1, O2	O1, O2
7*	O1,C	O1,C
8	New Year Holiday	O1
9	O1	O1
10	O1, O2	O1, O2

Note: Camera (C), Observer1 (O1), observer2 (O2), * symbolize the treatment weeks.

Table 3.23 Inter reliability values from different observations

Case A				Case B			
Type and Name of OCLI	NTO	NCO	Inter reliability	Type and Name of OCLI	NTO	NCO	Inter reliability
(31-32)	175	170	0.971	(1-2)	160	154	0.963
(33-34)	175	172	0.983	(3-4)	155	155	1.000
(37-38)	*175*	*175*	*1.000*	*(7-8)*	*160*	*159*	*0.994*
(39-40)	*175*	*174*	*0.994*	*(9-10)*	*160*	*160*	*1.000*
(45-46)	150	147	0.980	(15-16)	155	150	0.968
(47-48)	165	162	0.982	(17-18)	175	172	0.983
(49-50)	*155*	*154*	*0.994*	*(19-20)*	*155*	*145*	*0.935*
(51-52)	*170*	*169*	*0.994*	*(21-22)*	*155*	*151*	*0.974*
(55-56)	165	165	1.000	(27-28)	160	159	0.994
(57-58)	170	170	1.000	(29-30)	145	145	1.000

*Re-observation from records are presented italic.

Summary of inter reliability values are given in Table 3.24.The inter reliability values are presented for both case A and B because there should be difference due to the characteristics of cases. However, all values from case A and B are approximately same.

Table 3.24 Summary of inter reliability values

Type of re-observation	Case A	Case B
Records	.995	.976
Other observer	.986	.984

3.3.6. Student questionnaire for comparing interaction among students before and during the motion unit

This questionnaire (SQCI) is applied to all the students in order to understand the students' perceptions about the interaction in the class. Tree types of observasions were asked; the blind student's, sighted friends' and his/her own interactions (Appendix G).

To analyze the consistency of subjects, descriptive statics of SQCI results and alpha values are only given for sighted friends' (S) and individual (I) interaction parts about before (B) and during (D) the treastment. Most of the students complated SQCI and standart daviation is around 1. Skewness and Kurtosis values in Table 3.25 and Table 3.26 are on the same direction. Moreover, Cronbach alpha values in Table 3.24 and 3.25 are more than .95; therefore, according to the alpha scores, SQCI should be used to decide the interaction difference.

In SQCI, there are six questions about interaction and the response are expected in five level of frequency from never to always. The subject decide the interaction before and during the motion unit. Therefore, appropriate numbers from one to five are written according to the subject's response.

Table 3.25 Sighted students' interaction scores before (SB) and during (SD) motion unit

	SB1	SB2	SB3	SB4	SB5	SB6	SD1	SD2	SD3	SD4	SD5	SD6
N	191	190	190	190	189	189	190	189	189	189	189	190
Mean	3.52	3.4	3.35	3.37	3.25	3.43	3.43	3.34	3.33	3.37	3.16	3.33
SD	1.12	1.14	1.21	1.26	1.30	1.24	1.21	1.18	1.27	1.32	1.410	1.30
Skew.	-.240	-.237	-.169	-.278	-.222	-.383	-.258	-.325	-.303	-.294	-.145	-.327
Kurto.	-.859	-.836	-1.06	-.971	-1.04	-.847	-.891	-.738	-.959	-1.05	-1.25	-.967
Sum	673	648	637	641	615	650	653	632	630	637	598	634
Alpha	.957	.957	.955	.955	.956	.956	.956	.955	.955	.955	.955	.955

Table 3.26 Individual interaction scores before (IB) and during (ID) motion unit

	IB1	IB2	IB3	IB4	IB5	IB6	ID1	ID2	ID3	ID4	ID5	ID6
N	190	189	190	190	188	190	190	189	189	189	188	190
Mean	3.37	3.25	3.24	3.22	3.10	3.32	3.34	3.21	3.22	3.29	3.10	3.32
SD	1.23	1.25	1.25	1.35	1.43	1.40	1.32	1.32	1.37	1.42	1.42	1.46
Skew.	-.258	-.130	-.200	-.214	-.080	-.250	-.252	-.101	-.195	-.255	-.043	-.264
Kurto.	-.894	-1.03	-.968	-1.13	-1.30	-1.21	-1.16	-1.26	-1.25	-1.29	-1.34	-1.33
Sum	642	616	617	612	583	631	635	608	610	623	584	632
Alpha	.955	.955	.956	.955	.956	.956	.954	.954	.954	.954	.955	.955

3.4. Research Design

This study includes different types of methods and designs. First of all, the process about how to design the enriched course materials is important. The first research method of this dissertation, the experimental design, is selected to understand the efficiency of enriched course materials.

The experimental and control groups are assigned and pre-post instruments are given. There is a treatment applied on experimental group and some factors like teacher effect are controlled by working with the same teacher in each case. Although cases are not randomly assigned, used instruments and their application sequence represent the experimental design (Figure 3.12).

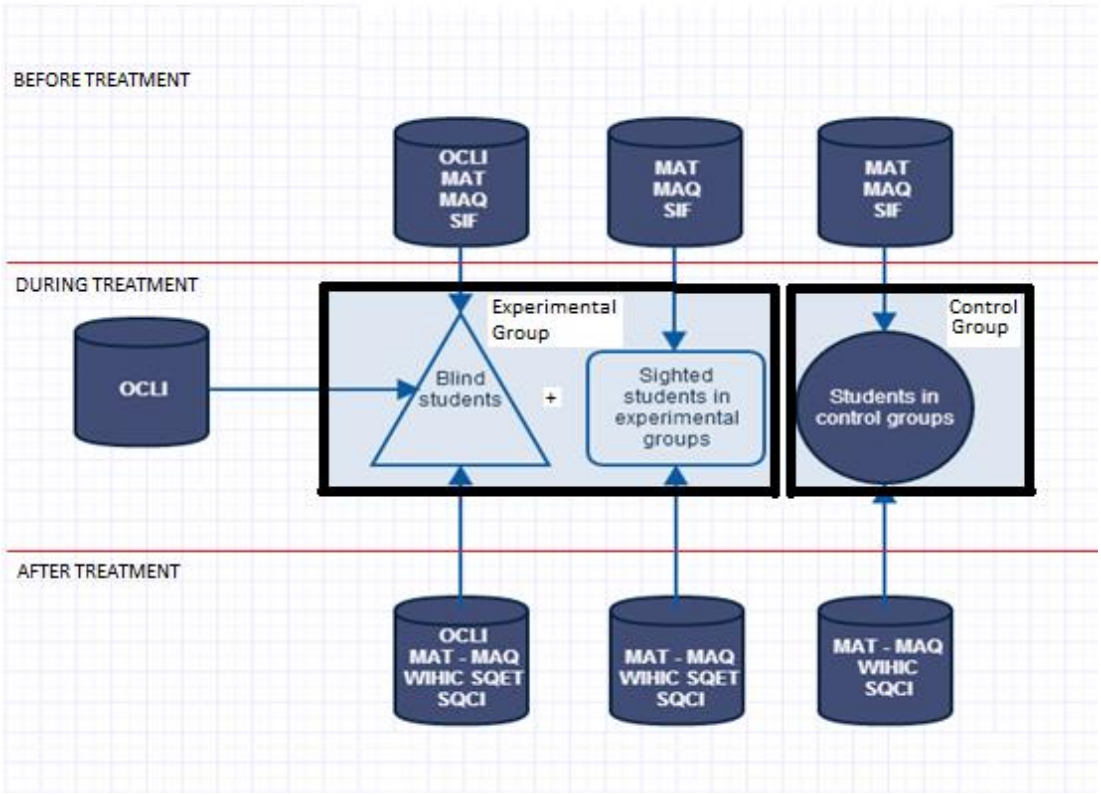


Figure 3.12 Used instruments and their sequence according to the treatment

Before the treatment, MAT, MAQ, and SIF are given to both totally blind and sighted students. After the treatment, MAT, MAQ, WIHIC, and SQCI are given to all students. Additionally, experimental group members are completed the SQET and OCLI is used during the whole study by the observers.

On the other hand, the blind students' interaction is the focus of this study and a single subject case design is applied into two different cases which makes the study "multi-element designs" (Kennedy, 2005). In terms of this perspective "Base (non-treatment)-Application (treatment)-Base (BAB)" formula is selected (Tekin-İftar & Kırcaali-İftar, 2006). Additionally, more cases make the inference stronger (Kennedy, 2005).

In Table 3.27, research problems are matched with used instruments. First research problem is about the effect sizes through MAT and MAQ scores of sighted, totally blind students in experimental and control groups. Second research problem represents in which level treatment worked; therefore, a questionnaire about

efficancy of treatment was conducted (SQET). Third research problem focuses on the learning environment and fourth research problem is about students'perceptions about the interaction. To answer the third and fourth research questions, respectly, WIHIC and SQCI are used. Although, in order to discuss the interaction of the blind students, results of OCLI are enough, other instruments (MAT, MAQ, SQET, WIHIC and SQCI) were used to triangulate the change of interaction level (Table 3.27).

Table 3.27 Matching the research problem and used instruments

Research problem	*Data collecting method and the used instruments*
R1a, R1b, R1c, R1d, R1e, R1f, R1g and R1h	MAT & MAQ
R2	SQET
R3	WIHIC
R4	SQCI
R5a, R5b, R5c, R5d, R5e, R5f, and R5g	OCLI

3.5. Procedure

The study began with the researcher's interest on special education. After deciding the research context, a detailed literature review on relevant issues was conducted. Key words, used for this review, are presented in Appendix H. The literature review started before the identification of research problem and continued until completion of the dissertation by using academic alerts of electronic sources. For the literature review, the electronic sources provided by the METU Library such as e-theses, e-journals, EBSCOhost, ERIC, Academic Search Complete, Education Research Complete, Dissertations and Theses, etc, available hard copies in the METU Library, METU thesis and dissertations, and Turkish Higher Education Council National

Dissertation Center/database, Google scholar search engine, UMI Disserattion abstracts international, Sociofile, MEDLINE, PsycINFO, and Social Sciences Citation Index (SSCI) databases were utilized. Most of these databases let the researcher construct an alert, so current studies are informed by their database services. This feature is used for this study to keep the review current. Turkish books were searched via the three huge educational publishers' web page; Anı, PagemA, and Nobel with the same key words. Giving a decision about the last version of research questions took a long period with reading these sources, working with blinds and discussing with the supervisor to make research questions feasible, clear, significant and ethical.

Deciding and developing the instruments and the treatment is taken the most of the time. Before the application, instruments and materials are presented in front of the thesis committee members and relevant permission from the Applied Ethics Research Center in Middle East Technical University and National Ministery of Education is taken (Appendix I). The parents of the blind students allowed the treatment and the teachers are persuaded to use the enriched course materials voluntarily.

The studies of this dissertation started the end of the year 2011 with material development. Developing enriched course materials approximately took one year. Among the instruments, OCLI, MAT, MAQ, SIF, SQET, SQCI, and WIHIC, the most time consuming instrument was MAT. The latest developed instrument was SQET because it includes enriched course materials. Developing the OCLI and SQCI were simultaneously continued due to their same content. Finally, the main application of the study took approximately two months.

Generally teachers don't prefer interfere in their teaching style, so for physics teachers only materials are given with the guide and wanted to follow the formal textbook step by step. The teacher training procedure took approximately one hour. While giving the materials, short explanations and answering the questions are the other parts of training. At last, teachers are informed about the additional materials given to the blind students. During the study, totally blind students used a CD (audio-

textbook), tactual textbook with descriptions, needle page and tactual textbook with original figures (acetates papers for studying with sighted friends and/or family members). During the instrument applications, teachers were active in their classes. The researcher started the filling the instrument process and checked other classes and the guidance office where the totally blind students took the instruments. Guidance teachers who are not physics experts read and wrote during this process instead of totally blind students.

3.6. The Implementation of the Treatment

Treatment is implemented by two different physics teachers. Control groups did what ever the formal course book suggests. Experimental groups followed the course book with a difference; in some determined times in the given guide, experimental group members used enriched course materials. These supplementary materials used by both sighted and blind students.

Additional to the experts, one week before teacher training, an expert opinion form (see Appendix B4) about the appropriateness of guide, materials and objectives is given to the teachers to analyze it and prepare a feedback to the researcher. During the teacher training, it was clearly explained the purpose of the study, the design of the research, and the role of the researcher and teachers. In the guide given to the teacher (see Appendix B5), there were some blanks to write some explanations, information about the time needed to use the ECM and in which page of the textbook they should use the defined ECM. The page numbers of textbooks for both the totally blind and sighted students were different, so both different numbers are given to the teacher with the guide and highlighted during the teacher training.

An observation checklist is prepared to follow how does the teacher used course materials, if any. This simple checklist (Appendix J) used during the treatments in both experimental and control groups. In experimental classes out of observing the blind students, this checklist is used whether the teacher used enriched course materials as planned or not. This form also used to be sure whether control groups

used the material. There were no explanation about the materials and treatment in both classes.

All instruments are filled during the guidence hours and one more hour after it. While collecting the data, the researcher was there and explaind how to fill and behave. There was no problem about instruments and timing. In some instruments, students prefer not to write their names; however, all papers are collected according to sitting order and then this order recorded with names to check the subject number. This method is selected not to lose any subject and if writing the name was announced as must, students may not response rightly.

3.7. Analyses of Data

Firstly, the data collected from the instruments; OCLI, MAT, MAQ, SIF, SQET, SQCI, and WIHIC. Secondly, all the students who attended the study have a new number different from the school number and all the data are recorded with this new student identification. Collected papers put into a folder according to this new student number. Before missing data analysis and cleaning data process, all the raw data collected from the instruments is given with frequency tables in Appendix K. Afterwards, missing data analysis and cleaning data process are completed and the data is analyzed in terms of the research questions.

In this study, generally effect size (ES) values and frequency rates are used. These analysis are explain in the related sections before the results.

3.7.1. Missing data analysis

Missing-data is a natural phenomenon in social science studies but the level of missing is important. For instance, if more than 50% in a subjects' questionnare is missing, conclusions and discussions may become meaningless. Although there is no consensus on the limit of missing, Graham (2009) suggest dropping the subject or variable if missings are more than 15%. For any subject or item there were some missings but not enough to drop the whole item or subject.

Analyses were started after all the unanswered questions detected. Replacing unanswered questions' data is conducted with mean score with a difference. Generally unanswered questions replace with the Colums' mean score; however, there are two different cases and experimental-control groups should be different. In otherwords, about one item all the values get the same mean score. The chosen method for replacing the unanswered questions is based on looking the most relevant values and replacing the missing with the mean of that relevant case. For instance, there may be two unanswered questions in item1, first unanswered questions is from case A and in control groups' values, therefore first missing value replaced with mean of the relevant values. If the second unanswered question is in case B, a new mean score should be calculated to replace.

3.8.Assumptions and Limitations

Like every study, this dissertaion includes some assumptions and limitations. First of all, it was assumed that all responces to the instruments are given seriously, consciously, and truthfully. Secondly, the number of totally blind students in Ankara is taken from relevent staff in Ministery of National Education and it was assumed that there is no unrecorded other totally blind student in Ankara.

There are three main limitation in this study; unit of concept, grade level and participants. The study gave explanations only about motion concept in 9th grade level. All blind students are totaly blind; therefore, visually impaired students may be different. Additionally, sighted students' responces reflected the stuation in the two ordinary high school in Ankara where totally blind students attended, not about all high schools.

CHAPTER 4

RESULTS

This chapter starts with data cleaning and missing data analysis. Then, results of the study are given in different sections according to the research problems sated in Chapter 1. After reporting the results related with five research problems, the chapter ends with introducing the methods used for triangulating the results and a summary of the results.

4.1 Data Cleaning and Missing Data Analysis

In this section, detailed information was given about the way of replacing the unanswered questions in the instruments. These replacement procedures are applied on the MAT, MAQ, and WIHIC responses; in the other instruments, unanswered responses are used with their original way. This section is concluded with the missing data issues.

At the beginning, the data were screened by the help of frequency tables to check whether all data were within the range of possible maximum and minimum values for each item. There was no additional unexpected alternatives and all frequency of anweres are distributed to defined alternatives for each instrument.

Secondly, number of unanswered questions in the MAT, MAQ, and WIHIC instruments was analysed. This analysis included some tables describing the

distribution of unanswered questions. All the tables in this section supported the idea that there is no problematic unanswered item in the MAT, MAQ or WIHIC.

The raw data of the MAT were provided in Appendix L, and the number of students who did not answer each item was given in Table 4.1. As seen in the table, the number of unanswered questions in the Post-MAT is decreased when compared with the Pre-MAT. This change was more visible in Case A for the control groups. The decrease in the number of unanswered questions after the instruction is an acceptable situation. Total number of unanswered questions is about 1% of all responses. Therefore, the researcher replaced the unanswered questions as if they were wrong. On the other hand, the number of unanswered questions in terms of the last three questions indicated that the allocated time was enough to solve MAT.

Table 4.1 The distribution of unanswered questions in MAT

	Question number in MAT																Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Case A																	
CPre-MAT	1	0	0	1	1	1	1	1	1	0	14	0	0	5	0	2	28
CPost-MAT	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
EPre-MAT	0	1	1	0	3	0	3	0	2	2	6	0	1	6	1	1	27
EPost-MAT	0	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	5
Total	1	1	1	1	4	1	5	1	3	2	24	0	2	11	1	3	61
Case B																	
CPre-MAT	0	0	0	0	1	0	0	0	0	0	4	0	2	3	0	0	10
CPost-MAT	0	1	0	0	0	0	0	0	1	1	7	0	1	2	1	0	14
EPre-MAT	1	0	0	0	0	0	0	0	2	1	3	0	0	2	0	0	9
EPost-MAT	0	0	0	0	0	0	2	0	0	0	1	1	0	1	0	0	5
Total	1	1	0	0	1	0	2	0	3	2	15	1	3	8	1	0	38
Total	2	2	1	1	5	1	7	1	6	4	39	1	5	19	2	3	99

In Table 4.1, two different schools in Ankara named Case A and Case B. Each of these cases included one totally blind student. In the tables given in the following parts, first letter of the variable was used to categorize the participants. ‘S’ is used for the sighted students, ‘B’ is for the totally blind students, ‘C’ is for the control groups, and ‘E’ is used for the experimental groups. The last two or three capital letters symbolize the instruments or sub-dimension of the instruments. In the middle of the

variable name, ‘Pre’ and ‘Post’ expressions are used to indicate the timing of application of the related instrument.

In Table 4.1, some of both experimental and control group students unanswered 11th and 14th questions according to Pre-MAT results, but according to Post-MAT results number of students who unanswered the 11th and 14th questions is decreased. These questions seem including more complicated contexts and difficult to answer without formule or specific information given in the motion unit.

The raw data of the MAQ were provided in two parts as seen in Appendix M1 and in Appendix M2 due to the huge number of responses. Appendix M1 included the results of Pre- MAQ and Appendix M2 demonstrated the results of Post-MAQ. When the number of unanswered questions in the MAQ was analysed (see Table 4.2), there seems no problematic variable or question because there are only a few (around three) unanswered questions among 191 students in the study. Responses to these unanswered questions were replaced with the mode value of related dimensions for each student.

Table 4.2 The distribution of unanswered questions in MAQ

	1	2	3	4	5	7	8	10	13	15	17	18	19	20	21	22	24	25	26	28	29	30	Total
Case A																							
CPre-MAQ	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	3
EPre-MAQ	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
CPost-MAQ	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
EPost-MAQ	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	1	0	0	0	1	0	0	0	1	0	0	0	1	1	0	1	0	1	0	0	0	0	7
Case B																							
CPre-MAQ	0	1	2	1	0	1	1	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	9
EPre-MAQ	0	0	0	1	0	0	1	1	0	0	1	1	0	0	1	0	1	2	1	1	1	1	13
CPost-MAQ	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	3
EPost-MAQ	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
Total	0	1	2	3	0	1	2	1	0	1	1	3	0	1	1	0	3	2	1	2	1	1	27
Total	1	1	2	3	1	1	2	1	1	1	1	3	1	2	1	1	3	3	1	2	1	1	34

In order to present the number of unanswered questions, similar to the MAT, each MAQ question number was used. There are some unused MAQ question numbers in Table 4.2, because all the students answered those question.

Number of unanswered questions in Table 4.3 is written according to total unanswered questions for each dimension of the WIHIC. The aim of Table 4.3 is to understand, if there is, cases and groups is the source of extreme or/and unexpected results although the number of questions in WIHIC is 56 (see Table 4.3). The distribution of unanswered questions for WIHIC was provided on a table according to the cases and groups. There is no extreme or/and unexpected results not only for each group but also for each dimension of WIHIC. In Table 4.3, situational interest (SI), importance of physics (IP), self-efficacy (SE), achievement motivation (AM), student motivation (SM), self-concept (SC), and test anxiety (TA) are expressed with their first letters.

Table 4.3 The distribution of unanswered questions in WIHIC

	Case A				Case B				
	During-WIHIC		Before-WIHIC		During-WIHIC		Before-WIHIC		Total
	C	E	C	E	C	E	C	E	
Student Cohesiveness	5	1	4	0	7	1	2	2	22
Teacher Support	4	2	4	4	16	1	5	1	37
Involvement	0	2	0	4	4	5	5	5	25
Investigation	0	0	0	0	3	2	3	1	9
Task Orientation	2	1	1	2	4	6	8	9	33
Cooperation	2	0	2	2	5	3	4	5	23
Equity	0	0	0	0	0	1	2	1	4
Total	13	6	11	12	39	19	29	24	153

All unanswered questions in the WIHIC are replaced with the mode value of the related dimension for each student. For the other instruments such as the SQET and SQCI, there were no replacement and the data were analysed with the raw data, because for these instruments there was no similar questions to put in same dimensions; each question presented different results. As a summary, during the implementation of the instruments, the participants were noticed about not to skip questions without answering, and they were appealed to take the instrument

applications serious. Therefore, among all the 191 students in the study there were a few missing items in the instruments.

Before the treatment, it was highlighted one or two times in all classes that they should come to the school during the motion unit and fill all the instruments without ignoring any question. The researcher repeated taking the students attention on unanswered questions or ignored instruments at the beginning of the test application and checked desk by desk during the test hours. All the data from all 191 students are collected without any missing for both Case A and B students.

4.2. The Results of Descriptive Analyses

In this section, the descriptive results about the first research question were given. Means, Standard deviations (SD), and effect sizes, skewness, kurtosis, number of participant (n), and minimum and maximum values of each variable (Min-Max) were provided in Table 4.4. In Table 4.4, situational interest (SINT), importance of physics (IMP), self-efficacy (SEFF), achievement motivation (ACHMO), student motivation (STUMO), self-concept (SCON), test anxiety (ANX), student cohesiveness (SRCO), teacher support (TESU), involvement (INT), investigation (INN), task orientation (TAOR), cooperation (COOP), and equity (EQU) are expressed in their abbreviated forms.

Table 4.4 The descriptive statistical results of MAQ and MAT scores

The name of variables	Mean	SD	Min-Max (Possible Min & Max)	Skewness	Kurtosis	n
BPre-MAT	3.5	3.5	1-6 (0-16)	-	-	2
BPost-MAT	12.5	0.7	12-13 (0-16)	-	-	2
SPre-MAT	4.0	2.0	1-10(0-16)	0.7	0.3	63
SPost-MAT	8.4	2.3	2-15 (0-16)	-0.2	1.5	63
CPre-MAT	3.6	1.7	0-8 (0-16)	0.4	-0.3	126
CPost-MAT	2.9	2.1	0-15 (0-16)	0.4	1.7	126
EPre-MAT	4.0	2.0	1-10 (0-16)	0.6	0.2	65
EPost-MAT	8.5	2.3	2-15 (0-16)	-0.2	1.2	65
BPre-MAQ	77.0	9.9	70-84 (0-150)	-	-	2
BPost-MAQ	109.9	19.3	64-150 (0-150)	-	-	2

Table 4.4 (cont.)

The name of variables	Mean	SD	Min-Max (Possible Min & Max)	Skewness	Kurtosis	n
SPre-MAQ	88.9	22.7	30-132 (0-150)	-0.5	-0.2	63
SPost-MAQ	115.5	12.0	107-124 (0-150)	-0.7	-0.3	63
CPre-MAQ	99.3	18.8	54-150 (0-150)	0.3	0.4	126
CPost-MAQ	78.2	22.2	30-150 (0-150)	0.7	0.8	126
EPre-MAQ	88.5	22.5	30-132 (0-150)	-0.5	-0.2	65
EPost-MAQ	110.0	19.1	64-150 (0-150)	-0.7	-0.3	65
BPre-WIHIC	195.0	3.0	192-198 (56-280)	-	-	2
BPost- WIHIC	213.5	19.5	194-233 (56-280)	-	-	2
SPre- WIHIC	180.0	45.1	56-280 (56-280)	-0.1	0.6	63
SPost- WIHIC	211.3	40.6	109-280 (56-280)	-0.2	-0.2	63
CPre- WIHIC	184.5	45.4	76-280 (56-280)	0.2	-0.4	126
CPost- WIHIC	169.6	50.8	56-280 (56-280)	0.3	-0.4	126
EPre- WIHIC	180.8	44.5	56-280 (56-280)	-0.7	0.7	65
EPost- WIHIC	211.3	40.1	109-280 (56-280)	-1.1	1.4	65
BPre-SINT	9.0	1.4	8-10 (0-25)	-	-	2
BPost- SINT	17.5	3.5	15-20 (0-25)	-	-	2
SPre- SINT	10.7	3.6	4-17 (0-25)	-0.2	-1.0	63
SPost- SINT	14.5	4.2	6-20 (0-25)	-0.5	-1.1	63
CPre- SINT	12.9	3.3	4-20 (0-25)	0.3	0	126
CPost- SINT	9.6	3.5	4-20 (0-25)	1.0	1.0	126
EPre- SINT	10.7	3.6	4-17 (0-25)	-0.2	-0.9	65
EPost- SINT	14.8	4.2	6-20 (0-25)	-0.6	-1.0	65
BPre-IMP	14.5	2.1	13-16 (0-25)	-	-	2
BPost- IMP	17.0	2.8	15-19 (0-25)	-	-	2
SPre- IMP	14.0	4.4	5-24 (0-25)	-0.4	-0.1	63
SPost- IMP	20.1	4.2	12-25 (0-25)	-0.5	-1.2	63
CPre- IMP	17.0	3.8	4-20 (0-25)	0.3	0.2	126
CPost- IMP	12.7	4.7	5-25 (0-25)	0.7	0.3	126
EPre- IMP	14.1	4.4	5-24 (0-25)	-0.4	0	65
EPost- IMP	20	4.2	12-25 (0-25)	-0.4	-1.2	65
BPre-SEFF	9.0	5.7	5-13 (0-25)	-	-	2
BPost- SEFF	22.0	4.2	19-25 (0-25)	-	-	2
SPre- SEFF	14.6	5.8	5-25 (0-25)	0	-1.0	63
SPost- SEFF	19.4	5.8	5-25 (0-25)	-1.4	1.0	63
CPre- SEFF	17.3	5.3	8-25 (0-25)	0.1	1.5	126
CPost- SEFF	13.2	5.2	5-25 (0-25)	0.4	-0.3	126
EPre- SEFF	14.4	5.9	5-25 (0-25)	0	-0.9	65
EPost- SEFF	19.5	5.8	5-25 (0-25)	-1.4	1.1	65

Table 4.4 (cont.)

The name of variables	Mean	SD	Min-Max (Possible Min & Max)	Skewness	Kurtosis	n
BPre-ACHMO	12.5	2.1	11-14 (0-25)	-	-	2
BPost-ACHMO	17.0	1.4	16-18 (0-25)	-	-	2
SPre- ACHMO	13.6	5.0	4-20 (0-25)	-0.7	-0.8	63
SPost-ACHMO	16.3	3.1	6-20 (0-25)	-1.4	2.3	63
CPre- ACHMO	15.3	3.5	4-20 (0-25)	-1.0	1.1	126
CPost-ACHMO	10.5	4.2	4-20 (0-25)	0.6	-0.4	126
EPre- ACHMO	13.6	4.9	4-20 (0-25)	-0.7	-0.8	65
EPost-ACHMO	16. 3	3.1	6-20 (0-25)	-1.4	2.4	65
BPre-STUMO	7.5	3.5	5-10 (0-25)	-	-	2
BPost-STUMO	16.0	2.8	14-18 (0-25)	-	-	2
SPre- STUMO	11.5	5.0	4-20 (0-25)	0	-1.2	63
SPost- STUMO	16.0	4.3	4-20 (0-25)	-0.5	-1.1	63
CPre- STUMO	13.0	4.2	4-20 (0-25)	-0.5	-0.2	126
CPost-STUMO	9.6	4.1	3-20 (0-25)	0.7	0.1	126
EPre- STUMO	11.4	4.9	4-20 (0-25)	0.1	-1.2	65
EPost- STUMO	16.0	4.3	4-20 (0-25)	-1.4	1.3	65
BPre-SCON	12.5	3.5	10-15 (0-25)	-	-	2
BPost- SCON	18.5	2.1	17-20 (0-25)	-	-	2
SPre- SCON	12.2	4.7	4-20 (0-25)	-0.2	-1.0	63
SPost- SCON	14.7	4.1	4-20 (0-25)	-0.9	0.1	63
CPre- SCON	13.3	4.3	4-20 (0-25)	0.4	-0.5	126
CPost- SCON	10.6	4.3	4-20 (0-25)	0.5	-0.2	126
EPre- SCON	12.2	4.7	4-20 (0-25)	-0.2	-0.9	65
EPost- SCON	14.8	4.1	4-20 (0-25)	-0.9	0.1	65
BPre-ANX	12.0	4.2	9-15 (0-25)	-	-	2
BPost- ANX	7.5	5.0	4-11 (0-25)	-	-	2
SPre- ANX	12.2	5.5	4-20 (0-25)	0	-1.3	63
SPost- ANX	8.7	4.8	4-20 (0-25)	1.1	0.3	63
CPre- ANX	10.6	4.6	4-20 (0-25)	0.4	-0.5	126
CPost- ANX	12.0	4.2	4-20 (0-25)	-0.1	-0.3	126
EPre- ANX	12.2	5.5	4-20 (0-25)	0	-1.3	65
EPost- ANX	8.7	4.8	4-20 (0-25)	1.1	0.4	65
BPre-SRCO	37.5	2.5	35-40 (8-40)	-	-	2
BPost-SRCO	39.0	1.0	38-40 (8-40)	-	-	2
SPre-SRCO	29.0	7.6	8-40 (8-40)	-0.7	0.0	63
SPost-STCO	32.7	6.0	11-40 (8-40)	-1.2	2.1	63
CPre-SRCO	28.8	7.0	8-40 (8-40)	-0.6	0.5	126
CPost-SRCO	26.2	7.5	8-40 (8-40)	-0.3	-0.2	126

Table 4.4 (cont.)

The name of variables	Mean	SD	Min-Max (Possible Min & Max)	Skewness	Kurtosis	n
EPre-SRCO	29.3	7.6	8-40 (8-40)	-0.9	0.0	65
EPost-SRCO	32.9	6.0	11-40 (8-40)	-1.8	2.9	65
BPre-TESU	20.5	6.5	14-24 (8-40)	-	-	2
BPost- TESU	25.5	8.5	17-34 (8-40)	-	-	2
SPre- TESU	22.7	9	8-40 (8-40)	-0.1	-0.8	63
SPost- TESU	26.9	9.7	8-40 (8-40)	-0.6	-0.5	63
CPre- TESU	24.3	9.2	8-40 (8-40)	-0.1	-0.9	126
CPost- TESU	21.5	8.7	8-40 (8-40)	0.3	-0.7	126
EPre- TESU	22.7	8.9	8-40 (8-40)	0.0	-0.9	65
EPost- TESU	26.9	9.6	8-40 (8-40)	-0.5	-0.8	65
BPre-INT	24.0	2.0	22-26 (8-40)	-	-	2
BPost- INT	26.0	5.0	21-31 (8-40)	-	-	2
SPre- INT	26.0	7.5	8-40 (8-40)	-0.1	-0.6	63
SPost- INT	29.9	7.3	16-40 (8-40)	0.0	-1.3	63
CPre- INT	25.9	8.5	8-40 (8-40)	0.0	-0.9	126
CPost- INT	23.4	8.8	8-40 (8-40)	0.3	-0.8	126
EPre- INT	25.9	7.4	8-40 (8-40)	-0.3	-0.5	65
EPost- INT	29.8	7.3	16-40 (8-40)	-0.4	-0.7	65
BPre- INN	28.5	4.5	24-33 (8-40)	-	-	2
BPost- INN	31.5	0.5	31-32 (8-40)	-	-	2
SPre- INN	24.3	8.5	8-40 (8-40)	-0.1	-0.7	63
SPost- INN	29.9	8.0	8-40 (8-40)	-0.7	0.0	63
CPre- INN	25.8	8.5	8-40 (8-40)	-0.2	-0.6	126
CPost- INN	24.1	9.1	8-40 (8-40)	0.1	-0.7	126
EPre- INN	24.4	8.5	8-40 (8-40)	-0.2	-0.8	65
EPost- INN	30.0	7.9	8-40 (8-40)	-0.9	0.1	65
BPre-TAOR	29.5	2.5	27-32 (8-40)	-	-	2
BPost- TAOR	32.5	5.5	27-38 (8-40)	-	-	2
SPre- TAOR	27.1	8.9	8-40 (8-40)	-0.4	-0.7	63
SPost- TAOR	31.7	7.4	8-40 (8-40)	-1.1	0.9	63
CPre- TAOR	27.6	8.1	8-40 (8-40)	-0.3	-0.4	126
CPost- TAOR	26.0	8.9	8-40 (8-40)	-0.1	-0.9	126
EPre- TAOR	27.2	8.7	8-40 (8-40)	-0.4	-0.7	65
EPost- TAOR	31.8	7.3	8-40 (8-40)	-1.2	0.9	65
BPre-COOP	29.5	8.5	21-38 (8-40)	-	-	2
BPost- COOP	31.0	5.0	26-36 (8-40)	-	-	2
SPre- COOP	25.5	8.1	8-40 (8-40)	-0.1	-0.6	63
SPost- COOP	29.9	6.8	11-40 (8-40)	-0.3	-0.3	63

Table 4.4 (cont.)

The name of variables	Mean	SD	Min-Max (Possible Min & Max)	Skewness	Kurtosis	n
CPre- COOP	25.4	9.3	8-40 (8-40)	-0.2	-0.8	126
CPost- COOP	23.2	9.3	8-40 (8-40)	0.2	-0.8	126
EPre- COOP	25.6	8.1	8-40 (8-40)	-0.1	-0.6	65
EPost- COOP	30.0	6.8	11-40 (8-40)	-0.7	0.3	65
BPre-EQU	25.5	1.5	24-27 (8-40)	-	-	2
BPost- EQU	28.0	7.0	21-35 (8-40)	-	-	2
SPre- EQU	25.7	8.7	8-40 (8-40)	-0.3	-0.7	63
SPost- EQU	30.1	7.7	11-40 (8-40)	-0.5	-0.7	63
CPre- EQU	26.7	8.4	8-40 (8-40)	-0.3	-0.6	126
CPost- EQU	25.3	9.0	8-40 (8-40)	0.0	-0.9	126
EPre- EQU	25.7	8.6	8-40 (8-40)	-0.4	-0.7	65
EPost- EQU	30.0	7.7	11-40 (8-40)	-0.6	-0.5	65

In Table 4.4, the lowest MAT mean score (3.5) belongs to the totally blind students before the treatment. The totally blind students' MAT mean scores (12.5) after the treatment was also the highest one. The totally blind students' Post-WIHIC score (213.5) was the highest one and the lowest Post-WIHIC mean score (169.6) belongs to the control group students.

In Table 4.4, although some SD values seem near to the half of the mean values, all mean values are bigger than the corresponding SD values and between the possible minimum and maximum values of each instrument. Due to the small number of totally blind students, SD values of them changed easily from pre-tests to post-tests. Although in both mean values there is an increase from pre-tests to post-test, totally blind students' INN mean values decreased from 4.5 to 0.5, and EQU mean values increased from 1.5 to 7.0 drastically. There are some other significant changes in SD values. For instance, 63 sighted students' Pre-MAQ SD values decreased from 22.7 to 12.0 and 65 experimental group students' ACHMO SD values decreased from 4.9 to 3.1 after the treatment. Among SD values of the control group students, Pre-IMP SD value increased from 3.8 to 4.7 after the treatment.

Kurtosis values change from -1.3 to 2.3 and Skewness values are in the -1.4 and 1.1 ranges. These Kurtosis and Skewness values are in acceptable range. These approximate values of Kurtosis and Skewness presented normal distributed results.

In the following sections, effect size (ES) values are calculated according to the formula of Cohen's d (Cohen, 1992). To compute the ES for the first research problem, means and SDs are used from Table 4.4. All ES values can be classified as small, medium, and large.

In this study, ES between 0.0 and 0.4 are accepted as small. From 0.41 to 0.6 are accepted as medium and marked with "*" one star. ES values larger than 0.61 are accepted as large and marked with "**" two stars.

4.3. The Results Related to the First Research Problem

In this section, the results related with the first research problem are given. To remind again, the research question was "What is the effect of using the enriched course materials on the sighted and totally blind 9^{th} grade students' physics achievement, and motivation and attitude towards the physics course in Ankara?" This research problem is given with its eight sub questions. During ES computations that are mentioned in the following parts, the mean of the second variable is substracted from the mean of the first variable.

In Table 4.5, the answers of two research questions are given together. One of these was "what is the effect size of using the enriched course materials on the post-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores of the sighted and totally blind students?"(1.a). The other was "what is the effect size of using the enriched course materials on the post-test achievement, and sub dimensions of the post-test motivation and attitude towards the physics course scores of the experimental and control group students?"(1.h).

Table 4.5 ES and used variables for the 1st and the 8th sub research questions (1.a & 1.h)

Used variables	ES	Used variables	ES
BPost-MAT vs SPost-MAT	1.79**	EPost-MAT ve CPost-MAT	2.57**
BPost-MAQ vs SPost-MAQ	-0.46*	EPost-MAQ ve CPost-MAQ	1.45**
BPost-SINT vs SPost- SINT	0.72**	EPost- SINT ve CPost-SINT	1.38**
BPost-IMP vs SPost-IMP	-0.74**	EPost-IMP ve CPost-IMP	1.60**
BPost-SEFF vs SPost-SEFF	0.45*	EPost-SEFF ve CPost-SEFF	1.16**
BPost-ACHMO vs SPost-ACHMO	0.23	EPost-ACHMO ve CPost-ACHMO	1.49**
BPost-STUMO vs SPost-STUMO	0.00	EPost- STUMO ve CPost-STUMO	1.53**
BPost-SCON vs SPost-SCON	0.93**	EPost-SCON ve CPost-SCON	0.99**
BPost-ANX vs SPost- ANX	-0.25	EPost- ANX ve CPost- ANX	-0.74**

In this sub question, "sighted students" means sighted students in the experimental class. Therefore, these ES values let the researcher to compare the effect of the ECM on the achievement, motivation and attitude of blind students with that of the sighted students. Additionally, the students from the experimental group performed better than the students from the control group in terms of the MAT scores.

Large ES values for the MAT, SI and SC results and medium ES value for SE results are obtained in favour of totally blind students. On the other hand, a large ES value for IP results and a medium ES value for MAQ results were obtained in favour of the sighted students. All ES values obtained from the experimental and control groups were large in favour of the experimental group except TA results.

In Table 4.6, the answers of two research questions are given together. One of these was "what is the effect size of the pre-tests of achievement, and sub dimensions of motivation and attitude towards the physics course scores of the sighted and totally blind students?"(1.b). The other was "what is the effect size of using the enriched course materials on the pre-test of the achievement, and sub dimensions of the post-test motivation and attitude towards the physics course scores of the experimental and control group students?"(1.g).

Table 4.6 ES and used variables for the 2nd and 7th sub research questions (1.b & 1.g)

Used variables	ES	Used variables	ES
BPre-MAT vs SPre-MAT	-0.25	EPre-MAT vs CPre-MAT	0.21
BPre-MAQ vs SPre-MAQ	-0.53*	EPre-MAQ vs CPre-MAQ	-0.52*
BPre-SINT vs SPre- SINT	-0.47*	EPre- SINT vs CPre- SINT	-0.64**
BPre-IMP vs SPre- IMP	0.11	EPre- IMP vs CPre- IMP	-0.71**
BPre-SEFF vs SPre- SEFF	-0.97**	EPre- SEFF vs CPre- SEFF	-0.52*
BPre-ACHMO vs SPre- ACHMO	-0.22	EPre- ACHMO vs CPre- ACHMO	-0.40
BPre-STUMO vs SPre- STUMO	-0.80**	EPre- STUMO vs CPre- STUMO	-0.35
BPre-SCON vs SPre- SCON	0.06	EPre- SCON vs CPre- SCON	-0.24
BPre-ANX vs SPre- ANX	-0.04	EPre- ANX vs CPre- ANX	0.31

According to Table 4.6, most of the ES values are negative for the sighted and totally blind students. These negative ES values are large level for the SM and SE, and medium level for the MAQ and SI. These results mean that according to pre scores of the MAT and MAQ, totally blind students were in disadvantageous position when compared with the sighted students in the beginning of the study.

On the other hand, most of the ES values are negative for the experimental and control group students. According to pre scores of the MAT, these results mean that background of the experimental group members were better than the control group members. Nevertheless, the control group members were more motivated than the experimental group members in the beginning of the study.

In Table 4.7, the answers of two research questions are given together. One of these was “what is the effect size of using enriched course materials between sighted students’ post and pre-tests of achievement, and sub dimensions of motivation and attitude towards physics course scores?”(1.c). The other was “what is the effect size of using enriched course materials between totally blind students’ post and pre-tests of achievement, and sub dimensions of motivation and attitude towards physics course scores?”(1.g).

Table 4.7 ES and used variables for the 3rd and 4th sub research questions (1.c & 1.d)

Used variables	ES	Used variables	ES
SPost-MAT vs SPre-MAT	2.05**	BPost-MAT vs BPre-MAT	4.28**
SPost-MAQ vs SPre-MAQ	3.52**	BPost-MAQ vs BPre-MAQ	1.00**
SPost-SINT vs SPre- SINT	0.97**	BPost- SINT vs BPre- SINT	3.47**
SPost-IMP vs SPre-IMP	1.42**	BPost-IMP vs BPre-IMP	1.00**
SPost-SEFF vs SPre-SEFF	0.83**	BPost-SEFF vs BPre-SEFF	2.60**
SPost-ACHMO vs SPre- ACHMO	0.68**	BPost- ACHMO vs BPre- ACHMO	2.50**
SPost-STUMO vs SPre- STUMO	0.67**	BPost- STUMO vs BPre- STUMO	2.66**
SPost-SCON vs SPre- SCON	0.97**	BPost- SCON vs BPre- SCON	2.14**
SPost-ANX vs SPre- ANX	0.57*	BPost- ANX vs BPre- ANX	0.98**

All of the ES values are positive and large. According to the pre and post scores of the MAT and MAQ, these results mean that, totally blind and sighted students' achievement, motivation and attitude are drastically improved during the treatment.

It is obvious that both sighted and totally blind students in the experimental groups improved their achievement, motivation and attitude in large ES except TA results. Although the ECM affected one group more than the others in some dimensions, this result indicates that the ECM has a positive effect on both the sighted and totally blind students.

The ES values of the control and experimental group students' post-test and pre-test achievements, and sub dimensions of motivation and attitude towards physics course scores are given in Table 4.8.

Table 4.8 ES and used variables for the 5th and 6th sub research questions (1.e & 1.f)

Used variables	ES	Used variables	ES
CPost-MAT vs CPre-MAT	-0.37	EPost-MAT vs EPre-MAT	2.09**
CPost-MAQ vs CPre-MAQ	-1.04**	EPost-MAQ vs EPre-MAQ	1.03**
CPost-SINT vs CPre- SINT	-0.97**	EPost- SINT vs Epre- SINT	1.05**
CPost-IMP vs CPre-IMP	-1.00**	EPost-IMP vs EPre-IMP	1.37**
CPost-SEFF vs CPre-SEFF	-0.78**	EPost-SEFF vs EPre-SEFF	0.87**
CPost-ACHMO vs CPre- ACHMO	-1.23**	EPost- ACHMO vs EPre- ACHMO	0.68**
CPost-STUMO vs CPre- STUMO	-0.82**	EPost- STUMO vs EPre- STUMO	1.00**
CPost-SCON vs CPre- SCON	-0.63**	EPost- SCON vs EPre- SCON	0.59*
CPost-ANX vs CPre- ANX	0.32	EPost- ANX vs EPre- ANX	0.67**

Although most of the effect size values for the control groups are negative and large, all effect size values of the experimental groups are positive and large or medium. Only the control groups' ES values for the MAT and TA are in small level. These

results also mean that there is a large increase in the experimental group members' MAT, motivation and attitude results from the pre-test to the post-test.

4.4. The Results Related to the Second Research Problem

The second research problem was stated as "What are the sighted and totally blind 9th grade students' perceptions and perception difference about the enriched course materials in terms of contribution on their learning, and to what extent they like the materials?" Perceptions about enjoyment level of the ECM and ECM's contribution on their learning were asked by the SQET, and the raw data of the SQET are given in Appendix N. There were two main parts in the SQET about enjoyment level of the ECM, and ECM's contribution on their learning. In each part, all ECM were asked and the students answered by giving degree from zero to four, namely, never, small, medium, large, and very large. In this section, the results of the experimental group members' perceptions about the ECM are analysed.

All experimental group students' perceptions about the ECM are given in Table 4.9. In Table 4.9, each ECM was presented with mean scores of totally blind (B) and sighted students (S) and with their SD values. Most of the mean scores are more than "3". Furthermore, most of the ES values are positive which means that the totally blind students enjoyed the ECM more than the sighted students. In addition to this, they think that the contribution of using ECM to their learning is larger than the sighted students. For instance, the ES value of the first ECM is "-1.7". This means that the totally blind students did not enjoy the first ECM as much as their sighted friends. The reason of this result is simple and based on the nature of material. The material is a video and sighted students learnt the relative motion clearly, however, blind students only heart the voice and descriptions from the video.

Table 4.9 Students' perceptions about ECM

ECM Numbers	Enjoyment level of materials					Materials' contribution on their learning				
	Blind		Sighted			Blind		Sighted		
	Mean	SD	Mean	SD	ES	Mean	SD	Mean	SD	ES
1	2.5	0.7	4.2	1.0	-1.7**	4.0	0.0	4.2	1.0	-0.2
2	5.0	0.0	3.7	1.2	1.1**	5.0	0.0	3.8	1.2	1.0**
3	3.5	0.7	3.4	1.3	0.1	5.0	0.0	3.5	1.5	1.0**
4	4.0	0.0	3.8	1.3	0.2	4.0	0.7	3.6	1.2	0.3
5	4.0	1.4	3.5	1.3	1.3**	5.0	0.0	3.5	1.4	0.1
6	4.5	0.7	3.2	1.5	0.6**	4.0	0.7	3.6	1.3	0.2
7	4.5	0.7	3.6	1.3	0.7**	5.0	0.0	3.6	1.3	1.1**
8	4.0	1.4	4.0	1.1	0.0	3.0	1.4	3.9	1.6	-0.6*
9	3.5	2.1	3.2	1.4	0.2	5.0	0.0	3.3	1.4	1.2**
10	4.0	0.0	3.4	1.5	0.4	3.0	0.7	3.6	1.4	-0.40
11	5.0	0.0	4.3	1.2	0.6**	5.0	0.0	4.1	1.2	0.8**

The totally blind students enjoyed the 2nd, 5th, 6th, 7th, and 11th ECM more than their sighted friends. They also thought that the 2nd, 3th, 7th, 9th, and 11th ECM' contributions on their learning are more than what are indicated by the sighted students. On the other side, the sighted students thought that 1st, 8th and 10th ECM' contributions on their learning are more than totally blind students' thoughts.

4.5. The Results Related to the Third Research Problem

The third research problem was "What are the sighted and totally blind 9th grade students' perceptions and perception difference in the control or experimental groups about what is happening in the class before and during studying motion topic?" In this section, the results of the WIHIC are reported. The raw data of WIHIC responses are provided in Appendix O. The aim of this research problem was to understand the learning environment of the control and experimental groups. In the experimental groups, the sighted or totally blind students' perceptions are important to understand the effect of the ECM.

In subsequent parts, three tables were used to demonstrate the perception of the students about the learning environment. The first two tables (Tables 4.10 and 4.11) represent the ES with two groups values of each group with other groups' ES with two groups values. The last table (Table 4.12) demonstrates the ES with four groups values of all groups.

In Table 4.10, the experimental and control groups' perceptions about before and during learning environment are presented with mean, SD, and ES values for seven sub dimension of the WIHIC. All ES values about the groups' ES with two groups values. ES values were calculated according to Cohen's d formula and their levels were marked with stars as indicated before.

Table 4.10 Comparison of the experimental and control groups' before and during WIHIC scores

	Experiment Group					Control Group				
	During		Before			During		Before		
	Mean	SD	Mean	SD	ES	Mean	SD	Mean	SD	ES
Student Cohesiveness	32.9	6.0	29.3	7.7	0.53*	28.5	7.8	29.0	7.2	-0.07
Teacher Support	26.9	9.7	22.7	9.0	0.45*	23.3	9.4	23.7	9.2	-0.04
Involvement	29.8	7.4	25.9	7.4	0.53*	25.6	8.9	25.9	8.1	-0.03
Investigation	30.0	8.0	24.5	8.6	0.67**	26.1	9.2	25.4	8.5	0.08
Task Orientation	31.8	7.4	27.2	8.8	0.57*	28.0	8.9	27.5	8.3	0.06
Cooperation	30.0	6.8	25.6	8.2	0.58*	25.5	9.1	25.5	8.9	0.01
Equity	30.1	7.7	25.6	8.7	0.54*	26.9	8.9	26.37	8.5	0.06
Total	211.3	40.4	180.8	44.8	0.72**	183.8	51.5	183.2	45.2	0.01

In general, the perceptions of the experimental group students about the learning environment increased from before using the ECM and during using the ECM. The ES value for the total WIHIC scores are large in favour of during using the ECM environment. There were no difference between the perceptions of the experimental

group' totally blind and sighted students with regards to the total WIHIC scores. In terms of the total WIHIC scores, the perceptions of the control group students about the learning environment didn't change; positive and small ES. According to the used ES formula, the experimental and control group students' before WIHIC scores removed from the during WIHIC scores to get the mean defference of ES.

Among all seven sub dimensions of the WIHIC, the experimental group students explained that their investigation is improved drastically. This dimension includes asking, answering, doing research, solving problem, and explaining the graphs or figures.

Table 4.11 shows the comparison of the totally blind and sighted students' before and during WIHIC scores. In general, the perceptions of both the totally blind and sighted students about learning environment increased from before using the ECM and during using the ECM. The ES values for total WIHIC scores are large in favour of during using the ECM environment.

Table 4.11 Comparison of totally blind and sighted students' before and during WIHIC scores

	Totally Blind Students					Sighted Students				
	During		Before			During		Before		
	Mean	SD	Mean	SD	ES	Mean	SD	Mean	SD	ES
Student Cohesiveness	39.0	1.4	37.5	3.5	0.61**	32.7	6.0	29.0	7.6	0.54*
Teacher Support	25.5	12.0	20.5	9.2	0.47*	26.9	9.7	22.8	9.0	0.44*
Involvement	26.0	7.07	24.0	2.8	0.40	29.9	7.4	26.0	7.5	0.53*
Investigation	31.5	0.7	28.5	6.4	0.85**	29.9	8.1	24.3	8.6	0.67**
Task Orientation	32.5	7.8	29.5	3.5	0.53*	31.7	7.4	27.1	8.9	0.57*
Cooperation	31.0	7.1	29.5	12.0	0.16	29.9	6.9	25.5	8.1	0.59*
Equity	28.0	9.9	25.5	2.1	0.42*	30.1	7.7	25.7	8.8	0.53*
Total	213.5	27.6	195.0	4.2	1.16**	211.3	40.9	180.4	45.4	0.72**

In Table 4.11, in addition to the dimension of "investigation", ES with two groups value of totally blind students' perceptions about "student cohesiveness" has two

stars. Other dimensions except “involvement” and “cooperation” have one star. The ES with two groups values of sighted students are at medium level accepting “investigation”. In a similar way, this dimension seems to be improved by the treatment.

ES values with four groups are presented in Table 4.12. The ES with four groups includes four different mean and SD values from two different groups. Detailed formula was given in Appendix T. The formula of ES with four groups includes mean difference and pooled SD (SDChangePooled) which correlation values of two groups’ pre and post-tests; for WIHIC it means before and during perceptions. All the ES values of the experimental and control groups are positive and medium or large. On the other hand, the ES values of the totally blind and sighted students are positive or negative and small; none of them is medium or large. According to the used ES formula, the totally blind and sighted students’ before WIHIC scores removed from the during WIHIC scores to get the mean defference.

Table 4.12 ES with four groups values for sub dimensions of WIHIC

Sub dimensions of WIHIC	ES with four groups Values	
	Experimental and Control groups	Totally blinds and Sighted students
Student Cohesiveness	0.53*	-0.31
Teacher Support	0.59*	0.12
Involvement	0.59*	-0.28
Investigation	0.62**	-0.29
Task Orientation	0.54*	-0.18
Cooperation	0.57*	-0.35
Equity	0.54*	-0.22
Total	0.75**	-0.28

As seen in Table 4.12, ES values of the experimental groups are practically different than ES values of the control groups. In other words, when compared with ES values of the control groups, ES values of the experimental groups’ indicate that the ECM

changed the learning environment in an excepted way. However, this change didn't make any difference between the totally blind and sighted students' perceptions about the learning environment.

To sum up, the ECM affected the experimental group students' learning environment positively relative to the control groups, but totally blind students take advantage of being the member of the experimental group as their sighted peers in equal amount.

4.6. The Results Related to the Forth Research Problem

The fourth research problem was "What are the sighted and totally blind 9th grade students' perceptions and perception difference in the control or experimental groups about their friends' and individual physical and cognitive interactions in the class before and during studying motion topic in the class?" In this section, the students' perceptions about the interactions in their classes which were assessed by the SQCI are provided (see Appendix P).

Results of the SQCI revealed three different perceptions that students have. All the students evaluated their totally blind friend (if exist in the class), sighted friends, and themselves in terms of physical and cognitive interactions by answering six items. The first five items was asking about the cognitive interactions and the last item was related with the physical interactions in the class. Items in the SQCI are shorten in the following tables as Answering (answering teacher's questions), Asking (asking questions to teacher), Commenting (commenting the topic), Exampling (giving example related to the topic), Using CM (using the course materials), and PA (being physically active).

In summary, two different kinds of perceptions appeared in students' responses, perception about themselves and perception about the other students, were used to confirm the data about interactions. Additionally, two different ES calculations were used for comparing the perceptions about interactions before and during motion unit (ES with two groups), and for comparing the difference between the experimental vs

control and totally blind vs sighted students about interactions before and during motion unit (ES with four groups).

These ES with two or four groups' values were given on the following tables. First of all, experimental and control groups' ES with two group values are provided. Then the totally blind and sighted students' ES with two group values are reported. ES with four groups values were also represented which were used for comparing the groups' mean difference. The comparison of experimental groups' perceptions relative to control groups' perceptions were provided first, and then totally blind students' perceptions relative to sighted students' perceptions on each item before and during the motion topic were reported.

The change of interaction in terms of the perceptions before and during motion unit in the experimental and control groups is given on Table 4.13. Table 4.13 shows the mean, SD, and ES values of the experimental and control group students' perceptions on each item before and during the motion topic. In other words, this ES values indicates the change in students' perceptions before and during the motion unit on each item. These whole values for each item were given for students' perception about other students and students' perception about themselves.

In Table 4.13, positive ES values indicate that students' perception on each item during the motion unit was higher than the perceptions before the motion unit. Although all the ES values for the experimental groups are positive, all the ES values for the control groups are negative. Experimental groups' ES values vary from medium to large, but all control groups' perceptions are small. These findings support the idea that students from the experimental group interact physically and cognitively more during the motion unit than what was observed in the previous unit. It can be concluded that, using ECM in the motion unit increased students' cognitive and physical interactions in the class.

Table 4.13 Results of the experimental and control group students' perceptions about their physical and cognitive interactions in the class before and during studying the motion topic

Items in SQCI	Experimental Groups					Control Groups				
	During motion unit		Before motion unit			During motion unit		Before motion unit		
	Mean	SD	Mean	SD	ES	Mean	SD	Mean	SD	ES
Perception of all students about others										
Answering	3.95	0.99	3.46	1.09	0.47*	3.17	1.23	3.56	1.14	-0.33
Asking	3.83	1.00	3.34	1.23	0.44*	3.09	1.19	3.45	1.10	-0.31
Commenting	4.02	0.97	3.32	1.19	0.65**	2.98	1.27	3.37	1.23	-0.31
Exampling	4.18	0.92	3.43	1.22	0.70**	2.94	1.3	3.34	1.29	-0.31
Using CM	4.09	1.03	3.42	1.25	0.59*	2.69	1.34	3.17	1.34	-0.36
PA	4.02	0.96	3.58	1.20	0.41*	2.98	1.32	3.36	1.27	-0.29
Perception of all students about themselves										
Answering	4.11	0.96	3.44	1.23	0.61**	2.95	1.32	3.35	1.23	-0.31
Asking	3.92	1.04	3.35	1.2	0.51*	2.86	1.31	3.21	1.28	-0.27
Commenting	3.98	1.02	3.22	1.14	0.70**	2.84	1.38	3.26	1.30	-0.31
Exampling	4.13	1.07	3.30	1.36	0.68**	2.88	1.39	3.18	1.35	-0.22
Using CM	3.92	1.02	3.19	1.31	0.63**	2.7	1.42	3.06	1.49	-0.25
PA	4.00	1.08	3.38	1.29	0.52*	2.98	1.51	3.29	1.46	-0.21

The change of the interactions in terms of the perceptions before and during the motion unit of totally blind and sighted students is given in Table 4.14. Table 4.14 demonstrates the mean and SD values of totally blind and sighted students' perceptions on each item before and during the motion topic. The table also shows ES values of students' perceptions before and during the motion topic. In other words, this ES value indicates the change in students' perceptions before and during motion unit on each item. These whole values for each item were given for students' perception about other students and students' perception about themselves.

In Table 4.14, positive ES values indicate that students' perception on each item during the motion unit is higher than the perceptions before the motion unit. Although all the ES values for both totally blind and sighted students are positive, level of ES values vary from small to large. These findings support the idea that

sighted students interact physically and cognitively more during the motion unit than what is observed in the previous unit. Thus, it can be said that using the ECM in the motion unit increased the sighted students' cognitive and physical interactions in the class.

Table 4.14 Results of the totally blind and sighted students' perceptions about their physical and cognitive interactions in the class before and during studying the motion topic

Items in SQCI	Totally Blind Students					Sighted Students				
	During motion unit		Before motion unit			During motion unit		Before motion unit		
	Mean	SD	Mean	SD	ES	Mean	SD	Mean	SD	ES
Perception of all students about others										
Answering	4.17	0.94	3.43	1.30	0.47*	3.95	0.99	3.46	1.09	0.46*
Asking	3.97	0.90	3.11	1.23	0.42*	3.83	1.01	3.34	1.23	0.45*
Commenting	4.18	0.84	3.32	1.36	0.63**	4.01	0.97	3.32	1.19	0.64**
Exampling	4.10	0.93	3.11	1.37	0.70**	4.18	0.92	3.43	1.23	0.71**
Using CM	4.03	1.09	3.27	1.32	0.57*	4.09	1.03	3.42	1.25	0.56*
PA	4.11	1.05	3.25	1.32	0.41*	4.02	0.96	3.58	1.20	0.41*
Perceptions of all students about themselves										
Answering	4.00	1.41	2.50	0.71	0.96**	4.06	1.03	3.43	1.27	0.49*
Asking	3.50	0.71	2.50	0.71	1.41**	3.90	1.07	3.35	1.23	0.49*
Commenting	3.50	0.71	2.50	0.71	1.41**	3.98	1.02	3.24	1.15	0.61**
Exampling	3.50	0.71	3.00	1.41	0.32	4.15	1.07	3.32	1.37	0.68**
Using CM	4.00	1.41	3.50	0.71	0.32	3.94	1.02	3.21	1.33	0.62**
PA	4.00	1.41	3.50	0.71	0.32	4.03	1.11	3.41	1.34	0.51*

On the other hand, there is a difference between perceptions indicated by the friends of totally blind students and their self-evaluation. Totally blind students think that they participated to the lesson with cognitive interactions during the treatment more than before the treatment. Conversely, their friends indicated that not only cognitive interactions such as asking, answering and commenting but also number of using CM and being physically active were increased. To compare two different groups in terms of their before and during perceptions, similar to pervious research problem, ES with four groups formulas are used and given in Appendix T.

In Table 4.15, the experimental groups' ES values with four groups with the control groups are given. This table includes perceptions about other students and themselves assessed by the items in the SQCI. These positive and medium or large ES values with four groups indicate that the ECM changes the perceptions of the experimental group students about the number of cognitive and physical interactions more than the control group students' perceptions.

Table 4.15 Comparing experimental and control groups' relative perceptions about their physical and cognitive interactions before and during the motion unit

Items in SQCI	Experimental groups' ES relative to Control groups' ES
Perceptions about other students	
Answering teacher's questions	0.60*
Asking questions to teacher	0.65**
Commenting the course	0.90**
Giving example related to the course	0.93**
Using the course materials	0.90**
Being physically active	0.67**
Perception about themselves	
Answering teacher's questions	0.87**
Asking questions to teacher	0.74**
Commenting the course	0.93**
Giving example related to the course	0.89**
Using the course materials	1.18**
Being physically active	0.67**

The formula of ES with four groups includes mean difference and pooled SD (SDChangePooled) which correlation values of two groups' before and during perceptions is used. According to the used formula of ES with four groups, the control group students' mean diffence removed from the experimental group students' mean difference. The control and experimental group students' mean diffences are calculated with before and during SQIT mean scores.

As seen in Table 4.16, only "answering teacher's questions" has one star. This exceptional condition can be explained by totally blind students' self-evaluation on the same item as seen in Table 4.16. Relative to the sighted students, the totally blind

students think that they answered their teacher's questions more than their sighted friends and this may make the difference.

Table 4.16 Comparing the totally blind and sighted students' perceptions about their physical and cognitive interactions in the class

Items in SQCI	Totally blind students' ES relative to Sighted students' ES
Perceptions about other students	
Answering teacher's questions	0.22
Asking questions to teacher	0.29
Commenting the topic	0.15
Giving example related to the topic	0.20
Using the course materials	0.09
Being physically active	0.39
Perception about themselves	
Answering teacher's questions	0.70**
Asking questions to teacher	0.40
Commenting the topic	0.24
Giving example related to the topic	-0.25
Using the course materials	-0.19
Being physically active	-0.09

Among the large ES values in Table 4.16, "using the course materials" item of relative self-evaluation has the highest ES value. This difference could be accepted as the natural result of the treatment. As seen in Table 4.16, this item is in small ES level because not only totally blind students used the ECM but also sighted students used it.

To sum up, using the ECM affected experimental group students' perceptions about number of physical and cognitive interactions positively when compared with the control group students' perceptions. However, there is no practically significant difference between the totally blind and sighted students' perceptions about their interactions in the class.

4.7. The Results Related to the Fifth Research Problem

The last important data source was the observations of totally blind students in the class. The schedule of using the OCLI is provided in Appendix R1 and the raw data of the OCLI can be found in Appendix R2.

The fifth research problem was "How the totally blind 9th grade students interact with the enriched course materials, their teachers and friends in the physics classes?" In this section, the results of classroom observations are given under six sub-research questions. The answer of these research questions are prepared according to frequency rates of the observations, and given by taking the study process into account. There are three parts in the observation process that are before (BT), during (DT), and after (AT) treatments. All figures in this section include these three processes. Frequency rates of the observed behaviours are calculated by dividing the number of observations to the observation period. Thus, frequency rates were converted a comparable mode.

To observe the totally blind students' different interactions with people or/and materials, in total 502 minutes in case A and 472 minutes in case B were spent during the study. Only 196 minutes in Case A and 184 minutes in Case B were spent during the treatment.

To follow Case A and B together, next three tables are given with the frequency rates of the observed behaviours. The frequency rate of Case A is symbolized with "f_A". Similarly "f_B" is used for frequency rate of Case B. Additional to these cases; "Both" is used for the total value of Case A and Case B. First frequency rate belongs to Case A, the following belongs to Case B, and the next belongs to "Both", respectively.

Frequency of the interaction rates in Case A, Case B and both cases before the treatment are given in Table 4.17. Similarly, Table 4.18 shows the frequency of the interaction rates in cases during the treatment and Table 4.19 is given to present the frequency of the interaction rates in both cases after the treatment.

There are three main columns in Table 4.17, 4.18, and 4.19. The first one is about frequency rates of relevant and irrelevant behaviours about the course topics. The other important column separates relevant and irrelevant behaviours into two groups; physical and cognitive interactions. Type of interaction column separates physical and cognitive interactions into other sub groups. These sub groups explain the position of totally blind student or whom totally blind student interacted with. Under these classifications, cognitive interactions with teachers or students include asking, answering, commenting, and giving example. Also physical interactions by sitting or standing include three different dimensions in terms of doing nothing, using course or other materials.

Following three tables include frequency rates about totally blind students' relevant or irrelevant interactions about the topics. Therefore, each case is compared with other frequency rate of that case by using percentages. The reader of this dissertation may follow the related percentages given in brackets to understand the type of totally blind students' interactions.

Table 4.17 is about the totally blind students' interactions before the treatment. According to this table, in all cases, the totally blind students are sitting by doing nothing. In Table 4.18, the number and types of interactions are increased during the treatments. The number and types of interactions are gone back to the before the treatment level in all cases as seen in Table 4.19.

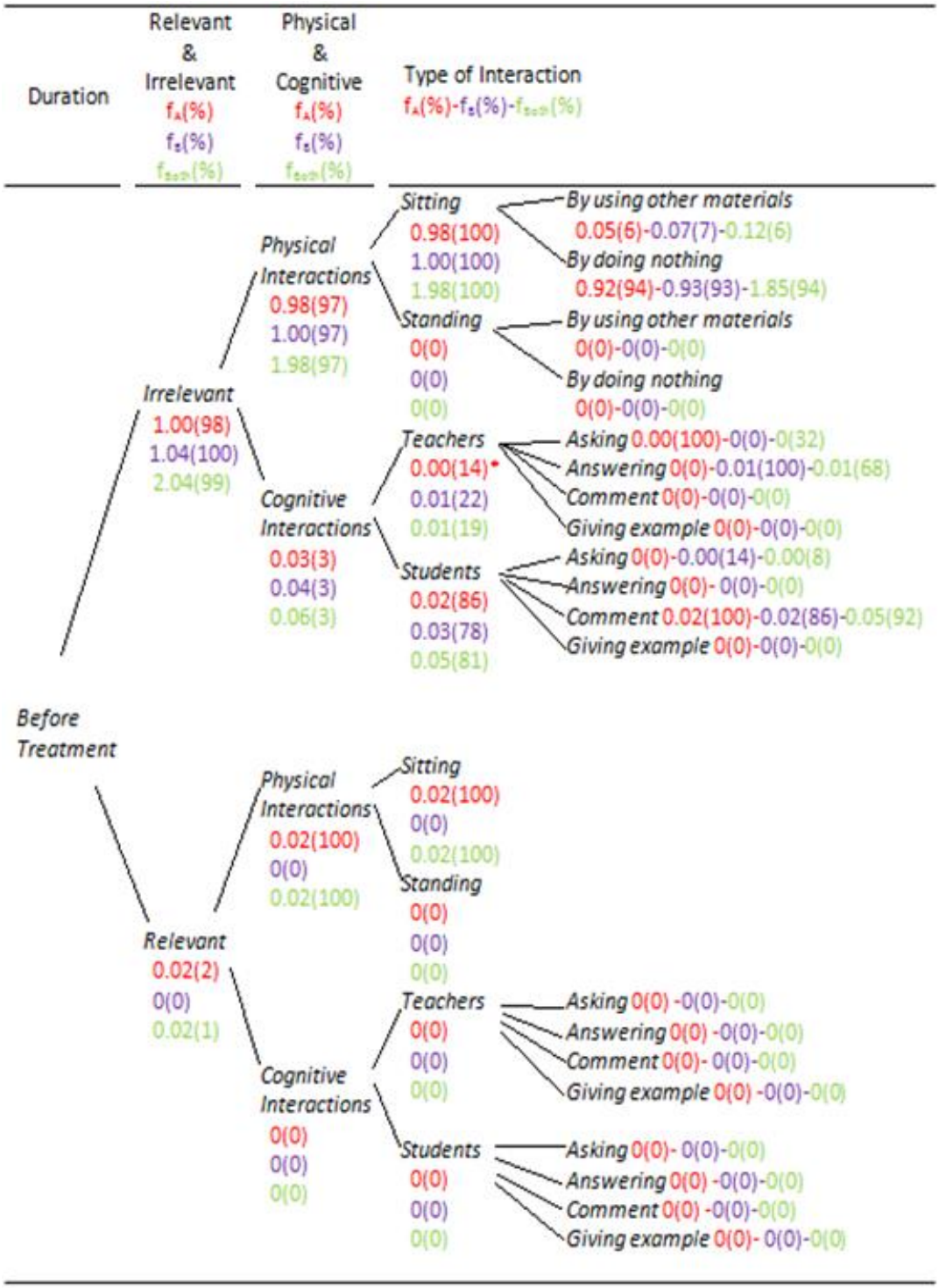
There are some interaction pairs which percentages are shared such as relevant and irrelevant interactions. The total percentange values in the brackets of the relevant and irrelevant interactions should be 100% and this total value is always for one case. In other words, about relevant and irrelevant interactions percentage rates are not comparable among Case A, Case B, and boths cases. To undertand the interaction pairs, following the branches is enough. For instance, under the "Before the treatment" branch, there are two other branches, namely relevant and irrelevant. These two sub branches includes three frequency rates about Case A, Case B and both Cases. As an example, frequency rate of irrelevant interactions in Case A is 1.00

and percentage of irrelevant interactions in total percentage of relevant and irrelevant interactions is 98.

Under the irrelevant interaction branch, interactions are categorized as physical and cognitive. Total values of these two branches constructed the irrelevant interaction branch. There may be some opraximate total values because of the numerical roundings. For instance, the frequency rate of irrelevant physical interactions is 0.98 and the frequency rate of irrelevant cognitive interactions is 0.03, however, total frequency rate of irrelevant interactions is 1.00, not 1.01 due to the numerical roundings.

Similarly cognitive interaction branch includes two other interaction pairs, namely, teachers and students. In Case B, the frequency rate of interactions with the students is 0.03 and the frequency rate of interactions with the teacher is 0.01. In total, the frequency rate of irrelevant cognitive interactions with the students and teacher is 0.04. Same distrubusion presented with percentages in the brackets.

Table 4.17 Frequency of the interaction rates in Case A, Case B and both cases before the treatment



"*" is used for small number of the observations which two digits is not enough to present.

Table 4.18 Frequency of the interaction rates in Case A, Case B and both cases during the treatment

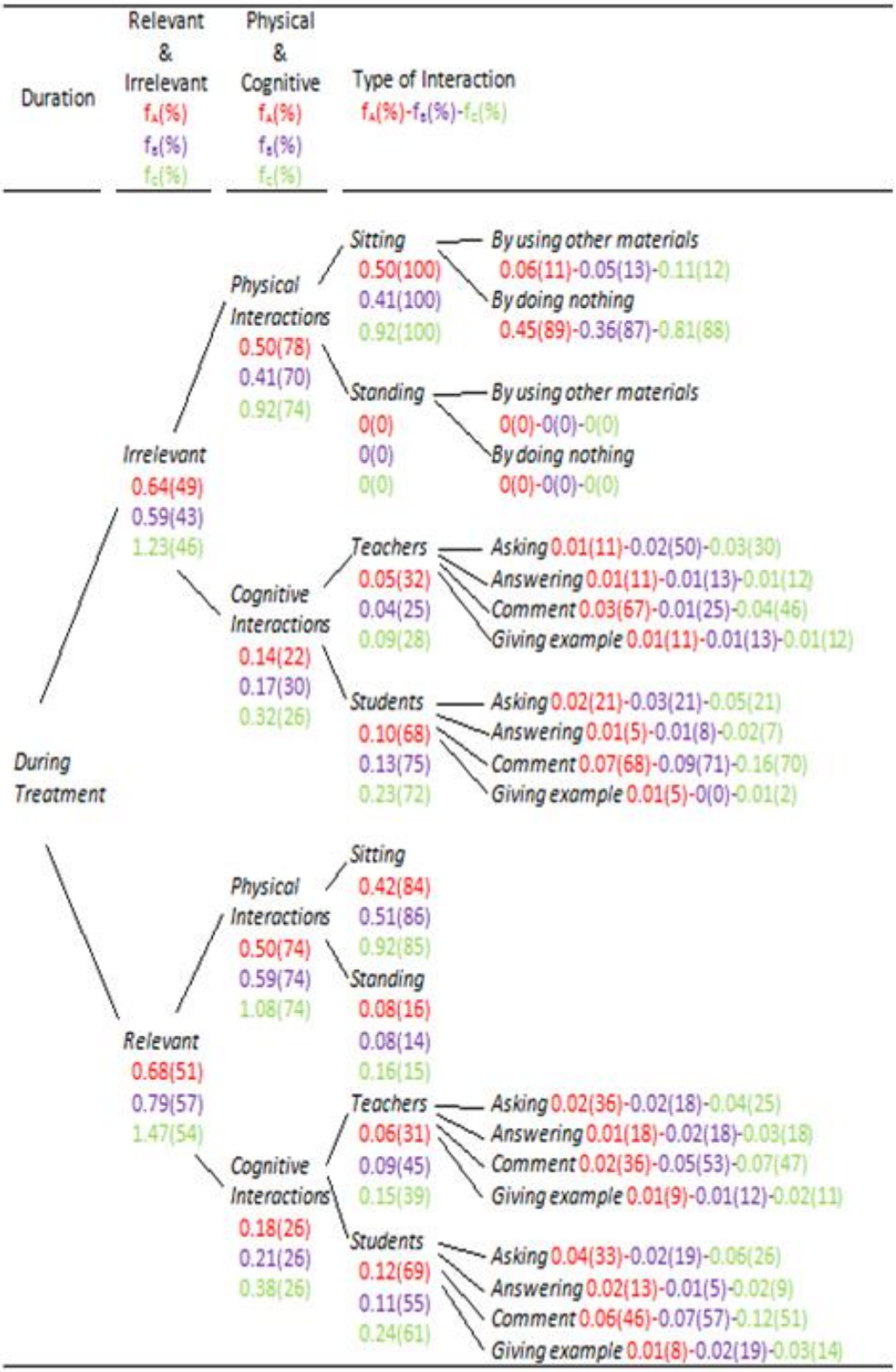
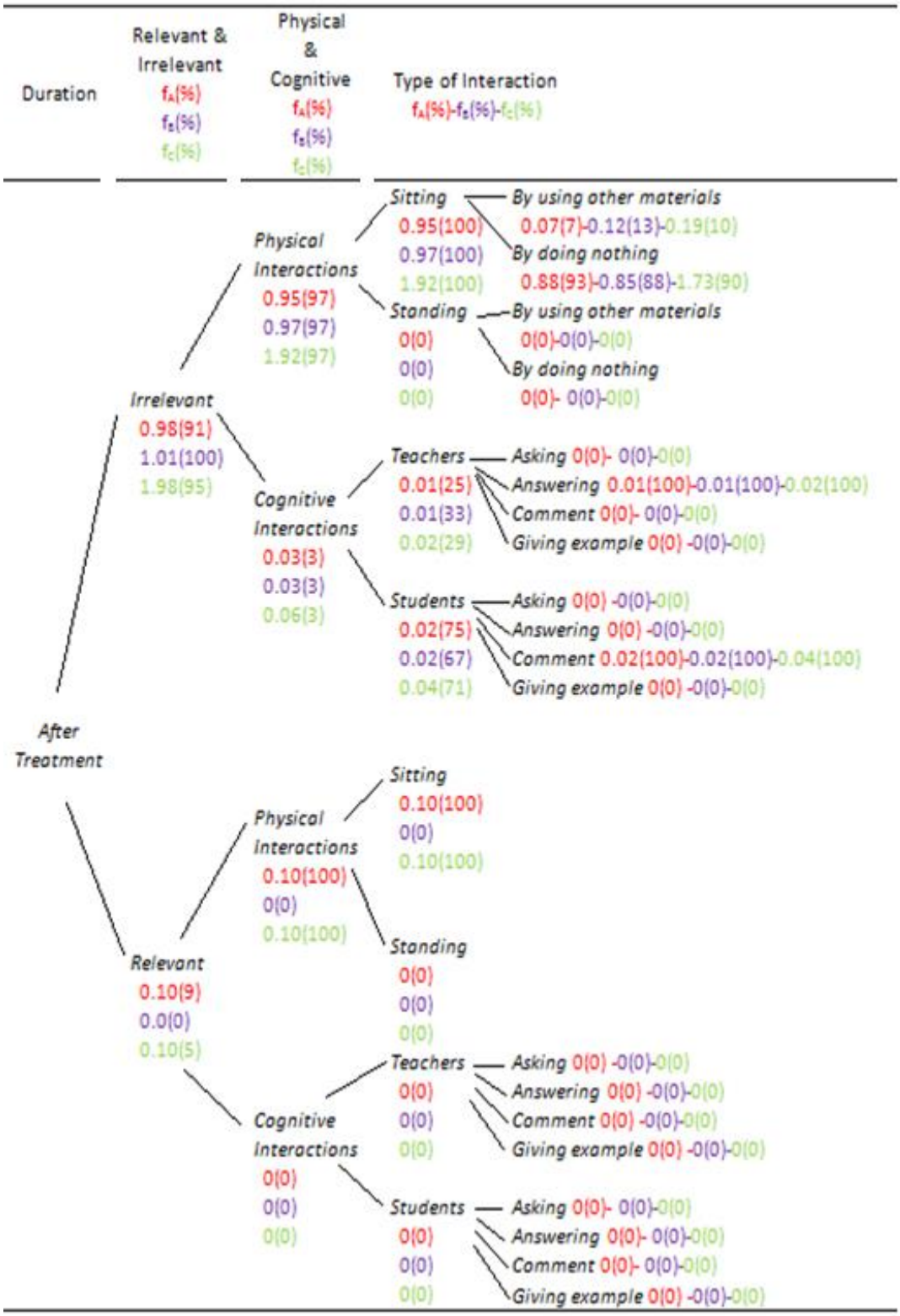


Table 4.19 Frequency of the interaction rates in Case A, Case B and both cases after the treatment



The first sub research question of the fifth research problem was "How does the treatment change the totally blind 9th grade students' relevant and irrelevant behaviors?". Frequency rates of interactions in terms of being relevant and irrelevant about the topic are given for before (BT), during (DT) and after the treatment (AT) periods in Figure 4.1. The graph has three parts; Case A, Case B, and Both. Frequency rates of the interactions in Both part are calculated by summing the rates in Case A and Case B.

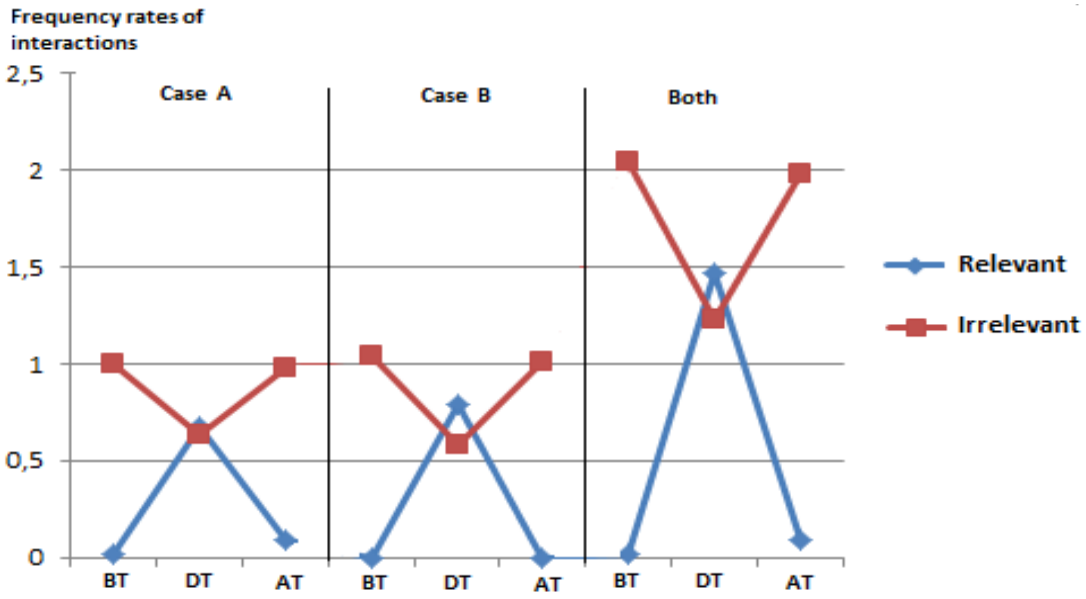


Figure 4.1 Totally blind students' change of relevant and irrelevant total interaction rates before, during, and after the treatment of Case A, Case B, and Both cases

In Figure 4.1, there is a simillar change in relevant and irrelevant interaction rates for Case A and Case B. There is an increase in relevant interactions during the treatment. However, this increase is not sustainable due to the inadequacy of the ECM for the next unit. On the other hand, frequency of irrelevant interaction rates has decreased during the treatment period for all cases. The reason of the existence of irrelevant interactions during the treatment may be explained as the habits of totally blind students that they do interactions by the way of irrelevant things.

The second sub research question was "What are the frequency rates of physical and cognitive interactions during the courses?". Frequency rates of physical and

cognitive interactions in terms of being relevant and irrelevant about the topic are given for before, during, and after treatment periods in Figure 4.2. The graph has six parts; first three parts are about irrelevant interactions in all cases, second three parts present relevant interactions in Case A, Case B, and Both. Similar to the previous graph, frequency rates of interactions in "Both" parts are calculated by summing the rates in Case A and Case B.

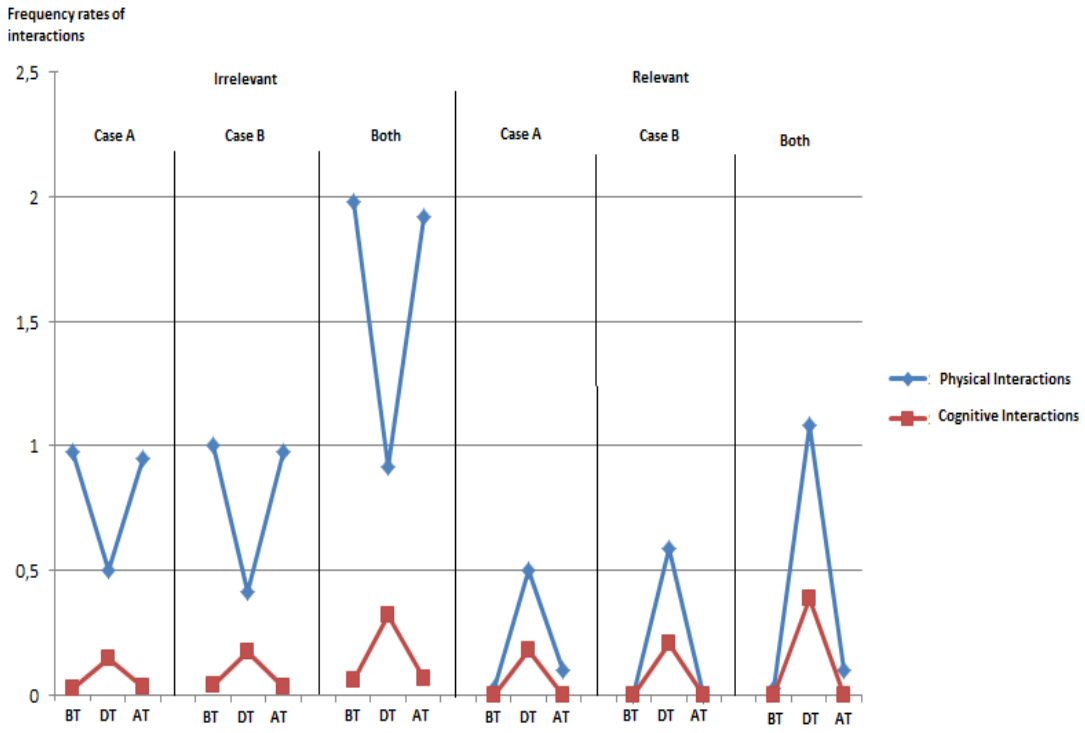


Figure 4.2 Totally blind students' change of physical and cognitive interaction rates in terms of topic relevance before, during, and after the treatment of Case A, Case B, and Both cases

In Case A and B, although all type of irrelevant and relevant cognitive interactions are climbed during the treatment, there is no similar change in physical interactions. In spite of the fact that irrelevant physical interactions are decreased, there is an increase in the frequency rates of relevant physical interactions. The important point is that not only the relevant physical and cognitive interactions are increased but also irrelevant cognitive interactions which has an inclusive role for totally blind students are increased.

The third sub research question was "What are the totally blind students' frequency rates of sitting and standing during the courses?". Frequency rates of physical interactions acted in sitting or standing positions are provided for before, during, and after treatment periods in Figure 4.3. The graph has two main parts that are relevant and irrelevant interactions about the topic. Each part divided into three sub-parts in order to show the situation for different cases.

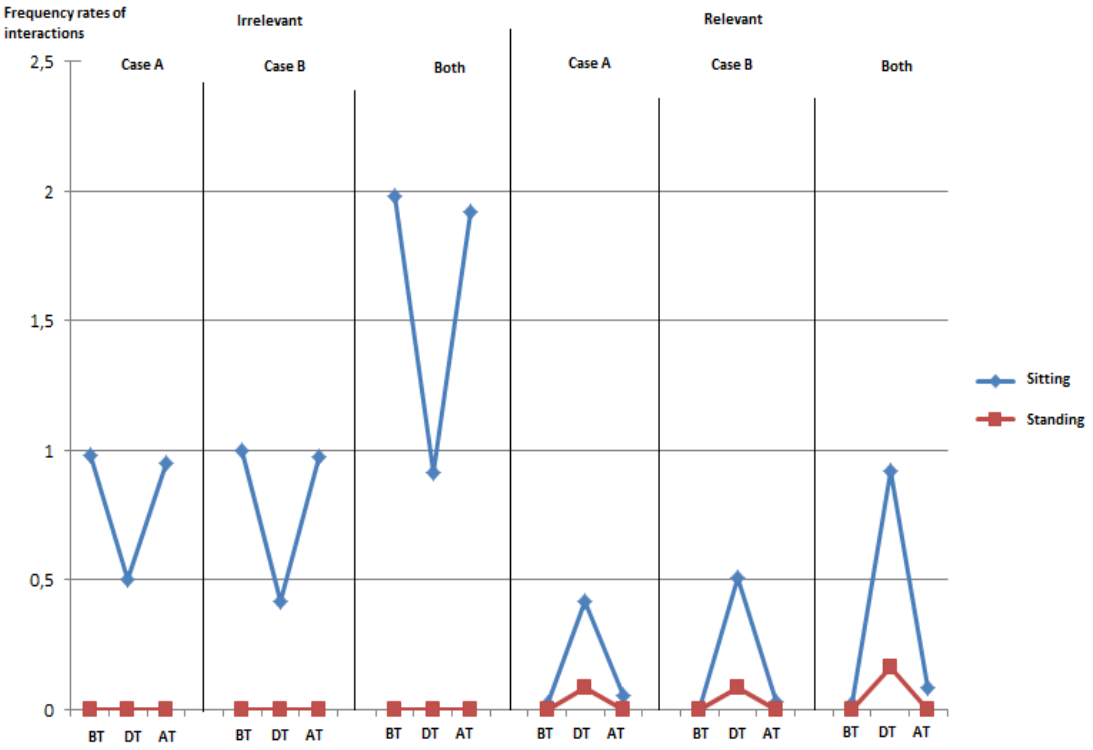


Figure 4.3 Totally blind students' change of relevant and irrelevant physical interaction rates about sitting and standing before, during, and after the treatment of Case A, Case B, and Both cases

During the treatment, in all cases, irrelevant interactions in sitting position decreased. This is because totally blind students started to do relevant interactions. The same graph shows that totally blind students' relevant interactions when they are standing are increased slightly by the help of the treatment in both cases. This interaction with 5th material can be seen in Appendix S. In Appendix S, there are some photos during

the treatment from different cases and totally blind students stand in front of the board while using the 5th ECM.

The 4th sub research question was "What are the totally blind students' frequency rates of cognitive interaction with the teachers and friends during the courses?". Frequency rates of cognitive interactions for before, during, and after treatment periods done with the teacher or students are given in Figure 4.4. The graph has two main parts; relevant and irrelevant interactions about the topic. Each part divided into three sub-parts to present the situation for each cases.

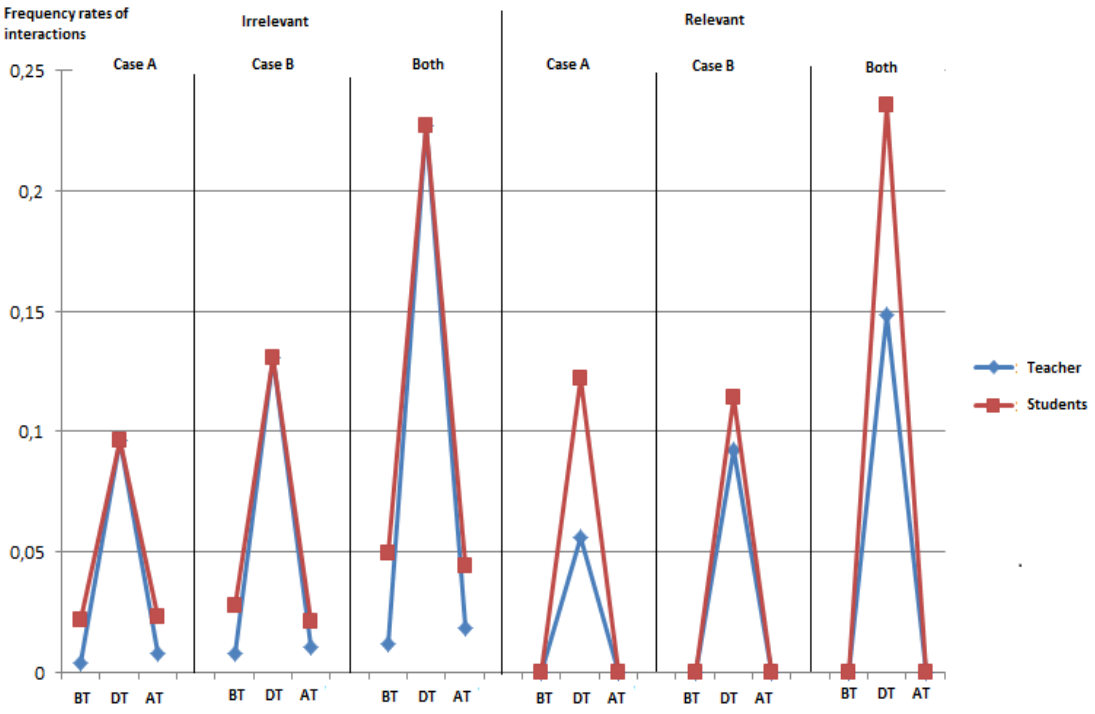


Figure 4.4 Totally blind students' change of relevant and irrelevant cognitive interaction rates with teacher and students before, during, and after treatment of Case A, Case B, and Both cases

In Figure 4.4, there are three important results. First of all, it is clear that both relevant and irrelevant interactions of the totally blind students with people around them is increased during the treatment. Second, this interaction with other students is generally equal or more than the interactions with the teachers. Moreover, Figure 4.4

indicates that before or after the treatment, totally blind students' interactions were irrelevant with the topic.

The 5th sub research question was "What is the frequency rate of the totally blind students' using the enriched course materials, during the course?". For this purpose, Figure 4.5 is prepared. In this figure, there is no classification such as relevant and irrelevant because observed behaviors explain whether they are relevant or not. Three behaviors were defined as physical interaction that are using the CM, using something out of the CM, and doing nothing.

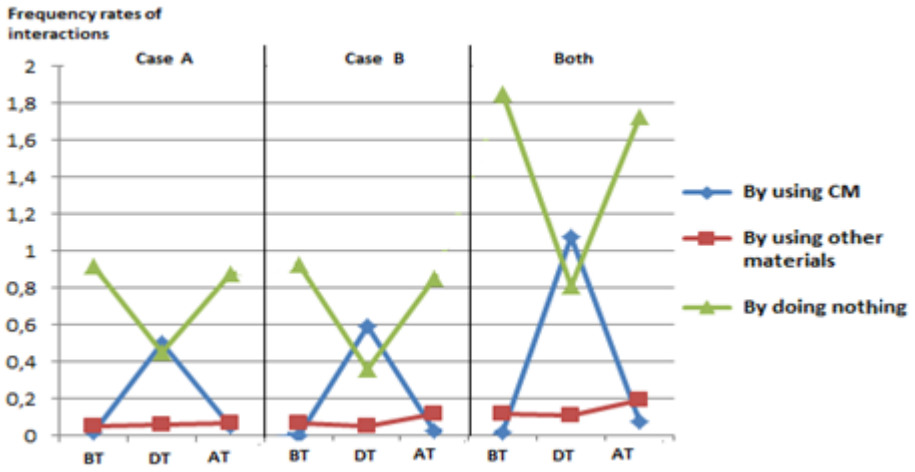


Figure 4.5 Totally blind students' change of physical interaction rates before, during, and after treatment of Case A, Case B, and Both cases

According to Figure 4.5, only the totally blind student in Case B changed the number of using other materials after the treatment but this increase is not drastic as observed for "using CM" or "doing nothing" behaviors. Moreover, this behavior is not observed in Case A. Therefore, this small increase doesn't seem valid for all cases.

The 6th research question was "What kind of and how many conversations do the totally blind 9th grade students make with each other during the courses?". Figure 4.6 presents the conversations of the totally blind students with others during the course. This figure answers the 6th sub research question and it involves four type of cognitive interaction that are asking, answering, commenting, and giving example.

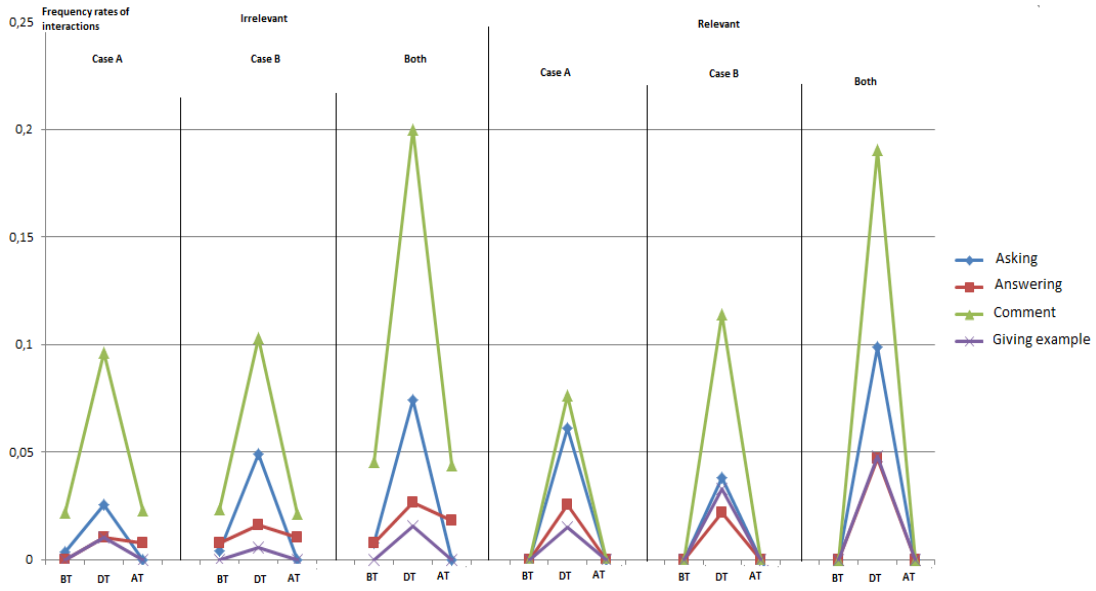


Figure 4.6 Totally blind students' change of relevant and irrelevant cognitive interaction rates before, during, and after treatment of Case A, Case B, and Both cases

According to Figure 4.6, all types of cognitive interactions are increased during the treatment. This increase is also valid for irrelevant conversations. Therefore, it is obvious that using the ECM changed the frequency rates of cognitive interactions and the totally blind students asked, answered, and talked more after the treatment when compared with before the treatment. In addition to this increase, the totally blind students talked and asked relevant things remarkably more than other cognitive interaction types.

4.8. Triangulation of the Results

In this section, all the results are evaluated in terms of the research problems and their relationship with the others to triangulate. For this purpose, Figure 4.7 is given to show the possible triangulation areas among the research problems. These areas are numbered from one to nine to follow the triangulation of the results easly. Following explainations include these triangulations. All triangulations except 9th are triangulated with results from different research problems, however, due to the results' structure of 4th research problem let the researcher triangulate the results in itself.

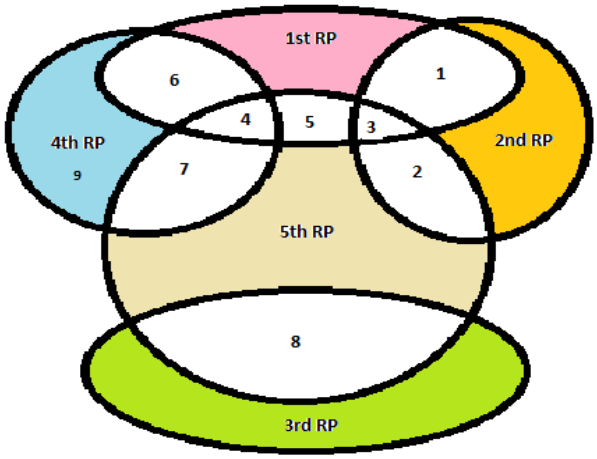


Figure 4.7 Triangulation map of the results among the five research problems

(1) This triangulation is related with the results of the 1st and 2nd research problems. In Table 4.20, ECM number, its related objectives, and question numbers which measure those related objectives are given together. The ECM can be seen in Appendix B5, the objectives of motion concept are in Appendix C3 and the final version of the asked questions is in Appendix C6. According to this table one material can be used for one or more objectives.

Table 4.20 Relationship between enriched course materials, objectives, and questions

Enriched Course Materials' number	Target objective numbers	Related questions in MAT
1	1.1	1-3
2	1.1, 1.2	1-7
3	1.2	4-7
4	1.2	4-7
5	1.2	4-7
6	1.3	8-10
7	1.3, 1.4, 1.5	8-14
8	1.3, 1.4, 1.5	8-14
9	1.3, 1.4, 1.5	8-14
10	1.3, 1.4, 1.5	8-14
11	1.6	15-16

Due to there is not only one material for each objective, the ECM clustered in terms of related objective. Also MAT questions are categorized according to the objectives. Then, Table 4.20 is used to match the ECM numbers and MAT question numbers.
In Table 4.21, the sighted and totally blind students' MAT scores are reanalysed in terms of the related materials. By using Table 4.21 and Table 4.9, Table 4.22 is prepared to understand the correlation between the students' perceptions about how using the ECM contributed to their learning and their success in the related questions. As it seen in Table 4.22, both the sighted and blind students are successful in related questions which the ECM generated for and they used to learn.

Table 4.21 Comparing the blind and sighted students' MAT scores with the MAT and ECM numbers

Used variables	MAT questions (ECM Number)											
	1-3 (1)		1-7 (2)		4-7 (3-5)		8-10 (6)		8-14 (7-10)		15-16 (11)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
BPre-MAT	17.0	4.4	18.9	11.2	20.3	15.2	13.7	9.0	13.1	6.5	14.0	8.5
SPost-MAT	43.0	5.2	35.4	8.87	29.8	6.2	30.3	2.1	29.7	3.2	36.0	0.0

According to Table 4.22, although it doesn't mean that other ECM are useless, totally blind students think that the 2nd and 11th ECM are more useful to learn the topic than the others. From the perspective of the sighted students, the 1st and 11th ECM contributed more to their learning. These results support the ES values of related material that is the two largest ES values belong to the 1st and 11th ECM.

Table 4.22 Comparing the totally blind and sighted students' ES and SQET results with ECM numbers

ECM Number	Mean		ES	
	(B) SQET	(S) SQET	BPost-MAT vs BPre-MAT	SPost-MAT vs SPre-MAT
1	4.0	4.2	1.14**	5.42**
2	5.0	3.8	0.92**	1.64**
3-5	4.7	3.6	0.70**	0.82**
6	4.0	3.6	4.07**	2.54**
7-10	4.0	3.6	4.24**	3.26**
11	5.0	4.1	3.00**	3.67**

(2) This triangulation is related with the results of the 2nd and 5th research problems. As seen in Figure 4.5, it is clear that totally blind students used CM more during the treatment. This result confirms the result given for the 2nd research problem in Table 4.9. According to this table, the totally blind students enjoyed all the materials and think that the contribution of these materials to their learning is equal or more than 3 out of 5.

(3) This triangulation is related with the results of the 1st, 2nd, and 5th research problems. For the 1st research problem, it is clear from Table 4.7 that the totally blind students performed better in the achievement test including graphs. There is also increase in using the CM given in Figure 4.5. These two results support the reason why they perceive that the ECM contributed to their learning.

(4) This triangulation is related with the results of the 1st, 4th, and 5th research problems. This triangulation is similar with the third triangulation. While the 3rd triangulation includes the perception about the ECM, the 4th triangulation includes the perception about their interactions. As seen in Table 4.14, the sighted students think that their totally blind friends provided comments and gave examples more than before the treatment. According to Figure 4.6, the frequency of providing comments during the treatment seems more than all other interaction types. Therefore, the sighted students' perceptions about the totally blind students and the observations indicate that totally blind students' cognitive interactions are increased. This increase is parallel to the achievement in motion topic.

(5) This triangulation is related with the results of the 1st and 5th research problems. In this triangulation, achievement scores and interaction with course materials are compared. As can be seen in Figure 4.5, it is clear that the totally blind students used the CM more than before and after the treatment.

Due to the fact that some of the ECM are designed for fostering students' learning of graphs, the 5th triangulation includes the analysis with Table 4.23 if they solved the questions about graphs or not.

Table 4.23 Total blind students' responses to the MAT questions

		Question number and students' responses															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Case A	PRE	A	D	E	B	D	C	B	C		D	A	B	E	A	D	C
	POST	B	B	E	B	C	C	A	D	E	A	C	C	C	D	D	A
Case B	PRE	E	A	C	B	B	A	D	C		D	B	A	A	D	E	C
	POST	A	B	D	B	D	D	A	D	E	B	C	D	C	E	D	A
Answer Key		A	B	E	B	D	C	A	D	E	A	C	C	C	E	D	A

In Table 4.23, the questions with graphs are marked with gray background. As it seen from this table, there are six questions including graphs and totally blind students' post MAT results indicate that they can solve these types of questions with a high rate. Similarly, this table indicates that the totally blind students solve both graph and non-graph questions.

(6) This triangulation is related with the results of the 1st and 4th research problems. As seen in Table 4.8, the ES value of pre and post MAT scores of the control groups is small. It has large ES for the experimental groups. These results in achievement are the same in terms of the perceptions of the experimental and control groups about the physical and cognitive interactions. As seen in Table 4.13, all interaction types for the experimental groups are in medium or large level. In the same table, the control groups' perceptions are in small level. These perceptions are conserved in both perceptions about others or self-evaluation.

(7) This triangulation is related with the results of the 4th and 5th research problems. As a member of the experimental group, the totally blind students' physical and cognitive interactions are increased. The experimental group students' perceptions about physical and cognitive interaction can be seen in Table 4.13. Additionally, relative to the control group students, most of the experimental group students' ES values about physical and cognitive interactions are in large level and can be seen in Table 4.15.

(8) This triangulation is related with results of the 3rd and 5th research problems. In Table 4.11, the totally blind students' perceptions about learning environment change in student cohesiveness, teacher support, investigation, task orientation, and equity dimensions with medium or large levels. This increase in learning environment can be seen in Figure 4.4. This figure explains how personal interaction with the teacher or students is increased during the treatment.

(9) This triangulation is related with the results of the 4th research problem. This triangulation includes two main parts. In the first part, to confirm the consistency of the ES with four groups between two groups' perceptions about interactions before and during motion unit, Table 4.24 and Table 4.25 are prepared. The formula used for this calculation is given in Appendix T. The second part is about the consistency of ES values with two groups between two different perception sources about the same groups' interactions before and during motion unit. For this purpose, Table 4.24 and Table 4.25 are prepared.

Table 4.24 Consistency of the experimental and control groups' ES with four groups values prepared from perceptions about others and themselves

Questions in SQCI	ES
Answering teacher's questions	-0.34
Asking questions to teacher	-0.07
Commenting the course	-0.08
Giving example related to the course	0.04
Using the course materials	-0.36
Being physically active	-0.08

Small ES values in Table 4.24 and 4.25 are expected. These small ES values indicate the consistency of different perceptions about the relative difference between two groups. Different ES values limit the evaluation of relative difference for that item. Most of the ES values in Table 4.24 and 4.25 are small and this means that two different perception sources confirm the consistency of the relative group difference.

Table 4.25 Consistency of the totally blind and sighted students' ES with four groups values prepared from perceptions about others and themselves

Questions in SQCI	ES
Answering teacher's questions	-0.58*
Asking questions to teacher	-0.11
Commenting the topic	-0.09
Giving example related to the topic	0.46*
Using the course materials	0.28
Being physically active	0.46*

In the second part of the 9th triangulation, the ES values with two groups calculated from different perception sources are used. This ES with two groups values are calculated between perceptions of others and themselves for the students from the same group and given in Table 4.26 and Table 4.27. Previous calculations demonstrate the consistency in difference and calculation in this part demonstrates the consistency in perceptions.

Table 4.26 Consistency of the totally blind and sighted students' perceptions about their physical and cognitive interactions

Questions in SQCI	ES	
	(B)	(S)
Answering teacher's questions	-0.72**	-0.14
Asking questions to teacher	-0.18	-0.04
Commenting the topic	-0.16	-0.04
Giving example related to the topic	0.44*	-0.03
Using the course materials	0.23	-0.06
Being physically active	0.32	-0.15

As seen in Table 4.26, only two questions are marked with one star. The reason of this is probably based on number of students in each group. For instance, number of

students from the control group is two times bigger than the number of students from the experimental group, but the number of sighted students is 30 times bigger than the number of totally blind students. This non-proportional distribution reflects to the ES values of the perceptions about totally blind students.

Table 4.27 Consistency of the experimental and control groups' perceptions about their physical and cognitive interactions

Questions in SQCI	ES	
	(E)	(C)
Answering teacher's questions	-0.16	0.01
Asking questions to teacher	-0.07	-0.04
Commenting the topic	-0.06	0.02
Giving example related to the topic	-0.04	-0.08
Using the course materials	-0.04	0.40
Being physically active	-0.16	-0.05

As seen in Table 4.27, consistencies of two different perceptions about the experimental groups or control groups are all in small level. This triangulation means that not only there is a consistency between the experimental and control groups' relative difference but also there is a consistency between each groups' two different perceptions; perceptions about others and themselves.

4.9. Summary of the Results

In this section, all given results of five main research problems are summarized. This summary starts with Table 4.28 which represents all the ES values with the related research questions.

Table 4.28 Summary of the first research problem

Variable	Research Question	ES
MAT		
Post Totally Blinds- Post Sighteds	1.a	**
Pre Totally Blinds- Pre Sighteds	1.b	
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	
Post Experimental Group - Post Control Group	1.h	**
MAQ		
Post Totally Blinds- Post Sighteds	1.a	*
Pre Totally Blinds- Pre Sighteds	1.b	**
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	*
Post Experimental Group - Post Control Group	1.h	**
MAQ-1: Situational interest		
Post Totally Blinds- Post Sighteds	1.a	**
Pre Totally Blinds- Pre Sighteds	1.b	*
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	**
Post Experimental Group - Post Control Group	1.h	**
MAQ-2: Importance of Physics		

Table 4.28 (cont.)

Variable	Research Question	ES
Post Total ly Blinds- Post Sighteds	1.a	**
Pre Totally Blinds- Pre Sighteds	1.b	
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	**
Post Experimental Group - Post Control Group	1.h	**
MAQ-3: Self- effcacy		
Post Totally Blinds- Post Sighteds	1.a	*
Pre Totally Blinds- Pre Sighteds	1.b	**
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	*
Post Experimental Group - Post Control Group	1.h	**
MAQ-4: Achievement motivation		
Post Totally Blinds- Post Sighteds	1.a	
Pre Totally Blinds- Pre Sighteds	1.b	
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	
Post Experimental Group - Post Control Group	1.h	**
MAQ-5: Student motivation		
Post Totally Blinds- Post Sighteds	1.a	
Pre Totally Blinds- Pre Sighteds	1.b	**

Table 4.28 (cont.)

Variable	Research Question	ES
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	
Post Experimental Group - Post Control Group	1.h	**
MAQ-6: Self-concept		
Post Totally Blinds- Post Sighteds	1.a	**
Pre Totally Blinds- Pre Sighteds	1.b	
Post Sighteds- Pre Sighteds	1.c	*
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	**
Post Experimental Group - Pre Experimental Group	1.f	*
Pre Experimental Group - Pre Control Group	1.g	
Post Experimental Group - Post Control Group	1.h	**
MAQ-7: Test-anxiety		
Post Totally Blinds- Post Sighteds	1.a	
Pre Totally Blinds- Pre Sighteds	1.b	
Post Sighteds- Pre Sighteds	1.c	**
Post Totally Blinds - Pre Totally Blinds	1.d	**
Post Control Group - Pre Control Group	1.e	
Post Experimental Group - Pre Experimental Group	1.f	**
Pre Experimental Group - Pre Control Group	1.g	
Post Experimental Group - Post Control Group	1.h	**

Out of the summary of the first research problems' results, following bullets are given to summerize other research problems' results.

- According to the sighted and totally blind students' post MAT and MAQ scores, using the ECM affected the totally blind students positively more than

the sighted students. The totally blind students were more successful than the sighted students. Additionally some items of the totally blind students' attitude and motivation increased more than the sighted students.

- According to pre MAT results of the totally blind and sighted students, the totally blind students' achievement level about motion concept was at lower level than the sighted students.

- There is a positive and large increase in totally blind students' achievement, motivation and attitude towards physics course. In all sub dimensions of the attitude and motivation, using the ECM affected the totally blind students positively according to pre and post test results of the MAT and MAQ.

- There is a decrease in the control group students' MAQ scores. However, the level of the MAT score difference is in small ES value range.

- There is a positive and large increase in the experimental group members' achievement and affective variables. In all sub dimensions of the attitude and motivation, using the ECM affected the experimental group members positively according to pre and post test results of the MAT and MAQ.

- According to the pre MAT scores, there is a small difference between the experimental and control groups in favour of the experimental group students.

- The control group students' pre attitude and motivation values were bigger than the experimental group students' affective values. Using the ECM changed the experimental group students' attitude and motivation positively more than the control group students' attitude and motivation.

- All the ECM is enjoyed by the sighted and totally blind students. They perceive that all materials are contributed to their learning.

- In contrast to the negative change of learning environment sub dimension in the control groups, the totally blind students' and the experimental group

students' perceptions about their learning environments were positively changed.

- The experimental group students' perceptions about their interaction level changed positively. Although there is an increase in the totally blind and the experimental group students' interactions, the control group students decreased their perceptions about interaction level.

- During the treatment, both the totally blind students increased their asking, answering, providing comment, and giving example. There is an increase in the totally blind students' interaction with the teachers and other students. Most of these interactions were related with concepts or/and course materials.

- During the entire course, the totally blind students interact with their friends and course materials in the treatment periods by standing. There is an obvious increase in using course materials during the treatment period.

- The totally blind students solved both types of questions; questions with graphics and without graphics. In both cases, from six MAT questions with graphics they solved more than four.

CHAPTER 5

DISCUSSION, CONCLUSION, AND IMPLICATIONS

This chapter begins with a summary of the study. It is followed by discussion on the results of the study. After the discussion section, the reliability and validity issues are discussed. Finally, conclusions, implementations, and recommendations are given at the end of the chapter.

5.1. Summary of the Study

This study investigates the effect of the ECM on the ninth grade totally blind students and their sighted friends in Ankara. The interaction among the totally blind students, course materials and teachers or the sighted friends are observed and triangulated with the perceptions of the students about their interactions in the class.

To understand the effect, a quasi-experimental design is used. Two schools including totally blind students were selected. The students in the experimental and control groups followed the formal course book. In addition to the course book, the students in the experimental group used the ECM. Before and after using the ECM, the Motion Achievement Test(MAT), attitude and motivation (MAQ), learning environment (WIHIC), perceptions about the ECM (SQET), and interaction (SQCI) are applied to the students. Moreover, during the treatment period both the experimental and control groups are observed for different reasons. The control group was observed to check whether they followed the textbook and the

experimental group was observed to see totally blind students interaction, and also to control whether the teacher used the ECM as planed and followed the textbook same as in the control group. The data collecting process approximately took 2.5-3 months.

In Figure 5.1, some results of the study are summarized. Arrows directed to up symbolize increased values and opposite arrows is used for decreased values. The instrument names written in arrows present ES results of written instruments. Arrows are related with the group of students written in the circle. If the value is in small ES, that variable isn't written in the arrows.

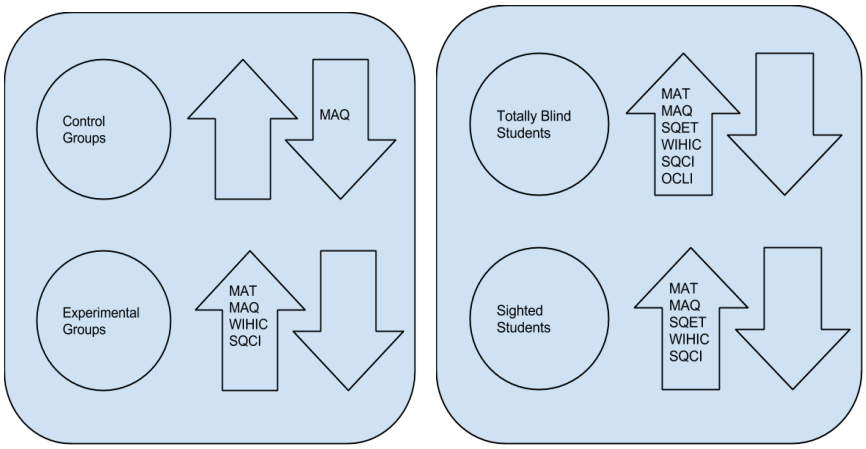


Figure 5.1 Summary of the results about the effect of the ECM on the students

To sum up, using ECM increased the experimental group students' achievement, motivation and attitude towards physics. Moreover, their perceptions about learning environment and the number of physical and cognitive interactions changed in a positive way. This treatment has no discriminative effect on the blind or sighted students. Furthermore, sighted and totally blind students enjoyed the ECM and think that there is a ECM's contribution to their learning.

5.2. Discussion of the Results

This section starts with the problem of control groups' situation and continues with the effect of using only textbook and the ECM supported textbook approach which is the design of this study. At the end of this section, there is an overview of the results.

According to the results, the experimental group students performed better than the control group students on their pre-test scores. However, all the effect sizes of control groups' achievement scores are close to zero. Although the instruction is applied as it was planned in the control groups, the results of achievement score needs to be explained. First of all, the control groups only followed the textbook. This methodology may let the researcher control the treatment's possible effects but it seems that just using the only formal textbook made the course ordinary and boring. Other results such as the control groups' perceptions about their learning environment or their motivation, attitude towards physics course changed from positive to negative which support the idea that only following the textbook is not a suggestible method.

With half an eye, the negative small ES of the control group students' pre and post MAT scores does not seem logical because after a course students' level should be increased; however, the average values do not mean that all the students are in the average value of the test. It was asked to the control group students after everything had finished why their post achievement scores are not increased. The students did not give any logical reasons that explain the results. For example, some of them said that they thought as the test would be never applied again but some others in the same class explained that they were expected the test again. All the control students in Case A said that there was another exam at the same day. However, this affected all the classes because the exam they talked was school-wide common exam and anyhow they were informed that they would have an exam about motion. Their first physics exam results in the school indicate that there was a small difference on behalf of the experimental groups.

It is known that negative gain is a negative reaction of students and generally appears after a change (Albanese, 2000). Negative effect size does not mean that the students had negative score; however, rather implies that the students' performance is not the same as predicted (Cooper & Cohn, 1997). Therefore, although there are some other studies reported negative gains (Albanese, 2000; Sevilla, Ortega, Blanco & Sanchez, 1991; Stadler, 2006) or no change situations (Harvey, 2013), the ineffectiveness of control groups in two cases could be explained in two ways; instrument's sensitivity and conceptual confusion. First, the change is smaller than the instrument's margin of error. This means that the number of questions was not enough to present the difference between the control groups' pre and post MAT scores. For instance, the MAT instrument with a hundred questions should be more sensitive; however, it should not be predicted that more sensitive instrument with a hundred questions is needed. The other explanation is about students' conceptual confusion. This should be possible because the pre-MAT scores are the result of their previous knowledge. They know some basic definitions and equations from previous classes (Özsevgeç, 2006) and the questions in the MAT are prepared from daily life. They answered the pre-MAT questions intuitively but after textbook based instruction they confused the concepts and failed the exam. To sum up, these two possible reasons seem more logical due to the fact that the control group students' explanations are not adequate.

Although well-written textbooks may engage students and hold their interest (Ogan-Bekiroglu, 2007), there are some studies which emphasize the negative ways of physics textbooks in Turkish (Demir, Maskan, Çevik & Baran, 2009; Marulcu & Doğan, 2010; Ogan-Bekiroglu, 2007). For instance, Marulcu and Doğan (2010) investigated the views of teachers and students about current physics textbooks in Turkey. According to their study, 53 percent of teachers explained that the content and the sequence of the textbook affect the efficiency of education negatively. Additionally, 58 percent of 1362 participants believe that the textbook is not enough to understand the content of the physics. The other study includes 40 pre-service physics teacher views and they all agreed that there is no summary part to connect the contents in or at the end of the text. Additionally, they all agreed that individual differences are ignored through current physics textbooks in Turkey (Demir,

Maskan, Çevik & Baran, 2009). Kouroupetroglou and Kacorri (2010) explained how to transform science textbooks to make it accessible for blinds. Not only 9th grade formal book for blind students is appropriate to follow the course, but also supplementary resources are prepared according to this transformation process. Therefore, there is no difference in terms of using formal textbooks for blinds and sighted.

In this study, the control group students followed only textbook based instruction and did not have large and positive ES as their friends in the experimental group. Morgan and Kittleson's (2013) survey which investigates what students want from Iowa physics teachers explained the problem why textbook based instruction could not increased the control groups' achievement, attitude and motivation. According to the answers, inquiry based approaches comes first and they do not want textbook based instruction with lots of numeric problems. This and similar studies may be an explanation why textbook based instruction with the ECM is more successful than the only textbook instruction.

This study indicated that the ECM supported course changed the experimental group students' learning environment with positive and large ES. Although to make the class more inclusive there are lots of strategies such as teacher training, curriculum analysis, a whole collaboration of school and family about blind students' needs (Hayward, 2006). This study includes these needs and curriculum analysis with teacher training by developing enriched course materials. It is easy to understand from the results of this study that the ECM development process seems enough to upgrade the level of classroom inclusion.

In this study, for each totally blind student a needle page is given. They used this tactual materials to study graphics out of the classes. Although after our treatment completed, a different study (Healy, Fernandes & Frant, 2013) for inclusive classes was published. In the same way of this study, they preferred the common strategy; designing material for all to make the learning environment more inclusive. They tested using tactual boxes for each number and they developed an electronic material which transforms the graphics in tactual form.

This dissertation supports the idea that for some haptic materials such as graphs, additional senses should be used. For instance, some audio graphs which make the data hearable are used during the class. Positive benefit of tactual materials is being aprropriate for both micro and macro scale such as sequence of gene (Butler, Bello, York, Orvis & Pittendrigh, 2013) or Geology (Asher, 2001). Moreover , this practice stimulates multiple senses and makes the course more flexible and rich. There are some audio graph practices in different fields (Pereira et al., 2013) and this dissertation is also an example about how new technologies used in other disciplines should be adapted into physics course.

This study improved the totally blind and sighted students' achievement, motivation and attitude with simple prepared ECM. This ECM could also be prepared by the teachers. During the courses, teachers generally say "this, that, these, those" and blind students have some difficulties to understand what the teacher is talking about. This problem should be overcome by the help of technologies. For instance, Quek and Oliveira (2013) developed a technology which alerts the blind learners about teachers' gestures. However, in near future, it seems more difficult to adapt these technologies. Awareness of this problem or giving a course assistant to blind students may be the first step in our country. This dissertation is one of the examples of how to keep both sighted and blind students' educational rights with low tech and without ignoring none of them.

In this study, simple prepared ECM increased both the sighted and totally blind students' the MAT, MAQ, WIHIC, and SQCI scores with medium or large ES. The effect of using ECM supported the idea that basic materials are appropriate to national conditions with the way of being easy and cheap to prepare (Uysal & Eryılmaz, 2002). Moreover, this study promoted these basic course materials which holds the students' interests and increases positive attitude towards science (Koç & Böyük, 2012). Özsevgenç (2006) developed some activities about force and motion unit for elementary schools which is appropriate to 5E learning cycle. His quasi-experimental study supported our study and presented that there is a meaningful change in terms of achievement test scores in the class in which these activities were

used. These activities included some basic materials and made the students mentally and physically active and the change in control groups' achievement was scarcely any.

There are some additional benefits of this study. For instance, by the help of 11th ECM which is context based material (Bülbül, Garip & Demirtaş, 2013), teachers are supported. This support was useful not only for the students' understanding of the concept but also for the teachers' understanding of the curriculum. Teachers' view about contexts in 9th grade textbooks is investigated by Ayvacı, Ültay and Mert (2013). According to their research, teachers do not generally prefer the contexts used in the textbook.

All the materials used in this dissertation included one more sense but out of others, the second ECM is used by the sighted and totally blind students with three different senses (watching, touching and listening). This material is the one marked with two stars in both dimension in Table 4.9. This means that blind students enjoyed it and learnt by using it more than sighted students. As mentioned in Chapter 2, Bülbül (2012b) suggested categorizing the course materials according to their universal design level. An inclusive material should be for all groups and should be for all senses as possible. According to Figure 5.2, the second ECM is more universal designed ECM.

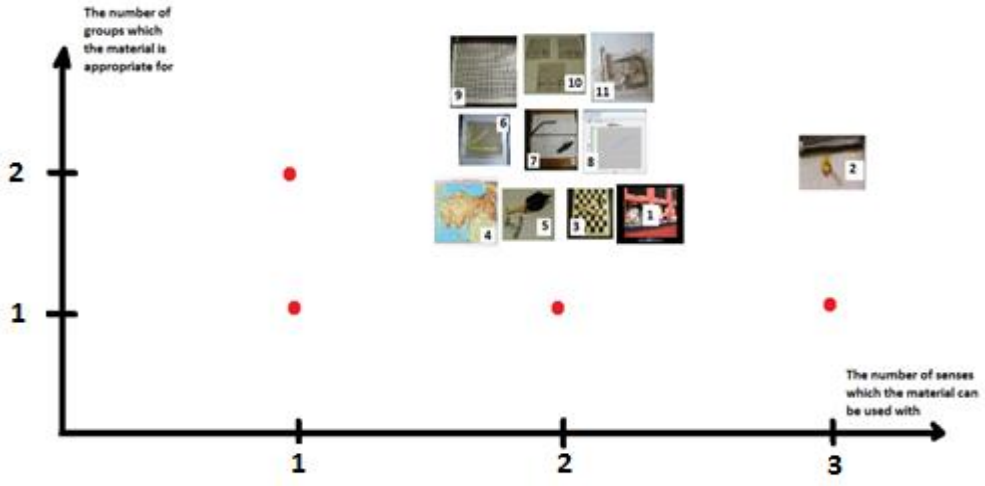


Figure 5.2 A categorization of enriched course materials in the dissertation

This study presented that these two totally blind students are not disable to learn motion concept. Similarly, according to Ambati and Ambati (2013), disability is not transient; one is disabled as regards to situation, not as a constant state of being. In other words, the participants of their study described themselves as disabled in some conditions due to the weakness of support services. It is valid for all students that in some conditions they have some understanding problems not the cause of their capacity or learning difficulty.

Research in special education needs complex methodologies to improve practical, ethical and scientific gains due to the participants' characteristics (Odom, Brantlinger, Gersten, Horner, Thompson & Harris, 2005). Beyond suggesting that the ECM were promoted to be useful in inclusive learning environment with an experimental design, this dissertation gives results of observations that present how totally blind students took advantage of the ECM.

This dissertation presented how totally blind students interact with physics course materials, sighted students and their teacher. For instance, the totally blind students' interactions with the ECM bored a hole in the idea that graphical questions were known as something not to ask in an exam question for totally blind students. However, this dissertation indicated that both totally blind students and their friends can learn graphics and concepts in the 9th grade motion unit and develop positive motivation and attitude towards the physics course together. Therefore, it is obvious that there is no need to discriminate students in terms of their sight ability.

5.3. Reliability of the Results of the Study

It is unusual to discuss the reliability of the dissertation' results because every dissertation should be unique and never lets to compare with others. However, in this dissertation, there are two independent cases and the results of these cases let the researcher to discuss whether the results of the dissertation are reliable or not. Repeated observations and instruments indicated that the result from one case is very similar to the other case. In other words, the students in both cases gave reaction to the treatment in a similar way. There is a positive increase in the experimental group

students' achievement, perceptions about the learning environment, level of interaction, motivation and and attitude towards physics course.

Not only the results of one case supported the other case's results, but also there is a consistency between inner-results of each case like student perceptions about the interaction of totally blind students and the researcher's observations.

5.4. Validity of the Results of the Study

In this section, different types of validity of the study are discussed. In qualitative studies, the *descriptive validity* which refers to accuracy of case descriptions is very important not to allow the reader to misunderstand the study (Johnson & Christensen, 2008). In methodology part, a detailed description of two cases is given with three different perspectives. Additionally, the data from student identification form and pre-test scores of students are given to make their background clear to the readers.

Johnson and Christensen (2008) suggested *investigator triangulation* strategy to promote descriptive validity. This strategy involves the use of more observers. In this study, a corroboration of observations about totally blind students' interactions is obtained by two observers.

The other evidence for validity is *interpretative validity* which refers to the subjects' inner world. The problem is how the researcher reflects the subjects' inner world to the study. To provide the interpretative validity, Johnson and Christensen (2008) suggested participant feedback which let the researcher to check the conclusion of the study and to clear up areas of miscommunication by the help of subjects' feedbacks. In this study, at the beginning of the followed semester, a pop up meetings were conducted with totally blind students, their friends, teachers, and other 9^{th} grade students to share the results. Unfortunately, all the experimental group students and teacher asked why the material support and activity suggestions are stopped. Totally blind students explained that their participation to physics course is drastically decreased and have some problems to understand the concepts. They had all approved the effect of the ECM and claimed the continuity of the support. The

increment of achievement, attitude and motivation with the support provided to the totally blind students shows the necessity of the support.

Theoretical validity is other evidence for validity which refers to the level of the data fits with the theoretical explanations of the study. To provide *theoretical validity,* Johnson and Christensen (2008) suggested extended fieldwork, theory triangulation, peer review and pattern matching. First of all, *extended fieldwork* is used for collecting data in the case over an extended period of time. During the study, 502 minutes in Case A and 472 minutes in Case B were spent to observe the totally blind students. For both cases it took 19 course day and 38 course hours. It seems enough for *extended fieldwork* strategy. *Theory triangulation* refers to using multiple theories and perspectives to explain the data. In this study, the number of cognitive and physical interactions of the blind students with their sighted peers is increased. Due to the fact that social learning theory explains the learning process through participation (Mezirow, 1997), it is easy to clarify the totally blind students' success by the help of cognitive and physical interactions. The next strategy for *theoretical validity* is named as *peer review* which let the researcher discuss one's perceptions with one's peers. About the interaction level, SQCI results are supported by other sources results. For instance, Table 4.14 described the same environment with different sources. The last strategy is *pattern matching* where the researcher should be able to predict the results for similar patterns. In this study, there are two similar cases and any of them verify the other case's results; therefore, the frequency rates of observations were parallel.

5.4.1. Internal validity

In this section, internal validity is discussed. The discussion includes both quantitative and qualitative perspectives and starts with quantitative one.

Fraenkel and Wallen (2000) explain the internal validity as directly relating observed differences on dependent variable to only the independent variable. There are some threads to internal validity and some of those should be overcome by the help of matching-only the pre-test and post-test control group design of the study. For

instance, the subject characteristics mortality, instrument decay, history, testing, regression, and maturation. However, some threats like *location, characteristics of data collector, implementation,* and *data collector bias* are not controlled with the matching-only pretest and posttest control group design (Fraenkel & Wallen, 2000). In following parts, all these threats are discussed.

First of all, *location* may affect students' achievement. For instance, students who learn with inquiry method in a poor equipment location may not be performing as expected. Therefore, during the treatment the researcher paid attention to control the location not to provide a difference out of planed manipulation. There were no disadvantaged groups among the experimental and control group students. However, between two cases, there was a difference in terms of location. Although there were smart-boards in both cases, it wasn't activated in Case A. The first and eighth materials of the ECM are played with a projector in Case A. There were no problem during the usage of these materials.

The next threat to internal validity which cannot be put out of using pretest and posttest designs in quantitative research is *data collector's effects*. According to Fraenkel and Wallen (2000) the characteristics of the person who gathers data may affect the results of instruments. To overcome this threat, same data collector should work in all cases. In this way, all classes should be exposed by the same effect. In guidance hour, the instruments were given by the teacher who has the responsibility of the class. The researcher walked among the classes to give the same direction and control the cheating and unexpected events. To overcome the *data collector bias* effect, the teachers are informed not to talk about the examination.

The other threat is called *implementation* which refers to different implementer. In both cases, there was only one physics teacher, so there wasn't any implementation difference. In each case, both the experimental and control group students worked with the same physics teachers. Additionally, the researcher was in the class during the treatment and checked the implementations with the treatment verification form about how does the teacher used ECM.

As it seen from the descriptions of cases in Chapter 3, although there may be some difference between two cases, there is no difference between the experimental and control groups in each cases in terms of *subject characteristics.* The research design of this study made these differences inaffective.

The other threat for internal validity is known as *loss of subjects (mortality).* The sample size should be conserved during the testing and applying the treatment processes. To control this threat all groups are informed not to be absent in physics lessons. Additionally, in a certain range, mortality should be acceptable; however, it was highlighted one or two times that they should come to the school and fill the instruments. For instance, one of the student was absent in test application date. The next day, she filled all relevant instruments. By this methodology, there is no missing data in the study.

The instruments were applied at the same time. This strategy prevented the results from *history effect*. This effect refers to the possible problems when the instruments are applied in different days. In both cases, the instruments were applied during the guidance hours and the break hours with the following course hours.

In this study, *testing effect* which explains the difference from pretest to post test scores with or without treatment is controlled with applying the instruments to both groups. The testing effect, if there is, should be valid for both groups; therefore, the difference between the experimental and control groups is still meaningful.

The difference between two groups, in long term studies, could be explained by natural *maturation*. In this study, it is impossible that the increase of the experimental groups' success cannot be explained by maturation. In other words, their natural physical and mental development in three weeks should not be the source of their success; this may be valid in long term studies.

Naturally, very low or very high scores aim to the average. This effect may be the reason for increase or decrease of the results and called as *regression* to the mean. In this study, the difference between two groups' pretest and posttest results could not

be explained by the regression effect because there were no extreme scores in the data.

In this study, the control groups' achievements in both cases are decreased in a small range. This change should be explained by *attitude of subjects* towards the passion of the experimental groups; however, the expression of students in the control groups doesn't support this idea. According to the interviews after treatment, some of them are unaware of totally blind student in neighbor 9^{th} grade class and most of them don't know anything about the treatment.

Although there is an inter-observer agreement about totally blind students' interaction which is supported by the perceptions of classmates, multiple-subject case studies should be checked in terms of *social validity*. This evidence for validity refers to the importance, effectiveness, appropriateness of the observed variable and the indicators of social validity are subjective evaluation, normative comparison, and sustainability (Kennedy, 2005). For subjective evaluation, different perceptions should be used for the observed variables. In this study, the interaction levels of totally blind students are triangulated by the perceptions of totally blind students and their friends. The other indicator of social validity is normative comparison which refers to the difference between the frequency of observed behaviors in treatment period and before or/and after the treatment. In this study, this difference is clear enough to conclude that the cognitive and physical interactions of totally blind students are increased. The last indicator of social validity is sustainability which needs multiple base-lines; it should not be discussed in this study due to the design. The second treatment should be provided to test the last social validity type.

Out of these threat for internal validity, this thesis is about ECM and studies about materials or media are generally criticized due to some reasons. For instance, Clark (1983) criticized the positive effects of some studies due to uncontrolled methods or material and method confusion. These critics are not related with this thesis by the reason of using the ECM because the ECM are not only 3D materials but also include a guide about how to use.

5.4.2. External validity

Although there are different types of external validity, all of them focus on different parts of generalizability of the study. First parts of this section are mostly related with external validity of quantitative and qualitative results in terms of population validity, ecological validity, temporal validity, treatment variation validity, and outcome validity. Then the external validity of other issues are discussed.

Population validity is one of the external validity type and focus on the population of the study. If the population validity is poor, this means that researcher should not generalize the results of the sample to the population. How well the researcher generalizes the sample results to the population depends on how well randomly assigned cases are used and how well these cases include adequate number of students. Population validity is important to find how widely does the results apply and increase with randomly assignment and large number of students due to the fact that if the number of students in sample cases increases, the generalizability of the study increases. In this study, classrooms occurred according to alignment of registration to the school this do not make the study randomly sellection but helps the generalizability of the cases' results to the population of 9^{th} grade totally blind students and their sighted friends in Ankara. Additionally, in each case, there were three classes which are enough to generalize the results to the school.

The other evidence for external validity is *ecological validity* and presents how well the results should be generalized across different settings. In this study, the settings were inclusive classes where the totally blind students involved. The positive findings of the study in two different cases support the ecological validity. The similarity of independent cases indicated that the ECM help both the totally blind and sighted students success together. During the data collecting process, there were no other school in Ankara which includes totally blind student among 9th grades accept the worked cases. Although the conclusion of this study is written according to the results of different districts, similar situations power the possibility of further inclusive classes' success whether they use the ECM. In other words, it is possible that the results of this study might be generalized to similar other inclusive settings

as well. The main threat to ecological validity is known as *reactivity* which is result of awareness of subjects. This threat occurs if the observed student change the behavior due to the observation. In this study, there is no evidence among interaction graphs that reactivity is occurred. The observation started before the treatment and if there was a reactivity effect, the number of interactions should be increased before the treatment. The study free from the reactivity should be also valid for unobserved settings. Otherwise, reactivity makes the study valid only for the observed settings. To sum up, this study got strong in terms of ecological validity due to the reactivity effect because it should be generalized not only to observed cases but also unobserved cases.

5.5. Conclusions of the Study

Wordle is an online program that gives a figure including words in different sizes. The size of word in the figure occurs according to the frequency of that word in the given text. Figure 5.3 reflects the frequency of words used in this study. This figure is prepared to control whether the purpose of the study correspond to the written text. The main purpose was to develop enriched course materials and analyze the effect of it on sighted and totally blind students. As it seen from Figure 5.3, most frequently used words in this dissertation from the biggest to the smallest one are parallel to the purpose of this study.

Figure 5.3 The output of this dissertation from the Wordle

The main conclusion of this dissertation is about educational paradigm which includes how educators design education. It is traditional approach that education

builds according to “average students”; however, it is not true that all students are like average student. Due to the fact that every student is different, on what kind of student should be the education based? This question is answered by this dissertation as “disadvantaged students”. In two cases, totally blind students were in disadvantaged position. Although course materials were useable by the totally blind students, the sighted students also used and gained positive achievement, motivation and attitude as their totally blind friends. Kumar, Ramasamy and Stefanich (2001) supported this paradigm and additionally explain that full participation in science by visually impaired students may be a rewarding experience for teachers.

Durre (2008) discusses visually impaired persons’ career opportunities and explains that these persons should be educated with assistive technologies which they need to access the public environments. For this dissertation, using audio graphs is not only benefit to pass the course or learn the motion graphs; this opportunity is introduced for totally blind students to learn the program out of the course and do not have difficulty to access the public environments. This kind of studies prepares the blind students to the real world out of the school. Improving blind students’ educational opportunities also gives a chance to attend the course otherwise restrictive settings are a strong barrier for students with special needs to continue their education (McLeskey, Landers, Williamson & Hoppey, 2012). The ECM which is suggested in this dissertation gives a chance to continue their science education and perhaps be a scientist because students do not have to be sighted to be a scientist (Erwin, Perkins, Ayala, Fine & Rubin, 2001). Additional to the personal development chance, it is our social chance that disadvantaged students centered educational designs support both disadvantaged students and their peers and increase the social inclusion (Thomas, 1997). In terms of the results, this dissertation seems more appropriate to support the idea of giving a chance for disadvantaged students’ development and social inclusion.

5.6. Implications of the Study

The implications of the study based on the results are given below for teachers, researchers, curriculum developers, textbook writers, and policy makers, respectively.

In this study, how to make ECM which affect both the totally and sighted students with positive and medium or large ES was explained. Therefore, teachers should;

- Use the explained ECM to support their 9^{th} grade students' learning about the motion context.
- Develop their own ECM by following the written process for any of the concepts.
- Use the MAT to understand their students' achievement because there is no problem about validity or reliability of MAT.
- Use student identification form to know the characteristics of their students and their opinion about learning the motion concept.

This study included ECM development process, useful instruments and comprehensive literature review of physics education with blind students. Therefore, researchers should;

- Follow the ECM development process to make new one without spending much time to decide how to start and continue when they need to produce a well employed course materials.
- Analyze the literature review part to understand the physics education studies with blind students.
- Use student identification form to know the characteristics of the students and their opinion about learning the motion concept.
- Use the instruments about motivation and attitude towards physics course and learning environment dimensions.
- Use or change OCLI and SQCI to present the students' interactions in the class.

In this study, it was observed that teachers need directions and material support during studing with the blind student. Therefore, curriculum developers should;

- Give more priority to students with special needs in terms of specific objectives and teacher informing documents for inclusive classes.

This study indicated that only textbooks are not enough to improve achievement, motivation and attitudes towards the physics course. Therefore, textbook writers should;

- Not forget the different kind of student characteristics and prepare the texts which include figures and descriptions of figures, tables and descriptions of tables together.
- Develop ECM coherent with textbooks and avoid from publishing just papers.

This dissertation is one of the examples of how a course should be designed according to totally blind students' characteristics. Therefore, policy makers;

- Should not ignore the disadvantaged students. Furthermore, school buildings, curricula, and national examinations should be appropriate for blind students.

5.7. Recommendations for Further Research

According to the researchers' experience, there are some recommendations for further research as given in the following list.

- The effect of ECM should be tested in a class where all the students are totally blind because inclusive class settings are different from classes where only blinds are the students.
- The instruments were used to understand whether the results are as excepted or not. However, open-ended interviews for each course hours might give more information about the totally blind students' needs. Therefore, analyses

should be focused on discourse or the experience gathered by face to face teaching and learning activities.

REFERENCES

Abak, A. (2003). *Modeling the Relationship Between University Students' Selected Affective Characteristics and Their Physics Achievement* (Doctoral dissertation).

Albanese, M. (2000). Problem-based learning: why curricula are likely to show little effect on knowledge and clinical skills. *Medical education, 34*(9), 729-738.

Ambati, N. R., & Ambati, H. (2013). Paradigm shift in German disability policy and its impact on students with disabilities in higher education. *International Journal of Social Science & Interdiciplineary research, 2*(4), 22-42.

Asher, P. (2001). Teaching an introductory physical geology course to a student with visual impairment. *Journal of Geoscience Education, 49*(2), 166-169.

Aycan, Ş., & Yumuşak, A. (2003). Lise müfredatındaki fizik konularının anlaşılma düzeyleri üzerine bir araştırma. *Milli Eğitim Dergisi, 159,* 171-180.

Ayvacı, H. Ş., Ültay, E., & Mert, Y. (2013). Evaluation of contexts appeared in 9th grade physics textbook. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 7*(1), 242-263.

Batu, E. S. (2008). Kaynaştırma ve destek özel eğitim hizmetleri. In Ibrahim Diken (Eds.), *Özel eğitime gereksinimi olan öğrenciler ve özel eğitim* (1st ed.) (pp. 89-105). Ankara: Pegem A.

Baughman, J., & Zollman, D. (1977). Physics Labs For The Blind. *The Physics Teacher, 15,* 339–342.

Beichner, R. J. (1994). Testing student interpretation of kinematics graphs. *American journal of Physics, 62*(8), 750-762.

Beukelman, D., & Mirenda, P. (2005). Augmentative and alternative communication: Management of severe communication impairments. *Baltimore: Brookes*.

Blackburn, B. R. (2006). *Study Guide--Classroom Motivation from A to Z: How to Engage Your Students in Learning*. Eye on Education. 6 Depot Way West Suite 106, Larchmont, NY 10538.

Boyd-Kimball, D. (2012). Adaptive Instructional Aids for Teaching a Blind Student in a Nonmajors College Chemistry Course. Journal of Chemical Education, 89(11), 1395-1399.

Brekelmans, M., van den Eeden, P., Terwel, J., & Wubbels, T. (1997). Student characteristics and learning environment interactions in mathematics and physics education: A resource perspective. *International Journal of Educational Research,27*(4), 283-292.

Brok, P., Telli, S., Cakiroglu, J., Taconis, R., & Tekkaya, C. (2010). Learning environment profiles of Turkish secondary biology classrooms. *Learning Environments Research*, *13*(3), 187-204.

Brophy, J. (2004). *Motivating students to learn* (Second edition). Mahway, NJ: Eribaum.

Bryan, A. H. (1951). Physics for the blind. *Science Education*, *35*(5), 271–274.

Bullock, D. W., LaBella, V. P., Clingan, T., Ding, Z., Stewart, G., & Thibado, P. M. (2002). Enhancing the student-instructor interaction frequency. *The Physics Teacher*, *40*, 535.

Burgstahler, S. (2002). Universal design of instruction. *Remedial and Special Education*, *24*(6), 369.

Butler, C. R., Bello, J., York, A., Orvis, K., & Pittendrigh, B. R. (2013). Genomics analogy model for educators (GAME): Fuzzy DNA model to enable the learning of gene sequencing for visually impaired and blind students. *The Science Education Review*, *7*(2), 1-9.

Bülbül, M. Ş. (2009a). Doğuştan görme engellinin Türkiye'de fizikçi olabilme ihtimali. *Eleştirel Pedagoji*, *2*(7), 52–59.

Bülbül, M. Ş. (2009b). The possiblity of learning Curved Mirrors' Structure By Blind Inborn Students. *26th International Physics Conference* (p. 225). Bodrum: Turkish Physics Society.

Bülbül, M. Ş. (2010a). Görme Engelliler ve Fizik Öğretimi. *Türkiye'de Fizik Eğitimi Alanındaki Tecrübeler, Sorunlar, Çözümler ve Öneriler* (pp. 9–12).

Bülbül, M. Ş. (2010b). Unseen Barriers for Disabled Science Learners: Misconceptions about Nature of Science. In H. Sarı (Ed.), *Internaional Conference on Inclusion*. Konya: Internaional Conference on Inclusion.

Bülbül, M. Ş. (2010c). Farklılıklarından ötürü çocuklarımızı ayırmalı mıyız yoksa kaynaştırmalı mıyız? *Cito Kuram ve Uygulama*, (8), 46–48.

Bülbül, M. Ş. (2011a). Inclusion: Something more than sitting together. *International Centre for Innovation in Education* (p. 7). İstanbul.

Bülbül, M. Ş. (2011b). Görme Engelli Öğrencilerin Işığın Yayılma Modeli ile İlgili Görüşleri. *20. Ulusal Eğitim Bilimleri Kurultayı* (p. 576). Burdur.

Bülbül, M. Ş. (2012a). Blind student's experience about 3D electric circuits through bloom's taxonomical method. *AWERProcedia Information Technology & Computer Science*, *1*(2012), 68–72.

Bülbül, M. Ş. (2012b). Görme engelliler ve fizik eğitimi Çalıştayı sonrası 9. Sınıf enerji Ünitesi ile ilgili öneriler. *Sosyal Politika Çalışmaları*, *7*(29), 79–85.

Bülbül, M. Ş. (2012c). Making wave concept tangible. *e-Journal of New World Sciences Academy*, *7*(1), 404–409.

Bülbül, M. Ş. (2012d). Görme engelli öğrencilerin olduğu kaynaştırmalı öğrenme ortamları için hareket eğitimi uygulamaları. *3.Uluslar Arası Kör ve Az Görenlerin Eğitimi, Rehabilitasyon Sorunları ve Çözüm Önerileri Sempozyumu* (pp. 132–139). Ankara: Türkiye Körler Federasyonu.

Bülbül, M. Ş. (2013a). Towards inclusive nature of science (iNOS) activities. *İnternational Journal on New Trends in Education and Their Implications*, *4*(1), 173–179.

Bülbül, M. Ş. (2013b). Görme engelli öğrenciler ile grafik çalışırken nasıl bir materyal kullanılmalıdır? *Fen Bilimleri Öğretimi Dergisi*, *1*(1), 1–12.

Bülbül, M. Ş., & Eryılmaz, A. (2010a). Görme engelli öğrencilerin kullanabilecekleri fizik ders araçlari. *IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Özet Kitapçığı* (p. 159). İzmir: Dokuz Eylül Üniversitesi, Buca Eğitim Fakültesi.

Bülbül, M. Ş., & Eryılmaz, A. (2010b). How does a blind student measure three basic units in mechanics. *27th International Physics Congress Book of Abstracts* (p. 352). Istanbul: Turkish Physical Society.

Bülbül, M. Ş., & Eryılmaz, A. (2010c). Fizik laboratuvarlarinin engellilere uyumlu hale getirilmesi. *IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi Özet Kitapçığı* (p. 159). İzmir: Dokuz Eylül Üniversitesi, Buca Eğitim Fakültesi.

Bülbül, M. Ş., & Eryılmaz, A. (2012). *Görme engelli öğrenciler için fizik ders araçları*. Ankara: Murat Kitapevi.

Bülbül, M. Ş., & Garip, B. (2012). Dengeli bir eğitim için nasıl bir denge eğitimi olmalı? *3.Uluslar Arası Kör ve Az Görenlerin Eğitimi, Rehabilitasyon Sorunları ve Çözüm Önerileri Sempozyumu* (pp. 125–131). Ankara: Türkiye Körler Federasyonu.

Bülbül, M. Ş., Demirtaş, D., Cansu, Ü., Oktay, Ö., & Garip, B. (2012). Views and recommendations about 9th grade force and motion unit from physics teachers who studied with visually impaired students. *Applied Education Congress*. Ankara: ODTÜ Eğitim Fakültesi.

Bülbül, M. Ş., & Garip, B. (2012). Dengeli bir eğitim için nasıl bir denge eğitimi olmalı? *3.Uluslar Arası Kör ve Az Görenlerin Eğitimi, Rehabilitasyon Sorunları ve Çözüm Önerileri Sempozyumu* (pp. 125–131). Ankara: Türkiye Körler Federasyonu.

Bülbül, M. Ş., Garip, B., Cansu, Ü., & Demirtaş, D. (2012). Mathematics instructional materials designed for visually impaired students : Needle page. *Elementary Education Online, 11*(4), 1–9.

Bülbül, M. Ş., Garip, B., & Demirtaş, D. (2013). Testing context based, self learning material with a blind student: a wisdom box. In *New Perspective in Science Education*. Florence, Italy: Libreria Universitaria.

Camargo, E. P., & Nardi, R. (2006). The Planning of Mechanics and Modern Physics Teaching Activities For Blind Students: Difficulties and Alternatives. *Revista Electronica De Investigacion En Educacion En Ciencias*, *1*(2), 39–64.

Capra, N., Logiurato, F., Danese, B., & Gratton, L. M. (2006). Laboratory Activities in Physics Education - Optics For the Blind (pp. 362–369). Trento: GREP.

Chiu, M. M., Kessel, C., Moschkovich, J., & Muñoz-Nuñez, A. (2001). Learning to graph linear functions: A case study of conceptual change. *Cognition and Instruction*, *19*(2), 215-252.

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53*(4), 445-459.

Clough, P. & Corbett, J. (2006). *Theories of inclusive education.* London: Paul Chapman Publishing.

Cohen, J. (1992). Quantitative methods in psychology. *Psychological bulletin,112*(1),155-159.

Connery, K. F. (2007). Graphing Predictions. *Science Teacher, 74*(2), 42-46.

Cooper, C. R., Baum, S. M., & Neu, T. W. (2004). Developing Scientific Talent in Students With Special Needs:. Assessment. *The Journal Of Secondary Gifted Education, 15*(4), 162-169.

Cooper, S. T., & Cohn, E. (1997). Estimation of a frontier production function for the South Carolina educational process. *Economics of Education Review, 16*(3), 313-327.

Demir, C., Maskan, A. K., Çevik, Ş., & Baran, M. (2009). Ortaöğretim 9. Sınıf fizik ders kitabının ders kitabı değerlendirme ölçütlerine göre incelenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 13,* 125-140.

Dorman, J. P. (2003). Cross-national validation of the What Is Happening In this Class?(WIHIC) questionnaire using confirmatory factor analysis. *Learning Environments Research, 6*(3), 231-245.

Döke, D. A., Garip, B., Bülbül, M. Ş., & Özel, C. (2012). Görme engelliler ile ilgili en çok neyi merak ediyoruz, nasıl merak etmeliyiz, ne biliyoruz, ne bilmeliyiz? *3.Uluslar Arası Kör ve Az Görenlerin Eğitimi, Rehabilitasyon Sorunları ve Çözüm Önerileri Sempozyumu* (pp. 52–62). Ankara: Türkiye Körler Federasyonu.

Durre, I. (2008). Untapped career opportunities for persons with visual impairments.*Bulletin of the American Meteorological Society, 89*(7), 987-996.

Duval, R. (2006). A cognitive analysis of problems of comprehension in a learning of mathematics. *Educational studies in mathematics, 61*(1-2), 103-131.

Enç., M. (2005). Görme özürlüler: Gelişim, uyum ve eğitimleri. Ankara: Gündüz Eğitim ve Yayıncılık.

Engel, D. M. (1991). Law, Culture, and Children with Disabilities: Educational Rights and the Construction of Difference. *Duke Law Journal, 1991*(1), 166-205.

Eraslan, A. (2009). Finlandiya'nın PISA'daki başarısının nedenleri: Türkiye için alınacak dersler. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 3*(2), 238-248.

Erwin, E. J., Perkins, T. S., Ayala, J., Fine, M., & Rubin, E. (2001). " You Don't Have to Be Sighted to Be a Scientist, Do You?" Issues and Outcomes in Science Education. *Journal of Visual Impairment and Blindness*, *95*(6), 338-352.

Foa, U. G. (1993). *Resource theory: Explorations and applications*. Academic Press.

Fraenkel, J. R., & Wallen, N. E. (2000). *How to design and evaluate research in education* (4th ed.). New York: McGraw-Hill.

Franks, F. L. (1975). Educational Materials Development in Primary Science: An Introductory Science Laboratory for Young Blind Students. Education of the Visually Handicapped, 7(4), 97-101.

Fraser, B. J. (1998). Science Learning Environments: Assesment, Effects and Determinants. In B. J. F. a. K. G. Tobin (Eds.), *International Handbook of Science Education*, pp(527-564), Kluwer: Academic Pubishers.

Fraser, B. J. (2007). Classroom Learning Environments. In S. K. A. a. N. G. Lederman (Eds.). *Research on Science Education.* pp(103-124), London: Lawrence Erlbaum Associates.

Fraser, B. J., Fisher, D. L., & McRobbie, C. J. (1996, April). Development, validation and use of personal and class forms of a new classroom environment instrument. In*annual meeting of the American Educational Research Association, New York*.

Gardner, J. (2006). Guest Editorial: My vision. *Journal of rehabılıtatıon research and development, 43*(4), xiii.

Garip, B., Eryılmaz, A., & Bülbül, M. Ş. (2012). Görme engelli öğrencilerin 9. sınıf fizik öğretim programı kazanımlarının kendilerine uygunluğu konusundaki fikirleri. *3.Uluslar Arası Kör ve Az Görenlerin Eğitimi, Rehabilitasyon*

Sorunları ve Çözüm Önerileri Sempozyumu (pp. 206–213). Ankara: Türkiye Körler Federasyonu.

Gliem, J. A., & Gliem, R. R. (2003, October). Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education, The Ohio State University, Columbus, OH.

Glynn, S. M., Taasoobshirazi, G., & Brickman, P., (2009). Science Motivation Questionnaire: Construct validation with nonscience majors. *Journal of Research in Science Teaching*, *46*, 127-146.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world.*Annual review of psychology*, *60*, 549-576.

Grice, N. (2007). Resources for Making Astronomy Accessible for Blind and Visually Impaired Students. *Astronomy Education Review*, *5*(1), 154–157.

Gungor, A. A., Eryılmaz, A., & Fakıoglu, T. (2007). The relationship of freshmen's physics achievement and their related affective characteristics. *Journal of Research in Science Teaching*, *44*(8), 1036-1056.

Gürsel, O. (2009). Görme yetersizliği olan öğrenciler. Diken. İ. H. (Edt.), Özel eğitime gereksinimi olan öğrenciler ve özel eğitim. (s. 167-216). Ankara: Pegem Akademi Yayınları.

Hake, R., (2002). Lessons from the physics education reform effort. *Conservation Ecology 5*(2): 28.

Hale, P. (2000). Kinematics and graphs: Students' difficulties and cbls. *Mathematics Teacher*, *93*(5), 414-417.

Hallahan, D. P. & Kauffman, J. M. (2006). Exceptional learners: introduction to special education. Pearson Education, 9th Edition, USA.

Hancock II, J. B., & Fornari, M. (2012). Minds-On Audio-Guided Activities (MAGA): More Than Hearing and Better Than Seeing. *The Physics Teacher*, *50*, 288.

Harvey, N. C. (2013). *The effects of peer instructıon on ninth grade students'conceptual understanding of forces and motion* (Master's thesis). Louisiana State University and Agricultural and Mechanical College, Louisiana.

Hayward, A. (2006). *Making inclusion happen: a practical guide*. Sage.

Healy, L., Hassan, S., Fernandes, A. A., & Frant, J. B. (2013). Designing tasks for a more inclusive school mathematics. *Proceedings of ICMI Study 22*, 63.

Henderson, D. R. (1965). *Laboratory Methods In Physics For The Blind*. University of Pittsburgh.

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. *American Journal of Physics*, *60*(7), 627-636.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, *6*(1).

Imrie, R. & Hall, P. (2001). *Inclusive design: Designing and developing accessible environments.* London: Spon Press.

Johnson, D. W. (1981). Student-student interaction: The neglected variable in education. *Educational researcher*, *10*(1), 5-10.

Johnson, B., & Christensen, L. (2008). *Educational research: Quantitative, qualitative, and mixed approaches*. Boston: Sage.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative learning returns to college what evidence is there that it works?. *Change: The Magazine of Higher Learning*, *30*(4), 26-35.

Jones, M. G., Minogue, J., Oppewal, T., Cook, M. P., & Broadwell, B. (2006). Visualizing without vision at the microscale: Students with visual impairments explore cells with touch. *Journal of science education and technology*, *15*(5-6), 345-351.

Jordan, A., & Stanovich, P. (2001). Patterns of Teacher-Student Interaction in Inclusive Elementary Classrooms and Correlates with Student Self-Concept.*International Journal of Disability, Development and Education*, *48*(1), 33-52.

Kandaz, Ş. (2004). *Görmezlerin fizik dersine bakış açıları, fizik öğrenmelerindeki zorluklar ve görmezlerle fizik deney uygulamaları*. Marmara Üniversitesi.

Kassop, M. (2003). Ten ways online education matches, or surpasses, face-to-face learning. The Technology Source, 3.

Keefe, C. H., & Davis, R. (1998). Inclusion means. *NASSP Bulletin*, *82*(594), 54-64.

Kennedy, C. H. (2005). *Single-case designs for educational research*. Pearson/A & B.

Kelloway, E. K. (1998). *Using LISREL for structural equation modeling: A researcher's guide*. SAGE Publications, Incorporated.

Kim, K. H. (2005). The relation among fit indexes, power, and sample size in structural equation modeling. *Structural Equation Modeling*, *12*(3), 368-390.

Koballa, T. R., & Glynn, S. M. (2007). Attitudinal and motivational constructs in science learning. *Handbook of research on science education*, 75-102.

Koç, A., & Böyük, U. (2012). Basit Malzemelerle Yapılan Deneylerin Fene Yönelik Tutuma Etkisi. *Türk Fen Eğitimi Dergisi*, *9*(4), 102-118.

Kouroupetroglou, G., & Kacorri, H. (2010, January). Deriving Accessible Science Books for the Blind Students of Physics. In *AIP Conference Proceedings* (Vol. 1203, p. 1308).

Kugelmass, J. W. (2004). *The inclusive school: Sustaining equity and standards.* New York: Teachers College Press.

Kunt, Z. (2013). *Friendship networks of people with visual impairment* (Doctoral dissertation). Central European University, Budapest, Hungary.

Kumar, D., Ramasamy, R., & Stefanich, G. P. (2001). Science for students with visual impairments: Teaching suggestions and policy implications for secondary educators. *Electronic journal of science education*, *5*(3).

Lapp, D. A., & Cyrus, V. F. (2000). Using data-collection devices to enhance students' understanding. *Mathematics Teacher*, *93*(6), 504-510.

Maddox, S., & Morgan, L. (2002). *Teaching a Physics Laboratory Module to Blind Students*. *Physics* (pp. 1–4). Hull.

Marulcu, İ., & Doğan, M. (2010). Ortaöğretim Fizik Ders Kitaplarına Ve Müfredatlarına Afyonkarahisar'daki Öğretmen ve Öğrencilerin Bakışı. *Sosyal Bilimler Enstitüsü Dergisi*, *29*(2), 193-209.

Mattias, D. (2013). *Creation and Evaluation of a Multimodal touch based Application for Learning the Physics of Motion* (Doctoral dissertation, LNU).

McDermott, L. C., Rosenquist, M. L., & Van Zee, E. H. (1987). Student difficulties in connecting graphs and physics: Examples from kinematics. *American Journal of Physics*, *55*(6), 503-513.

McGinnis, J. R., & Stefanich, G. P. (2007). Special needs and talents in science learning. In S. K. Abell & N. G. Lederman (Eds.), (pp. 287-317). Lawrence Erlbaum Associates.

McLean, A. (2003). *The motivated school*. SAGE Publications Limited.

McLeskey, J., Landers, E., Williamson, P., & Hoppey, D. (2012). Are We Moving Toward Educating Students With Disabilities in Less Restrictive Settings?. *The Journal of Special Education*, *46*(3), 131-140.

McNary, S. J., Glasgow, N. A. & Hicks, C. D. (2005). *What successful teachers do in inclusive classrooms.* London: Corwin Press.

Meb. (2004). *9. Sınıf fizik öğretim programı*. Ankara: Milli Eğitim Yayınevi.

Mezirow, J. (1997). Transformative learning: Theory to practice. *New directions for adult and continuing education*, *1997*(74), 5-12.

Morgan, J. T., & Kittleson, T. (2013). What Constitutes Effective Physics Instruction? Surveying the Views of Iowa High School Physics Teachers. *Electronic Journal of Science Education*, *16*(2).

Morris, R. C. (2000). How to make your school inclusive. *Principal Leadership*, *1*(3), 81-82.Nardi, B. A. (1996). *Context and consciousness: activity theory and human-computer interaction.* The MIT Press.

Nichols, B. (2008). *Improving student achievement: 50 research-Based strategies.* London: Linworth Books.

Nuhoğlu, H. (2008). İlköğretim öğrencilerinin hareket ve kuvvet hakkındaki bilgilerinin değerlendirilmesi. *İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9*(16), 123-140.

Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. R. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children*, *71*(2), 137-148.

Ogan-Bekiroglu, F. (2007). To what degree do the currently used physics textbooks meet the expectations?. *Journal of Science Teacher Education*, *18*(4), 599-628.

Özmen, R. G., & Karakoç, T., (2010). Fen bilgisi öğretimi. Diken. İ. H. (Edt.), İlköğretimde kaynaştırma (s. 519-556). Ankara: Pegem Akademi Yayınları.

Özsevgeç, T. (2006). Kuvvet ve hareket ünitesine yönelik 5E modeline göre geliştirilen öğrenci rehber materyalinin etkililiğinin değerlendirilmesi. *Türk Fen Eğitimi Dergisi*, *3*(2), 36-48.

Parry, M., Brazier, M., & Fischbach, E. (1997). Teaching College Physics to a Blind Student. *The Physics Teacher*, *35*, 470–474.

Penrod, W. M., Haley, C. D., & Matheson, L. P. (2005). A Model for Improving Science Teaching for Students with Visual Impairments. *RE: view: Rehabilitation Education for Blindness and Visual Impairment*, *37*(2), 53-58.

Pereira, F., Ponte-e-Sousa, J. C., Fartaria, R. P., Bonifácio, V. D., Mata, P., Aires-de-Sousa, J., & Lobo, A. M. (2013). Sonified Infrared Spectra and Their Interpretation by Blind and Visually Impaired Students. *Journal of Chemical Education, 90*(7), 1-4.

Peşman, H. (2012). *Method-approach interaction: the effects of learning cycle vs traditional and contextual vs non-contextual instruction on 11th grade students'acheivement in and attitudes towards physics* (Doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Peşman, H., & Özdemir, Ö. F. (2012). Approach–Method Interaction: The role of teaching method on the effect of context-based approach in physics instruction. *International Journal of Science Education*, *34*(14), 2127-2145.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education*. Merrill.

Quek, F., & Oliveira, F. (2013). Enabling the blind to see gestures. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *20*(1), 4.

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A Review of Research on Universal Design Educational Models. *Remedial and Special Education*, 0741932513518980.

Rayner, S. (2007). Managing special and inclusive education. Los Angeles: SAGE Publications.

Reid, G. (2005). *Learning styles and inclusion.* London: Paul Chapman Publishing.

Rose, K. K. (2009). Student perceptions of the use of instructor-made videos in online and face-to-face classes. Journal of Online Learning and Teaching, 5(3), 487-495.

Sands, D. J., Kozleski, E. B. & French, N. K. (2000). *Inclusive education for the 21st century*. Stamford: Wadsworth.

Scott, S. S., Loewen, G. & Funckes, C. (2003). Implementing universal design in higher education: Moving beyond the built environment. *Journal on postsecondary education and disability*, *16*(2), 78-89.

Sevilla, J., Ortega, J., Blanco, F., & Sanchez, C. (1991). Physics for blind students: a lecture on equilibrium. Physics Education, 26(4), 227–230.

Sahyun, S. C. (1999). A comparison of auditory and visual graphs for use in physics and mathematics.

Shah, P., & Hoeffner, J. (2002). Review of graph comprehension research: Implications for instruction. *Educational Psychology Review*, *14*(1), 47-69.

Sideridis, G. D. (2009). Motivation and learning disabilities; Past, present, and future. In K. R. Wentzel and A. Wigfield (Eds.), Handbook of motivation at school, (pp. 605-625), Routledge: New York.

Stadler, K. (2006). Student Attitudes Toward Math and Science: A Quantitative Measurement and Comparison of Attitudes Between Minority and Non-minority Students. *Mechanics*, *42*(6), 34.

Sucuoğlu, B., & Kargın, T., (2006). İlköğretimde kaynaştırma uygulamaları: Yaklaşımlar, yöntemler ve teknikler. İstanbul: Morpa Yayınları.

Swing, S. R., & Peterson, P. L. (1982). The relationship of student ability and small-group interaction to student achievement. *American Educational Research Journal*, *19*(2), 259-274.

Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental designs using ANOVA*. Thomson/Brooks/Cole.

Tanrıkulu, M. (2011). Kaynaştırma Ortamlarında Öğrenim Gören 9. Sınıf Total Görme Engelli Öğrencilere Harita Bilgisinin Öğretimi. *TSA, 5*(3), 71-83.

Tanrıverdi, C., (2012). Fin okullarından ders çıkarmak. *Çağdaş Eğitim Dergisi*, *37*(400), 26-29.

Taşar M.F., İngeç Ş.K., Güneş P., (2002). Grafik Çizme ve Anlama Becerisinin Saptanması, V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi ODTÜ, Ankara

Tekin-İftar, E., & Kırcaali-İftar, G. (2006). *Özel eğitimde yanlışsız öğretim yöntemleri*. Ankara: Nobel Yayın Dağıtım.

Telli, S., Brok, D. P., Tekkaya, C., & Cakiroglu, J. (2009). Turkish students' perceptions of their biology learning environments: the effects of gender and grade level. *Asian Journal of Educational Research and Synergy*, *1*(1), 110.

Thomas, G. (1997). Inclusive schools for an inclusive society. *British Journal of Special Education*, *24*(3), 103-107.

Thompson, D. M. (2005). LaTeX2Tri: Physics and Mathematics for the Blind or Visually Impaired. *Technology*, 3–6.

Thompson, R. H., White, K. R., & Morgan, D. P. (1982). Teacher-student interaction patterns in classrooms with mainstreamed mildly handicapped students. *American Educational Research Journal*, *19*(2), 220-236.

Thornton, R. K., & Sokoloff, D. R. (1998). Assessing student learning of Newton's laws: The force and motion conceptual evaluation and the evaluation of active learning laboratory and lecture curricula. *American Journal of Physics*, *66*, 338.

Tuncer, T., (2009). Görme yetersizliği olan çocuklar. Ataman. A. (Edt.), Özel gereksinimli çocuklar ve özel eğitime giriş (s. 215-230). Ankara: Gündüz Eğitim ve Yayıncılık.

Turgut, Ü., Karaman, İ., Sönmez, E., Dilber, R., Şimşek, Ö., & Altun, S. (2006). Fizikte öğrenme güçlüklerinin saptanmasına yönelik bir çalışma. *Kazım Karabekir Eğitim Fakültesi Dergisi*, *13*, 431-437.

Ustun, U. (2010). The comparison of Finnish and Turkish physics curricula. *Procedia Social and Behavioral Sciences*, *2*(2010), 2789-2793.

Uysal, E. & Eryılmaz, A. (2002). *Newton'un 1. ve 3. hareket yasalarıyla ilgili günlük hayattan basit malzemelerle deneyler.*

Ünlü, P., Pehlivan, D., & Tarhan, H. (2010). Ortaöğretim Kurumlarında Öğrenim Gören Görme Engelli Öğrencilerin Fizik Dersi Hakkındaki Düşünceleri. *Gazi Eğitim Fakültesi Dergisi*, *30*(1), 39–54.

Weems, B. (1977). A physical science course for the visually impaired. *The Physics Teacher*, *15*(6), 333–338.

Wemyss, T., & van Kampen, P. (2013). Categorization of first-year university students' interpretations of numerical linear distance-time graphs. *Physical Review Special Topics-Physics Education Research*, *9*(1), 010107.

Wild, T., & Trundle, K. (2010). Conceptual understandings of seasonal change by middle school students with visual impairments. *Journal of Visual Impairment & Blindness*, *104*(2), 107-108.

Winchatz, B. B., & Ostro, S. J. (2004). Using Asteroid Scale Models in Space Science Education for Blind and Visually Impaired Students. *Astronomy Education Review*, *2*(2), 118–126.

Windelborn, A. F. (1999). Doing Physics Blind. *The Physics Teacher*, *37*, 366–367.

Woolnough, J. (2000). How do students learn to apply their mathematical knowledge to interpret graphs in physics. *Research in Science Education*, *30*(3), 259-267.

Yılmaz, V., & Çelik, H. E. (2009). *Lisrel ile yapısal eşitlik modellemesi*. Ankara: Pegem Akademi.

Yoshikawa, H. (2002). Modeling humans in human-computer interaction. *Human-computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, 118-146.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary educational psychology*, *25*(1), 82-91.

Zuber-Skerritt, O. (2001). Action learning and action research: paradigm, praxis and programs. *Effective change management using action research and action learning: Concepts, frameworks, processes and applications*, 1-20.

APPENDIX A

STUDENT IDENTIFICATION FORM

Öğrencileri Tanıma Formu

Cinsiyetin:	Erkek ( ) Kız ( )
Sınıfın:	……..……
Şuben :	……..……
Yaşın :	……..……
Kaç kişilik bir ailesiniz?	……..……
Kaç kardeşsiniz?	……..……
Kendine ait odan var mı?	Evet ( ) Hayır ( )
Annen ve baban sağ mı?	Annem sağ ( ) Babam sağ ( ) ikisi de sağ ( )
Eğitimini engelleyecek derecede maddi imkansızlıklar yaşadığını düşünüyor musun?	Evet ( ) Hayır ( )
Ailenle birlikte mi kalıyorsun?	Evet ( ) Hayır ( )
Okula gidip gelmelerin bir sorun oluyor mu?	Evet ( ) Hayır ( )
Annen ve baban birlikte mi yaşıyor?	Evet ( ) Hayır ( )
Görme engelli isen ne kadar süredir görme engellisin?	……..……
Görme engelli isen ne kadar bir görme yetisine sahipsin?	……..……
Fizik dersi ile ilgili çalışmalarına yardımcı olacak yeterince malzemeye sahip olduğunu düşünüyor musun?	Evet ( ) Hayır ( )
Fizik dersi ile ilgili okul dışı destek alıyor musun?	Evet ( ) Hayır ( ) Evet ise cevabın; Ne gibi destek alıyorsun: Kaç saatlik bir destek alıyorsun:

Fizik dersinde, 45 dk boyunca, genelde ne yaparsın?	○ Not tutarım ○ Kitabı takip ederim ○ Diğer:……..
Hareket konusunu en iyi nasıl öğrenirsin?	……..…….
Fizik dersine nasıl çalışırsın?	……..……
Hareket konusunda ne yapılırsa öğrenmene katkı sağlar?	……..…….

Bu formdaki sorular eğitim sürecinizi etkileyebilecek önemli değişkenleri ortaya çıkaracak içerikte olup siz katılımcıları daha yakından tanımak amacıyla hazırlanmıştır. Bilimsel çalışmanın dışında kullanılmayacaktır. Soruları doğru ve eksiksiz cevaplamanız beklenmektedir. Teşekkürler.

APPENDIX B1

PHYSICS TEACHERS' VIEW FORM

Görüş Formu

Görme engelli öğrencinizin 9. Sınıf fizik dersinde hangi ünitede zorlandıklarını düşünüyorsunuz?

- Fiziğin Doğası
- Enerji
- Madde ve Özelikleri
- Kuvvet ve Hareket
- Elektrik ve Manyetizma
- Dalgalar

Görme engelli öğrencinizin 9. Sınıf fizik dersinde başarılı olabilmesi için hangi ünite ile ilgili destek almak isterdiniz?

- Fiziğin Doğası
- Enerji
- Madde ve Özelikleri
- Kuvvet ve Hareket
- Elektrik ve Manyetizma
- Dalgalar

Bu güne kadar;

- Hiç olmadı.
- 1-5 arası görme engelli öğrencim oldu.
- 6-10 arası görme engelli öğrencim oldu.
- 11 ve yukarısı görme engelli öğrencim oldu.

1.1 Kazanım:

Bilgi katmanı: **Hareketin göreceli bir olgu olduğunu fark eder.**

Beceri katmanı: Tanımlanmamış.

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

1.2 Kazanım:

Bilgi katmanı: **Konum, yer değiştirme ve hız kavramlarını açıklar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Çözülecek problemi tanımlar.
- Ön bilgi ve deneyimlerini de kullanarak araştırmaya başlamak için çeşitli kaynaklardan bilgi toplar.
- Bilimsel bilgi ile görüş ve değerleri birbirinden ayırt eder.
- Belirlediği problem için test edilebilir bir hipotez kurar.
- Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.
- Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.
- Problem için uygun bir çözüm tasarlar.

Fen-Teknoloji-Toplum ve Çevre Becerisi:

- Fizik bilimindeki bilgilerin ivmeli bir şekilde arttığını fark eder.

Bilişim ve İletişim Becerileri:

- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

1.3 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Deney ve gözlemlerden toplanan verileri tablo, grafik, istatistiksel yöntemler veya matematiksel işlemler kullanarak analiz eder.
- Analiz ve modelleme sürecinde sayısal işlem yaparken hesap makinesi, hesap çizelgesi, grafik programı vb. araçları kullanır.
- Verilerin analizi sonucunda ulaştığı bulguları matematiksel eşitlikler gibi modellerle ifade eder.

Fen-Teknoloji-Toplum ve Çevre Becerisi:

Bilişim ve İletişim Becerileri:

- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Bilişim becerilerini kullanacağı bir strateji geliştirir.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

1.4 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

1.5 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

1.6 Kazanım:

Bilgi katmanı: **Günlük yaşamdan örnekler vererek ivmeyi tanımlar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

- Bu kazanımın *görme engelli öğrenciye uygun olup olmadığı* ile ilgili görüşünüz:

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **materyal** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşabilmesi için nasıl bir **yöntem** önerirsiniz?

- Görme engelli bir öğrencinin bu kazanıma ulaşıp ulaşmadığını **ölçmek** için nasıl bir materyal ve yöntem önerirsiniz?

APPENDIX B2

EXPERT FORM ABOUT 9th GRADE MOTION CONCEPT

9. sınıf Hareket Konuları için Etkinlik Öneri Formu

Uzmanın adı:

Kurumu:

Bu form, gören ve görmeyen öğrenciler için kazanımlar doğrultusunda yapılabilecek çalışmaları araştırmak amacıyla hazırlanmıştır. Formun devamındaki kitap fotokopileri ise bu konuda size fikir verebilir düşüncesiyle eklenmiştir. İlgili kazanımlar için önerilerinizi boş bırakılmış yerlere yazınız. Gerekli gördüğünüz durumlarda iletişime geçmekten lütfen çekinmeyiniz. Destekleriniz için teşekkürler.

M Şahin BÜLBÜL: sahin@metu.edu.tr 0 312 2107503 Doç. Dr. Ali ERYILMAZ: Eryılmaz@metu.edu.tr 0 312 2104055

1.1 Kazanım:

Bilgi katmanı: **Hareketin göreceli bir olgu olduğunu fark eder.**

Beceri katmanı: Tanımlanmamış.

<table>
<tr><td colspan="2">• Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir materyal, etkinlik ve/veya yöntem önerirsiniz?</td></tr>
<tr><td>Görmeyen öğrenci için:</td><td>Gören öğrenci için:</td></tr>
</table>

1.2 Kazanım:

Bilgi katmanı: **Konum, yer değiştirme ve hız kavramlarını açıklar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Çözülecek problemi tanımlar.
- Ön bilgi ve deneyimlerini de kullanarak araştırmaya başlamak için çeşitli kaynaklardan bilgi toplar.
- Bilimsel bilgi ile görüş ve değerleri birbirinden ayırt eder.
- Belirlediği problem için test edilebilir bir hipotez kurar.
- Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.
- Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.
- Problem için uygun bir çözüm tasarlar.
- Fizik bilimindeki bilgilerin ivmeli bir şekilde arttığını fark eder.

Bilişim ve İletişim Becerileri:

- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

Fen-Teknoloji-Toplum ve Çevre Becerisi:

- Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir **materyal, etkinlik ve/veya yöntem** önerirsiniz?

Görmeyen öğrenci için:	Gören öğrenci için:

1.3 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Deney ve gözlemlerden toplanan verileri tablo, grafik, istatistiksel yöntemler veya matematiksel işlemler kullanarak analiz eder.
- Analiz ve modelleme sürecinde sayısal işlem yaparken hesap makinesi, hesap çizelgesi, grafik programı vb. araçları kullanır.
- Verilerin analizi sonucunda ulaştığı bulguları matematiksel eşitlikler gibi modellerle ifade eder.

Fen-Teknoloji-Toplum ve Çevre Becerisi:Tanımlanmamıştır.

Bilişim ve İletişim Becerileri:

- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Bilişim becerilerini kullanacağı bir strateji geliştirir.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

- Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir **materyal, etkinlik ve/veya yöntem** önerirsiniz?

Görmeyen öğrenci için:	Gören öğrenci için:

1.4 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

• Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir **materyal, etkinlik ve/veya yöntem** önerirsiniz?	
Görmeyen öğrenci için:	Gören öğrenci için:

1.5 Kazanım:

Bilgi katmanı: **Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

• Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir **materyal, etkinlik ve/veya yöntem** önerirsiniz?	
Görmeyen öğrenci için:	Gören öğrenci için:

1.6 Kazanım:

Bilgi katmanı: **Günlük yaşamdan örnekler vererek ivmeyi tanımlar.**

Beceri katmanı:

Problem Çözme Becerileri:

- Oluşturulan modeli değişik problemlerin çözümüne uyarlar.
- Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.
- Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.
- Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.
- Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.

Fen-Teknoloji-Toplum ve Çevre Becerileri:

Bilişim ve İletişim Becerileri:

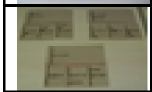
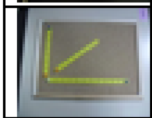
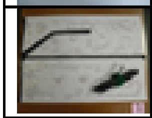
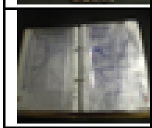
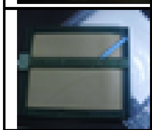
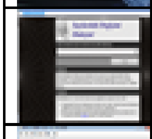
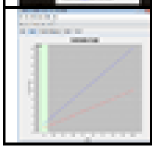
- Farklı bilgi kaynaklarını kullanır.
- Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.
- Çoklu arama kriterleri kullanır.
- Amacına uygun bilgiyi arar, bulur ve seçer.
- Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.
- Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.

• Bir öğrencinin hem beceri hem bilgi kazanımlarına , zihinsel ve mümkünse bedensel olarak aktif biçimde ulaşabilmesi için bir **materyal, etkinlik ve/veya yöntem** önerirsiniz?	
Görmeyen öğrenci için:	Gören öğrenci için:

APPENDIX B3

SIGHTEDS' VIEWS ABOUT ENRICHED COURSE MATERIALS

Cinsiyet: Kız ( ) Erkek ( ) Sınıf: 9 ( ) 10 ( ) 11 ( ) 12 ( )

	Fizik birimlerinin kullanılabilirlik düzeyi	Materyalin öğreticilik düzeyi	Materyalin dayanıklılık düzeyi	Materyalin gören ve görmeyenin birlikte kullanabilme düzeyi	Materyalin güvenli oluş düzeyi	Materyalin hazırlanmasının ekonomik olma düzeyi	Materyalin farklı kullanımlara izin verme düzeyi	Materyalin kolay hazırlanabilirlik düzeyi
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)
	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)	Düşük (O) Orta (O) Yüksek (O)

APPENDIX B4

EXPERT OPINION FORM ABOUT THE APPROPRIATENESS AMONG GUIDE, MATERIALS AND OBJECTIVES

KILAVUZ, MATERYALLER VE KAZANIMLAR ARASINDAKİ UYGUNLUK HAKKINDA UZMAN GÖRÜŞ FORMU

Değerli uzman,

Aşağıdaki tablo geliştirilen materyal ve kılavuzların 9. sınıf hareket konuları ile ilgili kazanıma uygun olup olmadığı konusunda görüşünüzü almak için hazırlanmıştır. Uygun bulduğunuzda ilgili kutuya sadece "X" işareti koymanız yeterli iken uygun bulmadığınız durumlar için önce "uygun değildir" kısmını "X" işaretini kullanarak seçmenizi ve "çünkü;" kısmına sebep belirten ifadeler yazmanızı beklemekteyiz. İlginiz ve yardımlarınız için teşekkür ederiz.

Uzmanın önerdiği materyal	Materyalin Adı	İncelenecek ilişki	Uygundur	Uygun değildir	Çünkü;
	1.Göreceli hareket videosu	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	2.Bisiklet ve çivili tahta	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	3.Raptiyeli tahta	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	4.Kabartma harita	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	5.Çengelli İğne	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	6.Mantar pano	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	7.Çıtçıtlı tahta	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	8.Sesli grafikler	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	9.Delikli tahta	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	10.Grafik kartları	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			
	11.Oyun parkı	Kılavuz kazanımlara			
		Materyal Kılavuza			
		Materyal Kazanımlara			

Önerileriniz doğrultusunda hazırlandığı düşünülen ve “uzmanın önerdiği materyal” sütununda “x” ile işaretlenmemiş materyal gerçekten de sizin önerdiğiniz biçimde midir?

Evet ( )

Hayır ( ) Çünkü;

1. Göreceli hareket videosu

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
- Hareketin göreceli bir olgu olduğunu fark eder.	Video sistemi kurulurken dikkatli olunmalıdır.	-Hareketin göreceliği -Referans noktası

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 127. sayfadaki 1. Etkinlikten önce yapılmalıdır.**

Nasıl Kullanılmalı?

- Hareketin göreceli olduğunu anlatmak için önce öğrencilere video izletileceği söylenmelidir.
- İlk 10 saniye sonunda video durdurulup gözlemcinin mi yoksa trenin mi hareketli olduğu sorulur. Öğrencilere söz verilir.
- Video baştan başlanarak sonuna kadar tekrar oynatılır ve tartışma tekrar başlatılır. Tartışma sırasında öğrencilerin video da gördükleri anlattırılır. Bu anlatımlar görmeyen öğrenci için önemlidir.
- En son olarak " gözlemcinin içinde bulunduğu tren ilk başlarda hareketli idi ama sonra durmasına rağmen biz bunu farkedemedik çünkü kıyaslayacağımız herhangi bir referans noktası göremedik. Ekranda sadece trenin olması, arka tarafın görünmemesi bizim hareketi tanımlamamızı güçleştirdi" denilmelidir.
- Günlük hayattan örnekler bulmaları ödev olarak verilmelidir.

Tanıtım

- Bu video yaklaşık 52 saniye sürmektedir ve her hangi bir anlatım içermez. Sadece hareket eden tren görüntüsü vardır. Ancak bu bu hareketin videoyu çekenden mi yoksa çektiği trenden mi kaynaklandığı konusunda izleyici şüphe duyabilir. Çünkü çekilen tren çok yakından geçmektedir. Arka plan pek görünmemektedir.
- Bu videonun duyulması için hoparlör, yansıtılması için projeksiyon cihazı ve bir adet bilgisayar gerekmektedir.
- Video aşağıdaki bağlantıdan alınmış ve indirilmiştir.

http://www.youtube.com/watch?v=AKhvqO5UBsA

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Süre:

10 dakika

2. Bisiklet ve çivili tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
- Hareketin göreceli bir olgu olduğunu fark eder. **- Konum, yer değiştirme ve hız kavramlarını açıklar.**	Çivilere dikkat edilmesi konusunda uyarı yapılmalıdır.	-Hareketin göreceliği -Hız

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 127. sayfadaki 1. Etkinlik bittikten sonra ya da 128. Sayfadaki "kime göre neredeyiz?" konusundan önce yapılmalıdır.**

Nasıl Kullanılmalı?

- Hareketin göreceli olduğunu anlatmak için önce bir çubukla çivilere sürtüp bir ses çıkarın ardından çubuğu sabit tutup tahtayı hareket ettirerek aynı sesi çıkarın. Bu olayı gördüğümüz günlük olaylara benzetin. Öğrencilerden denemek istiyen olursa izin verin.
- Önce bisiklet tekerini sabit ve sabit olmayan hareketler yaptırarak nasıl hareket olduğunu sorun.
- Hızlanan yavaşlayan ve sabit hızlı hareket olduğu yorumlarını alınca "bu bisikletin sepetindeki makaralar çivilerin üzerine düşmüş, düzenli düşen bu makaralar … biçiminde dizilirse bisiklet nasıl hareket etmiştir" diye sorun ve farklı durumlar deneyin. En son asetatlı şeritlerin nasıl hareketlere ait olduğunu belirlemelerini isteyin ve sonra bunların doğru cevaplarını verin. Asetatın tüm sınıfta dolaşmasını sağlayın. Etkinliği görme engelli öğrencinin sırasında yapın.

Tanıtım

- Bu material üç temel kısımdan oluşmaktadır. Birinci ve en büyük parça çivilidir. Çiviler eşit aralıklı dizilmiştir. Tahtada ayrıca içinde makara olan bir kutu da bulunmaktadır.
- İkinci parça döndükçe ses çıkaran bir oyuncak tekerlektir. Bu tekerlek bisikletin tekeri olarak sunulacaktır.
- Son parça ise dört şerit biçiminde kesilmiş ve izler bırakılmış asetat bulunan bir çubuktur. Asetattaki izler arası mesafe değişebilmektedir.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Süre:

15 dakika

3. Raptiyeli tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	Çubukların uç kısımlarının bir miktar sivri olduğu belirtilmelidir.	Vektörel nicelikler, Konum

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 129. sayfasındaki 2. Etkinlikten hemen sonra yapılmalıdır.**

Süre: 10 dakika

Nasıl Kullanılmalı?

- Vektör kavramını anlattıktan sonra çubukların ne anlama geldiği söylenebilir.
- Bir noktaya göre bir cismin konumunun nasıl gösterileceği material üzerinde anlatılabilir.
- Materyal görme engelli öğrencinin sırasında kullanılmalı anlatım sonrasında sırasına bırakılmalıdır.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Tanıtım

- Materyal bir tahta üzerine eşit aralıklarda yerleştirilmiş raptiyeler, ucu sivri vektörleri gösteren oklar ve bu okların sabit kalmasını sağlayacak hamurlardan oluşmaktadır.

4. Kabartma harita

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	Haritanın kenarlarının ellerini kesmemesi için dikkatli olunması söylenmelidir.	Konum, yer değiştirme ve alınan yol

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 130. Sayfasında bulunan 3. Etkinlik süresince kullanmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Kitaptaki 3. Etkinlikteki biçimiyle hamurlar ve iplik kullanılarak ya da 30 cm'lik cetvel yardımıyla etkinlik istenildiği gibi gerçekleştirilmelidir.
- Gören öğrenciler etkinliği fotokopi ile yaparken görmeyen öğrenci kabartma haritayı kullanmalıdır.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Tanıtım

- Materyal, piyasada satılan dağların ve ovaların kabartma biçimde gösterildiği Türkiye haritasıdır. İp, hamur ve cetvel mesafe ölçümü ve sabitlenmesi için kullanılmalıdır.

5. Çengelli İğne

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	İğnelere dikkat edilmesi söylenmelidir.	Konum ve yer değiştirme

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki Sayfa 130'daki 3. Etkinlikten hemen sonra uygulanmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Sınıf içinden 4-5 öğrenci seçilmelidir. Bu öğrenciler hareketli öğrencinin doğrultu değiştirdiği yerler olacaktır. Dağınık bulunan öğrencilerin yanından geçen diğer öğrenci, ipliğini öğrencinin çengelinden geçirir. Yolu tamamladığında ipin uzunluğu alınan yolu verir.
- İlk ve son çengelli iğneler kalacak şekilde diğerleri çıkarıldığında ve ipler gergin hale getirildiğinde ise yerdeğiştirmenin büyüklüğü ortaya çıkar.
- Görme engelli öğrenciye mutlaka rol verilmelidir.

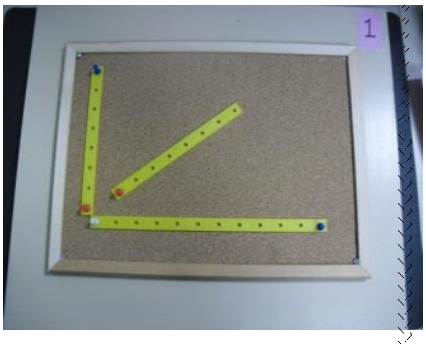
Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Tanıtım

- Bu material uzunca bir ip ve bir miktar çengelli iğneden oluşmaktadır.
- Çengelli iğne öğrencilerin uygun bir yerlere takmaları içindir.
- İp bu iğnelerin içinden geçirilecektir.

6. Mantar pano



KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.	Pano üzerindeki raptiyelerin sivri uçları hatırlatılmalıdır.	Eğim ile grafiğin yorumlanması

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 138. sayfasındaki eğim ile ilgili anlatım esnasında kullanılmalıdır.**

Süre:

5 dakika

Nasıl Kullanılmalı?

- İlgili yere gelindiğinde çubuğun eğimi değiştirilerek karşılık geldiği değerlerin nasıl değiştiği tartışılır.
- Tartışmalar esnasında materyal görme engelli öğrencinin önüne bırakılır.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Tanıtım

- Sabitlenmiş mantar pano üzerinde bulunan delikli çubuklar, mantar pano üzerine raptiyelerle yerleştirilir. Ortaya bir grafik çıkar. Grafiğin değişebilir olması kıyaslama amaçlı kullanmak içindir. Bu nedenle eksenler değişmez iken grafik değişebilir olmalıdır.

7. Çırtçırtlı tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Materyalin sabitlendiği tahtanın ağır olduğu hatırlatılmalıdır.	Konum-zaman Hız-zaman grafikleri ve dönüşümü

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 141. sayfada bulunan "problem çözelim" kısmında kullanılmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Soru okunmadan önce soruya uygun biçimde çırtçırtlar yerleştirilmeli ve eksenler, kestiği noktalar tahta üzerinde belirtilmelidir. Oluşan diktörtgenler materyal üzerinden gösterilmeli ve alannın nasıl hesaplanacağı hatırtılmalıdır.
- Son olarak bulunan alanların nasıl yorumlanacağı materyal üzerinde gösterilmelidir.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

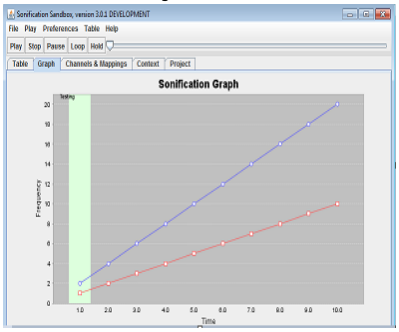
Tanıtım

- Bu material üzerine yapışan çırtçırtlardan oluşmaktadır. Zıt renkler olan siyah ve beyaz seçilmiştir.
- Ortadaki çizgi negatif ve pozitif durumları ayıran eksendir.
- Negatif zamandan bahsedilmeyeceği için iki bölümlü yapısı vardır.
- Dikey eksen ise bazen konum bazen de hız ekseni olabilir.

8. Sesli grafikler

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Sistemin kurulması elektrik gerektirdiği için dikkatli olunmalıdır.	Değişim, grafik okuma ve yorumlama

Şekil-1



Şekil-2

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 142. sayfasındaki örnek bu programlar yardımıyla çözülebilir.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Grafikteki değerler önce yazılıma girilir ve sistemin çalışması sağlanır. Aynı grafik iki ayrı sistem de de çalıştırılmalıdır.
- Bu sesli dosyaları dinlemeden önce öğrenci kabartma ya da ders kitabından grafiği incelemelidir. Birkaç defa istek üzerine dinletilebilir.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

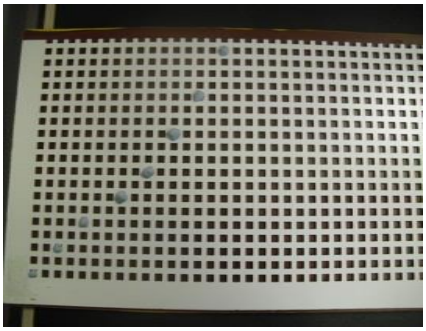
……
……
……
……
……
……

Tanıtım

- Sayılardaki değişimi dinleyin: girilen sayıları hem grafik hem de sesli biçimde veren bu program internet üzerinden çalışmaktadır. Sayılardaki değişim miktarı ile orantılı tonda ses duyulur.
- Sonification_sandbox_6.1 isimli program ise grafiği hem görüntülü hem de eksenleri ve değeri ayrı frekanslardaki iki ses olarak çıkartır.
- Bu sistem için hoparlör, bilgisayar, internet ve programlarının yüklenmiş olması gerekir.

9. Delikli tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Sabitlendiği zeminin ağır olduğu hatırlatılmalıdır.	Grafik çizme ve yorumlama



Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 143. sayfasındaki örnek çözülürken kullanılmalıdır.**

Nasıl Kullanılmalı?

- İlgili soru çözülürken veriler doğrultusunda hamurlar yerleştirilir.
- Bu hamurlar çeşitli pipet veya kağıt şerit yardımıyla birleştirilir.
- Elde edilen grafik gösterilir ve yorumlanması istenir.

Tanıtım

- Üzerinde düzenli biçimde çok sayıda delik bulunan tahtaya grafik çizmek için küçük hamurlar kullanılır.
- Hamur parçaları dışında şerit kağıtlarda kullanılabilir.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

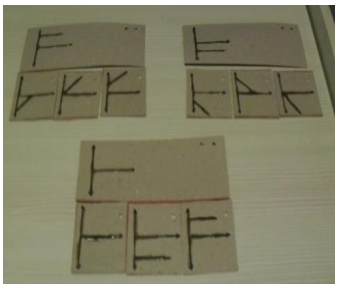
……
……
……
……
……
……

Süre:

10 dakika

10. Grafik kartları

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Materyalin üzerindeki maddenin kurumuş tutkal olduğu belirtilmelidir.	Konum-zaman Hız-zaman grafikleri ve dönüşümü



Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 144, sayfada bulunan "otobüsün fren ve gaz pedallarının gerçekleştirdikleri" başlığından once kullanılmalıdır.**

Nasıl Kullanılmalı?

- Oyun şeklinde oynanabilir. Kartlar karışık olarak verilir ve eşleştirmeleri istenir. En son doğrusu söylenir.
- Gören öğrencilere fotokopileri kesilerek dağıtılır, görmeyen öğrenci kabartmalı halini kullanır.

Tanıtım

- Bu material, 3 adet hız-zaman grafiği ve 9 adet konum zaman garafiğinin kabartmalı biçimidir.
- Kabartmalar mukavva üzerine tutkalla yapılmıştır.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Süre:

10dakika

11. Oyun parkı

KAZANIM	GÜVENLİK	İLGİLİ KAVRAM
Günlük yaşamdan örnekler vererek ivmeyi tanımlar.	Kaydırağın menteşe yerlerine dikkat edilmesi söylenmelidir.	İvme

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 144. Sayfada bulunan "araştıralım" isimli etkinlik sonunda yapılmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Bu materyalli kullanmadan önce "oyun parkları neden eğlenceli?" diye soru sormalısınız. Bu sorunun cevaplarından birisi ivmeli hareket olabilir.
- Maketleri tek tek gösterip dokunmalarına izin verip nasıl hareket yapıldığı konuşulmalıdır. Bu aletlerdeki insan, bazen hareketin yönü değiştiği için bazen de büyüklüğü değiştiği için ivmeli hareket yaparlar.

Varsa değiştirilmesi gerektiğini düşündüğünüz kısımlar nelerdir?

……
……
……
……
……
……

Tanıtım

- Bu maketler tahtadan yapılmış olup oyun parkında bulunan oyun aletleri düşünülerek üretilmiştir.
- Bu oyun aletleri olarak tahterevalli, salıncak, kaydırak, dönme dolap ve zıpzıp hazırlanmıştır.

APPENDIX B5

GUIDE OF MOTION ACTIVITIES FOR INCLUSIVE CLASSES

9. Sınıf Fizik Dersi için; KAYNAŞTIRMA SINIFLARI İÇİN UYGUN HAREKET ETKİNLİKLERİ (Rehber Kitapçık)

Etkinlikte kullanılan materyalin adı	Kullanılacak yer	Süre (dk)	Tarih	Açıklama
1.Göreceli hareket videosu	127. sayfadaki 1. Etkinlikten önce yapılmalıdır.	10		
2.Bisiklet ve çivili tahta	127. sayfadaki 1. Etkinlik bittikten sonra ya da 128. Sayfadaki "kime göre neredeyiz?" konusundan önce yapılmalıdır.	15		
3.Raptiyeli tahta	129. sayfasındaki 2. Etkinlikten hemen sonra yapılmalıdır.	10		
4.Kabartma harita	130. Sayfasında bulunan 3. Etkinlik süresince kullanmalıdır.	10		
5.Çengelli İğne	130'daki 3. Etkinlikten hemen sonra uygulanmalıdır.	10		
6.Mantar pano	138. sayfasındaki eğim ile ilgili anlatım esnasında kullanılmalıdır.	5		
7.Çıtçıtlı tahta	141. sayfada bulunan "problem çözelim" kısmında kullanılmalıdır.	10		
8.Sesli grafikler	142. sayfasındaki örnek bu programlar yardımıyla çözülebilir.	10		
9.Delikli tahta	143. sayfasındaki örnek çözülürken kullanılmalıdır.	10		
10.Grafik kartları	144, sayfada bulunan "otobüsün fren ve gaz pedallarının gerçekleştirdikleri" başlığından önce kullanılmalıdır.	10		
11.Oyun parkı	144. Sayfada bulunan "araştıralım" isimli etkinlik sonunda yapılmalıdır.	10		

1. Göreceli hareket videosu

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
- Hareketin göreceli bir olgu olduğunu fark eder.	Video sistemi kurulurken dikkatli olunmalıdır.	-Hareketin göreceliği -Referans noktası

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 127. sayfadaki 1. Etkinlikten önce yapılmalıdır.**

Nasıl Kullanılmalı?

- Hareketin göreceli olduğunu anlatmak için önce öğrencilere video izletileceği söylenmelidir.
- İlk 10 saniye sonunda video durdurulup gözlemcinin mi yoksa trenin mi hareketli olduğu sorulur. Öğrencilere söz verilir.
- Video baştan başlanarak sonuna kadar tekrar oynatılır ve tartışma tekrar başlatılır. Tartışma sırasında öğrencilerin video da gördükleri anlattırılır. Bu anlatımlar görmeyen öğrenci için önemlidir.
- En son olarak " gözlemcinin içinde bulunduğu tren ilk başlarda hareketli idi ama sonra durmasına rağmen biz bunu fark edemedik çünkü kıyaslayacağımız herhangi bir referans noktası göremedik. Ekranda sadece trenin olması, arka tarafın görünmemesi bizim hareketi tanımlamamızı güçleştirdi" denilmelidir.
- Günlük hayattan örnekler bulmaları ödev olarak verilmelidir.

Tanıtım

- Bu video yaklaşık 52 saniye sürmektedir ve her hangi bir anlatım içermez. Sadece hareket eden tren görüntüsü vardır. Ancak bu hareketin videoyu çekenden mi yoksa çektiği trenden mi kaynaklandığı konusunda izleyici şüphe duyabilir. Çünkü çekilen tren çok yakından geçmektedir. Arka plan pek görünmemektedir.
- Bu videonun duyulması için hoparlör, yansıtılması için projeksiyon cihazı ve bir adet bilgisayar gerekmektedir.
- Video aşağıdaki bağlantıdan alınmış ve indirilmiştir.

http://www.youtube.com/watch?v=AKhvqO5UBsA

Süre:

10 dakika

2. Bisiklet ve çivili tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
- Hareketin göreceli bir olgu olduğunu fark eder. **- Konum, yer değiştirme ve hız kavramlarını açıklar.**	Çivilere dikkat edilmesi konusunda uyarı yapılmalıdır.	-Hareketin göreceliği -Hız

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 127. sayfadaki 1. Etkinlik bittikten sonra ya da 128. Sayfadaki "kime göre neredeyiz?" konusundan önce yapılmalıdır.**

Nasıl Kullanılmalı?

- Hareketin göreceli olduğunu anlatmak için önce bir çubukla çivilere sürtüp bir ses çıkarın ardından çubuğu sabit tutup tahtayı hareket ettirerek aynı sesi çıkarın. Bu olayı gördüğümüz günlük olaylara benzetin. Öğrencilerden denemek isteyen olursa izin verin.
- Önce bisiklet tekerini sabit ve sabit olmayan hareketler yaptırarak nasıl hareket olduğunu sorun.
- Hızlanan yavaşlayan ve sabit hızlı hareket olduğu yorumlarını alınca "bu bisikletin sepetindeki makaralar çivilerin üzerine düşmüş, düzenli düşen bu makaralar … biçiminde dizilirse bisiklet nasıl hareket etmiştir" diye sorun ve farklı durumlar deneyin. En son asetatlı şeritlerin nasıl hareketlere ait olduğunu belirlemelerini isteyin ve sonra bunların doğru cevaplarını verin. Asetatın tüm sınıfta dolaşmasını sağlayın. Etkinliği görme engelli öğrencinin sırasında yapın.

Tanıtım

- Bu materyal üç temel kısımdan oluşmaktadır. Birinci ve en büyük parça çivilidir. Çiviler eşit aralıklı dizilmiştir. Tahtada ayrıca içinde makara olan bir kutu da bulunmaktadır.
- İkinci parça döndükçe ses çıkaran bir oyuncak tekerlektir. Bu tekerlek bisikletin tekeri olarak sunulacaktır.
- Son parça ise dört şerit biçiminde kesilmiş ve izler bırakılmış asetat bulunan bir çubuktur. Asetattaki izler arası mesafe değişebilmektedir.

Süre:

15 dakika

3. Raptiyeli tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	Çubukların uç kısımlarının bir miktar sivri olduğu belirtilmelidir.	Vektörel nicelikler, Konum

Ne zaman kullanılmalı?	Nasıl Kullanılmalı?	***Tanıtım***
❖ **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 129. sayfasındaki 2. Etkinlikten hemen sonra yapılmalıdır.**	❖ Vektör kavramını anlattıktan sonra çubukların ne anlama geldiği söylenebilir. ❖ Bir noktaya göre bir cismin konumunun nasıl gösterileceği materyal üzerinde anlatılabilir. ❖ Materyal görme engelli öğrencinin sırasında kullanılmalı anlatım sonrasında sırasına bırakılmalıdır.	❖ Materyal bir tahta üzerine eşit aralıklarda yerleştirilmiş raptiyeler, ucu sivri vektörleri gösteren oklar ve bu okların sabit kalmasını sağlayacak hamurlardan oluşmaktadır.

Süre:

10 dakika

4. Kabartma harita

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	Haritanın kenarlarının ellerini kesmemesi için dikkatli olunması söylenmelidir.	Konum, yer değiştirme ve alınan yol

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 130. Sayfasında bulunan 3. Etkinlik süresince kullanmalıdır.**

Nasıl Kullanılmalı?

- Kitaptaki 3. Etkinlikteki biçimiyle hamurlar ve iplik kullanılarak ya da 30 cm'lik cetvel yardımıyla etkinlik istenildiği gibi gerçekleştirilmelidir.
- Gören öğrenciler etkinliği fotokopi ile yaparken görmeyen öğrenci kabartma haritayı kullanmalıdır.

Tanıtım

- Materyal, piyasada satılan dağların ve ovaların kabartma biçimde gösterildiği Türkiye haritasıdır. İp, hamur ve cetvel mesafe ölçümü ve sabitlenmesi için kullanılmalıdır.

Süre:

10 dakika

5. Çengelli İğne

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Konum, yer değiştirme ve hız kavramlarını açıklar.	İğnelere dikkat edilmesi söylenmelidir.	Konum ve yer değiştirme

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki Sayfa 130'daki 3. Etkinlikten hemen sonra uygulanmalıdır.**

Nasıl Kullanılmalı?

- Sınıf içinden 4-5 öğrenci seçilmelidir. Bu öğrenciler hareketli öğrencinin doğrultu değiştirdiği yerler olacaktır. Dağınık bulunan öğrencilerin yanından geçen diğer öğrenci, ipliğini öğrencinin çengelinden geçirir. Yolu tamamladığında ipin uzunluğu alınan yolu verir.
- İlk ve son çengelli iğneler kalacak şekilde diğerleri çıkarıldığında ve ipler gergin hale getirildiğinde ise yer değiştirmenin büyüklüğü ortaya çıkar.
- Görme engelli öğrenciye mutlaka rol verilmelidir.

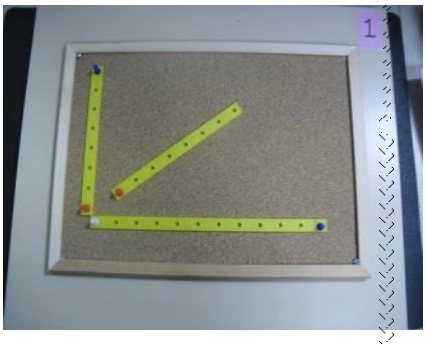
Tanıtım

- Bu materyal uzunca bir ip ve bir miktar çengelli iğneden oluşmaktadır.
- Çengelli iğne öğrencilerin uygun bir yerlere takmaları içindir.
- İp bu iğnelerin içinden geçirilecektir.

Süre:

10 dakika

6. Mantar pano



KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.	Pano üzerindeki raptiyelerin sivri uçları hatırlatılmalıdır.	Eğim ile grafiğin yorumlanması

Ne zaman kullanılmalı?	Nasıl Kullanılmalı?	***Tanıtım***
❖ **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 138. sayfasındaki eğim ile ilgili anlatım esnasında kullanılmalıdır.**	❖ İlgili yere gelindiğinde çubuğun eğimi değiştirilerek karşılık geldiği değerlerin nasıl değiştiği tartışılır. ❖ Tartışmalar esnasında materyal görme engelli öğrencinin önüne bırakılır.	❖ Sabitlenmiş mantar pano üzerinde bulunan delikli çubuklar, mantar pano üzerine raptiyelerle yerleştirilir. Ortaya bir grafik çıkar. Grafiğin değişebilir olması kıyaslama amaçlı kullanmak içindir. Bu nedenle eksenler değişmez iken grafik değişebilir olmalıdır.

Süre:

5 dakika

7. Çırtçırtlı tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Materyalin sabitlendiği tahtanın ağır olduğu hatırlatılmalıdır.	Konum-zaman Hız-zaman grafikleri ve dönüşümü

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 141. sayfada bulunan "problem çözelim" kısmında kullanılmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Soru okunmadan önce soruya uygun biçimde çırtçırtlar yerleştirilmeli ve eksenler, kestiği noktalar tahta üzerinde belirtilmelidir. Oluşan dikdörtgenler materyal üzerinden gösterilmeli ve alanın nasıl hesaplanacağı hatırlatılmalıdır.
- Son olarak bulunan alanların nasıl yorumlanacağı materyal üzerinde gösterilmelidir.

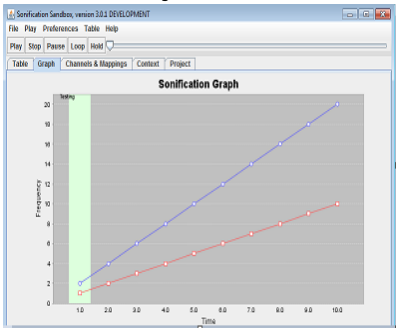
Tanıtım

- Bu materyal üzerine yapışan çırtçırtlardan oluşmaktadır. Zıt renkler olan siyah ve beyaz seçilmiştir.
- Ortadaki çizgi negatif ve pozitif durumları ayıran eksendir.
- Negatif zamandan bahsedilmeyeceği için iki bölümlü yapısı vardır.
- Dikey eksen ise bazen konum bazen de hız ekseni olabilir.

8. Sesli grafikler

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Sistemin kurulması elektrik gerektirdiği için dikkatli olunmalıdır.	Değişim, grafik okuma ve yorumlama

Şekil-1



Şekil-2

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 142. sayfasındaki örnek bu programlar yardımıyla çözülebilir.**

Süre:

10 dakika

Nasıl Kullanılmalı?

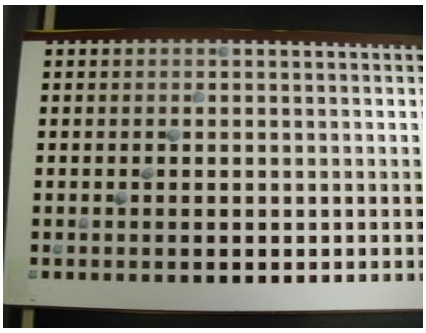
- Grafikteki değerler önce yazılıma girilir ve sistemin çalışması sağlanır. Aynı grafik iki ayrı sistem de de çalıştırılmalıdır.
- Bu sesli dosyaları dinlemeden önce öğrenci kabartma ya da ders kitabından grafiği incelemelidir. Birkaç defa istek üzerine dinletilebilir.

Tanıtım

- Sayılardaki değişimi dinleyin: girilen sayıları hem grafik hem de sesli biçimde veren bu program internet üzerinden çalışmaktadır. Sayılardaki değişim miktarı ile orantılı tonda ses duyulur.
- Sonification_sandbox_6.1 isimli program ise grafiği hem görüntülü hem de eksenleri ve değeri ayrı frekanslardaki iki ses olarak çıkartır.
- Bu sistem için hoparlör, bilgisayar, internet ve programlarının yüklenmiş olması gerekir.

9. Delikli tahta

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Sabitlendiği zeminin ağır olduğu hatırlatılmalıdır.	Grafik çizme ve yorumlama



Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 143. sayfasındaki örnek çözülürken kullanılmalıdır.**

Nasıl Kullanılmalı?

- İlgili soru çözülürken veriler doğrultusunda hamurlar yerleştirilir.
- Bu hamurlar çeşitli pipet veya kağıt şerit yardımıyla birleştirilir.
- Elde edilen grafik gösterilir ve yorumlanması istenir.

<u>Tanıtım</u>

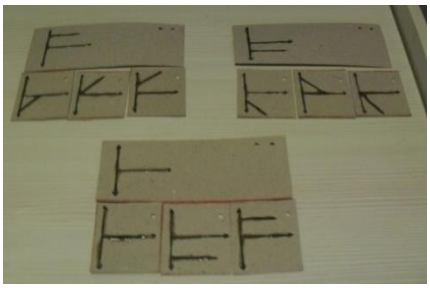
- Üzerinde düzenli biçimde çok sayıda delik bulunan tahtaya grafik çizmek için küçük hamurlar kullanılır.
- Hamur parçaları dışında şerit kağıtlar da kullanılabilir.

Süre:

10dakika

10. Grafik kartları

KAZANIM	GÜVENLİK	İLGİLİ KAVRAMLAR
-Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar. **- Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.** **-Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	Materyalin üzerindeki maddenin kurumuş tutkal olduğu belirtilmelidir.	Konum-zaman Hız-zaman grafikleri ve dönüşümü



Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 144, sayfada bulunan "otobüsün fren ve gaz pedallarının gerçekleştirdikleri" başlığından önce kullanılmalıdır.**

Süre:

10 dakika

Nasıl Kullanılmalı?

- Oyun şeklinde oynanabilir. Kartlar karışık olarak verilir ve eşleştirmeleri istenir. En son doğrusu söylenir.
- Gören öğrencilere fotokopileri kesilerek dağıtılır, görmeyen öğrenci kabartmalı halini kullanır.

Tanıtım

- Bu materyal, 3 adet hız-zaman grafiği ve 9 adet konum zaman grafiğinin kabartmalı biçimidir.
- Kabartmalar mukavva üzerine tutkalla yapılmıştır.

11. Oyun parkı

KAZANIM	GÜVENLİK	İLGİLİ KAVRAM
Günlük yaşamdan örnekler vererek ivmeyi tanımlar.	Kaydırağın menteşe yerlerine dikkat edilmesi söylenmelidir.	İvme

Ne zaman kullanılmalı?

- **MEB 'nın 2011 yılında dağıttığı Ortaöğretim Fizik 9 kitabındaki 144. Sayfada bulunan "araştıralım" isimli etkinlik sonunda yapılmalıdır.**

Nasıl Kullanılmalı?

- Bu materyalli kullanmadan önce "oyun parkları neden eğlenceli?" diye soru sormalısınız. Bu sorunun cevaplarından birisi ivmeli hareket olabilir.
- Maketleri tek tek gösterip dokunmalarına izin verip nasıl hareket yapıldığı konuşulmalıdır. Bu aletlerdeki insan, bazen hareketin yönü değiştiği için bazen de büyüklüğü değiştiği için ivmeli hareket yaparlar.

Tanıtım

- Bu maketler tahtadan yapılmış olup oyun parkında bulunan oyun aletleri düşünülerek üretilmiştir.
- Bu oyun aletleri olarak tahterevalli, salıncak, kaydırak, dönme dolap ve zıpzıp hazırlanmıştır.

Süre:

10 dakika

Materyallerin kazanım ve ders kitabı sayfalarıyla olan ilişkisi

Kazanım	Görme engelli öğrencinin kullanacağı materyal	Gören öğrencilerin kullanılacağı materyal
1.1, Hareketin göreceli bir olgu olduğunu fark eder.	1. araç	1. araç
	2. araç	2. araç
	Ders kitabı (123-126)	Ders kitabı (127-128)
1.2. Konum, yer değiştirme ve hız kavramlarını açıklar.	2. araç	2. araç
	3. araç	3. araç
	4. araç	4. araç
	5. araç	5. araç
	Ders kitabı (126-131)	Ders kitabı (128-134)
1.3. Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.	6. araç	6. araç
	7. araç	7. araç
	8. araç	8. araç
	9. araç	9. araç
	10. araç	10. araç
	Ders kitabı (131-137)	Ders kitabı (135-139)
1.4. Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.	7. araç	7. araç
	8. araç	8. araç
	9. araç	9. araç
	10. araç	10. araç
	Ders kitabı (135-137)	Ders kitabı (137-139)
1.5. Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.	7. araç	7. araç
	8. araç	8. araç
	9. araç	9. araç
	10. araç	10. araç
	Ders kitabı (137-146)	Ders kitabı (140-144)
1.6. Günlük yaşamdan örnekler vererek ivmeyi tanımlar.	11. araç	11. araç
	Ders kitabı (147)	Ders kitabı (144)

APPENDIX B6

MATCHING THE SKILLS, KNOWLEDGE AND TEXTBOOK PAGES

Ortaöğretim Fizik 9, MEB, 2011 içerisindeki kazanımın başladığı (S) ve bittiği (F) için sayfa /satır numaraları.						
Bilgi ve beceri kazanımları	**Hareketin göreceli bir olgu olduğunu fark eder.**	**Konum, yer değiştirme ve hız kavramlarını açıklar.**	**Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.**	**Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.**	**Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.**	**Günlük yaşamdan örnekler vererek ivmeyi tanımlar.**
	S:(128/30) F:(129/20)	S:(129/4) F:(139/26)	S:(135/1) F:(139/16)	S:(137/10) F:(139/22)	S:(140/1) F:(144/1)	S:(144/1) F:(144/16)
	1.Etkinlik					
PÇB-1a: Çözülecek problemi tanımlar.		S:(134/1) F:(134/9) Problem çözelim etkinliği				
PÇB-1b: Ön bilgi ve deneyimlerini de kullanarak araştırmaya başlamak için çeşitli kaynaklardan bilgi toplar.		S:(131/5) F:(131/10) Tartışalım				
PÇB-1c:Bilimsel bilgi ile görüş ve değerleri birbirinden ayırt eder.		S:(130/3) F:(130/17) 3. Etkinlik				
PÇB-1d:Belirlediği problem için test edilebilir bir hipotez kurar.		S:(131/5) F:(131/10) Tartışalım				
PÇB-1e: Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.		S:(131/13) F:(131/16) Tartışalım				
PÇB-1f: Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.		S:(130/3) F:(130/17) 3. Etkinlik				
PÇB-1g:Problem için uygun bir çözüm tasarlar.		S:(129/4) F:(129/20) 2. Etkinlik				
PÇB-3a: Deney ve gözlemlerden toplanan verileri tablo, grafik, istatistiksel yöntemler veya matematiksel işlemler kullanarak analiz eder.			S:(135/1) F:(136/13) 5. Etkinlik			
PÇB-3b: Analiz ve modelleme sürecinde sayısal işlem yaparken hesap makinesi, hesap çizelgesi,grafik programı vb. araçları kullanır.			S:(135/1) F:(136/13) 5. Etkinlik			
PÇB-3c: Verilerin analizi sonucunda ulaştığı bulguları matematiksel eşitlikler gibi modellerle ifade eder.			S:(136/16) F:(138/6)			
PÇB-3d: Bulguları veya			S:(137/9) F:(137/11)			

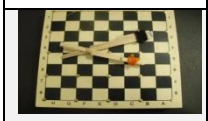
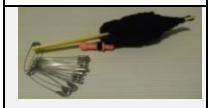
oluşturulan modeli yorumlar.						
PÇB-3e: Oluşturulan modeli değişik problemlerin çözümüne uyarlar.			S:(138/7) F:(139/16) Problem çözelim			
PÇB-3e: Oluşturulan modeli değişik problemlerin çözümüne uyarlar.				S:(137/10) F:(139/22)	S:(141/1) F:(143/1) Problem çözelim	
PÇB-3f: Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.				S:(137/10) F:(139/22)	S:(141/1) F:(143/1) Problem çözelim	
PÇB-3g: Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.				S:(137/10) F:(138/6)	S:(140/1) F:(140/10) 6.etkinlik	
PÇB-3h: Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.				S:(138/7) F:(139/16) Problem çözelim	S:(141/1) F:(143/1) Problem çözelim	
PÇB-3i: Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.				S:(138/7) F:(139/16) Problem çözelim	S:(141/1) F:(144/1) Problem çözelim	
FTTÇ-1c: Fizik bilimindeki bilgilerin ivmeli bir şekilde arttığını fark eder.		S:(134/1) F:(134/9) Problem çözelim etkinliği				
BİB-1a: Farklı bilgi kaynaklarını kullanır.		S:(130/3) F:(130/17) 3. Etkinlik	S:(135/1) F:(136/13) 5. Etkinlik			S:(144/11) F:(144/17) Araştıralım
BİB-1b: Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.		S:(132/26) F:(132/9) 4. Etkinlik	S:(138/7) F:(139/16) Problem çözelim			S:(144/6) F:(144/11) Tartışalım
BİB-1c: Çoklu arama kriterleri kullanır.		S:(131/13) F:(131/16) Tartışalım	S:(138/7) F:(139/16) Problem çözelim			S:(144/11) F:(144/17) Araştıralım
BİB-1d: Amacına uygun bilgiyi arar, bulur ve seçer.		S:(131/16) F:(131/24) Tartışalım	S:(135/1) F:(136/13) 5. Etkinlik			S:(144/6) F:(144/11) Tartışalım
BİB-1e: Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.			S:(138/7) F:(139/16) Problem çözelim			
BİB-1f: Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.			S:(138/7) F:(139/16) Problem çözelim			
BİB-1g: Problem için uygun bir çözüm tasarlar.			S:(138/7) F:(139/16) Problem çözelim			
BİB-4c:Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.		S:(133/16) F:(133/25)	S:(136/13) F:(136/15)			S:(144/11) F:(144/17) Araştıralım
BİB-4d:Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.		S:(130/3) F:(130/17) 3. Etkinlik	S:(135/1) F:(136/13) 5. Etkinlik			S:(144/17) F:(144/21)

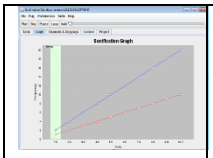
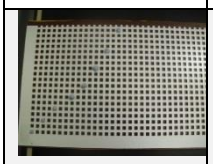
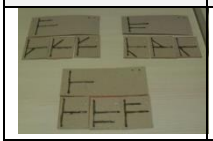
APPENDIX B7

STUDENT QUESTIONNAIRE ABOUT EFFICIENCY OF TREATMENT

9. SINIF FİZİK DERSİ	[HAREKET KONULARINDA GEEN UYGULAMALAR İLE İLGİLİ ÖĞRENCİ GÖRÜŞ FORMU]

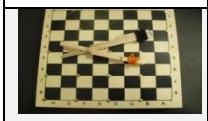
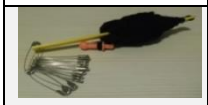
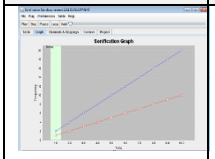
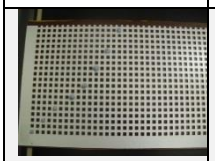
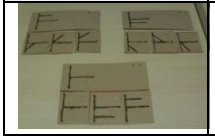
Bu ankette sizlerin hareket konuları süresince kullanılan bazı materyal ve uygulamalar ile ilgili görüşlerinizi almayı amaçlamaktayız. Resim ve yanında geçen ismi inceleyip derece belirten kolondaki beş farklı seçenekten birini işaretleyip nedenini yanındaki boş alana yazmanız beklenmektedir. Burada belirteceğiniz ifadeler sadece araştırma amaçlı kullanılacaktır. Katkılarınızdan dolayı teşekkür ederiz.

Derste kullanılan materyal		**Ne derece hoşuna gitti?**	**Neden bu materyalin hoşuna gittiğini/gitmediğini <u>materyalin özelliklerine</u> dayandırarak açıklayabilir misin?**
	1.Göreceli hareket videosu	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	2.Bisiklet ve çivili tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	3.Raptiyeli tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	4.Kabartma harita	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	5.Çengelli İğne	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	6.Mantar pano	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	7.Çıtçıtlı tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

	8.Sesli grafikler	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	9.Delikli tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	10.Grafik kartları	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	11.Oyun parkı	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

Bahsedilen materyaller dışında hareket konuları anlatılırken başarını etkileyecek kadar hoşuna giden/gitmeyen ders anlatım yöntemi, sınıf düzeni, etkileşim gibi yöntem/ materyal/ortam isimlerini birinci kolona yazınız. Daha sonra öncekiler gibi ikinci ve üçüncü kolonları doldurunuz.

Derste kullanılan materyal/yöntem	**Ne derece hoşuna gitti?**	**Neden bu materyalin hoşuna gittiğini/gitmediğini <u>materyalin özelliklerine</u> dayandırarak açıklayabilir misin?**
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

Derste kullanılan materyal		Ne derece öğrenmene katkı sağladı?	Neden bu materyalin öğrenmene katkı sağladığını/sağlamadığını <u>materyalin özelliklerine</u> dayandırarak açıklayabilir misin?
	1.Göreceli hareket videosu	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	2.Bisiklet ve çivili tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	3.Raptiyeli tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	4.Kabartma harita	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	5.Çengelli İğne	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	6.Mantar pano	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	7.Çıtçıtlı tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	8.Sesli grafikler	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	9.Delikli tahta	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	10.Grafik kartları	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

	11.Oyun parkı	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

Bahsedilen materyaller dışında hareket konuları anlatılırken başarını etkileyecek kadar öğrenmene katkı sağlayan/sağlamayan ders anlatım yöntemi, sınıf düzeni, etkileşim gibi yöntem/ materyal/ortam isimlerini birinci kolona yazınız. Daha sonra öncekiler gibi ikinci ve üçüncü kolonları doldurunuz.

Derste kullanılan materyal/yöntem	**Ne derece öğrenmene katkı sağladı?**	**Derste kullanılan materyal/Yöntem**
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	
	Hiç (O) Az (O) Orta (O) Fazla (O) Çok Fazla (O)	

APPENDIX C1

MOTION ACHIEVEMENT TEST VERSION1

9. Sınıf fizik dersi için

Yaşam Temelli Hareket Başarı Testi (YTH-BT)

Bu test 16 çoktan seçmeli sorudan oluşmaktadır.

SÜRÜM:1

24.06.2012

YÖNERGE: Bu testte bulunan 16 (onaltı) test sorusu öğrencilerin 9. sınıf kuvvet ve hareket ünitesinde bulunan hareket ünitesindeki bilgi ve beceri kazanımlarını ölçmektedir. Sorular öğretim programındaki bilgi kazanımlarının sırası takip edilerek sıralanmış olmasına karşın dilediğiniz sorudan başlayabilirsiniz.

1. Bir otobüste yolculuk yapan iki kişiyi düşünelim. Bu yolculardan birisi oturmakta diğeri arka koltuklardan şoföre doğru hareket etmektedir. Bu iki yolcu ile ilgi olarak;
    I. Otobüsün dışındaki bir kişi, iki yolcunun farklı hızlarda gittiğini gözlemler.
    II. Otobüsün dışındaki bir kişi, iki yolcunun aynı hızlarda gittiğini gözlemler.
    III. Otobüsün dışındaki bir kişi, iki yolcunun aynı ama zıt yönlü hızlarda gittiğini gözlemler.
    IV. Otobüsün dışındaki bir kişi iki yolcunun farklı hızlarda ama zıt yönlerde gittiğini gözlemler.

   ifadelerinden hangisi ya da hangileri doğrudur?

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve IV
2. Otobüs terminalinde hareketli bir zemin bulunmaktadır. Bu zemin üzerinde durduğunuzda düz bir şerit üzerinde sizi hareket ettirmektedir. Böylece eşya taşırken bu hareketli zemini kullandığınız için yorulmazsınız. Gelen yolcular ve giden yolcular için iki farklı şerit zıt yönlerde çalışır. Bu hareketli zemin üzerindeki kişiler ile ilgili olarak;
    I. Yanyana duran iki kişi, hareketli zemin dışındaki birine göre hareketlidir.
    II. Hareketli zemin üzerinde duran bir gelen yolcu, yine hareketli zemin üzerinde duran bir giden yolcuyu duruyor olarak görür.
    III. Giden yolcu şeridinde, zeminin hareket yönüne zıt hareket yapan bir yolcu, gelen yolcu tarafında yine zeminin hareketine zıt hareket eden bir yolcuyu aynı hızda hareket ediyorlarsa duruyor olarak görebilir.

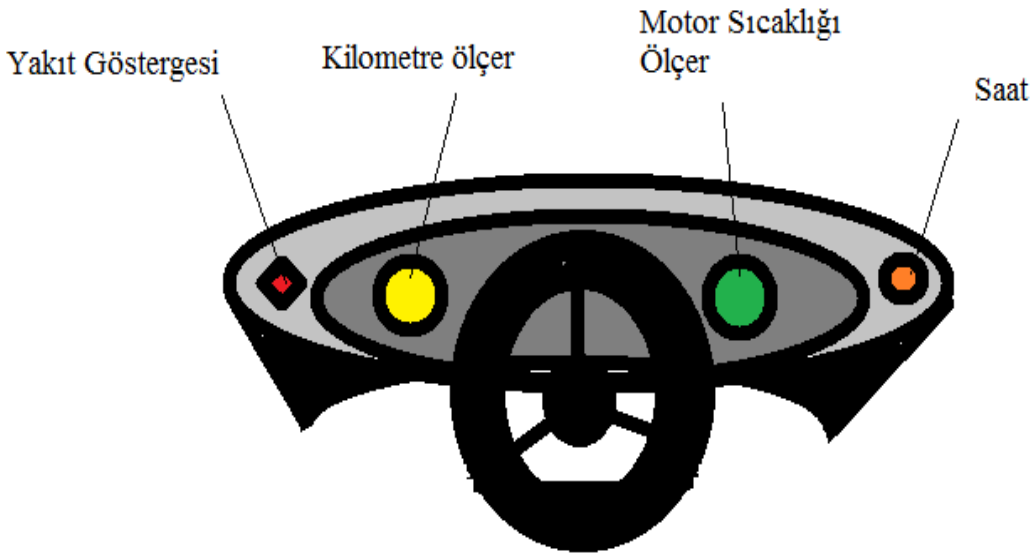
   Hangi ifade ya da ifadeler **yanlıştır**?

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve II
3. Öğretmen “hareketin göreceli” olduğunu öğrencilere anlatmış ve öğrencilerden üç tane örnek sınıfa getirmelerini istemiştir. Erkan’ın hazırladığı
    I. Aynı sürat ve yönde yürüdüğünüz arkadaşınızın söylediklerini anlıyor olmanız birbirinize göre duruyor olmanızın sonuçlarından biridir.
    II. Tüm evler Dünya üzerindedir ve Dünya döndüğü için onlarda hareket etmektedir. Ancak bizim onları duruyor olarak algılamamızın sebebi, bizimde evlerle birlikte aynı sürat ve yönde dönüyor olmamızdır.
    III. Araba yıkayan makineler arabanız dururken bir arkaya bir öne hareket eder ve yıkamasını tamamlar. Yıkama işlemi esnasında arabanın içinde iseniz ve arabayı yıkayan hareketli makineyi gözlemliyorsanız bir anda arabanın hareket ettiğini düşünebilirsiniz.

   üç örnekten hangisi ya da hangileri “hareketin göreceli bir kavram” olduğu konusunda doğru bir örnektir?

   A. Yalnız I
   B. Yalnız II
   C. Yalnız III
   D. II ve III
   E. I, II ve III

4. Aşağıdaki şekil bir arabada bulunabilecek bazı göstergeleri belirtmek için çizilmiştir. Bu çizimde soldan sağa doğru yakıt göstergesi, kilometre ölçer, motor sıcaklığı ölçer ve saat yer almaktadır.



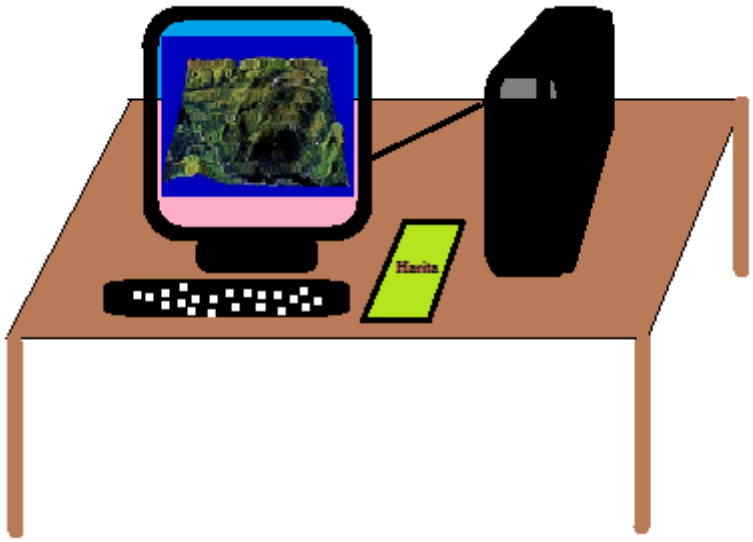
Uzakta yaşayan ve arabası olan bir akrabanızın geldiğini, sizinle ufak bir tur atmak istediğini düşünelim. Evinizin önünden başlayan gezinti öncesi ve sonrası bahsedilen dört göstergedeki değerler aşağıdaki tabloda verilmiştir.

	Yakıt göstergesi	Kilometre ölçer	Motor sıcaklığı ölçer	Saat
Önce	15 litre	100.000 km	20 ^{0}C	12:45
Sonra	10 litre	100.020 km	45 ^{0}C	14:45

Yolculuğunuz süresince hiç durmadığınızı ve sabit bir sürat ile hareket ettiğinize göre sürat değeriniz için hangi göstergeleri kullanmanız yeterli olur?

A. Yakıt göstergesi ve saat.
B. Kilometre ölçer ve saat.
C. Motor sıcaklığı ölçer ve Yakıt göstergesi.
D. Kilometre ölçer ve Yakıt göstergesi.
E. Motor sıcaklığı ölçer ve saat.

5. Aşağıdaki şekilde bir masa üzerinde duran şehirlerarası harita ve internete bağlı bilgisayar, Ankara'dan Kars'a yolculuk yapmak isteyen kardeşinizin çalışma masasını belirtmek için çizilmiştir. Bu çizimde ekranda internetten elde edilen üç boyutlu bir harita görünmektedir. Bu harita yolculukta karşılaşılacak engebeli yolları göstermektedir. Bu iniş-çıkışlı yollar kâğıttan hazırlanmış haritada görünmemektedir.



Kardeşiniz otobüsle gitmeye karar vermiş, kâğıt haritayı açıp iki şehir arasını cetvelle ölçmüş ve otobüsün en fazla yapabileceği sürati de dikkate alıp 8 (sekiz) saatlik bir yolculuk planlamış. Ancak yolculuk planladığından fazla sürmüştür.

Otobüsün beklenen süreden geç varmasının temel nedeni ne olabilir?

A. Otobüs kardeşinizin tahmin ettiği süratten fazla bir süratle yolculuk etmiştir.
B. Kardeşiniz cetvelle olması gerekenden daha fazla bir mesafe ölçmüştür.
C. Kardeşiniz cetveldeki santimetreyi kilometreye çevirirken olması gerekenden fazla bir mesafe belirlemiştir.
D. Cetvel ile ölçülen yer değiştirme yerine alınan yol değerini hesaplanmada kullanmalıydı.
E. Üç boyutlu çizimlerde görünen inişler ve çıkışlar dikkate alınmamıştır.

6. Aşağıda trafik kazalarının temel nedenini anlatan iki gazete kupürü bulunmaktadır. Bu kupürler içinde bazı yanlış kullanımlar bulunabilir.

Trafik Polisi Suat ÇAYIR'ın açıklamaları

Yaklaşık 20 yıldır trafik polisliği yapan Suat ÇAYIR, "Trafik, aracınızın hangi yöne gittiği ile ilgilenmez, nasıl gittiğinizle ilgilenir. Alkol sınırını aşmış ya da aşırı süratli biçimde yol almakta iseniz müdahale ederiz" dedi.

Astronomi Profesörü Nihat PÜRDİKKAT'in açıklamaları

Uzay araştırmaları üzerine yaptığı araştırmalar ile tanınan Prof. Dr. Nihat PÜRDİKKAT, yaptığı açıklamada trafik kazalarının temel nedeni olarak aşırı hızı işaret etti. "Son 10 yılda yapılan kazaların %90'ı yasal hız sınırının aşılması ile gerçekleşmiştir" dedi.

Bu iki haber kupürü dikkate alındığında kim ya da kimler "Hız veya Sürat" terimlerini **yanlış** kullanmıştır.

A. Trafik Polisi
B. Profesör
C. Trafik Polisi ve Profesör

7. Aşağıda bir alışveriş merkezinde arkadaşlarla yukarı çıkan ve aşağıya inen merdivenlerde çekindiğimiz resim bulunmaktadır. Bu resimde aşağı inmiş, yukarı çıkmış ve merdivende hareket eden arkadaşlarımız bulunmaktadır.

Yıllar sonra arkadaşlarla bir araya geldiğimizde bu fotoğraf ile ilgili kurduğumuz aşağıdaki cümlelerden

Ali: "Ben yukarı çıkıp aşağıya inmiştim, Necla ise aşağı inip yukarı çıkmıştı. Her ikimizde aynı yer değiştirmeyi yapmıştık".

Necla: "Farklı merdivenlerde, benim aşağı iniş hızımla senin yukarı çıkış hızın aynıydı".

Zeynep: "Aynı merdivende aramızda 4-5 basamak olacak biçimde yukarı çıktığım Mehmet ile aynı süratte hareket etmiştik".

Mehmet: "Bir ara ben 10 dakika yürüdüm ama hiç yer değiştirme yapamamıştım çünkü aşağı inen merdivenle yukarı çıkmaya çalışıyordum".

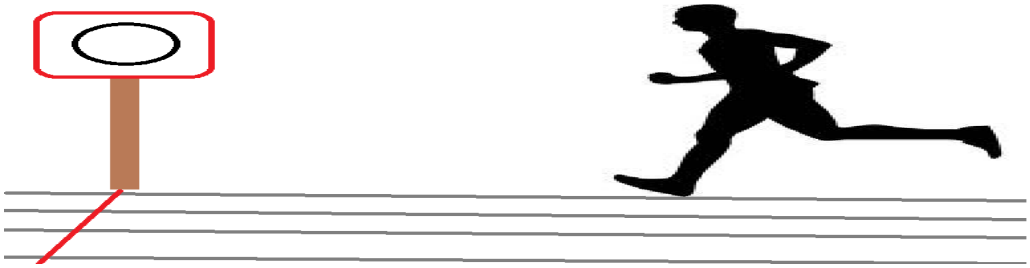
Yavuz: "Ali ve Zeynep bir ara hareketsiz merdivenlerin orada oturuyorlardı. Öğretmenimizin merdivenin yakınında olan ama resimde çıkmayan çay içtiği masaya göre herkesin konumu sürekli değişirken, onların konumları değişmiyordu".

hangisi ya da hangilerinde **yanlış** bir ifade kullanılmıştır?

A. Yalnız Ali'nin ifadesinde yanlış kullanım bulunmaktadır.
B. Yalnız Necla'nın ifadesinde yanlış kullanım bulunmaktadır.
C. Yalnız Mehmet'in ifadesinde yanlış kullanım bulunmaktadır.
D. Yavuz ve Mehmet'in ifadelerinde yanlış kullanım bulunmaktadır.
E. Zeynep ve Ali'nin ifadelerinde yanlış kullanım bulunmaktadır.

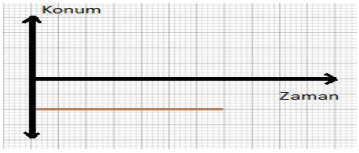
NOT: Devam eden 3(üç) soru 8. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

8. Aşağıdaki resim koşu parkına yerleştirilmiş bir tabelayı ve koşan bir kişiyi göstermektedir. Bu koşucunun hareketini gözlemleyen beş kişinin meslekleri tesadüfen; öğretmen, hakem, bilim insanı, şoför ve doktordur. Bu meslek gruplarına ait olduğunu belirten kişilerden koşucunun başlangıç tabelasına göre *konum-zaman grafiğini* çizmeleri rica edilmiştir. Bu resimdeki koşucu tabela önünden sabit hızla koşarak geçmektedir. Koşucunun tabelaya yaklaşırken koştuğu bölgenin pozitif olarak düşünülmesi gerektiği gözlemcilere belirtilmiştir.



Gözlemcilerin çizdikleri grafiklerden hangisi hareketi doğru anlatmaktadır?

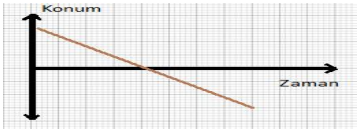
A. Öğretmen



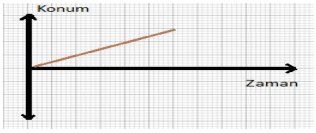
B. Hakem

C. Bilim insanı

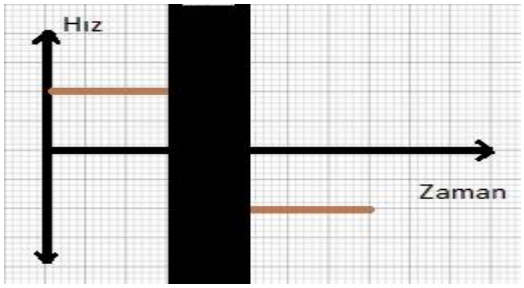
D. Şoför



E. Doktor



9. Aşağıdaki grafik koşucunun yapmış olduğu başka bir hareketi sonunda çizilmiştir. Bu hareketin ortasında bir bölgenin yorumlanması istenmediği için karalanmıştır.



Bu grafik incelendiğinde koşucunun yaptığı hareket ile ilgili olarak;

I. Koşucu önce tabelaya doğru sabit hızla koşmuş sonra geri dönmüş, aynı hızla koşmaya devam etmiştir.
II. Koşucu önce sabit hızla algılayıcıya koşmuş sonra daha az bir hızla koşmaya devam etmiştir.
III. Koşucu başladığı noktaya geri dönmüştür.

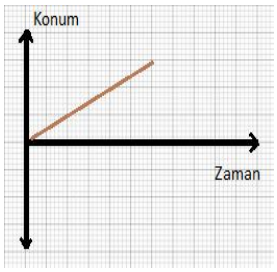
çıkarımlardan hangisi ya da hangileri **yanlıştır?**

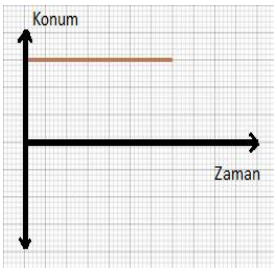
A. Yalnız I B. Yalnız II C. I ve II D. II ve III E. I ve III

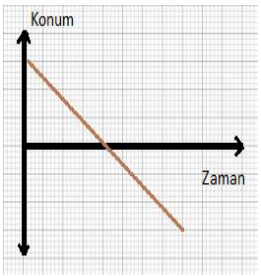
10. Koşucunun yaptığı hareketlere ilişkin çeşitli grafikler çizen gözlemcilerin grafikleri toplanmıştır ama aşağıdaki altı grafiğin kimin tarafından çizildiği bilinmemektedir. Bu grafikler bir konum-zaman ve bir hız-zaman olacak biçimde rastgele eşleştirilmiştir.

I. II. III.

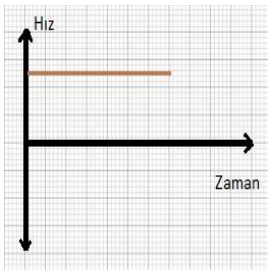
Konum-zaman Konum-zaman Konum-zaman

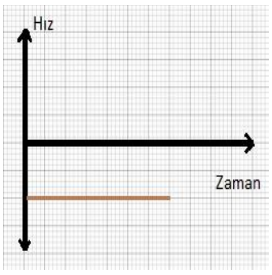


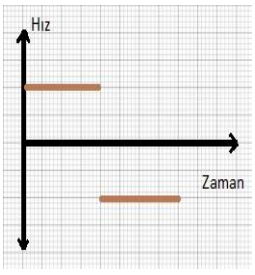




Hız-zaman Hız-zaman Hız-zaman







Bu eşleştirmelerin hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız II C. II ve III D. I ve II E. I ve III

NOT: Devam eden 2(iki) soru 11. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

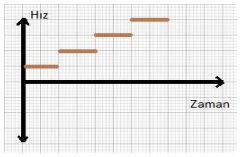
11. Nazımın babası otobüs şoförüdür. Şehirlerarası yolculuğa çıktığı bir gün Nazım babasını her saat başı arayıp telefonla görüşmüştür. Görüşmelerinde yola çıktıktan beri kaç kilometre yol gittiğini ve o an için kaç km/saat hız ile yolculuk yaptığını sormuştur. Ankara'dan İstanbul'a giden babasının verdiği cevaplar aşağıdaki tablodaki gibidir.

	Ankara	**Ankara**	**Bolu**	**Sakarya**	**Kocaeli**	**İstanbul**
Saat	09:00	10:00	11:00	12:00	13:00	14:00
Aldığı yol (km)	0	100	200	300	350	500

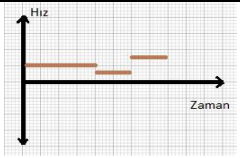
Babasının Nazım'a söylediği hız değerleri (km/saat) için aşağıdaki önerilerden hangisinin olma ihtimali en yüksektir. Lütfen karar verirken babasının sabit hızla hareket ettiğini düşününüz.

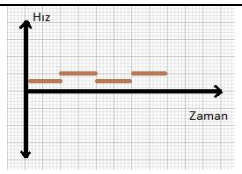
Saat	**A.**	**B.**	**C.**	**D.**	**E.**
10:00	100	200	300	350	500
11:00	50	50	50	50	50
12:00	100	100	100	50	150
13:00	50	100	50	100	50

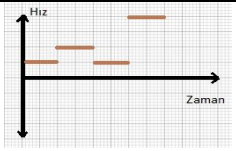
12. Nazım'ın babasından elde ettiği verilere göre bir hız-zaman grafiği hazırlasaydı grafik aşağıdakilerden hangisine benzerdi?

A. 

B. 

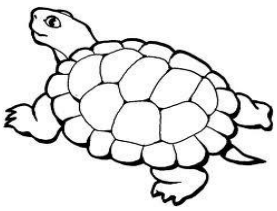
C. 

D. 

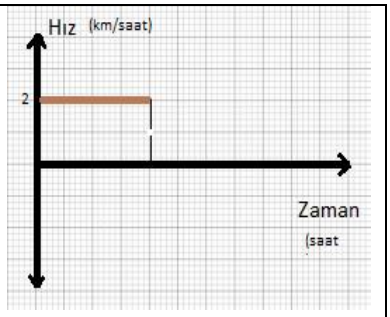
E. 

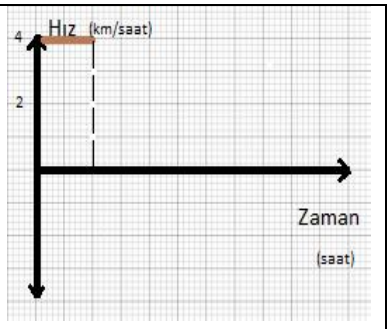
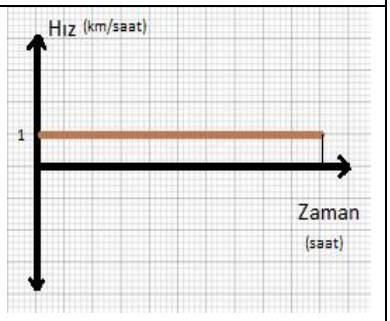
13. Bir bilim insanı hayvanların hareketlerini incelemiş ve ortalama bir gün boyunca elde ettiği sayısal verileri "en fazla yer değiştiren hayvan" konusunda yorum yapabilmek için grafiğe dökmüştür.

Aşağıdaki grafikler o hayvanın bir gün boyunca hesaplanan ortalama hızının zamana göre değişimini ve dinlenme sürelerini göstermektedir (Eğer hayvanın zaman ekseninde belirli bir hız değeri yok ise o süre boyunca dinlendiğini düşünebiliriz).



KAPLUMBAĞA



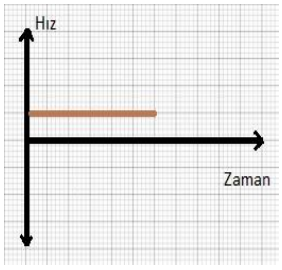
 TAVŞAN	
 KARINCA	

Bu grafikler dikkate alınarak en çok yer değiştiren hayvandan en az yer değiştiren hayvana doğru nasıl bir sıralama yapılabilir?

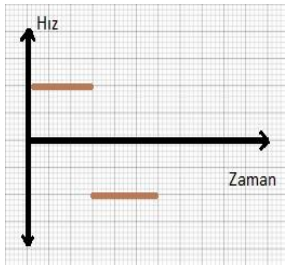
A. Kaplumbağa-Tavşan-Karınca
B. Kaplumbağa-Karınca-Tavşan
C. Karınca-Kaplumbağa ve Tavşan
D. Tavşan-Kaplumbağa-Karınca
E. Tavşan – Karınca- Kaplumbağa

14. Bir belediye en temiz sokağı seçmek istemektedir. Sonbahar aylarında olunduğu için temizlik görevlilerinin işi de zordur. Altmış dakika içinde temizlik görevlileri beş ayrı sokakta aşağıdaki hız-zaman grafiklerini oluşturacak biçimde temizlik yapmıştır. Süre bitiminde kuru yaprakların en az olduğu sokak hangi grafiğe ait sokak olur?

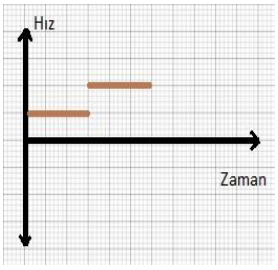
A.



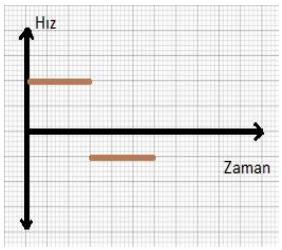
B.



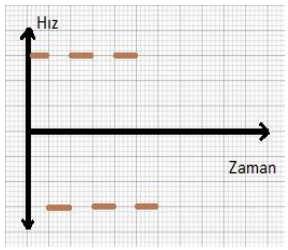
C.



D.



E.



NOT: Devam eden 2(iki) soru 15. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

15. Mahmut “ivme” kavramı hakkında bir araştırma yapmak istiyor. Bu araştırmayı internet üzerinden ve Google arama motoru kullanarak yapmayı düşünüyor. İvme kelimesi kullanmadan hangi üç kelimeyi yazarsa yapacağı araştırma sonucunda fizik dersi için kullanabileceği bilgilere ulaşması daha kolay olur?
    A. Hareket, Zaman, Grafik
    B. Fizik, Sınav, Hareket
    C. Hız, Değişim, Araba
    D. Hareket, Zaman, Yol
    E. Saat, Yol, Değişim

16. Mahmut ivme ile ilgili araştırmasını tamamlamıştır. Bu araştırma sonucunda aşağıdaki örnekleri ivmeli harekete örnek olacağını düşünmektedir. Hangi örnek için Mahmut yanılmaktadır?
    A. Arabanın penceresinden bir çocuğun eşit zaman aralıklarında leblebi attığını düşünürsek leblebiler arası mesafe zamanla değişmiyorsa arabanın yaptığı hareket ivmeli harekete örnektir.
    B. Salıncakta sallanan bir çocuk ivmeli hareket yapar.
    C. Hızlı giderken aniden fren yapan bir motosikletli duruncaya kadar ivmeli hareket yapar.
    D. Yavaş giderken yavaşça firen yapan motosikletli duruncaya kadar ivmeli hareket yapar.
    E. Çok katlı bir apartmanda çatıdan bırakılan topun düşme doğrultusundaki pencerelere otomatik fotoğraf makinesi yerleştirilmiş. Bu makineler her saniye resim çekebilmekte. İlk saniye 9. kattaki fotoğraf makinesi, ikinci saniye 6. kattaki ve üçüncü saniye 1. kattaki fotoğraf makinesi topu görüntülediğine göre topun düşme hareketi ivmeli harekete örnek olarak verilebilir.

APPENDIX C2

EXPERT OPINION FORM ABOUT MOTION ACHIEVEMENT TEST

Yaşam Temelli Hareket Başarı Testi Uzman Görüşü Formu

Açıklamalar

Yaşam temelli yaklaşım, eğitim ve öğretim çalışmalarının yaşamdan beslenmesi ve yaşama katkı sağlamasını öncelik haline getirmeyi amaçlamış bir yaklaşımdır. Bu yaklaşım doğrultusunda ölçme araçlarının da yeniden gözden geçirilmesi kaçınılmazdır. İncelemenizi istediğimiz test, bu yaklaşıma uygun hazırlandığı düşünülmektedir. Sizin bu konudaki görüşünüzü merak ediyoruz. Bir sorunun yaşam temelli olması için;
1.Öğrencinin seviyesine uygun olması,
2.Sorunun içeriğinin öğrencinin ilgisini çekecek nitelikte olması,
3.Soruda geçen verilerin gerçek değerleri yansıtması ve
4.Sorunun geçtiği bağlamın öğrenciye yabancı olması ihtimaline karşı yeterli açıklama içeriyor olması gibi ilkeler göz önünde bulundurulmuştur. Testin biçimsel ve içerik açısından da değerlendirmenizi talep etmekteyiz. Biçimsel açıdan sorunun test tekniğine uygunluğunu değerlendirmeniz beklenmektedir. İçerik olarak dikkat etmenizi istediğimiz ölçütler ise bilgi ve beceri kazanımlarının soru tarafından ölçüp ölçmediği ile ilgilidir. Ayrıca içerik olarak kullanılan temel fizik kavramlarını ve uygulamalarını da bilimsellik açısından değerlendirmenizi istiyoruz. Eğer soru için ek bir değerlendirme ölçütü kullanmak istiyorsanız lütfen “diğer” yazan kısma ölçütünüzü belirtiniz. Testin geliştirilmesinde gösterdiğiniz katkı için teşekkür ederim. Çalışmamın yayınlanması durumunda yayın içerisinde de tarafınıza teşekkür etmeyi planlamaktayım.

Soru	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
1	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
2	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
3	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
4	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
5	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
6	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru Numarası	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
7	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
8	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru Numarası	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
9	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
10	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru Numarası	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
11	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
12	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru Numarası	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
13	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
14	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Soru Numarası	Değerlendirme ölçütü		Uygundur.	Uygun değil.	Çünkü;
15	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			
16	Yaşam Temelli	Öğrenci seviyesine…			
		Öğrencinin ilgisine…			
		Gerçek değerlere…			
		Açıklamalar bilmeyenler için…			
	Biçimsel	Test tekniği açısından…			
		Diğer biçimsel ölçütler açısından…			
	İçerik	Bilgi kazanımları açısından…			
		Beceri Kazanımları açısından…			
		Kullanılan temel fizik kavramları ve uygulamaları açısından bilimselliğe…			
		Diğer içerik ölçütler açısından…			

Ek olarak belirtmek istediklerinizi lütfen aşağıdaki boş kısma yazınız.

Size göre Yaşam Temelli Hareket Başarı Testinin doğru cevapları nelerdir?

Soru Numarası	Seçenek
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

APPENDIX C3

MATCHING LIST BETWEEN SKILLS AND COGNITIVE DOMAINS

Yaşam Temelli Hareket Başarı Testinde Kullanılan Bilgi ve Beceri Kazanımları Listesi

1,2 ve 3. Sorular için Bilgi kazanımı	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.1. Hareketin göreceli bir olgu olduğunu fark eder.						
4. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.2. Konum, yer değiştirme ve hız kavramlarını açıklar.						
PÇB-1d:Belirlediği problem için test edilebilir bir hipotez kurar.						
PÇB-1f: Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.						
PÇB-1e: Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.						
PÇB-1g:Problem için uygun bir çözüm tasarlar.						
5. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.2. Konum, yer değiştirme ve hız kavramlarını açıklar.						
FTTÇ-1c: Fizik bilimindeki bilgilerin ivmeli bir şekilde arttığını fark eder.						
BİB-1a: Farklı bilgi kaynaklarını kullanır.						
BİB-1b: Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.						
BİB-1c: Çoklu arama kriterleri kullanır.						
6. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.2. Konum, yer değiştirme ve hız kavramlarını açıklar.						
BİB-1b: Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.						
BİB-1d: Amacına uygun bilgiyi arar, bulur ve seçer.						
BİB-4c:Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.						
BİB-4d:Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.						
7. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.2. Konum, yer değiştirme ve hız kavramlarını açıklar.						
PÇB-1a: Çözülecek problemi tanımlar.						
PÇB-1b: Ön bilgi ve deneyimlerini de kullanarak araştırmaya başlamak için çeşitli kaynaklardan bilgi toplar.						
PÇB-1c:Bilimsel bilgi ile görüş ve değerleri birbirinden ayırt eder.						
8. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.3. Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.						
BİB-1a: Farklı bilgi kaynaklarını kullanır.						
BİB-1b: Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.						
BİB-1c: Çoklu arama kriterleri kullanır.						
BİB-1d: Amacına uygun bilgiyi arar, bulur ve seçer.						
BİB-1e: Söz konusu problem veya araştırmadaki bağımlı, bağımsız ve kontrol edilen değişkenleri belirler.						
BİB-1f: Değişkenlerin ölçüleceği uygun ölçüm aracını belirler.						
9. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.3. Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.						
PÇB-3a: Deney ve gözlemlerden toplanan verileri tablo, grafik, istatistiksel yöntemler veya matematiksel işlemler kullanarak analiz eder.						
PÇB-3b: Analiz ve modelleme sürecinde sayısal işlem yaparken hesap makinesi,hesap çizelgesi,grafik programı vb. araçları kullanır.						
10. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.3. Düzgün doğrusal hareket için konum-zaman ve hız zaman grafiklerini çizerek yorumlar.						

BİB-1g: Problem için uygun bir çözüm tasarlar.						
PÇB-3c: Verilerin analizi sonucunda ulaştığı bulguları matematiksel eşitlikler gibi modellerle ifade eder.						
PÇB-3d: Bulguları veya oluşturulan modeli yorumlar.						
PÇB-3e: Oluşturulan modeli değişik problemlerin çözümüne uyarlar.						
BİB-4c: Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.						
BİB-4d: Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.						
11. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.4. Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.						
PÇB-3e: Oluşturulan modeli değişik problemlerin çözümüne uyarlar.						
PÇB-3g: Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.	En üst seviye tutum					
12. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.4. Düzgün doğrusal hareket için konum-zaman grafiğinden yararlanarak hareketlinin hızını hesaplar.						
PÇB-3f: Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.						
PÇB-3h: Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.						
PÇB-3i: Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.						
13. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.5. Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.						
PÇB-3e: Oluşturulan modeli değişik problemlerin çözümüne uyarlar.						
PÇB-3g: Problem çözümlerinde matematiksel işlemleri kullanmayı yaşam tarzı hâline getirir.	En üst seviye tutum					
14. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.5. Düzgün doğrusal hareket için hız-zaman grafiğinden yararlanarak hareketlinin yer değiştirmesini hesaplar.						
PÇB-3f: Problem çözümü esnasında yapılabilecek olası hata kaynaklarının farkına varır.						
PÇB-3h: Araştırmanın sınırlılıklarını sonucu yorumlamada kullanır.						
PÇB-3i: Kendi bulgularını diğer bulgularla karşılaştırarak aralarında ilişki kurar.						
15. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.6. Günlük yaşamdan örnekler vererek ivmeyi tanımlar.						
BİB-1a: Farklı bilgi kaynaklarını kullanır.						
BİB-1b: Bilgi kaynaklarının güvenilir ve geçerli olup olmadığını kontrol eder.						
BİB-1c: Çoklu arama kriterleri kullanır.						
BİB-4c:Fizikle ilgili iletişimlerinde (sözlü, yazılı, görsel vb.) uygun terminolojileri kullanır.						
16. Soru için Bilgi ve beceri kazanımları paketi	*Bilme*	*Kavrama*	*Uygulama*	*Analiz*	*Sentez*	*Değerlendirme*
1.6. Günlük yaşamdan örnekler vererek ivmeyi tanımlar.						
BİB-1d:Amacına uygun bilgiyi arar, bulur ve seçer.						
BİB-4d: Karmaşık bilgileri açık, anlaşılır ve öz olarak ifade eder.						

APPENDIX C4

MOTION ACHIEVEMENT TEST VERSION 2

9. Sınıf fizik dersi için

Yaşam Temelli Hareket Başarı Testi (YTH-BT)

SÜRÜM:2

30.07.2012

YÖNERGE: Bu testte bulunan 16 (onaltı) test sorusu öğrencilerin 9. sınıf kuvvet ve hareket ünitesinde bulunan hareket konusuna yönelik bilgi ve beceri kazanımlarını ölçmektedir ve araştırma amaçlı hazırlanmıştır. Sorular öğretim programındaki bilgi kazanımlarının sırası takip edilerek sıralanmış olmakla birlikte dilediğiniz sorudan başlayabilirsiniz. Yanlış seçenekleriniz doğru cevaplarınızı götürmeyeceğinden ötürü size gore doğru olan seçenekleri işaretlemekten çekinmeyiniz. Testi cevaplama süreniz bir ders saatini geçmemelidir.

1. Bir otobüste yolculuk yapan iki kişiyi düşünelim. Bu yolculardan birisi oturmakta diğeri arka koltuklardan şoföre doğru hareket etmektedir.

   Otobüsün dışındaki bir kişi, iki yolcunun;

   I. farklı hızlarda gittiğini gözlemler.
   II. aynı hızlarda gittiğini gözlemler.
   III. aynı ama zıt yönlü hızlarda gittiğini gözlemler.
   IV. farklı hızlarda ama zıt yönlerde gittiğini gözlemler.
   ifadelerinden hangisi ya da hangileri doğrudur?

   A.Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve IV

2. Otobüs terminalinde hareketli bir zemin bulunmaktadır. Bu zemin üzerinde durduğunuzda düz bir şerit üzerinde sizi hareket ettirmektedir. Böylece eşya taşırken bu hareketli zemini kullandığınız için yorulmazsınız. Gelen yolcular ve giden yolcular için iki farklı şerit zıt yönlerde çalışır. Bu hareketli zemin üzerindeki kişiler ile ilgili olarak;
   I. Hareketli zemin üzerinde yan yana duran iki kişi, hareketli zemin dışındaki birine göre hareketlidir.
   II. Hareketli zemin üzerinde duran bir gelen yolcu, yine hareketli zemin üzerinde duran giden yolcuyu duruyor olarak görür.
   III. Giden yolcu şeridinde, zeminin hareket yönüne zıt hareket yapan bir yolcu, gelen yolcu tarafında yine zeminin hareketine zıt hareket eden bir yolcuyu aynı hızda hareket ediyorlarsa duruyor olarak görebilir.

   ifadelerden hangisi ya da hangileri <u>yanlıştır?</u>

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve II

3. Öğretmen “hareketin göreceli” olduğunu öğrencilere anlatmış ve öğrencilerden sınıfa üç tane örnek getirmelerini istemiştir. Erkan’ın hazırladığı
   IV. Bir araba içerisinde iken karşıdan gelen arabaların olduğundan daha süratli olarak algılamamızın nedeni hareketin göreceli olmasının bir sonucudur.
   V. Tüm evler Dünya üzerindedir ve Dünya döndüğü için onlarda hareket etmektedir. Ancak bizim onları duruyor olarak algılamamızın sebebi, bizimde evlerle birlikte aynı sürat ve yönde dönüyor olmamızdır.
   VI. Araba yıkayan makineler arabanız dururken bir arkaya bir öne hareket eder ve yıkamasını tamamlar. Yıkama işlemi esnasında arabanın içinde iseniz ve arabayı yıkayan hareketli makineyi gözlemliyorsanız bir anda arabanın hareket ettiğini düşünebilirsiniz.

   üç örnekten hangisi ya da hangileri “hareketin göreceli bir kavram” olduğu konusunda doğru bir örnektir?

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I, II ve III

4. Uzakta yaşayan ve arabası olan bir akrabanızın geldiğini, sizinle ufak bir tur atmak istediğini düşünelim. Evinizin önünden başlayan gezinti öncesi ve sonrası arabanın dört göstergesindeki değerler aşağıdaki tabloda verilmiştir.

	Yakıt göstergesi	Kilometre ölçer	Motor sıcaklığı ölçer	Saat
Önce	15 litre	100.000 km	20 ^{0}C	12:45
Sonra	10 litre	100.012 km	45 ^{0}C	14:45

Yolculuğunuz süresince hiç durmadığınızı ve sabit bir sürat ile hareket ettiğinize göre süratinizi hesaplayabilmek için hangi göstergeleri kullanmanız gerekir?

A. Yakıt göstergesi ve saat.
B. Kilometre ölçer ve saat.
C. Motor sıcaklığı ölçer ve Yakıt göstergesi.
D. Kilometre ölçer ve Yakıt göstergesi.
E. Motor sıcaklığı ölçer ve saat.

5. Kardeşiniz otobüsle Ankara'dan Kars'a gitmeye karar vermiş, kâğıt haritayı açıp iki şehir arasını cetvelle ölçmüş ve otobüsün en fazla yapabileceği sürati de dikkate alıp 9 (dokuz) saatlik bir yolculuk planlamış. Ancak yolculuk planladığından 1 saat 45 dakika fazla sürmüştür. Otobüsün beklenen süreden geç varmasının nedeni olarak kardeşinizin aklına gelen;

I. Otobüs kardeşinizin tahmin ettiği süratten fazla bir süratle yolculuk etmiştir.
II. Kardeşiniz cetvelle olması gerekenden daha fazla bir mesafe ölçmüştür.
III. Kardeşiniz cetveldeki santimetreyi kilometreye çevirirken olması gerekenden fazla bir mesafe belirlemiştir.
IV. Cetvel ile ölçülen yer değiştirme yerine alınan yol değerini hesaplanmada kullanmalıydı.

açıklamalardan hangisi ya da hangileri <u>yanlıştır</u>?

A. I ve II B. II ve III C. III ve IV D. I, II ve III E. Yalnız IV

6. Aşağıda trafik kazalarının temel nedenini anlatan iki gazete kupürü bulunmaktadır. Bu kupürler içinde bazı yanlış kullanımlar bulunabilir.

Trafik Polisi Suat ÇAYIR'ın açıklamaları

Yaklaşık 20 yıldır trafik polisliği yapan Suat ÇAYIR, "Trafik, aracınızın hangi yöne gittiği ile ilgilenmez, nasıl gittiğinizle ilgilenir. Alkol sınırını aşmış ya da aşırı süratli biçimde yol almakta iseniz müdahale ederiz" dedi.

Astronomi Profesörü Nihat PÜRDİKKAT'in açıklamaları

Uzay araştırmaları üzerine yaptığı araştırmalar ile tanınan Prof. Dr. Nihat PÜRDİKKAT, yaptığı açıklamada trafik kazalarının temel nedeni olarak aşırı hızı işaret etti. "Son 10 yılda yapılan kazaların %90'ı yasal hız sınırının aşılması ile gerçekleşmiştir" dedi.

Bu iki haber kupürü dikkate alındığında kim ya da kimler "Hız veya Sürat" terimlerini yanlış kullanmıştır.

A. Trafik Polisi
B. Trafik Polisi ve Profesör
C. Profesör
D. Terimler yanlış kullanılmamıştır.

7. Aşağıda bir alışveriş merkezinde arkadaşlarla yukarı çıkan ve aşağıya inen merdivenlerde çekindiğimiz resim bulunmaktadır. Bu resimde aşağı inmiş, yukarı çıkmış ve merdivende hareket eden arkadaşlarımız bulunmaktadır.

Yıllar sonra arkadaşlarla bir araya geldiğimizde bu fotoğraf ile ilgili aşağıdaki ifadeler kullanılmıştır.

I. **Necla:** "Farklı merdivenlerde, benim aşağı iniş hızımla senin yukarı çıkış hızın aynıydı".

II. **Zeynep:** "Aynı merdivende aramızda 4-5 basamak olacak biçimde yukarı çıktığım Mehmet ile aynı süratte hareket etmiştik".

III. **Mehmet:** "Bir ara ben 10 dakika yürüdüm ama hiç yer değiştirme yapamamıştım çünkü aşağı inen merdivenle yukarı çıkmaya çalışıyordum".

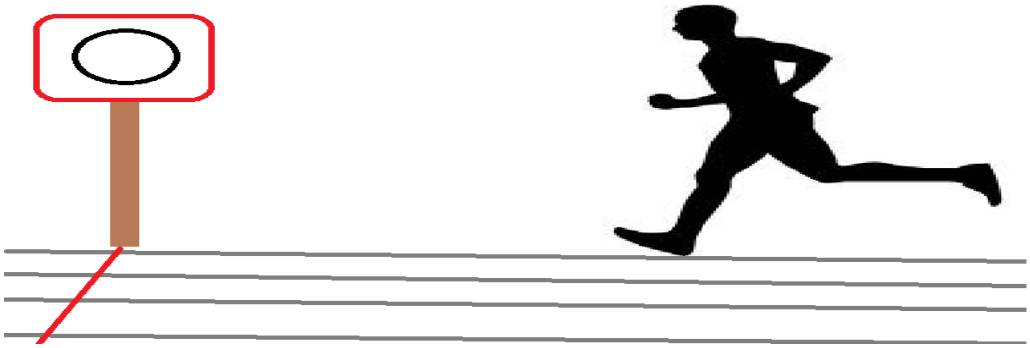
IV. **Yavuz:** "Ali ve Zeynep bir ara hareketsiz merdivenlerin orada oturuyorlardı. Öğretmenimizin merdivenin yakınında olan ama resimde çıkmayan çay içtiği masaya göre herkesin konumu sürekli değişirken, onların konumları değişmiyordu".

Bu ifadelerden hangisi ya da hangileri <u>yanlış</u> kullanılmıştır?

A. Yalnız I B. Yalnız II C. Yalnız IV D. III ve IV E. I ve III

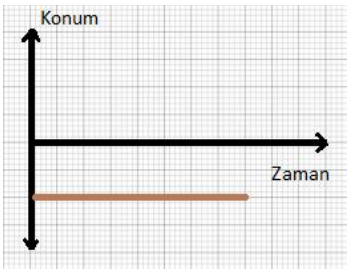
NOT: Devam eden 3(üç) soru 8. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

8. Aşağıdaki resim koşu parkına yerleştirilmiş bir tabelayı ve koşan bir kişiyi göstermektedir. Bu koşucunun hareketini gözlemleyen beş kişinin meslekleri tesadüfen; öğretmen, hakem, bilim insanı, şoför ve doktordur. Bu meslek gruplarına ait olduğunu belirten kişilerden koşucunun başlangıç tabelasına göre *konum-zaman grafiğini* çizmeleri rica edilmiştir. Bu resimdeki koşucu tabela önünden sabit hızla koşarak geçmektedir. Koşucunun tabelaya yaklaşırken koştuğu bölgenin pozitif olarak düşünülmesi gerektiği gözlemcilere belirtilmiştir.

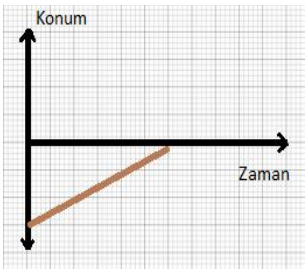


Gözlemcilerin çizdikleri grafiklerden hangisi hareketi doğru anlatmaktadır?

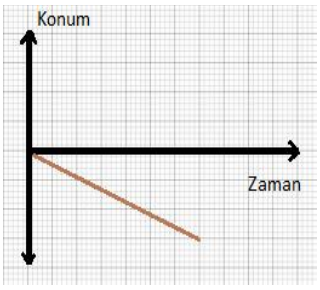
A. Öğretmen



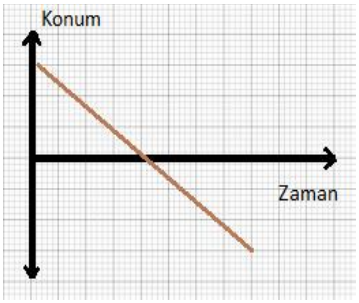
B. Hakem



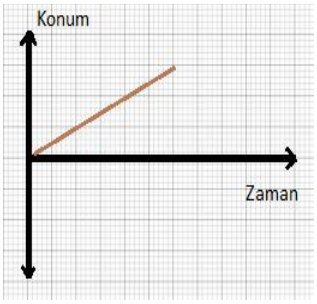
C. Bilim insanı



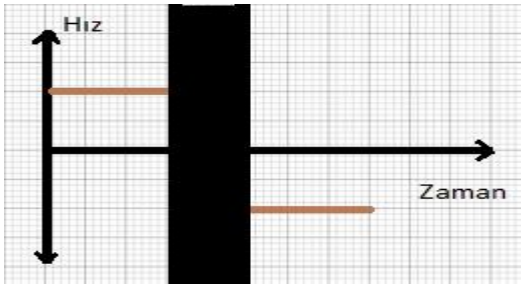
D. Şoför



E. Doktor



9. Aşağıdaki grafik koşucunun yapmış olduğu başka bir hareketi sonunda çizilmiş olan hız zaman grafiğidir. Bu hareketin ortasında bir bölgenin yorumlanması istenmediği için karalanmıştır.



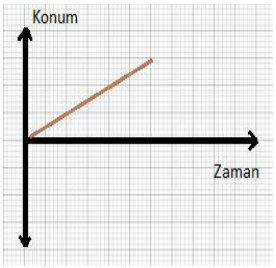
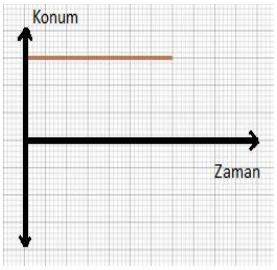
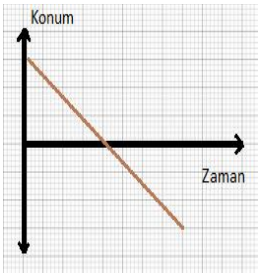
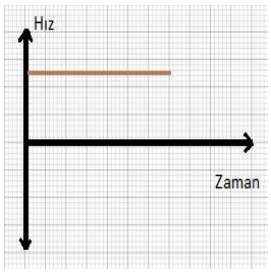
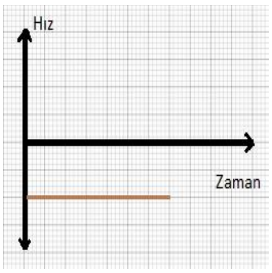
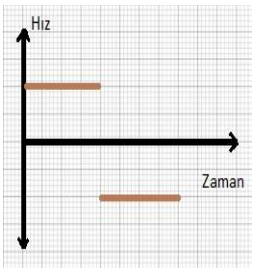
Bu grafik incelendiğinde koşucunun yaptığı hareket ile ilgili olarak;

I. Koşucu önce tabelaya doğru sabit hızla koşmuş sonra geri dönmüş, aynı hızla koşmaya devam etmiştir.
II. Koşucu önce sabit hızla tabelaya doğru koşmuş sonra daha az bir hızla koşmaya devam etmiştir.
III. Koşucu başladığı noktaya geri dönmüştür.

çıkarımlardan hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız II C. I ve II D. II ve III E. I ve III

10. Koşucunun yaptığı başka hareketlere ilişkin çeşitli grafikler aşağıdaki gibi eşleştirilmiştir.

I.	II.	III.
Konum-zaman	Konum-zaman	Konum-zaman
		
Hız-zaman	Hız-zaman	Hız-zaman
		

Bu eşleştirmelerin hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız II C. II ve III D. I ve II E. I ve III

NOT: Devam eden 2(iki) soru 11. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

11. Nazımın babası otobüs şoförüdür. Şehirlerarası yolculuğa çıktığı bir gün Nazım babasını her saat başı arayıp telefonla görüşmüştür. Görüşmelerinde yola çıktıktan beri kaç kilometre yol gittiğini sormuştur. Ankara'dan İstanbul'a giden babasının verdiği cevaplar aşağıdaki tablodaki gibidir.

	Ankara Merkez	**Ankara Sınırı**	**Bolu**	**Sakarya**	**Kocaeli**	**İstanbul**
Saat	09:00	10:00	11:00	12:00	13:00	14:00
Aldığı yol (km)	0	100	200	300	350	500

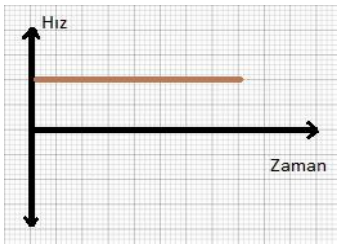
Nazım babasının iki telefon görüşmesi arasındaki ortalama hızını hesaplamak istiyor ve babasının telefon görüşmesinden sonra bir sonraki görüşmeye kadar sabit hızla hareket ettiğini biliyor. Nazım'ın babasının hız değerleri (km/saat) için aşağıdaki önerilerden hangisinin olma ihtimali en yüksektir?

Saat	**A.**	**B.**	**C.**	**D.**	**E.**
10:00	100	50	100	50	100
11:00	200	50	100	100	50
12:00	300	50	100	50	100
13:00	350	50	50	100	50
14:00	500	50	150	50	100

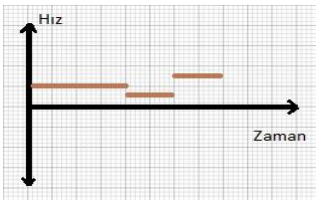
12. Nazım, babasından elde ettiği verilere göre doğru bir hız-zaman grafiği hazırlasaydı grafik aşağıdakilerden hangisine benzerdi?

A.

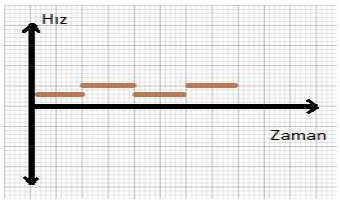
B.



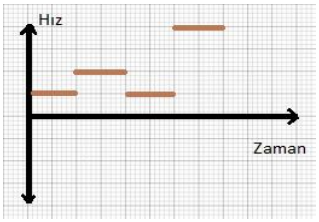
C.



D.

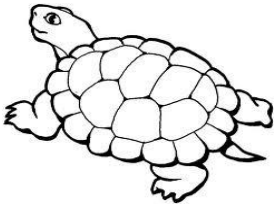


E.

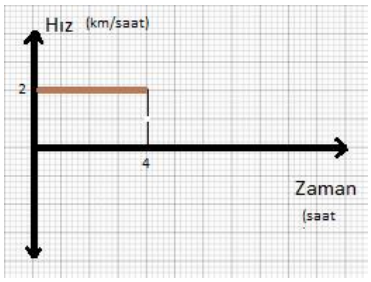


13. Bir bilim insanı hayvanların hareketlerini incelemiş ve ortalama bir gün boyunca elde ettiği sayısal verileri “en fazla yer değiştiren hayvan” konusunda yorum yapabilmek için grafiğe dökmüştür.

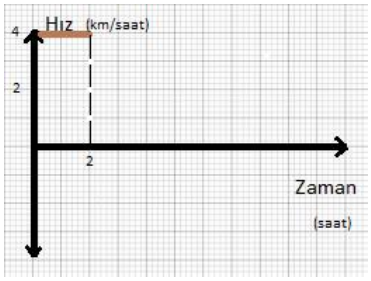
Aşağıdaki grafikler o hayvanın bir gün boyunca hesaplanan ortalama hızının zamana göre değişimini ve dinlenme sürelerini göstermektedir (Eğer hayvanın zaman ekseninde belirli bir hız değeri yok ise o süre boyunca dinlendiğini düşünebiliriz).



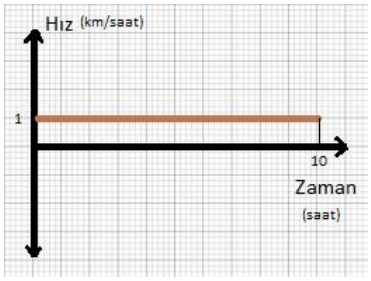
KAPLUMBAĞA



TAVŞAN



KARINCA



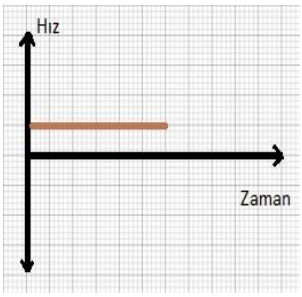
Bu grafikler dikkate alınarak en çok yer değiştiren hayvandan en az yer değiştiren hayvana doğru nasıl bir sıralama yapılabilir?

A. En fazla kaplumbağa yer değiştirmiş, en az ise karınca yer değiştirmiştir.
B. En fazla kaplumbağa yer değiştirmiş, en az ise tavşan yer değiştirmiştir.
C. En fazla karınca yer değiştirmiş, Kaplumbağa ve Tavşan ise daha az ve eşit yer değiştirmiştir.
D. En fazla tavşan yer değiştirmiş, en az ise karınca yer değiştirmiştir.
E. En fazla tavşan yer değiştirmiş, en az ise kaplumbağa yer değiştirmiştir.

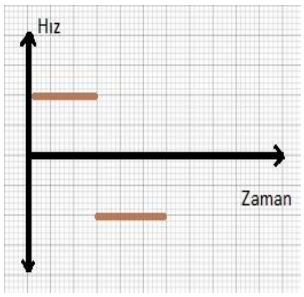
14. Bir belediye sonbaharda dökülen yaprakların temizliği ile ilgili Araştırma-Geliştirme (AR-GE) çalışması yapmaktadır. Amaçları sokak uzunluğu, yol yapısı, sokaktaki ağaç türü ve sayısı gibi tüm dökülen yaprak miktarını etkileyecek değişkenler açısından eşit olan sokaklardaki eşit süre sonundaki yerde bulunan yaprak miktarlarını karşılaştırmaktır. Temizlik işini temizlik kamyonları yapmaktadır. Temizlik kamyonu; altında süpürgesi ve su püskürtme bölümü olan sadece şoförün sokakların temizliği için yeterli olabileceği temizlik araçlarıdır. Temizlik görevlilerinin işi sonbahar olduğu için zordur; ağaçlar sürekli yaprak dökmektedir. Temizlik kamyonları dökülen yaprakların üzerinden geçtiğinde hepsini toplayabilmektedir ama kamyon süpürüp gittikten sonra ağaç tekrar yaprak dökebilmektedir.

İncelenen birçok grafikten aşağıdaki beş grafik yorumlamak için ayırılmıştır. Altmış dakika içinde temizlik kamyonları beş ayrı sokakta aşağıdaki hız-zaman grafiklerini oluşturacak biçimde yaprak topladığına göre süre bitiminde kuru yaprakların en az olduğu sokak hangi grafiğe ait sokak olur?

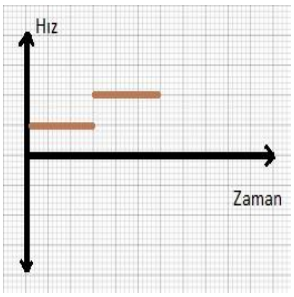
A.



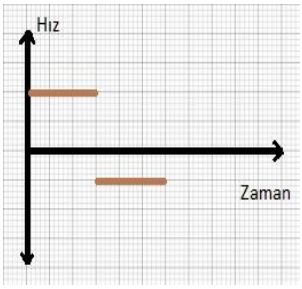
B.



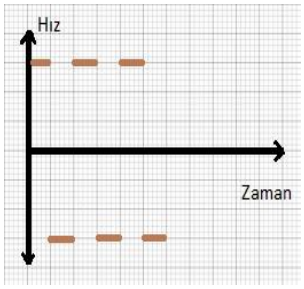
C.



D.



E.



NOT: Devam eden 2(iki) soru 15. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

15. Mahmut internet üzerinden Google arama motoru kullanarak “ivme” kavramı hakkında bir araştırma yapmak istiyor. İvme kelimesi kullanmadan yapacağı araştırma sonucunda hangi seçenekteki kelimeleri kullanırsa fizik dersindeki “ivme” hakkındaki çalışmalar arama motorunda üst sıralarda yer alır?

A. Hareket, Mesafe, Yolculuk
B. Fiziksel, Sınav, Hareket
C. Hareket, Saat, Kavram
D. Hız, Değişim, Zaman
E. Saat, Yol, Değişim

16.

I. Mahmut ivme ile ilgili araştırmasını tamamlamıştır. Bu araştırma sonucunda aşağıdaki örnekleri ivmeli harekete örnek olacağını düşünmektedir.
II. Arabanın penceresinden bir çocuğun eşit zaman aralıklarında leblebi attığını düşünürsek leblebiler arası mesafe zamanla değişmiyorsa arabanın yaptığı hareket ivmeli harekete örnektir.
III. Hızlı giderken aniden fren yapan bir motosikletli duruncaya kadar ivmeli hareket yapar.
IV. On katlı bir apartmanda çatıdan bırakılan topun düşme doğrultusundaki pencerelere otomatik fotoğraf makinesi yerleştirilmiş. Bu makineler her saniye resim çekebilmekte. İlk saniye 9. kattaki fotoğraf makinesi, ikinci saniye 6. kattaki ve üçüncü saniye 1. kattaki fotoğraf makinesi topu görüntülediğine göre topun düşme hareketi ivmeli harekete örnek olarak verilebilir.

Hangi örnek ya da örnekler konusunda Mahmut yanılmaktadır?

A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve II

Cevap Anahtarı

1. A
2. B
3. E
4. B
5. D
6. C
7. A
8. D
9. E
10. A
11. C
12. C
13. C
14. E
15. D
16. A

APPENDIX C5

ITEMAN RESULTS OF PILOT STUDY

Item Statistics				Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
1	0-1	.54	.25	.23	A	.54	.36	.61	.23	*
					B	.07	.14	.00	-.25	
					C	.23	.30	.29	-.00	
					D	.05	.05	.04	-.10	
					E	.10	.16	.06	-.09	
					Other	.00	.00	.00		
2	0-2	.41	.26	.23	A	.04	.09	.00	-.19	
					B	.41	.31	.57	.23	*
					C	.04	.05	.02	-.04	
					D	.44	.45	.35	-.12	
					E	.07	.09	.06	-.03	
					Other	.00	.00	.00		
3	0-3	.80	.30	.38	A	.05	.13	.00	-.22	
					B	.07	.03	.04	-.02	
					C	.02	.05	.00	-.20	
					D	.06	.14	.00	-.31	
					E	.80	.66	.96	.38	*
					Other	.00	.00	.00		
4	0-4	.77	.26	.31	A	.05	.09	.00	-.22	
					B	.77	.66	.92	.31	*
					C	.04	.06	.00	-.14	
					D	.07	.13	.04	-.14	
					E	.06	.06	.04	-.06	
					Other	.00	.00	.00		
5	0-5	.74	.48	.42	A	.07	.13	.02	-.18	
					B	.04	.06	.00	-.13	
					C	.09	.14	.00	-.16	
					D	.74	.50	.98	.42	*
					E	.07	.17	.00	-.27	
					Other	.00	.00	.00		
6	0-6	.46	.28	.36	A	.23	.36	.14	-.23	
					B	.25	.19	.14	-.12	
					C	.46	.39	.67	.36	*
					D	.06	.06	.04	-.14	
					Other	.00	.00	.00		

		Item Statistics			Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
7	0-7	.25	.57	.57	A	.25	.05	.61	.57	*
					B	.31	.23	.24	-.03	
					C	.15	.27	.00	-.25	
					D	.10	.25	.00	-.30	
					E	.20	.20	.14	-.14	
					Other	.00	.00	.00		
8	0-8	.33	.27	.28	A	.06	.06	.06	-.03	
					B	.12	.19	.08	-.13	
					C	.07	.13	.06	-.14	
					D	.33	.14	.41	.28	*
					E	.43	.48	.39	-.10	
					Other	.00	.00	.00		
9	0-9	.39	.78	.69	A	.18	.27	.00	-.25	
					B	.06	.06	.00	-.12	
					C	.15	.38	.00	-.44	
					D	.20	.17	.14	-.11	
					E	.39	.08	.86	.69	*
					Other	.02	.00	.00	-.08	
10	0-10	.42	.27	.30	A	.42	.30	.57	.30	*
					B	.09	.13	.00	-.21	
					C	.39	.48	.33	-.20	
					D	.07	.05	.04	-.00	
					E	.04	.05	.06	.04	
					Other	.00	.00	.00		
11	0-11	.67	.58	.51	A	.07	.13	.00	-.16	
					B	.07	.08	.00	-.09	
					C	.67	.42	1.00	.51	*
					D	.13	.30	.00	-.41	
					E	.05	.08	.00	-.15	
					Other	.00	.00	.00		
12	0-12	.58	.77	.65	A	.12	.23	.00	-.24	
					B	.07	.09	.04	-.14	
					C	.58	.19	.96	.65	*
					D	.17	.39	.00	-.46	
					E	.06	.09	.00	-.16	
					Other	.00	.00	.00		

		Item Statistics			Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
13	0-13	.47	.60	.56	A	.05	.05	.00	-.11	
					B	.00	.00	.00		
					C	.47	.23	.84	.56	*
					D	.36	.53	.16	-.33	
					E	.07	.06	.00	-.09	
					Other	.05	.00	.00	-.34	
14	0-14	.25	.42	.49	A	.09	.08	.00	-.07	
					B	.06	.11	.00	-.16	
					C	.33	.23	.41	.03	
					D	.15	.13	.06	-.06	
					E	.25	.11	.53	.49	*
					Other	.13	.00	.00	-.43	
15	0-15	.52	.71	.60	A	.15	.09	.04	-.08	
					B	.05	.08	.00	-.13	
					C	.02	.02	.00	-.07	
					D	.52	.25	.96	.60	*
					E	.02	.05	.00	-.17	
					Other	.25	.00	.00	-.48	
16	0-16	.32	.60	.55	A	.32	.09	.69	.55	*
					B	.07	.06	.00	-.06	
					C	.07	.05	.10	.07	
					D	.15	.11	.14	.04	
					E	.07	.14	.06	-.19	
					Other	.31	.00	.00	-.49	

APPENDIX C6

MOTION ACHIEVEMENT TEST VERSION 5

9. Sınıf fizik dersi için

Hareket Başarı Testi

(HBT)

Öğrenci No:……
Şube:……
Okul:……
Cinsiyet:……

Sürüm:5
20.10.2012

YÖNERGE: Bu testte bulunan 16 (onaltı) test sorusu öğrencilerin 9. sınıf kuvvet ve hareket ünitesinde bulunan hareket konusuna yönelik bilgi ve beceri kazanımlarını ölçmektedir ve araştırma amaçlı hazırlanmıştır. Sorular öğretim programındaki bilgi kazanımlarının sırası takip edilerek sıralanmış olmakla birlikte dilediğiniz sorudan başlayabilirsiniz. Yanlış seçenekleriniz doğru cevaplarınızı götürmeyeceğinden ötürü size gore doğru olan seçenekleri işaretlemekten çekinmeyiniz. Testi cevaplama süreniz bir ders saatini geçmemelidir.

1. Bir otobüste yolculuk yapan iki kişiyi düşünelim. Bu yolculardan birisi hareketli otobüsün koltuğunda oturmakta diğeri arka koltuklardan şoföre doğru hareket etmektedir.
   Otobüsün dışında ve sabit durumdaki bir kişi, iki yolcunun;

   I. farklı hızlarda gittiğini gözlemler.
   II. aynı hızlarda gittiğini gözlemler.
   III. aynı büyüklükte ama zıt yönlü hızlarda gittiğini gözlemler.
   IV. farklı hızlarda ama zıt yönlerde gittiğini gözlemler.
   ifadelerinden hangisi ya da hangileri doğrudur?

   A. Yalnız I B. Yalnız II C. Yalnız III D. Yalnız IV E. I ve IV

2. Otobüs terminalinde hareketli bir zemin bulunmaktadır. Bu zemin üzerinde durduğunuzda düz bir şerit üzerinde sizi hareket ettirmektedir. Böylece eşya taşırken bu hareketli zemini kullandığınız için yorulmazsınız. Gelen yolcular ve giden yolcular için iki farklı şerit zıt yönlerde çalışır. Bu hareketli zemin üzerindeki kişiler ile ilgili olarak;
   I. hareketli zemin üzerinde yan yana duran iki kişi, hareketli zemin dışındaki sabit birine göre hareketlidir.
   II. Gelen yolcu zemininde yürümeden ilerleyen bir yolcu, yine giden yolculara ait zeminde yürümeden ilerleyen yolcuyu duruyor olarak görür.
   III. giden yolcu şeridin de, zeminin hareket yönüne zıt hareket yapan bir yolcu, gelen yolcu tarafında yine zeminin hareketine zıt hareket eden bir yolcuyu aynı hızda hareket ediyorlarsa duruyor olarak görebilir.

   ifadelerden hangisi ya da hangileri <u>yanlıştır?</u>

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. II ve III

3. Öğretmen “hareketin göreceli bir kavram” olduğunu öğrencilere anlatmış ve öğrencilerden sınıfa üç tane örnek getirmelerini istemiştir. Erkan’ın hazırladığı
   I. Bir araba içerisinde iken karşıdan gelen arabaların olduğundan daha süratli olarak algılamamızın nedeni hareketin göreceli olmasının bir sonucudur.
   II. Tüm evler Dünya üzerindedir ve Dünya döndüğü için onlarda hareket etmektedir. Ancak bizim onları duruyor olarak algılamamızın sebebi, bizimde evlerle birlikte aynı sürat ve yönde dönüyor olmamızdır.
   III. Araba yıkayan makineler, arabanızı yıkarken bir arkaya bir öne hareket eder. Yıkama işlemi esnasında arabanın içinde iseniz ve arabayı yıkayan hareketli makineyi gözlemliyorsanız bir an için arabanın hareket ettiğini düşünebilirsiniz.

   üç örnekten hangisi ya da hangileri “hareketin göreceli bir kavram” olduğu konusunda doğru bir örnektir?

   A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I, II ve III

4. Uzakta yaşayan ve arabası olan bir akrabanızın geldiğini, sizinle ufak bir tur atmak istediğini düşünelim. Evinizin önünden başlayan gezinti öncesi ve sonrası arabanın dört göstergesindeki değerler aşağıdaki tabloda verilmiştir.

	Yakıt göstergesi	Kilometre ölçer	Motor sıcaklığı ölçer	Saat
Önce	13 litre	100.000 km	20 ^{0}C	12:45
Sonra	10 litre	100.060 km	45 ^{0}C	14:45

Yolculuğunuz süresince hiç durmadığınıza ve sabit bir sürat ile hareket ettiğinize göre süratinizi hesaplayabilmek için hangi göstergeleri kullanmanız gerekir?

A. Yakıt göstergesi ve saat
B. Kilometre ölçer ve saat
C. Motor sıcaklığı ölçer ve Yakıt göstergesi
D. Kilometre ölçer ve Yakıt göstergesi
E. Motor sıcaklığı ölçer ve saat

5. Kardeşiniz otobüsle Ankara'dan Kars'a gitmeye karar vermiş, kâğıt haritayı açıp iki şehir arasını cetvelle ölçmüş ve otobüsün en fazla yapabileceği sürati de dikkate alıp 9 (dokuz) saatlik bir yolculuk planlamış. Ancak yolculuk planladığından 1 saat 45 dakika fazla sürmüştür. Otobüsün beklenen süreden geç varmasının nedeni olarak kardeşinizin aklına gelen;
   I. Otobüs kardeşinizin tahmin ettiği süratten fazla bir süratle yolculuk etmiştir.
   II. Kardeşiniz cetvelle olması gerekenden daha fazla bir mesafe ölçmüştür.
   III. Kardeşiniz cetvelle ölçtüğü santimetre birimli mesafeyi kilometreye oranlarlarken olması gerekenden fazla bir mesafe belirlemiştir.
   IV. Cetvel ile ölçülen değer *yer değiştirme* değeriydi ama tüm hareketi içine katan *alınan yol* değerini hesaplanmada kullanmalıydı.

   açıklamalardan hangisi ya da hangileri <u>yanlıştır</u>?

A. I ve II B. II ve III C. III ve IV D. I, II ve III E. Yalnız IV

6. Aşağıda trafik kazalarının temel nedenini anlatan iki gazete kupürü bulunmaktadır. Bu kupürler içinde bazı yanlış kullanımlar bulunabilir.

Trafik Polisi Suat ÇAYIR'ın açıklamaları

Yaklaşık 20 yıldır trafik polisliği yapan Suat ÇAYIR, "Trafik, aracınızın hangi yöne gittiği ile ilgilenmez, nasıl gittiğinizle ilgilenir. Alkol sınırını aşmış ya da aşırı süratli biçimde yol almakta iseniz müdahale ederiz" dedi.

Astronomi Profesörü Nihat PÜRDİKKAT'in açıklamaları

Uzay araştırmaları üzerine yaptığı araştırmalar ile tanınan Prof. Dr. Nihat PÜRDİKKAT, yaptığı açıklamada trafik kazalarının temel nedeni olarak aşırı hızı işaret etti. "Son 10 yılda yapılan kazaların %70'i yasal hız sınırının aşılması ile gerçekleşmiştir" dedi.

Bu iki haber kupürü dikkate alındığında kim ya da kimler "Hız veya Sürat" terimlerini yanlış kullanmıştır?

A. Trafik Polisi
B. Trafik Polisi ve Profesör
C. Profesör
D. Terimler yanlış kullanılmamıştır.

7. Aşağıda bir alışveriş merkezinde arkadaşlarla yukarı çıkan ve aşağıya inen merdivenlerde çekindiğimiz resim bulunmaktadır. Bu resimde aşağı inmiş, yukarı çıkmış ve merdivende hareket eden arkadaşlarımız bulunmaktadır.

Yıllar sonra arkadaşlarla bir araya gelip konuştuğumuzda bu fotoğraf ile ilgili aşağıdaki ifadeler kullanıldı.

I. **Necla:** "Farklı merdivenleri yürümeden kullanıyorduk ve benim aşağı iniş hızımla arkadaşımın yukarı çıkış hızın aynıydı".

II. **Zeynep:** "Aynı merdivende aramızda 4-5 basamak olan Mehmet ile yukarı doğru yürümeden aynı hızla çıkıyorduk.".

III. **Mehmet:** "Bir ara ben 10 dakika yürüdüm ama hiç yer değiştirme yapamadım çünkü aşağı inen merdivenle yukarı çıkmaya çalışıyordum".

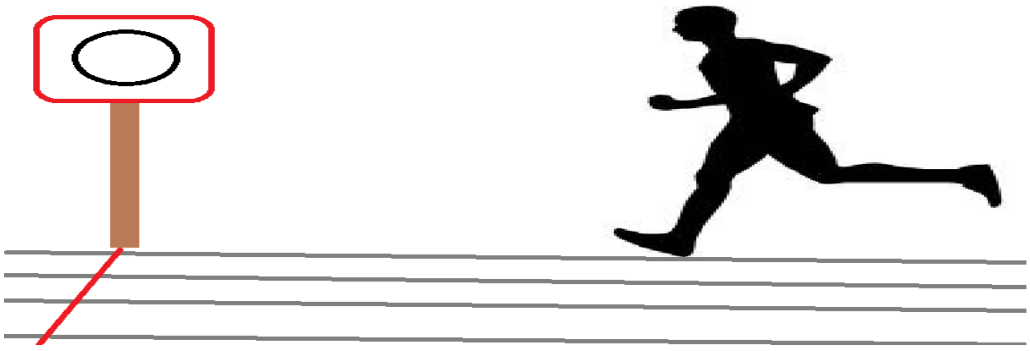
IV. **Yavuz:** "Ali ve Zeynep bir ara hareketsiz merdivenlerin orada oturuyorlardı. Öğretmenimizin merdivenin yakınında olan ama resimde çıkmayan çay içtiği masaya göre herkesin konumu sürekli değişirken, onların konumları değişmiyordu".

Bu ifadelerden hangisi ya da hangileri <u>yanlış</u> kullanılmıştır?

A. Yalnız I B. Yalnız II C. Yalnız IV D. III ve IV E. I ve III

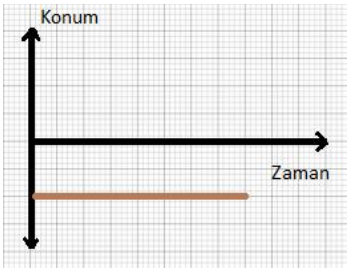
NOT: Devam eden 3(üç) soru 8. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

8. Aşağıdaki resim koşu parkına yerleştirilmiş bir başlangıç tabelasını ve koşan bir kişiyi göstermektedir. Bu koşucunun hareketini gözlemleyen beş kişinin meslekleri tesadüfen; öğretmen, hakem, bilim insanı, şoför ve doktordur. Bu meslek gruplarına ait olduğunu belirten kişilerden koşucunun başlangıç tabelasına göre *konum-zaman grafiğini* çizmeleri rica edilmiştir. Bu resimdeki koşucu tabela önünden sabit hızla koşarak geçmektedir. Koşucunun tabelaya yaklaşırken koştuğu bölgenin pozitif olarak düşünülmesi gerektiği gözlemcilere belirtilmiştir.

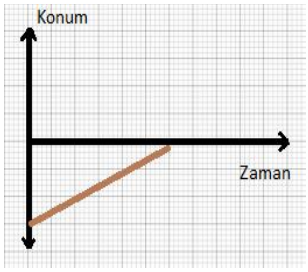


Gözlemcilerin çizdikleri grafiklerden hangisi hareketi doğru anlatmaktadır?

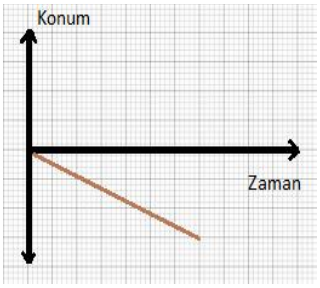
A. Öğretmen



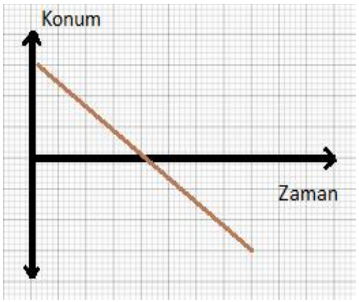
B. Hakem



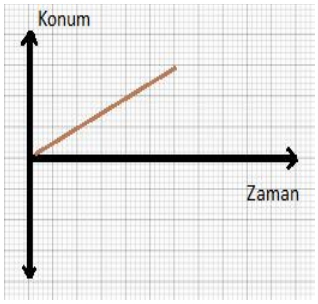
C. Bilim insanı



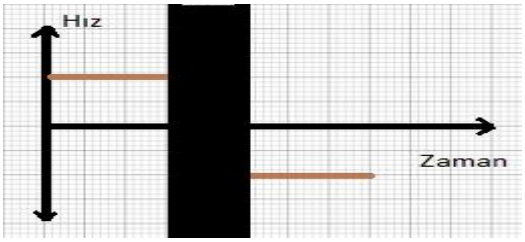
D. Şoför



E. Doktor



9. Aşağıdaki grafik koşucunun yapmış olduğu başka bir hareketi sonunda çizilmiş olan hız zaman grafiğidir. Bu hareketin ortasında bir bölgenin yorumlanması istenmediği için karalanmıştır.



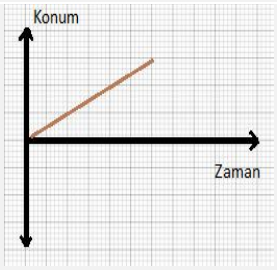
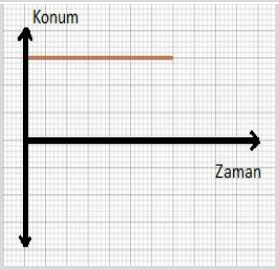
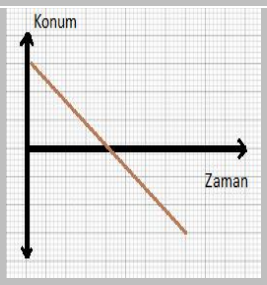
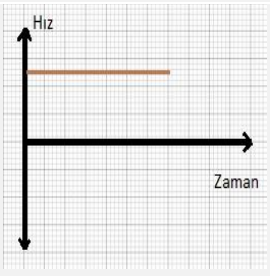
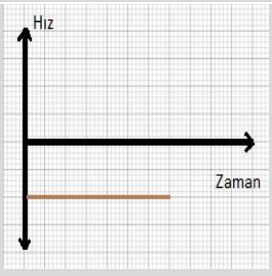
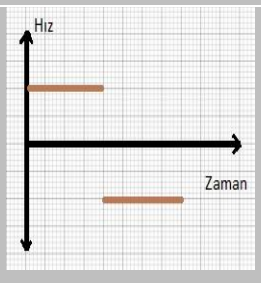
Bu grafik incelendiğinde koşucunun yaptığı hareket ile ilgili olarak;

I. Koşucu önce tabelaya doğru sabit hızla koşmuş sonra geri dönmüş, aynı hızla koşmaya devam etmiştir.
II. Koşucu önce sabit hızla tabelaya doğru koşmuş sonra daha az bir hızla koşmaya devam etmiştir.
III. Koşucu başladığı noktaya geri dönmüştür.

çıkarımlardan hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız II C. I ve II D. II ve III E. I ve III

10. Koşucunun yaptığı başka hareketlere ilişkin çeşitli grafikler aşağıdaki gibi eşleştirilmiştir.

I.	II.	III.
Konum-zaman	Konum-zaman	Konum-zaman
		
Hız-zaman	Hız-zaman	Hız-zaman
		

Bu eşleştirmelerin hangisi ya da hangileri doğrudur?

A. Yalnız I B. Yalnız II C. II ve III D. I ve II E. I ve III

NOT: Devam eden 2(iki) soru 11. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

11. Nazımın babası otobüs şoförüdür. Şehirlerarası yolculuğa çıktığı bir gün Nazım babasını her saat başı aramış ve otobüsü durduran babası ile kısa görüşmeler yapmıştır. Görüşmelerinde yola çıktıktan beri kaç kilometre yol gittiğini sormuştur. Ankara'dan İstanbul'a giden babasının verdiği cevaplar aşağıdaki tablodaki gibidir.

	Ankara Merkez	**Ankara Sınırı**	**Bolu**	**Sakarya**	**Kocaeli**	**İstanbul**
Saat	09:00	10:00	11:00	12:00	13:00	14:00
Aldığı yol (km)	0	100	200	300	350	500

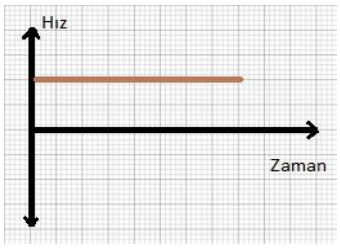
Nazım babasının iki telefon görüşmesi arasındaki ortalama süratını hesaplamak istiyor ve babasının telefon görüşmesinden sonra bir sonraki görüşmeye kadar sabit süratla hareket ettiğini biliyor. Nazım'ın babasının sürat değerleri (km/saat) için aşağıdaki önerilerden hangisinin olma ihtimali en yüksektir?

Saat	**A.**	**B.**	**C.**	**D.**	**E.**
10:00	100	50	100	50	100
11:00	200	50	100	100	50
12:00	300	50	100	50	100
13:00	350	50	50	100	50
14:00	500	50	150	50	100

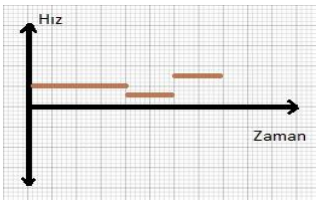
12. Nazım, babasından elde ettiği verilere göre doğru bir hız-zaman grafiği hazırlasaydı grafik aşağıdakilerden hangisine benzerdi?

A.

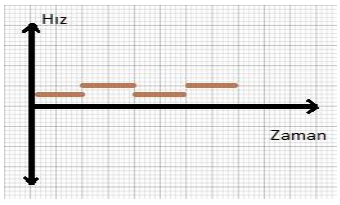
B.



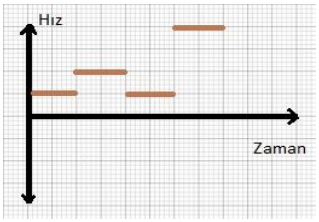
C.



D.

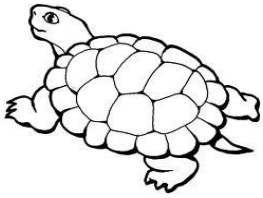


E.

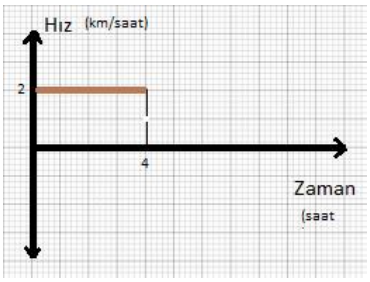


13. Bir bilim insanı hayvanların hareketlerini incelemiş ve ortalama bir gün boyunca elde ettiği sayısal verileri “en fazla yer değiştiren hayvan” konusunda yorum yapabilmek için grafiğe dökmüştür.

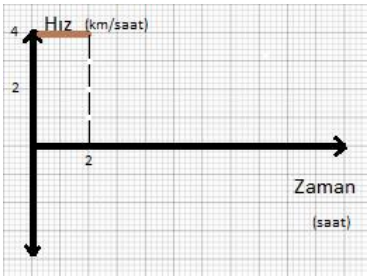
Aşağıdaki grafikler o hayvanın bir gün boyunca hesaplanan ortalama hızının zamana göre değişimini ve dinlenme sürelerini göstermektedir (Eğer hayvanın zaman ekseninde belirli bir hız değeri yok ise o süre boyunca dinlendiğini düşünebiliriz).



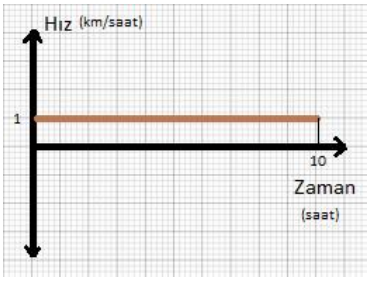
KAPLUMBAĞA



TAVŞAN



KARINCA



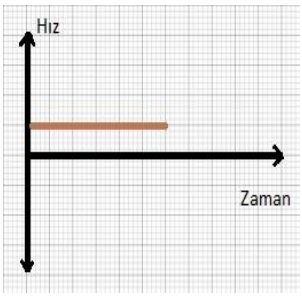
Bu grafikler dikkate alınarak en çok yer değiştiren hayvandan en az yer değiştiren hayvana doğru nasıl bir sıralama yapılabilir?

A. En fazla karınca yer değiştirmiş, en az ise kaplumbağa yer değiştirmiştir.
B. En fazla kaplumbağa yer değiştirmiş, en az ise karınca yer değiştirmiştir.
C. En fazla karınca yer değiştirmiş, Kaplumbağa ve Tavşan ise daha az ve eşit yer değiştirmiştir.
D. En fazla tavşan yer değiştirmiş, en az ise karınca yer değiştirmiştir.
E. En fazla tavşan yer değiştirmiş, en az ise kaplumbağa yer değiştirmiştir.

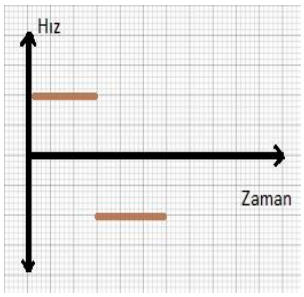
14. Bir belediye sonbaharda dökülen yaprakların temizliği ile ilgili Araştırma-Geliştirme (AR-GE) çalışması yapmaktadır. Temizlik işini temizlik kamyonları yapmaktadır. Temizlik kamyonu; altında süpürgesi ve su püskürtme bölümü olan temizlik araçlarıdır. Temizlik kamyonları dökülen yaprakların üzerinden geçtiğinde hepsini toplayabilmektedir ama kamyon süpürüp gittikten sonra ağaç tekrar yaprak dökebilmektedir. AR-Ge Ekibinin amacı eşit süre sonunda, sokak uzunluğu, yol yapısı, sokaktaki ağaç türü ve sayısı gibi tüm dökülen yaprak miktarını etkileyecek değişkenler açısından yaklaşık olarak aynı olan sokaklardaki yaprak miktarlarını karşılaştırmaktır.

    Altmış dakika içinde temizlik kamyonları beş ayrı sokakta aşağıdaki hız-zaman grafiklerini oluşturacak biçimde yaprak topladığına göre süre bitiminde kuru yaprakların en az olduğu sokak hangi grafiğe ait sokak olur?

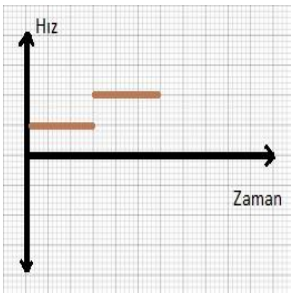
A.



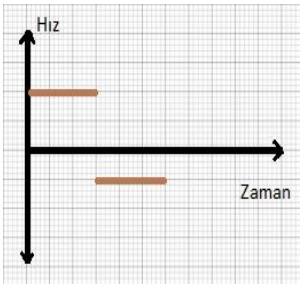
B.



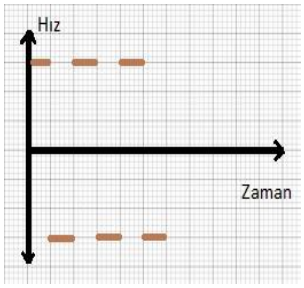
C.



D.



E.



NOT: Devam eden 2(iki) soru 15. sorudaki açıklamalar doğrultusunda cevaplandırılmalıdır.

15. Mahmut internet üzerinden Google arama motoru kullanarak “ivme” kavramı hakkında bir araştırma yapmak istiyor. İvme kelimesi kullanmadan yapacağı araştırma sonucunda hangi seçenekteki kelimeleri kullanırsa fizik dersindeki “ivme” hakkındaki çalışmalar arama motorunda üst sıralarda yer alır?
    A. Hareket, Mesafe, Yolculuk
    B. Fiziksel, Sınav, Hareket
    C. Hareket, Saat, Kavram
    D. Hız, Değişim, Zaman
    E. Saat, Yol, Değişim

16. Mahmut ivme ile ilgili araştırmasını tamamlamıştır. Bu araştırma sonucunda aşağıdaki örnekleri ivmeli harekete örnek olacağını düşünmektedir.

I. Arabanın penceresinden bir çocuğun eşit zaman aralıklarında leblebi attığını ve bu leblebilerin düştüğü yerde kaldığını düşünürsek leblebiler arası mesafenin zamanla değişmediği zaman arabanın yaptığı hareket ivmeli harekete örnektir.

II. Hızlı giderken aniden fren yapan bir motosikletli duruncaya kadar ivmeli hareket yapar.

III. On katlı bir apartmanda çatıdan bırakılan topun düşme doğrultusundaki pencerelere otomatik fotoğraf makinesi yerleştirilmiş. Bu makineler her saniye resim çekebilmekte. İlk saniye 9. kattaki fotoğraf makinesi, ikinci saniye 6. kattaki ve üçüncü saniye 1. kattaki fotoğraf makinesi topu görüntülediğine göre topun düşme hareketi ivmeli harekete örnek olarak verilebilir.

Hangi örnek ya da örnekler konusunda Mahmut yanılmaktadır?

A. Yalnız I B. Yalnız II C. Yalnız III D. II ve III E. I ve II

APPENDIX C7

ITEMAN RESULTS OF MAIN STUDY

		Item Statistics			Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
1	0-1	.35	.62	.53	A	.35	.10	.72	.53	*
					B	.27	.37	.13	-.20	
					C	.24	.33	.11	-.21	
					D	.06	.08	.00	-.17	
					E	.09	.13	.04	-.13	
					Other	.00	.00	.00		
2	0-2	.42	.60	.47	A	.12	.19	.09	-.12	
					B	.42	.13	.74	.47	*
					C	.25	.46	.09	-.27	
					D	.15	.12	.06	-.12	
					E	.06	.10	.02	-.15	
					Other	.00	.00	.00		
3	0-3	.39	.79	.63	A	.17	.23	.02	-.25	
					B	.13	.21	.00	-.28	
					C	.13	.29	.04	-.23	
					D	.19	.25	.13	-.12	
					E	.39	.02	.81	.63	*
					Other	.00	.00	.00		
4	0-4	.48	.51	.40	A	.07	.10	.08	-.06	
					B	.48	.13	.64	.40	*
					C	.06	.06	.02	-.11	
					D	.20	.33	.15	-.15	
					E	.19	.38	.11	-.25	
					Other	.00	.00	.00		
5	0-5	.22	.41	.43	A	.36	.54	.28	-.19	
					B	.20	.25	.11	-.17	
					C	.17	.12	.13	-.01	
					D	.22	.06	.47	.43	*
					E	.05	.04	.00	-.09	
					Other	.00	.00	.00		
6	0-6	.23	.45	.45	A	.21	.19	.13	-.09	
					B	.28	.48	.15	-.27	
					C	.23	.02	.47	.45	*
					D	.28	.31	.25	-.08	
					Other	.00	.00	.00		

		Item Statistics			Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
7	0-7	.29	.47	.46	A	.29	.13	.60	.46	*
					B	.30	.35	.09	-.26	
					C	.18	.25	.21	-.04	
					D	.14	.13	.08	-.08	
					E	.09	.13	.02	-.17	
					Other	.00	.00	.00		
8	0-8	.28	.56	.55	A	.15	.13	.06	-.06	
					B	.22	.29	.08	-.27	
					C	.17	.31	.06	-.24	
					D	.28	.10	.66	.55	*
					E	.19	.17	.15	-.05	
					Other	.00	.00	.00		
9	0-9	.23	.51	.50	A	.14	.13	.04	-.14	
					B	.16	.27	.17	-.09	
					C	.31	.46	.06	-.36	
					D	.16	.10	.19	.09	
					E	.23	.04	.55	.50	*
					Other	.00	.00	.00		
10	0-10	.34	.36	.32	A	.34	.15	.51	.32	*
					B	.32	.42	.23	-.19	
					C	.16	.19	.19	-.05	
					D	.11	.13	.06	-.07	
					E	.07	.10	.02	-.11	
					Other	.00	.00	.00		
11	0-11	.42	.47	.41	A	.19	.25	.11	-.14	
					B	.15	.21	.11	-.14	
					C	.42	.21	.68	.41	*
					D	.17	.27	.06	-.22	
					E	.07	.04	.04	-.03	
					Other	.01	.00	.00	-.08	
12	0-12	.26	.57	.49	A	.26	.38	.06	-.29	
					B	.19	.21	.09	-.15	
					C	.26	.02	.58	.49	*
					D	.22	.27	.21	-.03	
					E	.07	.12	.06	-.06	
					Other	.00	.00	.00		

		Item Statistics			Alternative Statistics					
Seq. No.	Scale -Item	Prop. Correct	Disc. Index	Point Biser.	Alt.	Prop. Total	Endorsing Low	Endorsing High	Point Biser.	Key
13	0-13	.34	.54	.44	A	.18	.25	.06	-.18	
					B	.13	.15	.11	-.08	
					C	.34	.13	.68	.44	*
					D	.21	.19	.09	-.13	
					E	.15	.27	.06	-.17	
					Other	.00	.00	.00		
14	0-14	.27	.41	.39	A	.19	.13	.23	.10	
					B	.14	.15	.11	-.08	
					C	.21	.31	.06	-.29	
					D	.20	.31	.11	-.16	
					E	.27	.08	.49	.39	*
					Other	.01	.00	.00	-.09	
15	0-15	.35	.51	.48	A	.23	.38	.15	-.20	
					B	.11	.12	.06	-.17	
					C	.16	.21	.13	-.08	
					D	.35	.10	.60	.48	*
					E	.11	.15	.06	-.15	
					Other	.03	.00	.00	-.07	
16	0-16	.25	.55	.55	A	.25	.08	.62	.55	*
					B	.08	.08	.08	-.05	
					C	.23	.35	.09	-.22	
					D	.18	.17	.13	-.08	
					E	.17	.27	.04	-.26	
					Other	.09	.00	.00	-.02	

APPENDIX *C8*

MOTION ACHIEVEMENT TEST AND EXAM RESULTS

CASE-A

	CONTROL GROUP					EXPERIMENT GROUP		
	Test	Exam	***ID***	Test	Exam	***ID***	Test	Exam
1	15	63	***60***	5	26	***30***	13	100
2	2	56	***61***	5	45	***31***	6	40
3	6	65	***62***	7	55	***32***	4	46
4	1	50	***63***	6	46	***33***	14	78
5	3	50	***64***	10	75	***34***	10	80
6	2	23	***65***	5	60	***35***	8	65
7	1	27	***66***	6	37	***36***	9	43
8	4	22	***67***	8	55	***37***	10	79
9	3	33	***68***	9	67	***38***	9	70
10	3	26	***69***	3	28	***39***	6	33
11	4	60	***70***	7	30	***40***	8	60
12	4	53	***71***	5	36	***41***	8	60
13	4	60	***72***	3	42	***42***	10	79
14	4	70	***73***	7	16	***43***	8	10
15	2	52	***74***	5	16	***44***	9	55
16	4	40	***75***	7	30	***45***	15	90
17	3	32	***76***	5	25	***46***	11	60
18	4	33	***77***	1	23	***47***	8	34
19	3	41	***78***	9	65	***48***	3	45
20	3	40	***79***	6	45	***49***	4	21
21	4	66	***80***	4	33	***50***	10	70
22	2	20	***81***	9	30	***51***	9	38
23	3	28	***82***	2	43	***52***	9	61
24	4	45	***83***	9	70	***53***	5	50
25	3	25	***84***	4	32	***54***	8	25
26	3	36	***85***	5	20	***55***	6	49
27	2	55	***86***	3	32	***56***	6	28
28	4	15	***87***	1	25	***57***	2	27
29	3	30	***88***	2	39	***58***	7	48
			89	3	40	***59***	7	53
Average	3,552	41,93		5,367	39,53		8,067	53,23

CASE-B

ID	CONTROL GROUP					EXPERIMENT GROUP		
	Test	Exam	***ID***	***Test***	Exam	***ID***	Test	Exam
90	1	25	***125***	2	40	***157***	10	55
91	1	35	***126***	2	40	***158***	9	70
92	3	40	***127***	2	20	***159***	12	85
93	2	15	***128***	3	55	***160***	8	35
95	1	20	***129***	3	50	***161***	7	70
96	2	30	***130***	1	30	***162***	10	65
97	2	60	***131***	2	5	***163***	10	75
98	2	45	***132***	1	30	***164***	10	50
99	1	25	***133***	3	55	***165***	10	65
100	3	50	***134***	0	50	***166***	10	55
101	4	40	***135***	3	50	***167***	10	50
102	1	70	***136***	5	60	***168***	10	45
103	4	60	***137***	2	20	***169***	10	40
104	5	65	***138***	2	30	***170***	10	50
105	2	55	***139***	2	20	***171***	10	30
106	13	80	***140***	4	55	***172***	9	50
107	3	65	***141***	1	65	***173***	10	50
108	2	50	***142***	3	45	***174***	10	50
109	2	60	***143***	5	60	***175***	10	30
110	1	50	***144***	3	40	***176***	10	25
111	3	35	***145***	2	20	***177***	8	65
112	0	65	***146***	5	40	***178***	9	50
113	0	45	***147***	4	25	***179***	7	65
114	1	55	***148***	4	45	***180***	9	70
115	2	65	***149***	6	40	***181***	8	75
116	1	50	***150***	3	50	***182***	7	35
117	3	15	***151***	2	30	***183***	8	65
118	2	45	***152***	3	65	***184***	9	50
119	3	75	***153***	4	40	***185***	8	60
120	4	55	***154***	3	25	***186***	7	50
121	2	65	***155***	3	60	***187***	8	75
122	1	30	***156***	2	35	***188***	10	90
123	3	50				***189***	6	45
124	2	60				***190***	12	75
						191	10	70
Average	2,412	48,53		2,813	40,47		9,147	56,32

APPENDIX D1

MOTIVATION AND ATTITUDE QUESTIONNAIRE
TUTUM VE MOTİVASYON ANKETİ

Bu anket fizik ve fizik dersleri hakkındaki görüşlerinizi öğrenmek için geliştirilmiştir. Her bir yargıyı dikkatlice okuduktan sonra yargıya ne derece katılıp katılmadığınızı en iyi yansıtan cevaba ait kutucuğu (X) ile işaretleyiniz. Verdiğiniz bilgiler sadece araştırmacı tarafından kullanılacak ve ders notlarınızı asla etkilemeyecektir. Samimi ve gerçek düşüncelerinizi yansıtan cevaplarınızdan dolayı çok: **TEŞEKKÜR EDERİM.**

No	*Yargılar*	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1	Fizik derslerimiz eğlencelidir.	O	O	O	O	O
2	Fizik dersini ilgi çekici buluyorum.	O	O	O	O	O
3	Fizik derslerine gitmek için can atıyorum.	O	O	O	O	O
4	Fizik derslerimiz sıkıcıdır.	O	O	O	O	O
5	Fizik dersinin, ilerideki çalışmalarımda bana yararlı olacağını düşünüyorum.	O	O	O	O	O
6	Fizik derslerinde öğrendiklerimin, gündelik hayatta işime yarayacağını düşünüyorum.	O	O	O	O	O
7	Fizik dersinde öğrendiğimiz şeylerin gerçek hayatta kullanılmayacağını düşünüyorum.	O	O	O	O	O
8	Fizik derslerinde öğrendiklerimin, hayatımı kolaylaştıracağını düşünüyorum.	O	O	O	O	O
9	Bu dönemki fizik dersinde öğrendiklerimi bir daha kullanmayacağım için bu derse ihtiyacım olmadığını düşünüyorum.	O	O	O	O	O
10	Fizik öğrenebileceğimden eminim.	O	O	O	O	O
11	Daha zor fizik problemleriyle başa çıkabileceğimden eminim.	O	O	O	O	O
12	Fizik derslerinde başarılı olabileceğimden eminim.	O	O	O	O	O
13	Fizik derslerinde zor işleri	O	O	O	O	O

	yapabileceğimden eminim.					
14	Yeterince vaktim olursa en zor fizik sorularını bile yapabileceğimden eminim.	O	O	O	O	O
15	Fizik dersinde başarılı olmak için elimden geleni yaparım.	O	O	O	O	O
16	Fizik dersinde yapılacak iş ne kadar zor olursa olsun, elimden geleni yaparım.	O	O	O	O	O
17	Fizik derslerinde başarısız olduğumda daha çok çabalarım.	O	O	O	O	O
18	Fizik derslerinde elimden gelenin en iyisini yapmaya çalışırım.	O	O	O	O	O
19	Zorunlu olmasam da fizik dersi almak isterim.	O	O	O	O	O
20	Fizikle ilgili daha çok şey öğrenmek istiyorum.	O	O	O	O	O
21	Fizik becerilerimi geliştirmek istiyorum.	O	O	O	O	O
22	Eğitim hayatım boyunca alabildiğim kadar fazla fizik dersi almak istiyorum.	O	O	O	O	O
23	Fizik derslerindeki yeteneğimle gurur duyarım.	O	O	O	O	O
24	Fizik dersiyle başa çıkabilecek kadar zekiyim.	O	O	O	O	O
25	Fizik derslerindeki başarılarımla gurur duyarım.	O	O	O	O	O
26	Fizik dersinde iyi notlar alma yeteneğine sahibim.	O	O	O	O	O
27	Fizik dersinde kendimi gergin hissederim.	O	O	O	O	O
28	Fizik dersine gitmek beni kaygılandırır.	O	O	O	O	O
29	Fizik dersi, kendimi rahatsız ve sinirli hissetmeme neden olur.	O	O	O	O	O
30	Fizik dersi, kendimi tedirgin ve şaşkın hissetmeme neden olur.	O	O	O	O	O

APPENDIX D2

CONFIRMATORY FACTOR ANALYSIS OF MOTIVATION AND ATTITUDE QUESTIONNAIRE WITH PRE RESULTS

STEP 1

DATE: 4/30/2013
TIME: 22:49
LISREL 8.80 (STUDENT EDITION)
BY
Karl G. Jöreskog and Dag Sörbom
This program is published exclusively by
Scientific Software International, Inc.
7383 N. Lincoln Avenue, Suite 100
Lincolnwood, IL 60712, U.S.A.
Phone: (800)247-6113, (847)675-0720, Fax: (847)675-2140
Copyright by Scientific Software International, Inc., 1981-2006
Use of this program is subject to the terms specified in the
Universal Copyright Convention.
Website: www.ssicentral.com

The following lines were read from file **C:\Documents and Settings\huri\Belgelerim\sahin\pre_acq\pre_cfa.SPJ:**

Raw Data from file 'C:and Settings_acq_cfa.psf'
Latent Variables motatt
Relationships
PRESINT = motatt
PREIMP = motatt
PRESEFF = motatt
PREACHMC = motatt
PRESTUMC = motatt
PRESCON = motatt
PREANX = motatt
Path Diagram
End of Problem
Sample Size = 191
pre_cfa

Covariance Matrix

	PRESINT	PREIMP	PRESEFF	PREACHMC	PRESTUMC	PRESCON
PRESINT	1.03					
PREIMP	0.37	0.67				

PRESEFF 0.64 0.42 1.16
PREACHMC 0.50 0.37 0.78 1.04
PRESTUMC 0.79 0.38 0.87 0.82 1.27
PRESCON 0.63 0.31 0.80 0.76 0.89 1.25
PREANX 0.37 0.39 0.32 0.35 0.26 0.26

Covariance Matrix

	PREANX
PREANX	1.52

pre_cfa
Number of Iterations = 8
LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESINT = 0.73*motatt, Errorvar.= 0.49 , Rý = 0.52
(0.065) (0.056)
11.20 8.79

PREIMP = 0.43*motatt, Errorvar.= 0.49 , Rý = 0.27
(0.057) (0.052)
7.50 9.43
PRESEFF = 0.90*motatt, Errorvar.= 0.35 , Rý = 0.70
(0.065) (0.046)
13.94 7.58
PREACHMC = 0.83*motatt, Errorvar.= 0.36 , Rý = 0.66
(0.063) (0.045)
13.25 8.01
PRESTUMC = 0.99*motatt, Errorvar.= 0.29 , Rý = 0.77
(0.066) (0.043)
15.03 6.64
PRESCON = 0.89*motatt, Errorvar.= 0.46 , Rý = 0.63
(0.069) (0.056)
12.84 8.21
PREANX = 0.36*motatt, Errorvar.= 1.39 , Rý = 0.086
(0.091) (0.14)
3.98 9.69

Correlation Matrix of Independent Variables

	motatt
motatt	1.00

Goodness of Fit Statistics
Degrees of Freedom = 14
Minimum Fit Function Chi-Square = 59.03 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 57.08 (P = 0.00)
Estimated Non-centrality Parameter (NCP) = 43.08
90 Percent Confidence Interval for NCP = (23.47 ; 70.25)
Minimum Fit Function Value = 0.31
Population Discrepancy Function Value (F0) = 0.23

90 Percent Confidence Interval for F0 = (0.12 ; 0.37)
Root Mean Square Error of Approximation (RMSEA) = 0.13
90 Percent Confidence Interval for RMSEA = (0.094 ; 0.16)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00017
Expected Cross-Validation Index (ECVI) = 0.45
90 Percent Confidence Interval for ECVI = (0.34 ; 0.59)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.72
Chi-Square for Independence Model with 21 Degrees of Freedom = 1077.71
Independence AIC = 1091.71
Model AIC = 85.08
Saturated AIC = 56.00
Independence CAIC = 1121.51
Model CAIC = 144.68
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.63
Comparative Fit Index (CFI) = 0.96
Incremental Fit Index (IFI) = 0.96
Relative Fit Index (RFI) = 0.92
Critical N (CN) = 95.30
Root Mean Square Residual (RMR) = 0.063
Standardized RMR = 0.060
Goodness of Fit Index (GFI) = 0.92
Adjusted Goodness of Fit Index (AGFI) = 0.84
Parsimony Goodness of Fit Index (PGFI) = 0.46
The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREACHMC	PRESINT	16.4	-0.15
PRESTUMC	PRESINT	11.9	0.13
PREANX	PREIMP	16.4	0.25

STEP 2

Covariance Matrix

	PRESINT	PREIMP	PRESEFF	PREACHMC	PRESTUMC	PRESCON
PRESINT	1.03					
PREIMP	0.37	0.67				
PRESEFF	0.64	0.42	1.16			
PREACHMC	0.50	0.37	0.78	1.04		
PRESTUMC	0.79	0.38	0.87	0.82	1.27	
PRESCON	0.63	0.31	0.80	0.76	0.89	1.25
PREANX	0.37	0.39	0.32	0.35	0.26	0.26

Covariance Matrix (continued)

PREANX

PREANX 1.52

pre_cfa

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESINT = 0.77*motatt, Errorvar.= 0.44 , R^2 = 0.58

(0.065) (0.053)

11.89 8.21

PREIMP = 0.43*motatt, Errorvar.= 0.48 , R^2 = 0.28

(0.057) (0.051)

7.67 9.49

PRESEFF = 0.89*motatt, Errorvar.= 0.37 , R^2 = 0.68

(0.065) (0.045)

13.73 8.13

PREACHMC = 0.85*motatt, Errorvar.= 0.31 , R^2 = 0.70

(0.062) (0.043)

13.82 7.33

PRESTUMC = 0.98*motatt, Errorvar.= 0.30 , R^2 = 0.76

(0.066) (0.042)

14.96 7.23

PRESCON = 0.87*motatt, Errorvar.= 0.48 , R^2 = 0.61

(0.069) (0.056)

12.65 8.59

PREANX = 0.38*motatt, Errorvar.= 1.38 , R^2 = 0.095

(0.090) (0.14)

4.23 9.70

Error Covariance for PREACHMC and PRESINT = -0.15

(0.034)

-4.46

Correlation Matrix of Independent Variables

motatt

1.00

Goodness of Fit Statistics

Degrees of Freedom = 13

Minimum Fit Function Chi-Square = 40.09 (P = 0.00013)

Normal Theory Weighted Least Squares Chi-Square = 41.96 (P = 0.00)

Chi-Square Difference with 1 Degree of Freedom = 15.12 (P = 0.00010)

Estimated Non-centrality Parameter (NCP) = 28.96

90 Percent Confidence Interval for NCP = (13.04 ; 52.47)

Minimum Fit Function Value = 0.21

Population Discrepancy Function Value (F0) = 0.15

90 Percent Confidence Interval for F0 = (0.068 ; 0.27)

Root Mean Square Error of Approximation (RMSEA) = 0.11

90 Percent Confidence Interval for RMSEA = (0.072 ; 0.15)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.0052

Expected Cross-Validation Index (ECVI) = 0.38

90 Percent Confidence Interval for ECVI = (0.29 ; 0.50)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.72
Chi-Square for Independence Model with 21 Degrees of Freedom = 1077.71
Independence AIC = 1091.71
Model AIC = 71.96
Saturated AIC = 56.00
Independence CAIC = 1121.51
Model CAIC = 135.82
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.96
Non-Normed Fit Index (NNFI) = 0.96
Parsimony Normed Fit Index (PNFI) = 0.60
Comparative Fit Index (CFI) = 0.97
Incremental Fit Index (IFI) = 0.97
Relative Fit Index (RFI) = 0.94
Critical N (CN) = 132.93
Root Mean Square Residual (RMR) = 0.057
Standardized RMR = 0.054
Goodness of Fit Index (GFI) = 0.94
Adjusted Goodness of Fit Index (AGFI) = 0.87
Parsimony Goodness of Fit Index (PGFI) = 0.44

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREANX	PREIMP	15.2	0.23
PREANX	PRESTUMC	8.6	-0.16

STEP 3

Covariance Matrix

	PRESINT	PREIMP	PRESEFF	PREACHMC	PRESTUMC	PRESCON
PRESINT	1.03					
PREIMP	0.37	0.67				
PRESEFF	0.64	0.42	1.16			
PREACHMC	0.50	0.37	0.78	1.04		
PRESTUMC	0.79	0.38	0.87	0.82	1.27	
PRESCON	0.63	0.31	0.80	0.76	0.89	1.25
PREANX	0.37	0.39	0.32	0.35	0.26	0.26

Covariance Matrix (continued)

	PREANX
PREANX	1.52

pre_cfa

Number of Iterations = 5

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESINT = 0.77*motatt, Errorvar.= 0.44 , R^2 = 0.57

(0.065) (0.054)

11.82 8.24

PREIMP = 0.43*motatt, Errorvar.= 0.49 , R^2 = 0.27

(0.057) (0.051)

7.55 9.49

PRESEFF = 0.89*motatt, Errorvar.= 0.37 , R^2 = 0.68

(0.065) (0.045)

13.74 8.10

PREACHMC = 0.85*motatt, Errorvar.= 0.32 , R^2 = 0.70

(0.062) (0.043)

13.77 7.36

PRESTUMC = 0.99*motatt, Errorvar.= 0.29 , R^2 = 0.77

(0.066) (0.041)

15.05 7.11

PRESCON = 0.88*motatt, Errorvar.= 0.48 , R^2 = 0.62

(0.069) (0.056)

12.70 8.55

PREANX = 0.36*motatt, Errorvar.= 1.39 , R^2 = 0.087

(0.090) (0.14)

4.02 9.70

Error Covariance for PREACHMC and PRESINT = -0.15

(0.034)

-4.31

Error Covariance for PREANX and PREIMP = 0.24

(0.063)

3.72

Correlation Matrix of Independent Variables

motatt

1.00

Goodness of Fit Statistics

Degrees of Freedom = 12

Minimum Fit Function Chi-Square = 24.32 (P = 0.018)

Normal Theory Weighted Least Squares Chi-Square = 23.46 (P = 0.024)

Chi-Square Difference with 1 Degree of Freedom = 18.50 (P = 0.00)

Estimated Non-centrality Parameter (NCP) = 11.46

90 Percent Confidence Interval for NCP = (1.42 ; 29.24)

Minimum Fit Function Value = 0.13

Population Discrepancy Function Value (F0) = 0.060

90 Percent Confidence Interval for F0 = (0.0075 ; 0.15)

Root Mean Square Error of Approximation (RMSEA) = 0.071

90 Percent Confidence Interval for RMSEA = (0.025 ; 0.11)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.19

Expected Cross-Validation Index (ECVI) = 0.29

90 Percent Confidence Interval for ECVI = (0.24 ; 0.38)

ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.72
Chi-Square for Independence Model with 21 Degrees of Freedom = 1077.71
Independence AIC = 1091.71
Model AIC = 55.46
Saturated AIC = 56.00
Independence CAIC = 1121.51
Model CAIC = 123.58
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.98
Parsimony Normed Fit Index (PNFI) = 0.56
Comparative Fit Index (CFI) = 0.99
Incremental Fit Index (IFI) = 0.99
Relative Fit Index (RFI) = 0.96
Critical N (CN) = 206.92
Root Mean Square Residual (RMR) = 0.037
Standardized RMR = 0.033
Goodness of Fit Index (GFI) = 0.97
Adjusted Goodness of Fit Index (AGFI) = 0.92
Parsimony Goodness of Fit Index (PGFI) = 0.41

APPENDIX D3

CONFIRMATORY FACTOR ANALYSIS OF MOTIVATION AND ATTITUDE QUESTIONNAIRE WITH POST RESULTS

STEP 1

DATE: 4/30/2013
TIME: 22:57
LISREL 8.80 (STUDENT EDITION)
BY
Karl G. Jöreskog and Dag Sörbom
This program is published exclusively by
Scientific Software International, Inc.
7383 N. Lincoln Avenue, Suite 100
Lincolnwood, IL 60712, U.S.A.
Phone: (800)247-6113, (847)675-0720, Fax: (847)675-2140
Copyright by Scientific Software International, Inc., 1981-2006
Use of this program is subject to the terms specified in the
Universal Copyright Convention.
Website: www.ssicentral.com

The following lines were read from file **C:\Documents and Settings\huri\Belgelerim\sahin\post_acq\post_cfa.SPJ:**

Raw Data from file 'C:and Settings_acq_cfa.psf'
Latent Variables motatt
Relationships
POSTSINT = motatt
POSTIMP = motatt
POSTSEFF = motatt
POSTACHM = motatt
POSTSTUM = motatt
POSTSCON = motatt
POSTANX = motatt
Path Diagram
End of Problem
Sample Size = 191
post_cfa

Covariance Matrix

	POSTSINT	POSTIMP	POSTSEFF	POSTACHM	POSTSTUM	POSTSCON
POSTSINT	0.82					
POSTIMP	0.37	0.48				
POSTSEFF	0.73	0.51	1.52			
POSTACHM	0.52	0.40	1.11	1.39		

POSTSTUM 0.63 0.45 1.22 1.18 1.63
POSTSCON 0.62 0.37 1.00 0.99 1.04 1.35
POSTANX 0.39 0.25 0.50 0.37 0.55 0.35

Covariance Matrix

	POSTANX
POSTANX	1.36

post_cfa
Number of Iterations = 10
LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSTSINT = 0.62*motatt, Errorvar.= 0.44 , Rý = 0.47
(0.059) (0.048)
10.50 9.13

POSTIMP = 0.44*motatt, Errorvar.= 0.29 , Rý = 0.40
(0.046) (0.031)
9.47 9.29

POSTSEFF = 1.11*motatt, Errorvar.= 0.30 , Rý = 0.80
(0.071) (0.045)
15.65 6.73
POSTACHM = 1.01*motatt, Errorvar.= 0.37 , Rý = 0.73
(0.069) (0.048)
14.51 7.74
POSTSTUM = 1.11*motatt, Errorvar.= 0.39 , Rý = 0.76
(0.074) (0.053)
15.00 7.37
POSTSCON = 0.93*motatt, Errorvar.= 0.48 , Rý = 0.64
(0.071) (0.057)
13.16 8.43

POSTANX = 0.45*motatt, Errorvar.= 1.15 , Rý = 0.15
(0.084) (0.12)
5.41 9.64

Correlation Matrix of Independent Variables

	motatt
motatt	1.00

Goodness of Fit Statistics
Degrees of Freedom = 14
Minimum Fit Function Chi-Square = 63.07 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 65.85 (P = 0.00)
Estimated Non-centrality Parameter (NCP) = 51.85
90 Percent Confidence Interval for NCP = (30.28 ; 80.95)
Minimum Fit Function Value = 0.33
Population Discrepancy Function Value (F0) = 0.27

90 Percent Confidence Interval for F0 = (0.16 ; 0.42)
Root Mean Square Error of Approximation (RMSEA) = 0.14
90 Percent Confidence Interval for RMSEA = (0.11 ; 0.17)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00
Expected Cross-Validation Index (ECVI) = 0.49
90 Percent Confidence Interval for ECVI = (0.38 ; 0.64)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 6.75
Chi-Square for Independence Model with 21 Degrees of Freedom = 1274.48
Independence AIC = 1288.48
Model AIC = 93.85
Saturated AIC = 56.00
Independence CAIC = 1318.28
Model CAIC = 153.45
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.63
Comparative Fit Index (CFI) = 0.96
Incremental Fit Index (IFI) = 0.96
Relative Fit Index (RFI) = 0.93
Critical N (CN) = 89.26
Root Mean Square Residual (RMR) = 0.049
Standardized RMR = 0.051
Goodness of Fit Index (GFI) = 0.91
Adjusted Goodness of Fit Index (AGFI) = 0.82
Parsimony Goodness of Fit Index (PGFI) = 0.46
The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POSTIMP	POSTSINT	18.2	0.12
POSTACHM	POSTSINT	18.7	-0.15
POSTSTUM	POSTACHM	9.4	0.13

STEP 2

post_cfa

Covariance Matrix

	POSTSINT	POSTIMP	POSTSEFF	POSTACHM	POSTSTUM	POSTSCON
POSTSINT	0.82					
POSTIMP	0.37	0.48				
POSTSEFF	0.73	0.51	1.52			
POSTACHM	0.52	0.40	1.11	1.39		
POSTSTUM	0.63	0.45	1.22	1.18	1.63	

POSTSCON	0.62	0.37	1.00	0.99	1.04	1.35
POSTANX	0.39	0.25	0.50	0.37	0.55	0.35

Covariance Matrix (continued)

	POSTANX
POSTANX	1.36

post_cfa

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSTSINT = 0.65*motatt, Errorvar.= 0.39 , R^2 = 0.52
(0.058) (0.045)
11.23 8.71

POSTIMP = 0.44*motatt, Errorvar.= 0.28 , R^2 = 0.41
(0.046) (0.030)
9.65 9.36

POSTSEFF = 1.09*motatt, Errorvar.= 0.33 , R^2 = 0.79
(0.071) (0.044)
15.46 7.41

POSTACHM = 1.03*motatt, Errorvar.= 0.33 , R^2 = 0.76
(0.069) (0.046)
14.98 7.13

POSTSTUM = 1.10*motatt, Errorvar.= 0.43 , R^2 = 0.74
(0.075) (0.053)
14.69 8.00

POSTSCON = 0.94*motatt, Errorvar.= 0.47 , R^2 = 0.65
(0.070) (0.055)
13.32 8.63

POSTANX = 0.45*motatt, Errorvar.= 1.16 , R^2 = 0.15
(0.083) (0.12)
5.41 9.67

Error Covariance for POSTACHM and POSTSINT = -0.16
(0.033)
-4.76

Correlation Matrix of Independent Variables

motatt
1.00

Goodness of Fit Statistics

Degrees of Freedom = 13
Minimum Fit Function Chi-Square = 41.16 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 41.59 (P = 0.00)
Chi-Square Difference with 1 Degree of Freedom = 24.26 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 28.59
90 Percent Confidence Interval for NCP = (12.78 ; 52.00)
Minimum Fit Function Value = 0.22
Population Discrepancy Function Value (F0) = 0.15
90 Percent Confidence Interval for F0 = (0.067 ; 0.27)

Root Mean Square Error of Approximation (RMSEA) = 0.11
90 Percent Confidence Interval for RMSEA = (0.072 ; 0.14)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.0057
Expected Cross-Validation Index (ECVI) = 0.37
90 Percent Confidence Interval for ECVI = (0.29 ; 0.50)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 6.75
Chi-Square for Independence Model with 21 Degrees of Freedom = 1274.48
Independence AIC = 1288.48
Model AIC = 71.59
Saturated AIC = 56.00
Independence CAIC = 1318.28
Model CAIC = 135.45
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.97
Non-Normed Fit Index (NNFI) = 0.96
Parsimony Normed Fit Index (PNFI) = 0.60
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.95
Critical N (CN) = 129.49
Root Mean Square Residual (RMR) = 0.044
Standardized RMR = 0.044
Goodness of Fit Index (GFI) = 0.94
Adjusted Goodness of Fit Index (AGFI) = 0.87
Parsimony Goodness of Fit Index (PGFI) = 0.44

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POSTIMP	POSTSINT	11.3	0.09
POSTSTUM	POSTSINT	12.0	-0.14

STEP 3

post_cfa

Covariance Matrix

	POSTSINT	POSTIMP	POSTSEFF	POSTACHM	POSTSTUM	POSTSCON
POSTSINT	0.82					
POSTIMP	0.37	0.48				
POSTSEFF	0.73	0.51	1.52			
POSTACHM	0.52	0.40	1.11	1.39		
POSTSTUM	0.63	0.45	1.22	1.18	1.63	
POSTSCON	0.62	0.37	1.00	0.99	1.04	1.35
POSTANX	0.39	0.25	0.50	0.37	0.55	0.35

Covariance Matrix (continued)

	POSTANX
POSTANX	1.36

post_cfa

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSTSINT = 0.62*motatt, Errorvar.= 0.44 , R^2 = 0.47
(0.059) (0.048)
10.50 9.13

POSTIMP = 0.44*motatt, Errorvar.= 0.29 , R^2 = 0.40
(0.046) (0.031)
9.47 9.29

POSTSEFF = 1.11*motatt, Errorvar.= 0.30 , R^2 = 0.80
(0.071) (0.045)
15.65 6.73

POSTACHM = 1.01*motatt, Errorvar.= 0.37 , R^2 = 0.73
(0.069) (0.048)
14.51 7.74

POSTSTUM = 1.11*motatt, Errorvar.= 0.39 , R^2 = 0.76
(0.074) (0.053)
15.00 7.37

POSTSCON = 0.93*motatt, Errorvar.= 0.48 , R^2 = 0.64
(0.071) (0.057)
13.16 8.43

POSTANX = 0.45*motatt, Errorvar.= 1.15 , R^2 = 0.15
(0.084) (0.12)
5.41 9.64

Correlation Matrix of Independent Variables

motatt
1.00

Goodness of Fit Statistics

Degrees of Freedom = 14
Minimum Fit Function Chi-Square = 63.07 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 65.85 (P = 0.00)
Chi-Square Difference with 1 Degree of Freedom = 24.26 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 51.85
90 Percent Confidence Interval for NCP = (30.28 ; 80.95)
Minimum Fit Function Value = 0.33
Population Discrepancy Function Value (F0) = 0.27
90 Percent Confidence Interval for F0 = (0.16 ; 0.42)
Root Mean Square Error of Approximation (RMSEA) = 0.14
90 Percent Confidence Interval for RMSEA = (0.11 ; 0.17)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00
Expected Cross-Validation Index (ECVI) = 0.49

90 Percent Confidence Interval for ECVI = (0.38 ; 0.64)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 6.75
Chi-Square for Independence Model with 21 Degrees of Freedom = 1274.48
Independence AIC = 1288.48
Model AIC = 93.85
Saturated AIC = 56.00
Independence CAIC = 1318.28
Model CAIC = 153.45
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.63
Comparative Fit Index (CFI) = 0.96
Incremental Fit Index (IFI) = 0.96
Relative Fit Index (RFI) = 0.93
Critical N (CN) = 89.26
Root Mean Square Residual (RMR) = 0.049
Standardized RMR = 0.051
Goodness of Fit Index (GFI) = 0.91
Adjusted Goodness of Fit Index (AGFI) = 0.82
Parsimony Goodness of Fit Index (PGFI) = 0.46

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POSTIMP	POSTSINT	18.2	0.12
POSTACHM	POSTSINT	18.7	-0.15
POSTSTUM	POSTACHM	9.4	0.13

STEP 4

post_cfa

Covariance Matrix

	POSTSINT	POSTIMP	POSTSEFF	POSTACHM	POSTSTUM	POSTSCON
POSTSINT	0.82					
POSTIMP	0.37	0.48				
POSTSEFF	0.73	0.51	1.52			
POSTACHM	0.52	0.40	1.11	1.39		
POSTSTUM	0.63	0.45	1.22	1.18	1.63	
POSTSCON	0.62	0.37	1.00	0.99	1.04	1.35
POSTANX	0.39	0.25	0.50	0.37	0.55	0.35

Covariance Matrix (continued)

	POSTANX

POSTANX 1.36

post_cfa

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSTSINT = 0.65*motatt, Errorvar.= 0.39 , R^2 = 0.52

(0.058) (0.045)

11.23 8.71

POSTIMP = 0.44*motatt, Errorvar.= 0.28 , R^2 = 0.41

(0.046) (0.030)

9.65 9.36

POSTSEFF = 1.09*motatt, Errorvar.= 0.33 , R^2 = 0.79

(0.071) (0.044)

15.46 7.41

POSTACHM = 1.03*motatt, Errorvar.= 0.33 , R^2 = 0.76

(0.069) (0.046)

14.98 7.13

POSTSTUM = 1.10*motatt, Errorvar.= 0.43 , R^2 = 0.74

(0.075) (0.053)

14.69 8.00

POSTSCON = 0.94*motatt, Errorvar.= 0.47 , R^2 = 0.65

(0.070) (0.055)

13.32 8.63

POSTANX = 0.45*motatt, Errorvar.= 1.16 , R^2 = 0.15

(0.083) (0.12)

5.41 9.67

Error Covariance for POSTACHM and POSTSINT = -0.16

(0.033)

-4.76

Correlation Matrix of Independent Variables

motatt

1.00

Goodness of Fit Statistics

Degrees of Freedom = 13

Minimum Fit Function Chi-Square = 41.16 (P = 0.00)

Normal Theory Weighted Least Squares Chi-Square = 41.59 (P = 0.00)

Chi-Square Difference with 1 Degree of Freedom = 24.26 (P = 0.0)

Estimated Non-centrality Parameter (NCP) = 28.59

90 Percent Confidence Interval for NCP = (12.78 ; 52.00)

Minimum Fit Function Value = 0.22

Population Discrepancy Function Value (F0) = 0.15

90 Percent Confidence Interval for F0 = (0.067 ; 0.27)

Root Mean Square Error of Approximation (RMSEA) = 0.11

90 Percent Confidence Interval for RMSEA = (0.072 ; 0.14)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.0057

Expected Cross-Validation Index (ECVI) = 0.37

90 Percent Confidence Interval for ECVI = (0.29 ; 0.50)

ECVI for Saturated Model = 0.29
ECVI for Independence Model = 6.75
Chi-Square for Independence Model with 21 Degrees of Freedom = 1274.48
Independence AIC = 1288.48
Model AIC = 71.59
Saturated AIC = 56.00
Independence CAIC = 1318.28
Model CAIC = 135.45
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.97
Non-Normed Fit Index (NNFI) = 0.96
Parsimony Normed Fit Index (PNFI) = 0.60
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.95
Critical N (CN) = 129.49
Root Mean Square Residual (RMR) = 0.044
Standardized RMR = 0.044
Goodness of Fit Index (GFI) = 0.94
Adjusted Goodness of Fit Index (AGFI) = 0.87
Parsimony Goodness of Fit Index (PGFI) = 0.44

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POSTIMP	POSTSINT	11.3	0.09
POSTSTUM	POSTSINT	12.0	-0.14

STEP 5

post_cfa

Covariance Matrix

	POSTSINT	POSTIMP	POSTSEFF	POSTACHM	POSTSTUM	POSTSCON
POSTSINT	0.82					
POSTIMP	0.37	0.48				
POSTSEFF	0.73	0.51	1.52			
POSTACHM	0.52	0.40	1.11	1.39		
POSTSTUM	0.63	0.45	1.22	1.18	1.63	
POSTSCON	0.62	0.37	1.00	0.99	1.04	1.35
POSTANX	0.39	0.25	0.50	0.37	0.55	0.35

Covariance Matrix (continued)

	POSTANX
POSTANX	1.36

post_cfa

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSTSINT = 0.70*motatt, Errorvar.= 0.33 , R^2 = 0.60
(0.058) (0.043)
12.01 7.65

POSTIMP = 0.44*motatt, Errorvar.= 0.28 , R^2 = 0.40
(0.045) (0.030)
9.67 9.54

POSTSEFF = 1.07*motatt, Errorvar.= 0.38 , R^2 = 0.75
(0.072) (0.046)
14.97 8.13

POSTACHM = 1.03*motatt, Errorvar.= 0.32 , R^2 = 0.77
(0.069) (0.046)
15.03 7.10

POSTSTUM = 1.13*motatt, Errorvar.= 0.35 , R^2 = 0.78
(0.074) (0.051)
15.32 6.81

POSTSCON = 0.93*motatt, Errorvar.= 0.49 , R^2 = 0.63
(0.070) (0.055)
13.14 9.01

POSTANX = 0.46*motatt, Errorvar.= 1.15 , R^2 = 0.15
(0.082) (0.12)
5.58 9.72

Error Covariance for POSTACHM and POSTSINT = -0.19
(0.035)
-5.50

Error Covariance for POSTSTUM and POSTSINT = -0.14
(0.037)
-3.87

Correlation Matrix of Independent Variables

motatt
1.00

Goodness of Fit Statistics

Degrees of Freedom = 12
Minimum Fit Function Chi-Square = 27.45 (P = 0.0066)
Normal Theory Weighted Least Squares Chi-Square = 27.90 (P = 0.0057)
Chi-Square Difference with 1 Degree of Freedom = 13.68 (P = 0.00022)
Estimated Non-centrality Parameter (NCP) = 15.90
90 Percent Confidence Interval for NCP = (4.20 ; 35.30)
Minimum Fit Function Value = 0.14
Population Discrepancy Function Value (F0) = 0.083
90 Percent Confidence Interval for F0 = (0.022 ; 0.18)
Root Mean Square Error of Approximation (RMSEA) = 0.083
90 Percent Confidence Interval for RMSEA = (0.043 ; 0.12)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.082
Expected Cross-Validation Index (ECVI) = 0.31
90 Percent Confidence Interval for ECVI = (0.25 ; 0.42)

ECVI for Saturated Model = 0.29
ECVI for Independence Model = 6.75
Chi-Square for Independence Model with 21 Degrees of Freedom = 1274.48
Independence AIC = 1288.48
Model AIC = 59.90
Saturated AIC = 56.00
Independence CAIC = 1318.28
Model CAIC = 128.02
Saturated CAIC = 175.21
Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.98
Parsimony Normed Fit Index (PNFI) = 0.56
Comparative Fit Index (CFI) = 0.99
Incremental Fit Index (IFI) = 0.99
Relative Fit Index (RFI) = 0.96
Critical N (CN) = 183.42
Root Mean Square Residual (RMR) = 0.037
Standardized RMR = 0.038
Goodness of Fit Index (GFI) = 0.96
Adjusted Goodness of Fit Index (AGFI) = 0.91
Parsimony Goodness of Fit Index (PGFI) = 0.41

APPENDIX E1

WHAT IS HAPPENING IN THE CLASS

KARŞILAŞTIRMALI ÖĞRENME ORTAMI ANKETİ

	Yönerge: Bu anket sınıfınızdaki öğrenme ortamını başarınızdaki değişim ile ilişkilendirmek için kullanılacaktır. ARAŞTIRMA AMACI DIŞINDA BAŞKA BİR AMAÇLA KULLANILMAYACAKTIR. Bu sebeple samimi cevap vermeniz beklenmektedir. Fizik Dersinde;	**Hareket konularından ÖNCE**					**Hareket konularından SÜRECİNDE**				
		Hiçbir zaman	Nadiren	Bazen	Genelde	Her zaman	Hiçbir zaman	Nadiren	Bazen	Genelde	Her zaman
1	Sınıfımdaki öğrenciler ile yakın arkadaşlık kurarım.	O	O	O	O	O	O	O	O	O	O
2	Sınıfımdaki diğer öğrencileri yakından tanıyorum.	O	O	O	O	O	O	O	O	O	O
3	Bu sınıftaki öğrenciler ile uyum içindeyim.	O	O	O	O	O	O	O	O	O	O
4	Sınıftaki herkes arkadaşımdır.	O	O	O	O	O	O	O	O	O	O
5	Bu sınıftaki diğer öğrencilerle birlikte çalışırım.	O	O	O	O	O	O	O	O	O	O
6	Derslerinde zorluk çeken arkadaşlarıma yardım ederim.	O	O	O	O	O	O	O	O	O	O
7	Sınıftaki diğer öğrenciler beni severler.	O	O	O	O	O	O	O	O	O	O
8	Sınıftaki arkadaşlarımdan yardım alırım.	O	O	O	O	O	O	O	O	O	O
9	Öğretmen benim ile kişisel olarak ilgilenir.	O	O	O	O	O	O	O	O	O	O
10	Öğretmen bana yardım etmek için ders işleme şeklini değiştirebilir.	O	O	O	O	O	O	O	O	O	O
11	Öğretmen benim duygularımı dikkate alır.	O	O	O	O	O	O	O	O	O	O

12	Öğretmen, derslerle ilgili bir problemim olduğunda bana yardımcı olur.	O	O	O	O	O	O	O	O	O	O
13	Öğretmen benimle diyalog kurar.	O	O	O	O	O	O	O	O	O	O
14	Öğretmen benim problemlerimle ilgilenir.	O	O	O	O	O	O	O	O	O	O
15	Öğretmen sınıf içinde benim ile konuşmak için yanıma gelir.	O	O	O	O	O	O	O	O	O	O
16	Öğretmen sorduğu sorularla konuları kavramama yardımcı olur.	O	O	O	O	O	O	O	O	O	O
17	Sınıfta fikirlerimi rahatlıkla tartışabilirim.	O	O	O	O	O	O	O	O	O	O
18	Sınıf tartışmalarında fikirlerimi rahatça söyleyebilirim.	O	O	O	O	O	O	O	O	O	O
19	Öğretmen bana sorular sorar.	O	O	O	O	O	O	O	O	O	O
20	Fikirlerim ve önerilerim sınıf tartışmalarında kullanılır.	O	O	O	O	O	O	O	O	O	O
21	Öğretmene sorular sorarım.	O	O	O	O	O	O	O	O	O	O
22	Diğer öğrencilere fikirlerimi açıklarım.	O	O	O	O	O	O	O	O	O	O
23	Sınıftaki arkadaşlarım, derste çözemedikleri problemler konusunda benim ile görüşürler.	O	O	O	O	O	O	O	O	O	O
24	Sınıfta problemleri nasıl çözdüğüm açıklamam istenir.	O	O	O	O	O	O	O	O	O	O
25	Fikirlerimin doğruluğundan emin olmak için araştırmalar yaparım.	O	O	O	O	O	O	O	O	O	O
26	Söylediklerimi destekleyen veriler bulmam istenir.	O	O	O	O	O	O	O	O	O	O
27	Tartışmalarda ortaya çıkan problemleri çözmek için araştırmalar yaparım.	O	O	O	O	O	O	O	O	O	O
28	Söylenen ifadelerin, şekillerin ve grafiklerin	O	O	O	O	O	O	O	O	O	O

	anlamını açıklarım.										
29	Kafamı karıştıran konuları cevaplayabilmek için araştırmalar yaparım.	O	O	O	O	O	O	O	O	O	O
30	Öğretmenin sorularını cevaplamak için araştırmalar yaparım.	O	O	O	O	O	O	O	O	O	O
31	Araştırmalar yaparak soruların cevaplarını bulmaya çalışırım.	O	O	O	O	O	O	O	O	O	O
32	Araştırmalardan elde ettiğim bilgiler ile problemleri çözerim.	O	O	O	O	O	O	O	O	O	O
33	Çalışmaları sonuçlandırmak benim için önemlidir.	O	O	O	O	O	O	O	O	O	O
34	Çalışabildiğim kadar çalışırım.	O	O	O	O	O	O	O	O	O	O
35	Bu dersin amaçlarını biliyorum.	O	O	O	O	O	O	O	O	O	O
36	Ders başladığında derse hazır olurum.	O	O	O	O	O	O	O	O	O	O
37	Bu sınıfta neyi başarmak için çabaladığımı biliyorum.	O	O	O	O	O	O	O	O	O	O
38	Ders sırasında dikkatimi toparlamaya çalışırım.	O	O	O	O	O	O	O	O	O	O
39	Sınıftaki yapılan çalışmaları anlamaya çalışırım.	O	O	O	O	O	O	O	O	O	O
40	Ne kadar çalışmam gerektiğini bilirim.	O	O	O	O	O	O	O	O	O	O
41	Ödevlerimi yaparken diğer öğrencilerle işbirliği yaparım.	O	O	O	O	O	O	O	O	O	O
42	Ödevlerimi yaparken arkadaşlarımla kitap ve kaynaklarımı paylaşırım.	O	O	O	O	O	O	O	O	O	O
43	Sınıfta grup çalışmaları yapılırken iş bölümü yapılır.	O	O	O	O	O	O	O	O	O	O

44	Sınıfta verilen projelerde diğer öğrencilerle çalışırım.	O	O	O	O	O	O	O	O	O	O
45	Sınıftaki diğer öğrencilerden öğrendiğim şeyler olur.	O	O	O	O	O	O	O	O	O	O
46	Bu sınıfta diğer öğrenci arkadaşlarımla çalışırım.	O	O	O	O	O	O	O	O	O	O
47	Sınıf içi faaliyetlerde diğer öğrencilerle işbirliği yaparım.	O	O	O	O	O	O	O	O	O	O
48	Arkadaşlarım sınıftaki hedeflerine ulaşmak için benim ile çalışır.	O	O	O	O	O	O	O	O	O	O
49	Öğretmen sınıftaki diğer öğrencilerin verdiği cevaplara gösterdiği dikkati, benim cevaplarıma da gösterir.	O	O	O	O	O	O	O	O	O	O
50	Öğretmenden, diğer öğrencilerle aynı ölçüde yardım alırım.	O	O	O	O	O	O	O	O	O	O
51	Sınıftaki diğer öğrenciler ile aynı derecede söz hakkı alırım.	O	O	O	O	O	O	O	O	O	O
52	Bana sınıftaki diğer öğrencilerle aynı biçimde davranılır.	O	O	O	O	O	O	O	O	O	O
53	Sınıftaki diğer öğrenciler ile aynı derecede öğretmenden destek alırım.	O	O	O	O	O	O	O	O	O	O
54	Sınıf tartışmalarına katılmak için diğer öğrenciler ile aynı fırsatı elde ederim.	O	O	O	O	O	O	O	O	O	O
55	Çalışmalarım sınıftaki diğer öğrenciler ile aynı miktarda takdir edilir.	O	O	O	O	O	O	O	O	O	O
56	Sınıftaki diğer öğrenciler ile aynı derecede soruları cevaplama imkanı elde ederim.	O	O	O	O	O	O	O	O	O	O

APPENDIX E2

CONFIRMATORY FACTOR ANALYSIS OF WIHIC WITH PRE RESULTS

STEP 1

DATE: 4/30/2013
TIME: 23:27
LISREL 8.80 (STUDENT EDITION)
BY
Karl G. Jöreskog and Dag Sörbom
This program is published exclusively by
Scientific Software International, Inc.
7383 N. Lincoln Avenue, Suite 100
Lincolnwood, IL 60712, U.S.A.
Phone: (800)247-6113, (847)675-0720, Fax: (847)675-2140

Website: www.ssicentral.com

The following lines were read from file C:\Documents and Settings\huri\Belgelerim\sahin\pre_wihic\cfapre.SPJ:

Latent Variables wihic
Relationships
PRESRCO = wihic
PRETESU = wihic
PREINT = wihic
PREINN = wihic
PRETAOR = wihic
PRECOOP = wihic
PREEQU = wihic
Path Diagram
End of Problem

Sample Size = 191

Covariance Matrix

	PRESRCO	PRETESU	PREINT	PREINN	PRETAOR	PRECOOP
PRESRCO	0.90					
PRETESU	0.36	1.51				
PREINT	0.53	0.85	1.16			
PREINN	0.36	0.67	0.66	1.17		
PRETAOR	0.35	0.43	0.57	0.77	1.12	
PRECOOP	0.51	0.64	0.72	0.82	0.78	1.38
PREEQU	0.43	0.45	0.57	0.68	0.76	0.63

Covariance Matrix

	PREEQU
PREEQU	1.23

Number of Iterations = 9

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESRCO = 0.50*wihic, Errorvar.= 0.64 , Rý = 0.28
(0.067) (0.069)
7.46 9.28

PRETESU = 0.73*wihic, Errorvar.= 0.98 , Rý = 0.35
(0.085) (0.11)
8.53 9.10

PREINT = 0.79*wihic, Errorvar.= 0.53 , Rý = 0.54
(0.070) (0.064)
11.31 8.31

PREINN = 0.88*wihic, Errorvar.= 0.39 , Rý = 0.67
(0.067) (0.053)
13.19 7.27

PRETAOR = 0.82*wihic, Errorvar.= 0.45 , Rý = 0.60
(0.067) (0.057)
12.22 7.89

PRECOOP = 0.92*wihic, Errorvar.= 0.54 , Rý = 0.61
(0.074) (0.069)
12.30 7.84

PREEQU = 0.77*wihic, Errorvar.= 0.63 , Rý = 0.48
(0.074) (0.074)
10.49 8.61

Correlation Matrix of Independent Variables

	wihic
wihic	1.00

Goodness of Fit Statistics

Degrees of Freedom = 14

Minimum Fit Function Chi-Square = 88.49 (P = 0.00)

Normal Theory Weighted Least Squares Chi-Square = 88.53 (P = 0.00)

Estimated Non-centrality Parameter (NCP) = 74.53

90 Percent Confidence Interval for NCP = (48.49 ; 108.07)

Minimum Fit Function Value = 0.47

Population Discrepancy Function Value (F0) = 0.39

90 Percent Confidence Interval for F0 = (0.26 ; 0.57)

Root Mean Square Error of Approximation (RMSEA) = 0.17

90 Percent Confidence Interval for RMSEA = (0.14 ; 0.20)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00

Expected Cross-Validation Index (ECVI) = 0.61

90 Percent Confidence Interval for ECVI = (0.48 ; 0.79)

ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.51
Chi-Square for Independence Model with 21 Degrees of Freedom = 1032.61
Independence AIC = 1046.61
Model AIC = 116.53
Saturated AIC = 56.00
Independence CAIC = 1076.37
Model CAIC = 176.06
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.91
Non-Normed Fit Index (NNFI) = 0.89
Parsimony Normed Fit Index (PNFI) = 0.61
Comparative Fit Index (CFI) = 0.93
Incremental Fit Index (IFI) = 0.93
Relative Fit Index (RFI) = 0.87
Critical N (CN) = 63.58
Root Mean Square Residual (RMR) = 0.081
Standardized RMR = 0.066
Goodness of Fit Index (GFI) = 0.88
Adjusted Goodness of Fit Index (AGFI) = 0.77
Parsimony Goodness of Fit Index (PGFI) = 0.44
The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREINT	PRESRCO	11.6	0.16
PREINT	PRETESU	37.0	0.36
PREINN	PRESRCO	8.3	-0.13
PRETAOR	PRETESU	16.4	-0.23
PRETAOR	PREINT	9.2	-0.14
PREEQU	PRETAOR	16.0	0.19

STEP 2

Covariance Matrix

	PRESRCO	PRETESU	PREINT	PREINN	PRETAOR	PRECOOP
PRESRCO	0.90					
PRETESU	0.36	1.51				
PREINT	0.53	0.85	1.16			
PREINN	0.36	0.67	0.66	1.17		
PRETAOR	0.35	0.43	0.57	0.77	1.12	
PRECOOP	0.51	0.64	0.72	0.82	0.78	1.38
PREEQU	0.43	0.45	0.57	0.68	0.76	0.63

Covariance Matrix (continued)

	PREEQU
PREEQU	1.23

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESRCO = 0.48*wihic, Errorvar.= 0.66 , R^2 = 0.26

(0.067) (0.070)
7.23 9.39
PRETESU = 0.79*wihic, Errorvar.= 0.89 , R^2 = 0.41
(0.085) (0.10)
9.30 8.69
PREINT = 0.80*wihic, Errorvar.= 0.52 , R^2 = 0.55
(0.069) (0.061)
11.56 8.49
PREINN = 0.88*wihic, Errorvar.= 0.40 , R^2 = 0.66
(0.067) (0.052)
13.19 7.70
PRETAOR = 0.85*wihic, Errorvar.= 0.40 , R^2 = 0.64
(0.067) (0.054)
12.72 7.40
PRECOOP = 0.90*wihic, Errorvar.= 0.57 , R^2 = 0.59
(0.074) (0.069)
12.07 8.29
PREEQU = 0.77*wihic, Errorvar.= 0.64 , R^2 = 0.48
(0.073) (0.073)
10.48 8.82
Error Covariance for PRETAOR and PRETESU = -0.23
(0.054)
-4.38

Correlation Matrix of Independent Variables

wihic
1.00

Goodness of Fit Statistics

Degrees of Freedom = 13
Minimum Fit Function Chi-Square = 69.69 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 65.87 (P = 0.00)
Chi-Square Difference with 1 Degree of Freedom = 22.66 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 52.87
90 Percent Confidence Interval for NCP = (31.18 ; 82.08)
Minimum Fit Function Value = 0.37
Population Discrepancy Function Value (F0) = 0.28
90 Percent Confidence Interval for F0 = (0.16 ; 0.43)
Root Mean Square Error of Approximation (RMSEA) = 0.15
90 Percent Confidence Interval for RMSEA = (0.11 ; 0.18)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00
Expected Cross-Validation Index (ECVI) = 0.50
90 Percent Confidence Interval for ECVI = (0.39 ; 0.66)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.51
Chi-Square for Independence Model with 21 Degrees of Freedom = 1032.61
Independence AIC = 1046.61
Model AIC = 95.87
Saturated AIC = 56.00

Independence CAIC = 1076.37
Model CAIC = 159.65
Saturated CAIC = 175.06

Normed Fit Index (NFI) = 0.93
Non-Normed Fit Index (NNFI) = 0.91
Parsimony Normed Fit Index (PNFI) = 0.58
Comparative Fit Index (CFI) = 0.94
Incremental Fit Index (IFI) = 0.94
Relative Fit Index (RFI) = 0.89
Critical N (CN) = 76.49
Root Mean Square Residual (RMR) = 0.073
Standardized RMR = 0.060
Goodness of Fit Index (GFI) = 0.91
Adjusted Goodness of Fit Index (AGFI) = 0.81
Parsimony Goodness of Fit Index (PGFI) = 0.42

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREINT	PRESRCO	12.9	0.17
PREINT	PRETESU	22.7	0.29
PREEQU	PRETAOR	8.6	0.14

STEP 3

Covariance Matrix

	PRESRCO	PRETESU	PREINT	PREINN	PRETAOR	PRECOOP
PRESRCO	0.90					
PRETESU	0.36	1.51				
PREINT	0.53	0.85	1.16			
PREINN	0.36	0.67	0.66	1.17		
PRETAOR	0.35	0.43	0.57	0.77	1.12	
PRECOOP	0.51	0.64	0.72	0.82	0.78	1.38
PREEQU	0.43	0.45	0.57	0.68	0.76	0.63

Covariance Matrix (continued)

	PREEQU
PREEQU	1.23

Number of Iterations = 9

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESRCO = 0.48*wihic, Errorvar.= 0.66 , R^2 = 0.26
(0.068) (0.071)
7.14 9.33

PRETESU = 0.69*wihic, Errorvar.= 1.01 , R^2 = 0.32
(0.088) (0.11)
7.91 8.89

PREINT = 0.75*wihic, Errorvar.= 0.60 , R^2 = 0.48
(0.072) (0.070)
10.40 8.58
PREINN = 0.89*wihic, Errorvar.= 0.37 , R^2 = 0.68
(0.067) (0.053)
13.35 7.11
PRETAOR = 0.86*wihic, Errorvar.= 0.39 , R^2 = 0.65
(0.066) (0.053)
12.88 7.33
PRECOOP = 0.91*wihic, Errorvar.= 0.54 , R^2 = 0.60
(0.075) (0.069)
12.25 7.87
PREEQU = 0.78*wihic, Errorvar.= 0.62 , R^2 = 0.50
(0.073) (0.072)
10.71 8.54
Error Covariance for PREINT and PRETESU = 0.32
(0.071)
4.45
Error Covariance for PRETAOR and PRETESU = -0.12
(0.050)
-2.44

Correlation Matrix of Independent Variables

wihic
1.00

Goodness of Fit Statistics

Degrees of Freedom = 12
Minimum Fit Function Chi-Square = 45.61 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 46.02 (P = 0.00)
Chi-Square Difference with 1 Degree of Freedom = 19.85 (P = 0.00)
Estimated Non-centrality Parameter (NCP) = 34.02
90 Percent Confidence Interval for NCP = (16.87 ; 58.73)
Minimum Fit Function Value = 0.24
Population Discrepancy Function Value (F0) = 0.18
90 Percent Confidence Interval for F0 = (0.089 ; 0.31)
Root Mean Square Error of Approximation (RMSEA) = 0.12
90 Percent Confidence Interval for RMSEA = (0.086 ; 0.16)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00096
Expected Cross-Validation Index (ECVI) = 0.41
90 Percent Confidence Interval for ECVI = (0.32 ; 0.54)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.51
Chi-Square for Independence Model with 21 Degrees of Freedom = 1032.61
Independence AIC = 1046.61
Model AIC = 78.02
Saturated AIC = 56.00
Independence CAIC = 1076.37
Model CAIC = 146.06

Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.96
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.55
Comparative Fit Index (CFI) = 0.97
Incremental Fit Index (IFI) = 0.97
Relative Fit Index (RFI) = 0.92
Critical N (CN) = 110.22
Root Mean Square Residual (RMR) = 0.053
Standardized RMR = 0.048
Goodness of Fit Index (GFI) = 0.94
Adjusted Goodness of Fit Index (AGFI) = 0.85
Parsimony Goodness of Fit Index (PGFI) = 0.40

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREINT	**PRESRCO**	17.4	0.18
PREEQU	**PRETAOR**	9.2	0.15

STEP 4

Covariance Matrix

	PRESRCO	PRETESU	PREINT	PREINN	PRETAOR	PRECOOP
PRESRCO	0.90					
PRETESU	0.36	1.51				
PREINT	0.53	0.85	1.16			
PREINN	0.36	0.67	0.66	1.17		
PRETAOR	0.35	0.43	0.57	0.77	1.12	
PRECOOP	0.51	0.64	0.72	0.82	0.78	1.38
PREEQU	0.43	0.45	0.57	0.68	0.76	0.63

Covariance Matrix (continued)

	PREEQU
PREEQU	1.23

Number of Iterations = 5

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESRCO = 0.46*wihic, Errorvar.= 0.68 , R^2 = 0.23
(0.068) (0.073)
6.74 9.38

PRETESU = 0.70*wihic, Errorvar.= 1.00 , R^2 = 0.33
(0.087) (0.11)
7.97 8.87

PREINT = 0.72*wihic, Errorvar.= 0.63 , R^2 = 0.45
(0.072) (0.071)
10.02 8.89

PREINN = 0.90*wihic, Errorvar.= 0.36 , R^2 = 0.69
(0.067) (0.052)

13.48 6.98
PRETAOR = 0.87*wihic, Errorvar.= 0.37 , R^2 = 0.67
(0.066) (0.053)
13.10 7.06
PRECOOP = 0.91*wihic, Errorvar.= 0.56 , R^2 = 0.60
(0.075) (0.070)
12.11 7.94
PREEQU = 0.78*wihic, Errorvar.= 0.62 , R^2 = 0.50
(0.073) (0.072)
10.69 8.55
Error Covariance for PREINT and PRESRCO = 0.19
(0.048)
3.93
Error Covariance for PREINT and PRETESU = 0.32
(0.068)
4.71
Error Covariance for PRETAOR and PRETESU = -0.15
(0.049)
-2.96

Correlation Matrix of Independent Variables

wihic
1.00

Goodness of Fit Statistics

Degrees of Freedom = 11
Minimum Fit Function Chi-Square = 27.56 (P = 0.0038)
Normal Theory Weighted Least Squares Chi-Square = 25.11 (P = 0.0088)
Chi-Square Difference with 1 Degree of Freedom = 20.91 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 14.11
90 Percent Confidence Interval for NCP = (3.23 ; 32.69)
Minimum Fit Function Value = 0.15
Population Discrepancy Function Value (F0) = 0.074
90 Percent Confidence Interval for F0 = (0.017 ; 0.17)
Root Mean Square Error of Approximation (RMSEA) = 0.082
90 Percent Confidence Interval for RMSEA = (0.039 ; 0.13)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.097
Expected Cross-Validation Index (ECVI) = 0.31
90 Percent Confidence Interval for ECVI = (0.25 ; 0.41)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.51
Chi-Square for Independence Model with 21 Degrees of Freedom = 1032.61
Independence AIC = 1046.61
Model AIC = 59.11
Saturated AIC = 56.00
Independence CAIC = 1076.37
Model CAIC = 131.40
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.97

Non-Normed Fit Index (NNFI) = 0.97
Parsimony Normed Fit Index (PNFI) = 0.51
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.95
Critical N (CN) = 171.47
Root Mean Square Residual (RMR) = 0.044
Standardized RMR = 0.037
Goodness of Fit Index (GFI) = 0.96
Adjusted Goodness of Fit Index (AGFI) = 0.91
Parsimony Goodness of Fit Index (PGFI) = 0.38

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
PREEQU	PRETAOR	8.1	0.14

STEP 5

Covariance Matrix

	PRESRCO	PRETESU	PREINT	PREINN	PRETAOR	PRECOOP
PRESRCO	0.90					
PRETESU	0.36	1.51				
PREINT	0.53	0.85	1.16			
PREINN	0.36	0.67	0.66	1.17		
PRETAOR	0.35	0.43	0.57	0.77	1.12	
PRECOOP	0.51	0.64	0.72	0.82	0.78	1.38
PREEQU	0.43	0.45	0.57	0.68	0.76	0.63

Covariance Matrix (continued)

	PREEQU
PREEQU	1.23

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

PRESRCO = 0.46*wihic, Errorvar.= 0.68 , R^2 = 0.24
(0.069) (0.073)
6.70 9.32

PRETESU = 0.70*wihic, Errorvar.= 1.00 , R^2 = 0.33
(0.087) (0.11)
8.05 8.87

PREINT = 0.73*wihic, Errorvar.= 0.62 , R^2 = 0.47
(0.072) (0.071)
10.14 8.72

PREINN = 0.91*wihic, Errorvar.= 0.34 , R^2 = 0.71
(0.067) (0.054)
13.57 6.34

PRETAOR = 0.83*wihic, Errorvar.= 0.42 , R^2 = 0.62
(0.068) (0.059)

12.25 7.20
PRECOOP = 0.92*wihic, Errorvar.= 0.52 , R^2 = 0.62
(0.075) (0.070)
12.36 7.48
PREEQU = 0.73*wihic, Errorvar.= 0.69 , R^2 = 0.44
(0.076) (0.082)
9.60 8.42
Error Covariance for PREINT and PRESRCO = 0.18
(0.048)
3.81
Error Covariance for PREINT and PRETESU = 0.32
(0.068)
4.68
Error Covariance for PRETAOR and PRETESU = -0.12
(0.047)
-2.55
Error Covariance for PREEQU and PRETAOR = 0.14
(0.053)
2.58

Correlation Matrix of Independent Variables

wihic
1.00

Goodness of Fit Statistics

Degrees of Freedom = 10
Minimum Fit Function Chi-Square = 19.88 (P = 0.030)
Normal Theory Weighted Least Squares Chi-Square = 18.19 (P = 0.052)
Chi-Square Difference with 1 Degree of Freedom = 6.92 (P = 0.0085)
Estimated Non-centrality Parameter (NCP) = 8.19
90 Percent Confidence Interval for NCP = (0.0 ; 24.22)
Minimum Fit Function Value = 0.10
Population Discrepancy Function Value (F0) = 0.043
90 Percent Confidence Interval for F0 = (0.0 ; 0.13)
Root Mean Square Error of Approximation (RMSEA) = 0.066
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.11)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.26
Expected Cross-Validation Index (ECVI) = 0.29
90 Percent Confidence Interval for ECVI = (0.24 ; 0.37)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 5.51
Chi-Square for Independence Model with 21 Degrees of Freedom = 1032.61
Independence AIC = 1046.61
Model AIC = 54.19
Saturated AIC = 56.00
Independence CAIC = 1076.37
Model CAIC = 130.73
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.98

Non-Normed Fit Index (NNFI) = 0.98
Parsimony Normed Fit Index (PNFI) = 0.47
Comparative Fit Index (CFI) = 0.99
Incremental Fit Index (IFI) = 0.99
Relative Fit Index (RFI) = 0.96
Critical N (CN) = 222.80
Root Mean Square Residual (RMR) = 0.036
Standardized RMR = 0.032
Goodness of Fit Index (GFI) = 0.97
Adjusted Goodness of Fit Index (AGFI) = 0.93
Parsimony Goodness of Fit Index (PGFI) = 0.35

APPENDIX E3

CONFIRMATORY FACTOR ANALYSIS OF WIHIC WITH POST RESULTS

STEP 1

DATE: 4/30/2013
TIME: 23:37
LISREL 8.80 (STUDENT EDITION)
BY
Karl G. Jöreskog and Dag Sörbom
This program is published exclusively by
Scientific Software International, Inc.
7383 N. Lincoln Avenue, Suite 100
Lincolnwood, IL 60712, U.S.A.
Phone: (800)247-6113, (847)675-0720, Fax: (847)675-2140

Website: www.ssicentral.com

The following lines were read from file **C:\Documents and Settings\huri\Belgelerim\sahin\post_wihic\cfapath.SPJ:**

Latent Variables wihic
Relationships
POSRCO = wihic
POTESU = wihic
POINT = wihic
POINN = wihic
POTAOR = wihic
POCOOP = wihic
POEQU = wihic
Path Diagram
End of Problem
Sample Size = 191

Covariance Matrix

	POSRCO	POTESU	POINT	POINN	POTAOR	POCOOP
POSRCO	1.06					
POTESU	0.59	1.52				
POINT	0.71	0.96	1.28			
POINN	0.61	0.84	0.92	1.31		
POTAOR	0.62	0.63	0.83	0.93	1.28	
POCOOP	0.70	0.76	0.93	1.03	0.90	1.40

POEQU 0.55 0.68 0.81 0.85 0.97 0.82

Covariance Matrix

	POEQU
POEQU	1.29

Number of Iterations = 7

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSRCO = 0.68*wihic, Errorvar.= 0.60 , Rý = 0.43
(0.068) (0.065)
9.94 9.16

POTESU = 0.83*wihic, Errorvar.= 0.84 , Rý = 0.45
(0.081) (0.092)
10.19 9.12

POINT = 0.95*wihic, Errorvar.= 0.37 , Rý = 0.71
(0.067) (0.047)
14.10 7.85

POINN = 0.99*wihic, Errorvar.= 0.33 , Rý = 0.75
(0.067) (0.045)
14.69 7.46

POTAOR = 0.93*wihic, Errorvar.= 0.42 , Rý = 0.67
(0.069) (0.051)
13.54 8.15

POCOOP = 0.99*wihic, Errorvar.= 0.43 , Rý = 0.70
(0.071) (0.054)
13.89 7.97

POEQU = 0.88*wihic, Errorvar.= 0.52 , Rý = 0.60
(0.071) (0.060)
12.42 8.59

Correlation Matrix of Independent Variables

	wihic
wihic	1.00

Goodness of Fit Statistics

Degrees of Freedom = 14

Minimum Fit Function Chi-Square = 74.03 (P = 0.00)

Normal Theory Weighted Least Squares Chi-Square = 74.36 (P = 0.00)

Estimated Non-centrality Parameter (NCP) = 60.36

90 Percent Confidence Interval for NCP = (37.02 ; 91.21)

Minimum Fit Function Value = 0.39

Population Discrepancy Function Value (F0) = 0.32

90 Percent Confidence Interval for F0 = (0.19 ; 0.48)

Root Mean Square Error of Approximation (RMSEA) = 0.15

90 Percent Confidence Interval for RMSEA = (0.12 ; 0.19)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00

Expected Cross-Validation Index (ECVI) = 0.54
90 Percent Confidence Interval for ECVI = (0.42 ; 0.70)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 8.02

Chi-Square for Independence Model with 21 Degrees of Freedom = 1510.60
Independence AIC = 1524.60
Model AIC = 102.36
Saturated AIC = 56.00
Independence CAIC = 1554.37
Model CAIC = 161.89
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.94
Parsimony Normed Fit Index (PNFI) = 0.63
Comparative Fit Index (CFI) = 0.96
Incremental Fit Index (IFI) = 0.96
Relative Fit Index (RFI) = 0.93
Critical N (CN) = 75.80
Root Mean Square Residual (RMR) = 0.060
Standardized RMR = 0.045
Goodness of Fit Index (GFI) = 0.90
Adjusted Goodness of Fit Index (AGFI) = 0.80
Parsimony Goodness of Fit Index (PGFI) = 0.45
The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POINT	POTESU	24.6	0.24
POTAOR	POTESU	13.8	-0.18
POEQU	POTAOR	32.0	0.23

STEP 2

Covariance Matrix

	POSRCO	POTESU	POINT	POINN	POTAOR	POCOOP
POSRCO	1.06					
POTESU	0.59	1.52				
POINT	0.71	0.96	1.28			
POINN	0.61	0.84	0.92	1.31		
POTAOR	0.62	0.63	0.83	0.93	1.28	
POCOOP	0.70	0.76	0.93	1.03	0.90	1.40
POEQU	0.55	0.68	0.81	0.85	0.97	0.82

Covariance Matrix (continued)

	POEQU
POEQU	1.29

Number of Iterations = 7

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSRCO = 0.68*wihic, Errorvar.= 0.59 , R^2 = 0.44

(0.068) (0.065)
10.03 9.09
POTESU = 0.85*wihic, Errorvar.= 0.81 , R^2 = 0.47
(0.081) (0.090)
10.46 9.00
POINT = 0.96*wihic, Errorvar.= 0.35 , R^2 = 0.73
(0.067) (0.047)
14.33 7.47
POINN = 0.99*wihic, Errorvar.= 0.33 , R^2 = 0.75
(0.067) (0.046)
14.70 7.17
POTAOR = 0.89*wihic, Errorvar.= 0.49 , R^2 = 0.62
(0.070) (0.058)
12.67 8.32
POCOOP = 1.00*wihic, Errorvar.= 0.41 , R^2 = 0.71
(0.071) (0.053)
14.02 7.69
POEQU = 0.83*wihic, Errorvar.= 0.60 , R^2 = 0.54
(0.073) (0.069)
11.45 8.68
Error Covariance for POEQU and POTAOR = 0.23
(0.050)
4.60

Correlation Matrix of Independent Variables

	wihic
wihic	1.00

Goodness of Fit Statistics

Degrees of Freedom = 13
Minimum Fit Function Chi-Square = 43.49 (P = 0.00)
Normal Theory Weighted Least Squares Chi-Square = 44.42 (P = 0.00)
Chi-Square Difference with 1 Degree of Freedom = 29.94 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 31.42
90 Percent Confidence Interval for NCP = (14.83 ; 55.59)
Minimum Fit Function Value = 0.23
Population Discrepancy Function Value (F0) = 0.17
90 Percent Confidence Interval for F0 = (0.078 ; 0.29)
Root Mean Square Error of Approximation (RMSEA) = 0.11
90 Percent Confidence Interval for RMSEA = (0.077 ; 0.15)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.0027
Expected Cross-Validation Index (ECVI) = 0.39
90 Percent Confidence Interval for ECVI = (0.30 ; 0.52)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 8.02
Chi-Square for Independence Model with 21 Degrees of Freedom = 1510.60
Independence AIC = 1524.60
Model AIC = 74.42

Saturated AIC = 56.00
Independence CAIC = 1554.37
Model CAIC = 138.20
Saturated CAIC = 175.06

Normed Fit Index (NFI) = 0.97
Non-Normed Fit Index (NNFI) = 0.97
Parsimony Normed Fit Index (PNFI) = 0.60
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.95
Critical N (CN) = 121.96
Root Mean Square Residual (RMR) = 0.046
Standardized RMR = 0.034
Goodness of Fit Index (GFI) = 0.94
Adjusted Goodness of Fit Index (AGFI) = 0.87
Parsimony Goodness of Fit Index (PGFI) = 0.44

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POINT	POTESU	20.9	0.22
POTAOR	POTESU	9.1	-0.14

STEP 3

Covariance Matrix

	POSRCO	POTESU	POINT	POINN	POTAOR	POCOOP
POSRCO	1.06					
POTESU	0.59	1.52				
POINT	0.71	0.96	1.28			
POINN	0.61	0.84	0.92	1.31		
POTAOR	0.62	0.63	0.83	0.93	1.28	
POCOOP	0.70	0.76	0.93	1.03	0.90	1.40
POEQU	0.55	0.68	0.81	0.85	0.97	0.82

Covariance Matrix (continued)

	POEQU
POEQU	1.29

Number of Iterations = 6

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSRCO = 0.68*wihic, Errorvar.= 0.60 , R^2 = 0.43
(0.068) (0.066)
9.90 9.06

POTESU = 0.79*wihic, Errorvar.= 0.90 , R^2 = 0.41
(0.083) (0.100)
9.47 9.03

POINT = 0.93*wihic, Errorvar.= 0.40 , R^2 = 0.68
(0.069) (0.052)
13.63 7.75

POINN = 1.00*wihic, Errorvar.= 0.31 , R^2 = 0.76

(0.067) (0.046)
14.85 6.79
POTAOR = 0.91*wihic, Errorvar.= 0.46 , R^2 = 0.64
(0.070) (0.057)
12.95 8.08
POCOOP = 1.01*wihic, Errorvar.= 0.38 , R^2 = 0.73
(0.071) (0.052)
14.29 7.30
POEQU = 0.84*wihic, Errorvar.= 0.59 , R^2 = 0.54
(0.073) (0.069)
11.49 8.57
Error Covariance for POINT and POTESU = 0.22
(0.056)
3.95
Error Covariance for POEQU and POTAOR = 0.21
(0.049)
4.34

Correlation Matrix of Independent Variables

	wihic
wihic	1.00

Goodness of Fit Statistics

Degrees of Freedom = 12
Minimum Fit Function Chi-Square = 23.24 (P = 0.026)
Normal Theory Weighted Least Squares Chi-Square = 21.86 (P = 0.039)
Chi-Square Difference with 1 Degree of Freedom = 22.56 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 9.86
90 Percent Confidence Interval for NCP = (0.48 ; 27.03)
Minimum Fit Function Value = 0.12
Population Discrepancy Function Value (F0) = 0.052
90 Percent Confidence Interval for F0 = (0.0025 ; 0.14)
Root Mean Square Error of Approximation (RMSEA) = 0.066
90 Percent Confidence Interval for RMSEA = (0.015 ; 0.11)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.25
Expected Cross-Validation Index (ECVI) = 0.28
90 Percent Confidence Interval for ECVI = (0.23 ; 0.37)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 8.02
Chi-Square for Independence Model with 21 Degrees of Freedom = 1510.60
Independence AIC = 1524.60
Model AIC = 53.86
Saturated AIC = 56.00
Independence CAIC = 1554.37
Model CAIC = 121.90
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.98
Non-Normed Fit Index (NNFI) = 0.99
Parsimony Normed Fit Index (PNFI) = 0.56

Comparative Fit Index (CFI) = 0.99
Incremental Fit Index (IFI) = 0.99
Relative Fit Index (RFI) = 0.97
Critical N (CN) = 215.35
Root Mean Square Residual (RMR) = 0.032
Standardized RMR = 0.026
Goodness of Fit Index (GFI) = 0.97
Adjusted Goodness of Fit Index (AGFI) = 0.93
Parsimony Goodness of Fit Index (PGFI) = 0.41

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
POINN	POSRCO	8.8	-0.12

STEP 4

Covariance Matrix

	POSRCO	POTESU	POINT	POINN	POTAOR	POCOOP
POSRCO	1.06					
POTESU	0.59	1.52				
POINT	0.71	0.96	1.28			
POINN	0.61	0.84	0.92	1.31		
POTAOR	0.62	0.63	0.83	0.93	1.28	
POCOOP	0.70	0.76	0.93	1.03	0.90	1.40
POEQU	0.55	0.68	0.81	0.85	0.97	0.82

Covariance Matrix (continued)

	POEQU
POEQU	1.29

Number of Iterations = 5

LISREL Estimates (Maximum Likelihood)

Measurement Equations

POSRCO = 0.72*wihic, Errorvar.= 0.54 , R^2 = 0.48
(0.068) (0.064)
10.45 8.52

POTESU = 0.79*wihic, Errorvar.= 0.89 , R^2 = 0.41
(0.083) (0.098)
9.61 9.15

POINT = 0.93*wihic, Errorvar.= 0.41 , R^2 = 0.68
(0.068) (0.051)
13.58 8.06

POINN = 1.02*wihic, Errorvar.= 0.27 , R^2 = 0.79
(0.067) (0.045)
15.26 6.00

POTAOR = 0.90*wihic, Errorvar.= 0.47 , R^2 = 0.63
(0.070) (0.057)
12.85 8.39

POCOOP = 1.00*wihic, Errorvar.= 0.40 , R^2 = 0.71
(0.071) (0.052)

14.15 7.72
POEQU = 0.83*wihic, Errorvar.= 0.61 , R^2 = 0.53
(0.073) (0.069)
11.34 8.82
Error Covariance for POINT and POTESU = 0.22
(0.054)
4.05
Error Covariance for POINN and POSRCO = -0.12
(0.038)
-3.23
Error Covariance for POEQU and POTAOR = 0.23
(0.049)
4.69

Correlation Matrix of Independent Variables

wihic
1.00

Goodness of Fit Statistics

Degrees of Freedom = 11
Minimum Fit Function Chi-Square = 13.51 (P = 0.26)
Normal Theory Weighted Least Squares Chi-Square = 12.95 (P = 0.30)
Chi-Square Difference with 1 Degree of Freedom = 8.91 (P = 0.0028)
Estimated Non-centrality Parameter (NCP) = 1.95
90 Percent Confidence Interval for NCP = (0.0 ; 15.20)
Minimum Fit Function Value = 0.071
Population Discrepancy Function Value (F0) = 0.010
90 Percent Confidence Interval for F0 = (0.0 ; 0.080)
Root Mean Square Error of Approximation (RMSEA) = 0.031
90 Percent Confidence Interval for RMSEA = (0.0 ; 0.085)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.66
Expected Cross-Validation Index (ECVI) = 0.25
90 Percent Confidence Interval for ECVI = (0.24 ; 0.32)
ECVI for Saturated Model = 0.29
ECVI for Independence Model = 8.02
Chi-Square for Independence Model with 21 Degrees of Freedom = 1510.60
Independence AIC = 1524.60
Model AIC = 46.95
Saturated AIC = 56.00
Independence CAIC = 1554.37
Model CAIC = 119.24
Saturated CAIC = 175.06
Normed Fit Index (NFI) = 0.99
Non-Normed Fit Index (NNFI) = 1.00
Parsimony Normed Fit Index (PNFI) = 0.52
Comparative Fit Index (CFI) = 1.00
Incremental Fit Index (IFI) = 1.00
Relative Fit Index (RFI) = 0.98
Critical N (CN) = 348.83

Root Mean Square Residual (RMR) = 0.025
Standardized RMR = 0.019
Goodness of Fit Index (GFI) = 0.98
Adjusted Goodness of Fit Index (AGFI) = 0.95
Parsimony Goodness of Fit Index (PGFI) = 0.39

APPENDIX F

OBSERVATION CHECK LIST OF INTERACTION

Observation Form about Interaction																			
Student: **Date:** **Setting:** **Observer:** **Start Time:** **Stop Time:**	*Interaction*																		
	Cognitive												*Physical*						
	How				*Whom*		Content				How		By using						
Fill the table in one minute intervals	*Ask*	Answer	*Comment*	*Give Example*	Teacher	Student	*Related with only CM*	*Related with both CM and concept*	*Related with only concept*	*Irrelevant to both concept and CM*	Sitting	Standing	CM	Others	Nothing				
Total number																			
Percent of observations																			

APPENDIX G

STUDENT QUESTIONNAIRE FOR COMPARING INTERACTIONS

Fizik dersinde ...	Hareket konularından **önce**					Hareket konuları **süresince**				
	Hiçbir zaman	Nadiren	Orta sıklıkta	Sık sık	Her zaman	Hiçbir zaman	Nadiren	Orta sıklıkta	Sık sık	Her zaman
Görme engelli arkadaşımız öğretmenin sorularına cevap verdi.	O	O	O	O	O	O	O	O	O	O
Görme engelli arkadaşımız öğretmene soru sordu.	O	O	O	O	O	O	O	O	O	O
Görme engelli arkadaşımız ders ile ilgili yorum yaptı.	O	O	O	O	O	O	O	O	O	O
Görme engelli arkadaşımız dersle ilgili örnek verdi.	O	O	O	O	O	O	O	O	O	O
Görme engelli arkadaşımız ders ile ilgili materyal kullandı.	O	O	O	O	O	O	O	O	O	O
Görme engelli arkadaşımız bedensel olarak aktifti.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım öğretmenin sorularına cevap verdi.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım öğretmene soru sordu.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım ders ile ilgili yorum yaptı.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım dersle ilgili örnek verdi.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım ders ile ilgili materyal kullandı.	O	O	O	O	O	O	O	O	O	O
Gören arkadaşlarım bedensel olarak aktifti.	O	O	O	O	O	O	O	O	O	O
Öğretmenin sorularına cevap verdim.	O	O	O	O	O	O	O	O	O	O
Öğretmene soru sordum.	O	O	O	O	O	O	O	O	O	O
Ders ile ilgili yorum yaptım.	O	O	O	O	O	O	O	O	O	O
Dersle ilgili örnek verdim.	O	O	O	O	O	O	O	O	O	O
Ders ile ilgili materyal kullandım.	O	O	O	O	O	O	O	O	O	O
Bedensel olarak aktiftim.	O	O	O	O	O	O	O	O	O	O

Sence hareket konuları ile birlikte fizik dersinde gören ve görmeyen öğrencilerin sınıfa katılımı ile ilgili neler değişti?

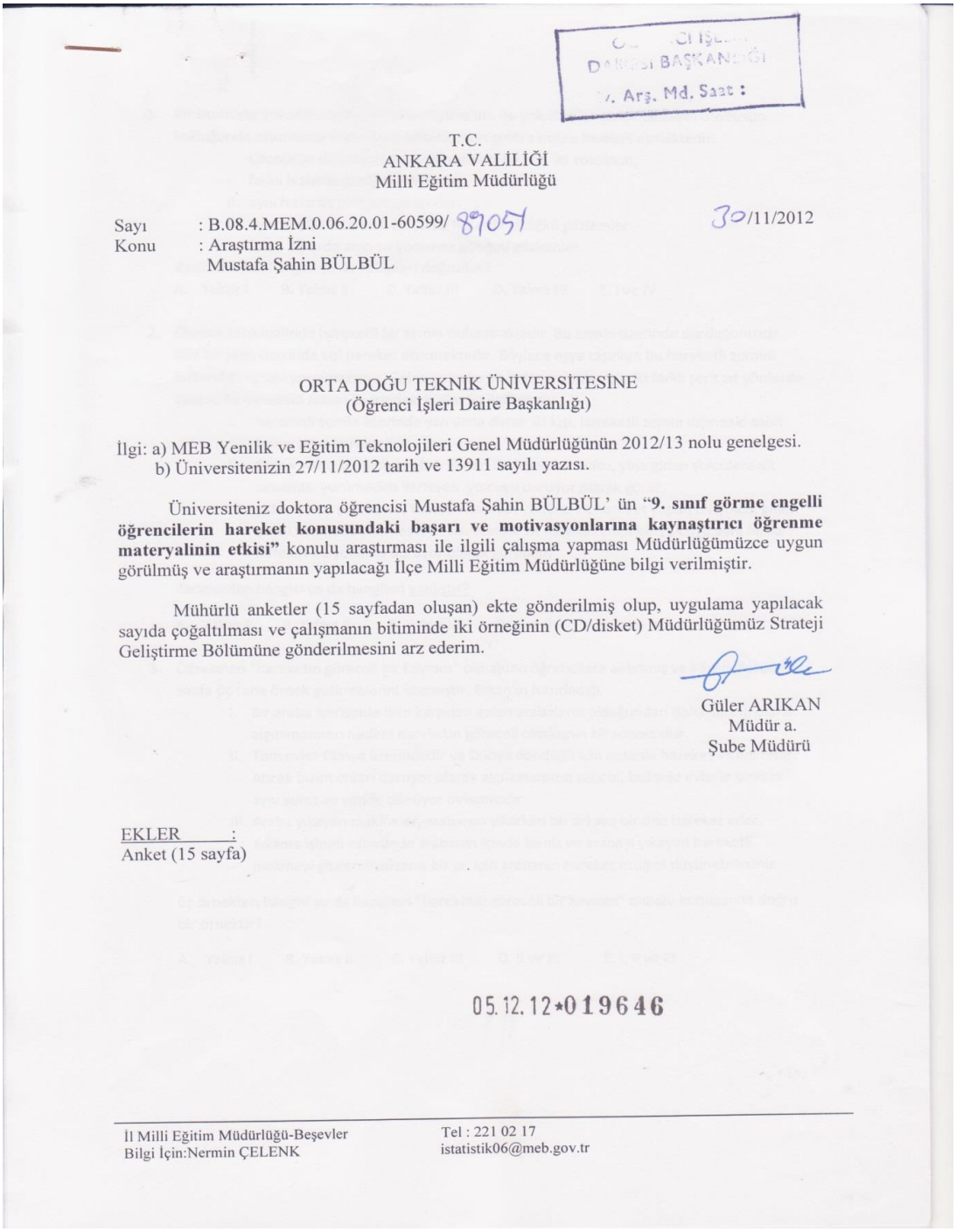
APPENDIX H

KEY WORDS USED IN THE LITERATURE REVIEW OF RELATED STUDIES

Special education + physics	Blind students + physics
Students with special needs + physics	Blind students + education
Inclusive education + physics	Visual impaired + physics

APPENDIX I

PERMISSION FROM NATIONAL MINISTERY OF EDUCATION



DAİRESİ BAŞKANLIĞI
Ar. Arş. Md. Saat :

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

Sayı : B.08.4.MEM.0.06.20.01-60599/ 89054 30/11/2012
Konu : Araştırma İzni
Mustafa Şahin BÜLBÜL

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE
(Öğrenci İşleri Daire Başkanlığı)

İlgi: a) MEB Yenilik ve Eğitim Teknolojileri Genel Müdürlüğünün 2012/13 nolu genelgesi.
b) Üniversitenizin 27/11/2012 tarih ve 13911 sayılı yazısı.

Üniversiteniz doktora öğrencisi Mustafa Şahin BÜLBÜL' ün **"9. sınıf görme engelli öğrencilerin hareket konusundaki başarı ve motivasyonlarına kaynaştırıcı öğrenme materyalinin etkisi"** konulu araştırması ile ilgili çalışma yapması Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Mühürlü anketler (15 sayfadan oluşan) ekte gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD/disket) Müdürlüğümüz Strateji Geliştirme Bölümüne gönderilmesini arz ederim.

Güler ARIKAN
Müdür a.
Şube Müdürü

EKLER :
Anket (15 sayfa)

05.12.12•019646

İl Milli Eğitim Müdürlüğü-Beşevler
Bilgi İçin:Nermin ÇELENK
Tel : 221 02 17
istatistik06@meb.gov.tr

APPENDIX J

OBSERVATION CHECKLIST: HOW DOES THE TEACHER USED ENRICHED COURSE MATERIALS

- ☐ **Control Group**
- ☐ **Experiment Group**

Class:

School:

CM Number	Used in the course	NOT used in the course	Used as planned	If not used as planned, explain why	Date
1st CM					
2nd CM					
3rd CM					
4th CM					
5th CM					
6th CM					
7th CM					
8th CM					
9th CM					
10th CM					
11th CM					

APPENDIX K

FREQUENCY TABLES OF EACH ITEM IN MAT, PRE-MAQ, POST-MAQ, SQET, AND SQCI

MATPRE1

		Frequency	Percent	Valid Percent	Cumulative Percent
		2	1,0	1,0	1,0
	A	54	28,3	28,3	29,3
	B	39	20,4	20,4	49,7
Valid	C	24	12,6	12,6	62,3
	D	26	13,6	13,6	75,9
	E	46	24,1	24,1	100,0
	Total	191	100,0	100,0	

MATPRE2

		Frequency	Percent	Valid Percent	Cumulative Percent
		1	,5	,5	,5
	A	17	8,9	8,9	9,4
	B	40	20,9	20,9	30,4
Valid	C	59	30,9	30,9	61,3
	D	43	22,5	22,5	83,8
	E	31	16,2	16,2	100,0
	Total	191	100,0	100,0	

MATPRE3

		Frequency	Percent	Valid Percent	Cumulative Percent
		1	,5	,5	,5
	A	22	11,5	11,5	12,0
	B	16	8,4	8,4	20,4
Valid	C	46	24,1	24,1	44,5
	D	26	13,6	13,6	58,1
	E	80	41,9	41,9	100,0
	Total	191	100,0	100,0	

MATPRE4

		Frequency	Percent	Valid Percent	Cumulative Percent
		1	,5	,5	,5
	A	28	14,7	14,7	15,2
	B	109	57,1	57,1	72,3
Valid	C	18	9,4	9,4	81,7
	D	19	9,9	9,9	91,6
	E	16	8,4	8,4	100,0
	Total	191	100,0	100,0	

MATPRE5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	2,6	2,6	2,6
	A	39	20,4	20,4	23,0
	B	40	20,9	20,9	44,0
	C	33	17,3	17,3	61,3
	D	42	22,0	22,0	83,2
	E	32	16,8	16,8	100,0
	Total	191	100,0	100,0	

MATPRE6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	46	24,1	24,1	24,6
	B	23	12,0	12,0	36,6
	C	33	17,3	17,3	53,9
	D	88	46,1	46,1	100,0
	Total	191	100,0	100,0	

MATPRE7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	2,1	2,1	2,1
	A	33	17,3	17,3	19,4
	B	76	39,8	39,8	59,2
	C	34	17,8	17,8	77,0
	D	27	14,1	14,1	91,1
	E	17	8,9	8,9	100,0
	Total	191	100,0	100,0	

MATPRE8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	59	30,9	30,9	31,4
	B	31	16,2	16,2	47,6
	C	21	11,0	11,0	58,6
	D	15	7,9	7,9	66,5
	E	64	33,5	33,5	100,0
	Total	191	100,0	100,0	

MATPRE9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	2,6	2,6	2,6
	A	46	24,1	24,1	26,7
	B	35	18,3	18,3	45,0
	C	32	16,8	16,8	61,8
	D	27	14,1	14,1	75,9
	E	46	24,1	24,1	100,0
	Total	191	100,0	100,0	

MATPRE10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1,6	1,6	1,6
	A	34	17,8	17,8	19,4
	B	35	18,3	18,3	37,7
	C	49	25,7	25,7	63,4
	D	27	14,1	14,1	77,5
	E	43	22,5	22,5	100,0
	Total	191	100,0	100,0	

MATPRE11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		27	14,1	14,1	14,1
	A	30	15,7	15,7	29,8
	B	42	22,0	22,0	51,8
	C	60	31,4	31,4	83,2
	D	26	13,6	13,6	96,9
	E	6	3,1	3,1	100,0
	Total	191	100,0	100,0	

MATPRE12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	44	23,0	23,0	23,0
	B	57	29,8	29,8	52,9
	C	44	23,0	23,0	75,9
	D	29	15,2	15,2	91,1
	E	17	8,9	8,9	100,0
	Total	191	100,0	100,0	

MATPRE13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1,6	1,6	1,6
	A	34	17,8	17,8	19,4
	B	20	10,5	10,5	29,8
	C	63	33,0	33,0	62,8
	D	44	23,0	23,0	85,9
	E	27	14,1	14,1	100,0
	Total	191	100,0	100,0	

MATPRE14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		16	8,4	8,4	8,4
	A	61	31,9	31,9	40,3
	B	38	19,9	19,9	60,2
	C	29	15,2	15,2	75,4
	D	20	10,5	10,5	85,9
	E	27	14,1	14,1	100,0
	Total	191	100,0	100,0	

MATPRE15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	51	26,7	26,7	27,2
	B	25	13,1	13,1	40,3
	C	20	10,5	10,5	50,8
	D	62	32,5	32,5	83,2
	E	32	16,8	16,8	100,0
	Total	191	100,0	100,0	

MATPRE16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1,6	1,6	1,6
	A	25	13,1	13,1	14,7
	B	32	16,8	16,8	31,4
	C	48	25,1	25,1	56,5
	D	60	31,4	31,4	88,0
	E	23	12,0	12,0	100,0
	Total	191	100,0	100,0	

MATPOST1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	66	34,6	34,6	34,6
	B	51	26,7	26,7	61,3
	C	46	24,1	24,1	85,3
	D	11	5,8	5,8	91,1
	E	17	8,9	8,9	100,0
	Total	191	100,0	100,0	

MATPOST2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	23	12,0	12,0	12,6
	B	80	41,9	41,9	54,5
	C	48	25,1	25,1	79,6
	D	29	15,2	15,2	94,8
	E	10	5,2	5,2	100,0
	Total	191	100,0	100,0	

MATPOST3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	32	16,8	16,8	16,8
	B	23	12,0	12,0	28,8
	C	24	12,6	12,6	41,4
	D	37	19,4	19,4	60,7
	E	75	39,3	39,3	100,0
	Total	191	100,0	100,0	

MATPOST4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	14	7,3	7,3	7,3
	B	92	48,2	48,2	55,5
	C	11	5,8	5,8	61,3
	D	38	19,9	19,9	81,2
	E	36	18,8	18,8	100,0
	Total	191	100,0	100,0	

MATPOST5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	68	35,6	35,6	35,6
	B	38	19,9	19,9	55,5
	C	32	16,8	16,8	72,3
	D	42	22,0	22,0	94,2
	E	11	5,8	5,8	100,0
	Total	191	100,0	100,0	

MATPOST6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	41	21,5	21,5	21,5
	B	52	27,2	27,2	48,7
	C	44	23,0	23,0	71,7
	D	54	28,3	28,3	100,0
	Total	191	100,0	100,0	

MATPOST7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1,6	1,6	1,6
	A	54	28,3	28,3	29,8
	B	59	30,9	30,9	60,7
	C	35	18,3	18,3	79,1
	D	24	12,6	12,6	91,6
	E	16	8,4	8,4	100,0
	Total	191	100,0	100,0	

MATPOST8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	27	14,1	14,1	14,1
	B	43	22,5	22,5	36,6
	C	31	16,2	16,2	52,9
	D	53	27,7	27,7	80,6
	E	37	19,4	19,4	100,0
	Total	191	100,0	100,0	

MATPOST9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	26	13,6	13,6	14,1
	B	29	15,2	15,2	29,3
	C	59	30,9	30,9	60,2
	D	31	16,2	16,2	76,4
	E	45	23,6	23,6	100,0
	Total	191	100,0	100,0	

MATPOST10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	64	33,5	33,5	34,0
	B	61	31,9	31,9	66,0
	C	31	16,2	16,2	82,2
	D	21	11,0	11,0	93,2
	E	13	6,8	6,8	100,0
	Total	191	100,0	100,0	

MATPOST11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		12	6,3	6,3	6,3
	A	29	15,2	15,2	21,5
	B	29	15,2	15,2	36,6
	C	77	40,3	40,3	77,0
	D	33	17,3	17,3	94,2
	E	11	5,8	5,8	100,0
	Total	191	100,0	100,0	

MATPOST12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	51	26,7	26,7	27,2
	B	38	19,9	19,9	47,1
	C	49	25,7	25,7	72,8
	D	40	20,9	20,9	93,7
	E	12	6,3	6,3	100,0
	Total	191	100,0	100,0	

MATPOST13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	1,0	1,0	1,0
	A	37	19,4	19,4	20,4
	B	24	12,6	12,6	33,0
	C	62	32,5	32,5	65,4
	D	38	19,9	19,9	85,3
	E	28	14,7	14,7	100,0
	Total	191	100,0	100,0	

MATPOST14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1,6	1,6	1,6
	A	35	18,3	18,3	19,9
	B	24	12,6	12,6	32,5
	C	42	22,0	22,0	54,5
	D	35	18,3	18,3	72,8
	E	52	27,2	27,2	100,0
	Total	191	100,0	100,0	

MATPOST15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	,5	,5	,5
	A	44	23,0	23,0	23,6
	B	22	11,5	11,5	35,1
	C	30	15,7	15,7	50,8
	D	71	37,2	37,2	88,0
	E	23	12,0	12,0	100,0
	Total	191	100,0	100,0	

MATPOST16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A	53	27,7	27,7	27,7
	B	17	8,9	8,9	36,6
	C	49	25,7	25,7	62,3
	D	39	20,4	20,4	82,7
	E	33	17,3	17,3	100,0
	Total	191	100,0	100,0	

Frequency Tables of Pre-MAQ

maqpre1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	36	18,8	18,8	18,8
	2,00	18	9,4	9,4	28,3
	3,00	51	26,7	26,7	55,0
	4,00	44	23,0	23,0	78,0
	5,00	42	22,0	22,0	100,0
	Total	191	100,0	100,0	

maqpre2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	27	14,1	14,2	14,2
	2,00	26	13,6	13,7	27,9
	3,00	52	27,2	27,4	55,3
	4,00	51	26,7	26,8	82,1
	5,00	34	17,8	17,9	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,5	17,5
	2,00	40	20,9	21,2	38,6
	3,00	59	30,9	31,2	69,8
	4,00	35	18,3	18,5	88,4
	5,00	22	11,5	11,6	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

maqpre4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	34	17,8	18,0	18,0
	2,00	50	26,2	26,5	44,4
	3,00	38	19,9	20,1	64,6
	4,00	35	18,3	18,5	83,1
	5,00	32	16,8	16,9	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

maqpre5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,0	10,0
	2,00	12	6,3	6,3	16,3
	3,00	45	23,6	23,7	40,0
	4,00	62	32,5	32,6	72,6
	5,00	52	27,2	27,4	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	21	11,0	11,0	11,0
	2,00	25	13,1	13,1	24,1
	3,00	41	21,5	21,5	45,5
	4,00	56	29,3	29,3	74,9
	5,00	48	25,1	25,1	100,0
	Total	191	100,0	100,0	

maqpre7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	41	21,5	21,6	21,6
	2,00	33	17,3	17,4	38,9
	3,00	41	21,5	21,6	60,5
	4,00	43	22,5	22,6	83,2
	5,00	32	16,8	16,8	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	16	8,4	8,5	8,5
	2,00	24	12,6	12,7	21,2
	3,00	50	26,2	26,5	47,6
	4,00	60	31,4	31,7	79,4
	5,00	39	20,4	20,6	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

maqpre9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	56	29,3	29,3	29,3
	2,00	46	24,1	24,1	53,4
	3,00	39	20,4	20,4	73,8
	4,00	30	15,7	15,7	89,5
	5,00	20	10,5	10,5	100,0
	Total	191	100,0	100,0	

maqpre10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	16	8,4	8,4	8,4
	2,00	16	8,4	8,4	16,8
	3,00	48	25,1	25,3	42,1
	4,00	57	29,8	30,0	72,1
	5,00	53	27,7	27,9	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,3	17,3
	2,00	33	17,3	17,3	34,6
	3,00	52	27,2	27,2	61,8
	4,00	46	24,1	24,1	85,9
	5,00	27	14,1	14,1	100,0
	Total	191	100,0	100,0	

maqpre12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	22	11,5	11,5	11,5
	2,00	20	10,5	10,5	22,0
	3,00	52	27,2	27,2	49,2
	4,00	59	30,9	30,9	80,1
	5,00	38	19,9	19,9	100,0
	Total	191	100,0	100,0	

maqpre13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	24	12,6	12,6	12,6
	2,00	30	15,7	15,8	28,4
	3,00	61	31,9	32,1	60,5
	4,00	43	22,5	22,6	83,2
	5,00	32	16,8	16,8	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	37	19,4	19,4	19,4
	2,00	26	13,6	13,6	33,0
	3,00	56	29,3	29,3	62,3
	4,00	37	19,4	19,4	81,7
	5,00	35	18,3	18,3	100,0
	Total	191	100,0	100,0	

maqpre15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	23	12,0	12,0	12,0
	2,00	11	5,8	5,8	17,8
	3,00	23	12,0	12,0	29,8
	4,00	64	33,5	33,5	63,4
	5,00	70	36,6	36,6	100,0
	Total	191	100,0	100,0	

maqpre16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	14	7,3	7,3	7,3
	2,00	22	11,5	11,5	18,8
	3,00	40	20,9	20,9	39,8
	4,00	69	36,1	36,1	75,9
	5,00	46	24,1	24,1	100,0
	Total	191	100,0	100,0	

maqpre17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	12	6,3	6,3	6,3
	2,00	19	9,9	10,0	16,3
	3,00	40	20,9	21,1	37,4
	4,00	71	37,2	37,4	74,7
	5,00	48	25,1	25,3	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	13	6,8	6,9	6,9
	2,00	15	7,9	7,9	14,8
	3,00	35	18,3	18,5	33,3
	4,00	75	39,3	39,7	73,0
	5,00	51	26,7	27,0	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

maqpre19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	40	20,9	21,1	21,1
	2,00	22	11,5	11,6	32,6
	3,00	43	22,5	22,6	55,3
	4,00	56	29,3	29,5	84,7
	5,00	29	15,2	15,3	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	29	15,2	15,3	15,3
	2,00	22	11,5	11,6	26,8
	3,00	48	25,1	25,3	52,1
	4,00	50	26,2	26,3	78,4
	5,00	41	21,5	21,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre21

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	25	13,1	13,2	13,2
	2,00	27	14,1	14,2	27,4
	3,00	40	20,9	21,1	48,4
	4,00	55	28,8	28,9	77,4
	5,00	43	22,5	22,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre22

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	37	19,4	19,5	19,5
	2,00	38	19,9	20,0	39,5
	3,00	61	31,9	32,1	71,6
	4,00	36	18,8	18,9	90,5
	5,00	18	9,4	9,5	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	30	15,7	15,7	15,7
	2,00	30	15,7	15,7	31,4
	3,00	51	26,7	26,7	58,1
	4,00	41	21,5	21,5	79,6
	5,00	39	20,4	20,4	100,0
	Total	191	100,0	100,0	

maqpre24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	29	15,2	15,3	15,3
	2,00	19	9,9	10,1	25,4
	3,00	49	25,7	25,9	51,3
	4,00	43	22,5	22,8	74,1
	5,00	49	25,7	25,9	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

maqpre25

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	21	11,0	11,2	11,2
	2,00	27	14,1	14,4	25,5
	3,00	46	24,1	24,5	50,0
	4,00	52	27,2	27,7	77,7
	5,00	42	22,0	22,3	100,0
	Total	188	98,4	100,0	
Missing	System	3	1,6		
Total		191	100,0		

maqpre26

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,4	17,4
	2,00	23	12,0	12,1	29,5
	3,00	61	31,9	32,1	61,6
	4,00	41	21,5	21,6	83,2
	5,00	32	16,8	16,8	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre27

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	39	20,4	20,4	20,4
	2,00	32	16,8	16,8	37,2
	3,00	49	25,7	25,7	62,8
	4,00	40	20,9	20,9	83,8
	5,00	31	16,2	16,2	100,0
	Total	191	100,0	100,0	

maqpre28

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	43	22,5	22,6	22,6
	2,00	47	24,6	24,7	47,4
	3,00	41	21,5	21,6	68,9
	4,00	24	12,6	12,6	81,6
	5,00	35	18,3	18,4	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre29

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	49	25,7	25,8	25,8
	2,00	46	24,1	24,2	50,0
	3,00	44	23,0	23,2	73,2
	4,00	22	11,5	11,6	84,7
	5,00	29	15,2	15,3	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpre30

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	52	27,2	27,4	27,4
	2,00	41	21,5	21,6	48,9
	3,00	41	21,5	21,6	70,5
	4,00	21	11,0	11,1	81,6
	5,00	35	18,3	18,4	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

Frequency Tables of Post-MAQ

maqpost1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	46	24,1	24,2	24,2
	2,00	53	27,7	27,9	52,1
	3,00	29	15,2	15,3	67,4
	4,00	43	22,5	22,6	90,0
	5,00	19	9,9	10,0	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	37	19,4	19,4	19,4
	2,00	53	27,7	27,7	47,1
	3,00	35	18,3	18,3	65,4
	4,00	42	22,0	22,0	87,4
	5,00	24	12,6	12,6	100,0
	Total	191	100,0	100,0	

maqpost3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	52	27,2	27,2	27,2
	2,00	52	27,2	27,2	54,5
	3,00	26	13,6	13,6	68,1
	4,00	33	17,3	17,3	85,3
	5,00	28	14,7	14,7	100,0
	Total	191	100,0	100,0	

maqpost4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,0	10,0
	2,00	50	26,2	26,3	36,3
	3,00	34	17,8	17,9	54,2
	4,00	36	18,8	18,9	73,2
	5,00	51	26,7	26,8	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	31	16,2	16,2	16,2
	2,00	49	25,7	25,7	41,9
	3,00	27	14,1	14,1	56,0
	4,00	44	23,0	23,0	79,1
	5,00	40	20,9	20,9	100,0
	Total	191	100,0	100,0	

maqpost6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	32	16,8	16,8	16,8
	2,00	48	25,1	25,1	41,9
	3,00	37	19,4	19,4	61,3
	4,00	34	17,8	17,8	79,1
	5,00	40	20,9	20,9	100,0
	Total	191	100,0	100,0	

maqpost7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	25	13,1	13,1	13,1
	2,00	50	26,2	26,2	39,3
	3,00	40	20,9	20,9	60,2
	4,00	34	17,8	17,8	78,0
	5,00	42	22,0	22,0	100,0
	Total	191	100,0	100,0	

maqpost8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	38	19,9	19,9	19,9
	2,00	41	21,5	21,5	41,4
	3,00	39	20,4	20,4	61,8
	4,00	30	15,7	15,7	77,5
	5,00	43	22,5	22,5	100,0
	Total	191	100,0	100,0	

maqpost9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	29	15,2	15,2	15,2
	2,00	54	28,3	28,3	43,5
	3,00	36	18,8	18,8	62,3
	4,00	24	12,6	12,6	74,9
	5,00	48	25,1	25,1	100,0
	Total	191	100,0	100,0	

maqpost10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	31	16,2	16,2	16,2
	2,00	32	16,8	16,8	33,0
	3,00	45	23,6	23,6	56,5
	4,00	36	18,8	18,8	75,4
	5,00	47	24,6	24,6	100,0
	Total	191	100,0	100,0	

maqpost11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	43	22,5	22,5	22,5
	2,00	38	19,9	19,9	42,4
	3,00	40	20,9	20,9	63,4
	4,00	35	18,3	18,3	81,7
	5,00	35	18,3	18,3	100,0
	Total	191	100,0	100,0	

maqpost12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	29	15,2	15,2	15,2
	2,00	37	19,4	19,4	34,6
	3,00	45	23,6	23,6	58,1
	4,00	41	21,5	21,5	79,6
	5,00	39	20,4	20,4	100,0
	Total	191	100,0	100,0	

maqpost13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	31	16,2	16,2	16,2
	2,00	36	18,8	18,8	35,1
	3,00	54	28,3	28,3	63,4
	4,00	36	18,8	18,8	82,2
	5,00	34	17,8	17,8	100,0
	Total	191	100,0	100,0	

maqpost14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,3	17,3
	2,00	40	20,9	20,9	38,2
	3,00	37	19,4	19,4	57,6
	4,00	39	20,4	20,4	78,0
	5,00	42	22,0	22,0	100,0
	Total	191	100,0	100,0	

maqpost15

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	21	11,0	11,1	11,1
	2,00	42	22,0	22,1	33,2
	3,00	36	18,8	18,9	52,1
	4,00	50	26,2	26,3	78,4
	5,00	41	21,5	21,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost16

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	30	15,7	15,7	15,7
	2,00	45	23,6	23,6	39,3
	3,00	39	20,4	20,4	59,7
	4,00	42	22,0	22,0	81,7
	5,00	35	18,3	18,3	100,0
	Total	191	100,0	100,0	

maqpost17

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	24	12,6	12,6	12,6
	2,00	48	25,1	25,1	37,7
	3,00	38	19,9	19,9	57,6
	4,00	50	26,2	26,2	83,8
	5,00	31	16,2	16,2	100,0
	Total	191	100,0	100,0	

maqpost18

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	34	17,8	17,9	17,9
	2,00	33	17,3	17,4	35,3
	3,00	36	18,8	18,9	54,2
	4,00	46	24,1	24,2	78,4
	5,00	41	21,5	21,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost19

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	40	20,9	20,9	20,9
	2,00	49	25,7	25,7	46,6
	3,00	36	18,8	18,8	65,4
	4,00	26	13,6	13,6	79,1
	5,00	40	20,9	20,9	100,0
	Total	191	100,0	100,0	

maqpost20

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	34	17,8	17,9	17,9
	2,00	45	23,6	23,7	41,6
	3,00	43	22,5	22,6	64,2
	4,00	23	12,0	12,1	76,3
	5,00	45	23,6	23,7	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost21

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,3	17,3
	2,00	35	18,3	18,3	35,6
	3,00	48	25,1	25,1	60,7
	4,00	33	17,3	17,3	78,0
	5,00	42	22,0	22,0	100,0
	Total	191	100,0	100,0	

maqpost22

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	36	18,8	18,8	18,8
	2,00	48	25,1	25,1	44,0
	3,00	48	25,1	25,1	69,1
	4,00	29	15,2	15,2	84,3
	5,00	30	15,7	15,7	100,0
	Total	191	100,0	100,0	

maqpost23

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	33	17,3	17,3	17,3
	2,00	48	25,1	25,1	42,4
	3,00	42	22,0	22,0	64,4
	4,00	36	18,8	18,8	83,2
	5,00	32	16,8	16,8	100,0
	Total	191	100,0	100,0	

maqpost24

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	31	16,2	16,3	16,3
	2,00	37	19,4	19,5	35,8
	3,00	35	18,3	18,4	54,2
	4,00	40	20,9	21,1	75,3
	5,00	47	24,6	24,7	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost25

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	41	21,5	21,5	21,5
	2,00	30	15,7	15,7	37,2
	3,00	52	27,2	27,2	64,4
	4,00	35	18,3	18,3	82,7
	5,00	33	17,3	17,3	100,0
	Total	191	100,0	100,0	

maqpost26

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	36	18,8	18,8	18,8
	2,00	30	15,7	15,7	34,6
	3,00	63	33,0	33,0	67,5
	4,00	28	14,7	14,7	82,2
	5,00	34	17,8	17,8	100,0
	Total	191	100,0	100,0	

maqpost27

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	44	23,0	23,0	23,0
	2,00	38	19,9	19,9	42,9
	3,00	60	31,4	31,4	74,3
	4,00	25	13,1	13,1	87,4
	5,00	24	12,6	12,6	100,0
	Total	191	100,0	100,0	

maqpost28

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	47	24,6	24,7	24,7
	2,00	39	20,4	20,5	45,3
	3,00	56	29,3	29,5	74,7
	4,00	25	13,1	13,2	87,9
	5,00	23	12,0	12,1	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

maqpost29

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	50	26,2	26,2	26,2
	2,00	35	18,3	18,3	44,5
	3,00	52	27,2	27,2	71,7
	4,00	32	16,8	16,8	88,5
	5,00	22	11,5	11,5	100,0
	Total	191	100,0	100,0	

maqpost30

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	48	25,1	25,1	25,1
	2,00	39	20,4	20,4	45,5
	3,00	46	24,1	24,1	69,6
	4,00	32	16,8	16,8	86,4
	5,00	26	13,6	13,6	100,0
	Total	191	100,0	100,0	

Frequency Table of SQET

E1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	1	1,5	1,5	1,5
	2,00	5	7,7	7,7	9,2
	3,00	8	12,3	12,3	21,5
	4,00	18	27,7	27,7	49,2
	5,00	33	50,8	50,8	100,0
	Total	65	100,0	100,0	

E2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	5	7,7	7,7	7,7
	2,00	4	6,2	6,2	13,8
	3,00	15	23,1	23,1	36,9
	4,00	22	33,8	33,8	70,8
	5,00	19	29,2	29,2	100,0
	Total	65	100,0	100,0	

E3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	6	9,2	9,2	9,2
	2,00	9	13,8	13,8	23,1
	3,00	18	27,7	27,7	50,8
	4,00	18	27,7	27,7	78,5
	5,00	14	21,5	21,5	100,0
	Total	65	100,0	100,0	

E4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	5	7,7	7,7	7,7
	2,00	5	7,7	7,7	15,4
	3,00	9	13,8	13,8	29,2
	4,00	22	33,8	33,8	63,1
	5,00	24	36,9	36,9	100,0
	Total	65	100,0	100,0	

E5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	5	7,7	7,7	7,7
	2,00	11	16,9	16,9	24,6
	3,00	17	26,2	26,2	50,8
	4,00	12	18,5	18,5	69,2
	5,00	20	30,8	30,8	100,0
	Total	65	100,0	100,0	

E6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	10	15,4	15,4	15,4
	2,00	12	18,5	18,5	33,8
	3,00	12	18,5	18,5	52,3
	4,00	12	18,5	18,5	70,8
	5,00	19	29,2	29,2	100,0
	Total	65	100,0	100,0	

E7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	6	9,2	9,4	9,4
	2,00	7	10,8	10,9	20,3
	3,00	10	15,4	15,6	35,9
	4,00	20	30,8	31,3	67,2
	5,00	21	32,3	32,8	100,0
	Total	64	98,5	100,0	
Missing	System	1	1,5		
Total		65	100,0		

E8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	2	3,1	3,1	3,1
	2,00	5	7,7	7,7	10,8
	3,00	11	16,9	16,9	27,7
	4,00	18	27,7	27,7	55,4
	5,00	29	44,6	44,6	100,0
	Total	65	100,0	100,0	

E9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	11	16,9	16,9	16,9
	2,00	10	15,4	15,4	32,3
	3,00	12	18,5	18,5	50,8
	4,00	16	24,6	24,6	75,4
	5,00	16	24,6	24,6	100,0
	Total	65	100,0	100,0	

E10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	9	13,8	14,1	14,1
	2,00	11	16,9	17,2	31,3
	3,00	7	10,8	10,9	42,2
	4,00	16	24,6	25,0	67,2
	5,00	21	32,3	32,8	100,0
	Total	64	98,5	100,0	
Missing	System	1	1,5		
Total		65	100,0		

E11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	5	7,7	7,8	7,8
	3,00	8	12,3	12,5	20,3
	4,00	10	15,4	15,6	35,9
	5,00	41	63,1	64,1	100,0
	Total	64	98,5	100,0	
Missing	System	1	1,5		
Total		65	100,0		

E12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3,00	1	1,5	16,7	16,7
	4,00	2	3,1	33,3	50,0
	5,00	3	4,6	50,0	100,0
	Total	6	9,2	100,0	
Missing	System	59	90,8		
Total		65	100,0		

E13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4,00	2	3,1	40,0	40,0
	5,00	3	4,6	60,0	100,0
	Total	5	7,7	100,0	
Missing	System	60	92,3		
Total		65	100,0		

E14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4,00	1	1,5	25,0	25,0
	5,00	3	4,6	75,0	100,0
	Total	4	6,2	100,0	
Missing	System	61	93,8		
Total		65	100,0		

C1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	1	1,5	1,5	1,5
	2,00	4	6,2	6,2	7,7
	3,00	7	10,8	10,8	18,5
	4,00	23	35,4	35,4	53,8
	5,00	30	46,2	46,2	100,0
	Total	65	100,0	100,0	

C2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	4	6,2	6,2	6,2
	2,00	6	9,2	9,2	15,4
	3,00	8	12,3	12,3	27,7
	4,00	28	43,1	43,1	70,8
	5,00	19	29,2	29,2	100,0
	Total	65	100,0	100,0	

C3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	9	13,8	13,8	13,8
	2,00	9	13,8	13,8	27,7
	3,00	10	15,4	15,4	43,1
	4,00	12	18,5	18,5	61,5
	5,00	25	38,5	38,5	100,0
	Total	65	100,0	100,0	

C4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	4	6,2	6,2	6,2
	2,00	9	13,8	13,8	20,0
	3,00	13	20,0	20,0	40,0
	4,00	19	29,2	29,2	69,2
	5,00	20	30,8	30,8	100,0
	Total	65	100,0	100,0	

C5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	8	12,3	12,3	12,3
	2,00	8	12,3	12,3	24,6
	3,00	13	20,0	20,0	44,6
	4,00	13	20,0	20,0	64,6
	5,00	23	35,4	35,4	100,0
	Total	65	100,0	100,0	

C6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	7	10,8	10,9	10,9
	2,00	5	7,7	7,8	18,8
	3,00	14	21,5	21,9	40,6
	4,00	18	27,7	28,1	68,8
	5,00	20	30,8	31,3	100,0
	Total	64	98,5	100,0	
Missing	System	1	1,5		
Total		65	100,0		

C7

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	9	13,8	13,8	13,8
	2,00	3	4,6	4,6	18,5
	3,00	7	10,8	10,8	29,2
	4,00	29	44,6	44,6	73,8
	5,00	17	26,2	26,2	100,0
	Total	65	100,0	100,0	

C8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	6	9,2	9,2	9,2
	2,00	5	7,7	7,7	16,9
	3,00	11	16,9	16,9	33,8
	4,00	12	18,5	18,5	52,3
	5,00	31	47,7	47,7	100,0
	Total	65	100,0	100,0	

C9

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	9	13,8	13,8	13,8
	2,00	10	15,4	15,4	29,2
	3,00	12	18,5	18,5	47,7
	4,00	17	26,2	26,2	73,8
	5,00	17	26,2	26,2	100,0
	Total	65	100,0	100,0	

C10

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	10	15,4	15,4	15,4
	2,00	4	6,2	6,2	21,5
	3,00	13	20,0	20,0	41,5
	4,00	15	23,1	23,1	64,6
	5,00	23	35,4	35,4	100,0
	Total	65	100,0	100,0	

C11

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	5	7,7	7,9	7,9
	2,00	1	1,5	1,6	9,5
	3,00	7	10,8	11,1	20,6
	4,00	17	26,2	27,0	47,6
	5,00	33	50,8	52,4	100,0
	Total	63	96,9	100,0	
Missing	System	2	3,1		
Total		65	100,0		

C12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,00	1	1,5	25,0	25,0
	5,00	3	4,6	75,0	100,0
	Total	4	6,2	100,0	
Missing	System	61	93,8		
Total		65	100,0		

C13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5,00	2	3,1	100,0	100,0
Missing	System	63	96,9		
Total		65	100,0		

C14

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5,00	2	3,1	100,0	100,0
Missing	System	63	96,9		
Total		65	100,0		

Frequency Table of SQCI

BSBM1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		128	67,0	67,0	67,0
	1	6	3,1	3,1	70,2
	2	7	3,7	3,7	73,8
	3	24	12,6	12,6	86,4
	4	6	3,1	3,1	89,5
	5	20	10,5	10,5	100,0
	Total	191	100,0	100,0	

BSBM2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		128	67,0	67,0	67,0
	1	7	3,7	3,7	70,7
	2	11	5,8	5,8	76,4
	3	25	13,1	13,1	89,5
	4	8	4,2	4,2	93,7
	5	12	6,3	6,3	100,0
	Total	191	100,0	100,0	

BSBM3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		131	68,6	68,6	68,6
	1	7	3,7	3,7	72,3
	2	11	5,8	5,8	78,0
	3	14	7,3	7,3	85,3
	4	12	6,3	6,3	91,6
	5	16	8,4	8,4	100,0
	Total	191	100,0	100,0	

BSBM4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		128	67,0	67,0	67,0
	1	10	5,2	5,2	72,3
	2	13	6,8	6,8	79,1
	3	12	6,3	6,3	85,3
	4	16	8,4	8,4	93,7
	5	12	6,3	6,3	100,0
	Total	191	100,0	100,0	

BSBM5

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	8	4,2	4,2	71,2
	2	9	4,7	4,7	75,9
Valid	3	19	9,9	9,9	85,9
	4	12	6,3	6,3	92,1
	5	15	7,9	7,9	100,0
	Total	191	100,0	100,0	

BSBM6

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	7	3,7	3,7	70,7
	2	13	6,8	6,8	77,5
Valid	3	14	7,3	7,3	84,8
	4	15	7,9	7,9	92,7
	5	14	7,3	7,3	100,0
	Total	191	100,0	100,0	

BSDM1

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	2	1,0	1,0	68,1
	2	1	,5	,5	68,6
Valid	3	8	4,2	4,2	72,8
	4	25	13,1	13,1	85,9
	5	27	14,1	14,1	100,0
	Total	191	100,0	100,0	

BSDM2

		Frequency	Percent	Valid Percent	Cumulative Percent
		129	67,5	67,5	67,5
	1	2	1,0	1,0	68,6
	2	1	,5	,5	69,1
Valid	3	13	6,8	6,8	75,9
	4	27	14,1	14,1	90,1
	5	19	9,9	9,9	100,0
	Total	191	100,0	100,0	

BSDM3

		Frequency	Percent	Valid Percent	Cumulative Percent
		129	67,5	67,5	67,5
	2	3	1,6	1,6	69,1
	3	8	4,2	4,2	73,3
Valid	4	26	13,6	13,6	86,9
	5	25	13,1	13,1	100,0
	Total	191	100,0	100,0	

BSDM4

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	2	1,0	1,0	68,1
	2	2	1,0	1,0	69,1
Valid	3	6	3,1	3,1	72,3
	4	31	16,2	16,2	88,5
	5	22	11,5	11,5	100,0
	Total	191	100,0	100,0	

BSDM5

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	4	2,1	2,1	69,1
	2	2	1,0	1,0	70,2
Valid	3	6	3,1	3,1	73,3
	4	27	14,1	14,1	87,4
	5	24	12,6	12,6	100,0
	Total	191	100,0	100,0	

BSDM6

		Frequency	Percent	Valid Percent	Cumulative Percent
		128	67,0	67,0	67,0
	1	3	1,6	1,6	68,6
	2	2	1,0	1,0	69,6
Valid	3	7	3,7	3,7	73,3
	4	24	12,6	12,6	85,9
	5	27	14,1	14,1	100,0
	Total	191	100,0	100,0	

CBM1

		Frequency	Percent	Valid Percent	Cumulative Percent
	1,00	6	3,1	3,1	3,1
	2,00	32	16,8	16,8	19,9
Valid	3,00	55	28,8	28,8	48,7
	4,00	52	27,2	27,2	75,9
	5,00	46	24,1	24,1	100,0
	Total	191	100,0	100,0	

CBM2

		Frequency	Percent	Valid Percent	Cumulative Percent
	1,00	9	4,7	4,7	4,7
	2,00	36	18,8	18,9	23,7
Valid	3,00	51	26,7	26,8	50,5
	4,00	56	29,3	29,5	80,0
	5,00	38	19,9	20,0	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

CBM3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	11	5,8	5,8	5,8
	2,00	44	23,0	23,2	28,9
	3,00	43	22,5	22,6	51,6
	4,00	51	26,7	26,8	78,4
	5,00	41	21,5	21,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

CBM4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	17	8,9	8,9	8,9
	2,00	33	17,3	17,4	26,3
	3,00	48	25,1	25,3	51,6
	4,00	46	24,1	24,2	75,8
	5,00	46	24,1	24,2	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

CBM5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	23	12,0	12,2	12,2
	2,00	33	17,3	17,5	29,6
	3,00	47	24,6	24,9	54,5
	4,00	45	23,6	23,8	78,3
	5,00	41	21,5	21,7	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CBM6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	16	8,4	8,5	8,5
	2,00	29	15,2	15,3	23,8
	3,00	46	24,1	24,3	48,1
	4,00	52	27,2	27,5	75,7
	5,00	46	24,1	24,3	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CDM1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	12	6,3	6,3	6,3
	2,00	32	16,8	16,8	23,2
	3,00	54	28,3	28,4	51,6
	4,00	45	23,6	23,7	75,3
	5,00	47	24,6	24,7	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

CDM2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	15	7,9	7,9	7,9
	2,00	31	16,2	16,4	24,3
	3,00	51	26,7	27,0	51,3
	4,00	58	30,4	30,7	82,0
	5,00	34	17,8	18,0	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CDM3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,1	10,1
	2,00	33	17,3	17,5	27,5
	3,00	44	23,0	23,3	50,8
	4,00	52	27,2	27,5	78,3
	5,00	41	21,5	21,7	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CDM4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	21	11,0	11,1	11,1
	2,00	30	15,7	15,9	27,0
	3,00	47	24,6	24,9	51,9
	4,00	40	20,9	21,2	73,0
	5,00	51	26,7	27,0	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CDM5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	32	16,8	16,9	16,9
	2,00	33	17,3	17,5	34,4
	3,00	41	21,5	21,7	56,1
	4,00	38	19,9	20,1	76,2
	5,00	45	23,6	23,8	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

CDM6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	22	11,5	11,6	11,6
	2,00	29	15,2	15,3	26,8
	3,00	46	24,1	24,2	51,1
	4,00	49	25,7	25,8	76,8
	5,00	44	23,0	23,2	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HBM1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	15	7,9	7,9	7,9
	2,00	32	16,8	16,8	24,7
	3,00	53	27,7	27,9	52,6
	4,00	46	24,1	24,2	76,8
	5,00	44	23,0	23,2	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HBM2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	17	8,9	9,0	9,0
	2,00	40	20,9	21,2	30,2
	3,00	49	25,7	25,9	56,1
	4,00	43	22,5	22,8	78,8
	5,00	40	20,9	21,2	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

HBM3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,0	10,0
	2,00	37	19,4	19,5	29,5
	3,00	48	25,1	25,3	54,7
	4,00	50	26,2	26,3	81,1
	5,00	36	18,8	18,9	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HBM4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	27	14,1	14,2	14,2
	2,00	33	17,3	17,4	31,6
	3,00	43	22,5	22,6	54,2
	4,00	45	23,6	23,7	77,9
	5,00	42	22,0	22,1	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HBM5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	35	18,3	18,6	18,6
	2,00	34	17,8	18,1	36,7
	3,00	40	20,9	21,3	58,0
	4,00	35	18,3	18,6	76,6
	5,00	44	23,0	23,4	100,0
	Total	188	98,4	100,0	
Missing	System	3	1,6		
Total		191	100,0		

HBM6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	26	13,6	13,7	13,7
	2,00	32	16,8	16,8	30,5
	3,00	42	22,0	22,1	52,6
	4,00	35	18,3	18,4	71,1
	5,00	55	28,8	28,9	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HDM1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,0	10,0
	2,00	40	20,9	21,1	31,1
	3,00	36	18,8	18,9	50,0
	4,00	47	24,6	24,7	74,7
	5,00	48	25,1	25,3	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

HDM2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	19	9,9	10,1	10,1
	2,00	51	26,7	27,0	37,0
	3,00	30	15,7	15,9	52,9
	4,00	48	25,1	25,4	78,3
	5,00	41	21,5	21,7	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

HDM3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	26	13,6	13,8	13,8
	2,00	40	20,9	21,2	34,9
	3,00	32	16,8	16,9	51,9
	4,00	47	24,6	24,9	76,7
	5,00	44	23,0	23,3	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

HDM4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	27	14,1	14,3	14,3
	2,00	37	19,4	19,6	33,9
	3,00	30	15,7	15,9	49,7
	4,00	43	22,5	22,8	72,5
	5,00	52	27,2	27,5	100,0
	Total	189	99,0	100,0	
Missing	System	2	1,0		
Total		191	100,0		

HDM5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	31	16,2	16,5	16,5
	2,00	43	22,5	22,9	39,4
	3,00	33	17,3	17,6	56,9
	4,00	37	19,4	19,7	76,6
	5,00	44	23,0	23,4	100,0
	Total	188	98,4	100,0	
Missing	System	3	1,6		
Total		191	100,0		

HDM6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	29	15,2	15,3	15,3
	2,00	34	17,8	17,9	33,2
	3,00	33	17,3	17,4	50,5
	4,00	34	17,8	17,9	68,4
	5,00	60	31,4	31,6	100,0
	Total	190	99,5	100,0	
Missing	System	1	,5		
Total		191	100,0		

APPENDIX L

RAW DATA of MAT

ID	Pre-Test																Post- Test													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	B	C	A	B	C	A	B	E	C	E	C	E	D	B	D	E	A	B	E	B	C	C	A	D	E	A	C	C	C	E	D	A
2	B	D	B	A	C	A	C	E	A	C	C	D	C	E	A	E	A	C	D	E	A	A	C	B	D	B	B	A	D		A	E
3	E	E	B	B	B	D	A	C	B	C	B	D	C	B	B	E	B	C	E	B	C	D	B	D	C	D	C	A	C	B		C
4	E	C	A	C	E	C	B	E	D	A	E	B	C	A	A	E	D	E	A	E	C	D	D	A	C	D	C	A	B	A	C	E
5	A	D	E	B	D	C	A	A	B	D	E	C	E	A	E	B	D	A	B	E	B	B	B	B	B	E	E	C	A	A	E	B	C
6	E	E	B	C	B	D	B	C	B	E	C	C	C	A	D	B	C	D	B	A	E	D	D	D	C	B	E	A	A	B	D	B
7	B	B	D	D	C	C	B	D	A	D	A	C	C	B	C	C	D	A	A	D	A	B	D	A	C	E	B	A	C	B	A	C
8	A	D	E	B	D	C	A	A	D	E	A	B	B	A	D	C	E	B	B	C	A	A	E	B	C	A	C	A	D	E	B	E
9	A	A	C	B	D	D	D	E	D	C	B	D	A	B	D	D	C	B	D	E	A	B	D	D	C	E	C	B	B	D	A	B
10	A	D	C	B	E	C	B	E	A	D	B	B	A	C	E	B	A	C	A	B	B	C	E	C	C	B	B	B	A	D	A	D
11	E	B	E	A	B	C	A	A	E	C	C	A	D	C	A	B	C	A	D	D	E	A	C	E	E	C	C	C	D	E	E	E
12	B	B	A	B	B	A	C	A	E	D	C	A	B	A	D	B	B	B	D	B	C	A	B	E	E	A	A	A	A	C	B	C
13	E	D	E	E	D	D	D	E	C	A	A	D	B	A	E	D	E	B	A	A	C	D	B	E	C	A		B	C	C	B	D
14	B	C	D	C	D	C	B	D	E	C	D	A	C	D	A	B	D	E	A	E	C	D	A	C	C	A	D	B	C	A	D	B
15	A	C	B	B	B	D	B	A	B	B	C	C	A	B	A	A	B	A	C	A	A	B	A	B	B	A	A	A	A	B	A	E
16	B	B	C	B	E	D	D	E	B	A	A	A	D	A	B	B	A	A	C	B	C	C	B	E	C	A	B	D	D	B	E	D
17	E	B	E	A	B	C	A	C	D	C	C	C	B	A	D	E	C	A	E	D	C	D	E	B	C	B	E	A	E	E	E	A
18	B	B	E	A	B	B	C	E	E	C		C	C	B	E	C	C	C	E	B	C	D	C	C	C	A	C	D	A	C	B	C
19	E	C	B	A	B	A	C	B	A	C	B	E	B	D	C	B	A	D	B	A	C	C	A	A	D	B	E	D	B	C	B	B
20	D	A	D	E	B	B	B	B	E	A		D	E		B	C	D	E	A	E	B	C	B	D	D	C	D	A	B	E	B	C
21	B	B	E	A	E	A	B	E	C	B	A	E	D	C	A	C	C	C	A	D	C	D	B	B	D	A	C	C	E	E	A	D
22	E	B	D	B	E	A	E	B	C	C		C	A		A	D	C	D	B	B	D	B	B	E	C	D	D	D	E	C	A	D
23	B	E	E	D	B	C	D	A	E	C	A	D	C	C	C	D	C	B	B	B	A	A	C	B	C	B	A	C	A	B	B	C
24	E	D	C	B	D	A	E	A	A	E	A	E	D	A	D	D	D	D	E	B	E	D	B	E	A	E	C	B	D	B	D	C
25	E	D	E	B	D	D	D	E	C	A	B	D	B	A	E	D	B	C	A	E	B	B	B	A	A	B	C	C	C	B	E	B
26	E	E	C	B	C	B	C	C	A	A	C	B	E	A	C	B	B	E	A	A	C	A	B	C	A	C	C	D	C	E	A	C
27	A	D	E	B	D	C	A	A	D	E	C	B	B	A	D	C	C	A	C	B	D	A	E	B	D	C	D	A	E	D	B	E
28	B	C	A	E	C	C	B	B	C	C	B	D	E	D	E	C	C	B	D	D	E	C	A	C	C	B	A	C	D	C	A	D
29	E	B	B	E	C	A	B	A	D	E	B	A	C	D	E	D	E	B	D	E	E	C	D	B	A	D	A	B	A	E	A	C
60	A	C	E	B	E	D	C	A	D	A	C	A	D	E	C	C	A	B	D	A	B	D	C	A	C	A		A	E	A	D	D
61	A	C	E	B	E	D	B	A	D	B	D	A	B	C	D	D	B	C	E	B	E	A	B	A	C	A	A	B	D	E	D	C
62	A	C	E	B	E	D	B	E	D	B	A	A	C	C	C	C	B	C	E	B	D	D	C	E	D	D	C	C	E	A	D	A
63	A	A	E	B	D	D	A	A	E	B	D	E	D	C	C	A	B	C	E	B	D	D	C	E	D	D	C	C	E	A	D	C
64	A	B	D	B	D	D	D	D	B	B	C	C	C	C	D	B	A	B	E	B	D	D	C	D	B	A	C	C	D	E	C	D
65	B	D	E	B	D	A	B	A	C	B	C	C	D	D	E	B	E	B	D	B	E	A	B	E	E	B		A	A	C	D	B

66 A E D B E D B A D B D D B C D D A C E B B A B A C A C B D C D C

67 A C E B E D B A D B B A C C C C A B D B D D C D B C C C C B C D

68 A B E B D D C E B E C C C C D B A B E B D D C D B B A C D E A

69 B C B E B B B D B A A A B D A E B D E D C D A C C D B D B E C

70 A C D D C B B D E A B C D A C B E E B E A B E E B A A E D C

71 A C E B D D A A A D C C D A D D B E E B B D B A B C C C A B D C

72 A D E B D D B A E B A B B E D C E B D B B A E A C B A B C A C D

73 A B E B D D A A A D C C D A D D A B E B B D A A C B A D A E D C

74 C D E D A C A A E D C D C A D D B D E B C C D B E E C D B A C D

75 A C E B E D B A D B A A C D B A A C E B E A B A D A C E D E D D

76 B D E A D A A A A B C C D D E B E B E B D D E E D B A A A C D D

77 A B E D A B A E C C E C D B B C A E C B C D C B B B A D C E

78 A C E B D D C B D C C C D E D C A B E B D B C D B C C C C A C D

79 E A C D C B A A A D C C C E D C C D A B A C A A E C B D A E C A

80 A C E B E D C E D B C B E C A A B D D E A C E A E C B D E B D

81 C D E D A C A A E D C D C A D D C D E B D C A A E D C D C A D D

82 A C E B E D C B D B A C C C C A E B D A B B C B B A E E A E

83 A C E B D B B D D C C C D B D B A B E B D D C D B C C C C B C D

84 B C D E A A B C D B B B E D D B B A D C A B C D D A C A C D

85 B C E A A C C A C B C B C A D C B A C B B C C A D B C B C A D E

86 A C E B E D B A D B A A D C C C E A C A A D B C C A A D A C

87 A B D B E D B A D B D A C E A C E A A C D C B A E B B E C D C

88 A C E C E D C A E B C B C A D C E A A D A D D B A A A A A D A A

89 D C D E A C A C A B D B E A A D A C B B A D D A C D B A A A B A

30 A D E B D C B C D A B E A D C B B E B C C A D E A C C C D D A

31 E D E B A A A E E E A A D B D D A B B B A A D A C A B B C A D D

32 B D A C B B E E C B D D A B D C C D E B D A E C A B C A A D E C

33 B B E B D D C A E A C C C B D D A B E B D C C D E D C C C E D A

34 D C E A D D B D D C C C D E A C A B E D A A A D E C C D A E D A

35 B C E B B D D B E E B A B A E A D E B A D A B E C C A C D E A

36 E E E B D D B C B A C D C D C C B E B C C C B E A C B C A E A

37 B D E B D C C A B C C A A B D E A B E B B C A C E C C B B E A A

38 B D E D E C D B B D C C D D C A B E D B A A D B A C B C A D C

39 B D A C D A B C D B D B B A D D A D E B A D B E B B C C D D D C

40 E D E B D A A E E E A A D B D D A A E A D D A E E D C D C B A A

41 B E B A D B A E A A B C B D D A B E B A D B A E A A C A B D C

42 B C C C A A A A A E C A A E C B A A B E B A C A E B B E C C E D C

43 A D D B A D A A C A B A D B D D A D E B A C D D C A A A C E B D

44 B B E A D A C A B C C A C B E E A B E A C C E B D A C D C E E A

45 C C D B C D B E A B D E B D D D A B E B D C A D D A C C C E D A

46 E C E B A C A B C A C C B D C A B E B A C D D B A C D C E D C

47	B	C	E	B	B	D	D	B	E	B	C	B	D		D	E	A	A	E	D	D	A	C	B	B	A	B	C	C	E	C	A
48	B	C	C	C	B	B	B	B	D	A	B	A	B	D	A	D	A	D	E	A	A	D	B	E	B	B	E	B	B	E	B	E
49	A	C	A	B	B	D	E	B	C	D	A	E	D	B	A	E	C	D	E	B	D	B	D	B	C	C	C	D	E	B	A	C
50	A	C	A	B	C	A	B	A	B	E	C	E	D	B	A	E	C	B	E	B	A	A	A	C	E	A		D	A		D	A
51	B	E	A	C	B	A	B	D	A	C	A	E	A	D	B	C	A	B	E	B	A	A		D	D	C	C		A	C	D	D
52	B	B	D	D	D	D	A	D	B	A	C	B	D	A	D	C	A	B	E	D	D	D	C	D	E	A	A	C	A	A	D	E
53	A	C	D	D	B	B	B	B	A	C	B	A	A	A	B	D	C	D	E	B	C	B	E	E	D	A	E	C	B	A	E	A
54	C	B	E	B	A	D	A	A	E	A	A	B	C	B	D	D	C	B	E	B	A	D	B	D	D	A	C	C	D	B	D	C
55	A	C	C	A	C	D	C	E	C	A	C	C	A	E	B	C	A	C	D	B	A	C	D	A	A	D	C	C	C	A	C	B
56	B	D	B	B	A	C	E	A	B	E	A	C	D	A	E	C	A	B	D	B	A	C		E	C	A	A	A	D	C	E	C
57	B	D	A	D	A	A	A	C	B	D	D	B	D	C	C	D	A	A	D	E	A	B	C	A	C	E	C	B	A	B	E	D
58	D	C	A	B	D	D	B	A			C	C	C	C	D	B	A	B	A	B	D	A	B	A	A	B	A	A	C	E	D	C
59	B	D	E	B	D	C	E	A	B	C	C	C	D	E	D	C	A	D	E	D	D	C	D	D	E	D	D	D	D	B	D	C
90	B	A	A	C	A	B	B	E	A	B	C	A	E	A	B		C	A	D	D	A	B	B	B	C	C	D	D	C	C	C	B
91	E	E	E	A	C	D	B	E	A	E	B	B	C	A	A	C	B	C	B	D	B	B	E	B	C	B	C	B	E	D	B	B
92	E	E	E	B	C	D	B	E	A	E	C	B	C	A	A	D	B	C	A	D	C	D	B	B	D	B	C	B	C	D	D	E
93	E	E	C	A	C	D	B	E	A	E	B	B	C	A	A	D	C	A	D	D	B	B	A	E	D	C	D	A	C	D	E	C
94	D	E	E	C	D	D	E	B	C	C	D	A	A		A	B	B	C	D	E	A	B	E	A	E	B	B	A	E	C	C	A
95	D	C	D	B	D	B	B	B	A	D	D	A	D	E	A	C	B	C	B	E	A	A	B	C	D	B	B	D	B	C	D	D
96	C	C	E	B	A	D	B	E	A	E	C	B	C	E	D		B	C	A	E	B	B	D	C	C	E	A	E	D	E	D	E
97	E	E	C	A	C	D	B	E	A	E	B	B	C	B	A	A	B	D	A	D	A	B	B	B	C	A	D	A	C	D	C	B
98	E	C	E	B	C	D	A	E	A	E		C	C	B	C	A	B	D	C	D	B	B	B	B	E	B	D	E	D	C	C	A
99	C	A	D	B	B	B	B	B	C	C	D	B	E	C	A	C	E	B	D	D	A	A	B	C	C	B	B	D	D	D	E	C
100	D	A	E	D	E	A	D	B	C	E	D	C	C	C	C	E	A	E	B	C	B	B	A	C	C	B	D	B	E	C	D	D
101	E	E	C	A	C	D	A	E	A	E	C	B	C	A	A	D	C	D	B	B	B	B	A	B	B	B	C	B	D	C	C	A
102	C	C	E	B	A	A	B	E	B	A	B	B	D	A	A	D	C	D	B	E	A	B	B	D	D	B	A	A	B	C	A	E
103	C	C	E	B	A	A	B	C	B	A	D	C	A	E	B	D	C	B	D	B	A	B	B	B	C	B	A	C	D	C	D	E
104	E	E	D	B	C	A	B	E	A	E	C	B	C	A	A	D	B	C	E	C	A	B	B	B	D	B	C	A	C	E	D	D
105	E	E	E	B	C	D	B	E	B	E	B	B	C	A	A	D	A	C	D	E	B	B	B	A	C	A	D	D	E	A	A	D
106	E	E	E	B	C	D	A	E	A	E	B	B	C	A	A	D	A	B	C	B	A	B	A	D	E	A	C	C	C	E	D	A
107	E	E	E	B	C	A	B	E	A	E	B	B	C	A	A	D	B	C	E	B	A	B	B	B	C	B	D	C	E	C	E	B
108	E	E	C	A	B	A	B	E	E	E	C	B	C	D	B	B	B	C	A	E	B	D	C	E	C	B	A	D	C	D	B	A
109	E	E	C	B	E	A	B	E	A	E	B	B	C	A	A	D	C	B	D	D	A	B	C	E	C	B	C	E	D	C	C	C
110	C	B	B	E	B	B	C	D	D	D	D	E	A	A	D	D	D	C	B	E	B	C	B	C	B	B	D	D	E	C	E	D
111	C	C	E	B	A	A	B	E	B	A	B	B	D	A	A	D	B	D	A	B	B	D	D	E	C	A	D	B	C	D	C	D
112	E	E	E	A	C	D	B	E	A	E	B	B	C	A	A	D	B	C	D	C	A	A	B	B	C	C	D	A	B	C	E	C
113	E	E	E	B	A	D	D	E	B	D	C	B	B	E	A	B	B	C	D	D	B	B	C	C	B	C	D	A	D	C	B	E
114	E	E	C	B	A	A	B	E	A	E	B	B	C	A	A	D	C	C	C	B	B	B	D	C	A	B	B	D	D	C	C	E
115	E	E	C	A	C	A	B	E	A	E	B	B	C	A	A	D	A	E	A	E	A	A	C	E	B	D	C	A	E	D	A	D
116	E	D	C	B		A	B	E	A	E	C	B	C	A	A	D	D	C	C	E	B	A	B	B	C	B	C	D	E	D	B	C
117	C	D	C	A	C	D	B	E	B	E	C	B	C	A	A	D	C	C	C	B	B	B	A	B	C	B	D	E	B	A	D	E
118	C	B	E	E	B	D	B	D	C	D	E	B	B	B	B	E	B	B	C	E	A	D	E	C	B	A	D	B	E	D	A	C
119	C	C	E	B	A	A	B	E	A	D	C	D	C	B	B	E	C	B	E	E	A	B	B	E	C	A	B	D	E	D	C	C
120	E	E	E	B	B	D	B	E	B	E	C	B	C	E	A	C	E	C	A	D	A	D	B	D	E	A	B	B	C	D	A	E

121	E	E	E	A	C	A	B	E	A	E	B	B	C	A	A	D	B	C	B	D	A	B	B	D	C	B	C	D	E	D	C	E
122	C	D	A	B	B	A	E	E	E	C		B	B		D	E	E	C	D	B	A	B	C	B	B	C	B	B	E	C	A	E
123	C	C	A	B	A	A	B	C	B	A	C	C	D	E	D	C	D	B	C	B	B	C	B	B	C	B	D	A	D	C	A	E
124	E	E	C	B	C	B	B	E	A	E	C	B	C	A	A	D	B	C	A	E	A	B	A	E	B	B	D	B	C	B	C	C
125	A	C	E	B	B	A	E	A	B	C	B	D	D	C	A	A	B	B	B	D	C	D	A	A	B	B	A	D	A	A	A	C
126	D	A	C	A	E	D	B	C	E	A	D	D	E	B	C	B	B	A	D	E	A	D	C	C	C	A	E	B	A	E	A	C
127	A	A	E	A	B	B	E	A	A	E		A	A		A	A	E	C	C	D	A	A	C	B	B	C	C	C	A	C	A	D
128	A	D	A	B	B	A	C	A	E	A	C	B	D	B	D	D	B	B	A	B	B	A	C	E	A	B	D	A	C	C	C	B
129	A	D	B	B	A	A	B	A	E	A	B	B	A	E	D	C	C	B	C	E	A	B	B	B	A	A	E	D	A	C	C	A
130	B	C	D	E	B	A	E	C	E	C		B	E	A	D	A	C	C	C	B	A	D	B	E	C	D	A	A	B	D	A	C
131	B	A	C	C	D	B	E	B	B	A	C	E	A	C	B	E	C	C	C	D	D	D	B	D	B	C	B	A	E	D	A	D
132	A	C	B	E	C	D	D	B	B	E		A	C	E	A	C	B	C	A	B	E	A	E	C	B	C	A	E	B	B	A	C
133	B	D	A	C	C	A	D	C	A	C		C	A	B	E	D	B	C	A	E	A	B	D	B	E	D	D	A	C	C	D	E
134	C	C	B	D	E	B	A	B	A	B	D	D	C	E	E	A	C	C	C	E	A	A	C	C	A	B	D	A	D	B	A	C
135	B	E	C	E	B	D	D	D	E	B	C	B	B	C	E	A	B	D	B	D	C	C	E	B	E	A	E	D	A	C	C	E
136	D	E	D	C	C		B		C	C		D	C	E	C	C	D	B	B	B	C	D	A	E	A	A	D	A	D	D	D	D
137	E	C	E	C	E	C	E	D	A	E	A	E	D	E	D	A	C	C	C	E	A	D	A	E	A	C	A	A	A	E	E	E
138	A	C	E	B	B	D	C	E	B	D		A	A	D	D	A	E	B	C	C	B	B	D	A	C	E	C	B	A	D	C	E
139	A	D	C	E	C	D	B	C	D	B		B	A	C	A	D	C	C	B	B	B	D	B	B	B	B	D	C	A	A	A	A	E
140	E	E	B	A	B	A	D	A	D	B	B	B	D		D	D	D	D	D	E	B	A	A	C	B	A	D	B	C	E	A	E
141	E	D	E	B	D	B	D	A	C	C	A	B	E	A	D	B	B	A	A	C	A	B	B	C	A	B	A	A	B	E	A	C
142	A	B	D	A	A	B	B	B	A	A		C	A	C	E	A	A	A	A	D	A	C	B	B	C	C	B	A	D	E	B	E
143	D	A	C	D	E	C	B	A		D	A	A	C	E	D	B	B	B	A	C	D	D	B	D	A	C	C	D	A	B	E	A
144	A	B	D	D	D	C	C	A	C	A		D	C	A	D	B	B	D	B	B	A	B	B	B	B	B	C	B	E	E	E	E
145	C	A	E	A	A	C	E	B	A	C		A	D	A	B	A	C	B	D	E	C	B	A	C	C	B	D	B	B	A	A	D
146	A	C	E	A	B	D	D	B	B	D	C	A	A	D	D	E	C	B	E	D	A	D	B	B	A	A	D	C	D	D	D	C
147	A	E	B		D	C	C	B	A	C	C	C	A	E	D	E	A	D	C	B	D	A	D	D	C	B	A	A	D	C	A	D
148	B	A	E	A	E	D	B	B	C	E	D	A	D	B	E	D	B	B	A	B	C	C		D	A	D	D	B	A	C	A	D
149	C	E	A	A	B	D	E	A	C	E	D	E	B	B	E	B	C	D	A	B	D	C	A	C	B	A	D	A	B	C	D	E
150	A	C	D	B	B	A		A	E	A		B	D		E	C	A	D	B	C	D	A	D	B	C	D	A	D	C	B	A	C
151	C	C	C	D	E	B	A	B	A	B	D	D	C	E	E	A	C	C	C	A	B	D	E	C	A	D	B	D	C	A	D	C
152	B	C	E	B	D	D	D	A	C	E	C	A	D	A	D	B	B	B	B	C	C	D	B	A	D	C	B	C	D	A	D	C
153	A	D	C	E	D	D	E	B	A	C	C	D	E	D	B	C	A	D	C	B	A	D	B	C	D	E	A	D	B	C	D	A
154	E	C	C	B	D	C	B	A	C	E	C	C	C	A	B	C	C	D	A	B	D	B	C	E	A	C	B	C	D	C	A	D
155	A	B	D	B	A	D	C	A	E	A		B	D	E	D	D	C	B	D	B	C	A	E	C	B	D	C	A	D	A	E	D
156		B	E	B	D	D	E	A	E	D	A	A	A	B	B	D	C	B	C	D	A	D	C	B	C	B	C	D	A	D	B	C
157	D	C	A	B		C	D	E	E	C	B	D	E	A	B	B	A	E	E	B	D	C	D	D	E	A	C	D	E	A	D	B
158	D	C	D	B	A	D	C	A	B	C	B	D	C	A	D	D	A	C	E	B	A	D	A	E	E	B	C	D	C	A	D	A
159	E	B	E	D	D	D	B	A	E	B	A	C	C	B	B	C	A	C	E	B	C	C	A	D	D	A	C	B	C	E	D	A
160	B	A	B	B	E	B	C	C	E	D	E	A	A		A	A	B	B	E	B	C	B	A	D	D	A	D	C	B	B	A	A
161	D	B	A	B		C	D	E	E	C	B	D	E	A	A		A	B	D	B	C	A	A	D	A	E	E	C	E	C	D	E
162	D	D	C	B	A	D	C	E	E	C	B	D	E	A	B	B	A	C	E	D	D	C	A	C	D	E	C	C	C	E	A	A
163	B	B	D	B	D	A	D	E	B	E		A	E		D	B	A	B	C	E	D	C	B	D	E	B	C	C	B	E	D	B

164	D	B	C	B	A	D	D	E	C		D	C	A	B	A	A	A	C	E	B	A	C	A	E	E	A	B	C	C	D	A	A
165	A	A	C	D	B	D	C	D	C	B		C	E		A	B	A	B	A	B	C	C	B	D	E	B	E	C	C	A	D	A
166	E	D	C	C	E	A	A	E	B	E	A	B	E	E	D	D	A	B	D	D	D	C	A	E	E	A	C	D	C	A	A	A
167	D	D	C	B	A	D	C	E	E	C	B	D	E	A	B	D	A	B	D	E	D	A	C	D	E	A	B	C	C	A	D	A
168	D	B	C	B		D	A	B	B	D	B	C	E		B	A	E	B	E	D	D	C	C	D	E	B	D	C	B	E	D	A
169	E	C	A	B	A	C	D	E	E	C	B	D	E			D	E	B	E	B	A	B	A	E	E	A	C	E		E	B	A
170	D	D	C	B	A	D	C	E	E	C	D	C	C	A	E	D	B	B	E	B	A	C	A	D	A	B		C	C	D	D	B
171	D	D	E	B	A	D	C	A	E	B	B	B	C	A	E	D	E	A	E	B	D	C	A	D	D	B	A	C	C	C	D	A
172	A	C	D	C	B	D	B	E	A	C	A	B	C	E	A	A	A	C	E	B	B	D	A	C	D	A	B	C	C	A	D	A
173	D	B	C	B	A	D		E	C	C	D	C	A		C	C	A	C	E	B	B	C	B	D	C	A		C	D	E	A	A
174	D	D	C	B	A	D	C	E	E	A	B	D	D	C	E	E	B	B	E	E	A	B	A	D	C	A	C	C	E	E	D	A
175	D	B	A	B	B	C	D	E	C	D		A	D	B	B	C	B	B	E	E	D	C	B	D	E	B	C	A	E	E	D	A
176	C	A	C	B	D	A	C	C	E	C	C	D	B	C	E	D	A	B	D	A	D	C	A	A	E	B	C	D	C	D	D	A
177	D	D	C	B	A	D	C	E	E	C	D	C		D	C	E	A	B	D	B	B	D	A	D	D	C	B	C	C	E	B	E
178	C	B	E	B	A	D	C	E	E		B	D	E	D	A	B	C	B	E	D	B	A	A	D	E	A	C	E	C	D	D	B
179	A	B	C	B	E	D	C	C	E	C	B	A	A	B	E	E	C	B	D	B	D	B	D	B	E	B	C	A	B	E	C	A
180	D	B	C	B	A	D		E	C	C	D	C	A	D	E	C	A	A	E	E	D	C	A	E	E	B	C	D	C	C	D	D
181	A	B	C	B	E	D	A	B		A		A	A	A	E	C	A	B	E	E	A	B	A	D	C	C	B	C	B	E	D	B
182	E	B	B	C	B	C	A	B	D	A	C	E	D	B	A	E	B	B	E	D	D	B	B	D	A	A		E	A	D	B	A
183	D	B	C	B	C	D		E	C	C	B	A	A	B	E	C	B	B	E	D	B	C	A	B	D	A		E	D	A	D	A
184	A	B	C	B	E	D	B	A	D	A		C	C	A	C	A	A	B	E	C	A	A	A	E	E	A	A	B	C	E	A	A
185	C	D	E	D	E	C	D	C	E	C		A	E	C	B	C	B	B	E	B	B	A	A	E	E	A	D	E	D	C	D	A
186	C	D	C	B	B	D	A	D	A	C	A	A	A	B	A	D	B	A	E	B	D	D	A	D	E	A	D	B	A	A	E	D
187	D	D	C	B	A	B	A	E	C	B	C	C	E	C	E	D	C	A	D	B	A	B	D	D	A	C	C	C	C	E	D	A
188	A			E	C	D	D	A	C	C	E	E	A	B	E	C	C	B	E	A	D	B	A	D	E	C	C	C	C	A	C	A
189	A	C	E	B	C	D	B	B	A	B	E	A	E	E	A	A	C	B	E	E	A	A	B	A	C	A	C	A	D	D	D	A
190	E	A	C	B	B	A	D	C		D	B	A	A	D	E	C	A	B	D	B	D	D	A	D	E	B	C	D	C	E	D	A
191	C	B	A	E	E	D	B	A	B	D	A	E	A	A	E	A	B	B	E	B	D	B	A	D	D	A	C	E	B	E	C	A

APPENDIX M1

RAW DATA of PRE-MAQ

ID	PRE-MAQ																														
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics				Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	2	4	3	2	4	3	3	4	3	5	1	3	1	3	5	5	5	5	1	3	3	1	5	5	5	5	4	3	3	3
2	1	1	3	5	1	1	3	1	3	3	1	1	1	1	1	1	3	3	1	1	1	1	1	5	1	3	5	5	5	5
3	3	4	2	2	5	5	1	5	1	4	4	4	3	4	4	4	4	4	4	4	4	2	3	2	2	2	2	2	2	2
4	4	3	3	2	4	5	2	4	1	4	3	4	4	3	5	3	3	4	1	1	1	1	1	3	4	4	2	1	2	2
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	5	5	4	3	2	2	3	3	2	5	4	5	4	4	4	4	4	4	2	4	4	3	4	4	5	3	2	2	3	2
7	3	4	1	3	3	4	1	4	2	4	3	4	5	5	5	4	4	5	3	4	4	1	2	5	2	2	2	2	1	2
8	5	4	4	1	5	5	1	5	1	5	5	4	1	5	1	2	2	2	3	1	1	2	2	1	1	1	1	1	1	1
9	4	3	4	5	3	4	5	4	4	4	4	4	4	4	5	5	2	4	5	4	3	4	5	4	4	4	4	4	4	5
10	1	1	1	5	3	2	4	3	4	5	1	1	1	1	3	1	3	3	1	1	1	1	1	1	1	1	5	5	5	5
11	1	1	1	5	1	3	3	3	3	2	1	1	1	1	1	5	5	4	1	1	1	1	1	1	1	1	1	1	1	1
12	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
13	1	1	1	5	4	4	3	4	5	4	3	3	3	4	3	3	3	3	4	1	2	3	4	3	3	4	1	5	2	3
14	1	2	1	5	2	1	1	1	3	1	1	1	1	1	4	3	3	2	1	1	1	1	5	1	5	1	3	5	3	3
15	3	4	2	2	5	5	1	5	1	4	4	4	3	4	4	4	4	4	4	4	2	3	2	2	2	2	2	2	2	2
16	1	1	4	5	1	1	5	1	5	1	1	1	2	3	1	1	1	1	1	1	1	2	1	1	1	1	4	5	5	5
17	5	5	5	2	5	5	2	5	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2
18	1	1	1	5	3	3	3	2	3	4	4	4	3	5	5	4	4	4	1	2	3	1	3	4	4	3	1	1	2	1
19	3	3	2	4	3	3	3	3	3	5	2	2	2	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21	5	1	1	4	3	4	3	3	4	4	3	2	3	5	1	4	4	3	1	2	3	3	5	5	5	1	1	5	3	3
22	1	1	1	5	1	3	3	3	3	2	1	1	1	1	1	5	5	4	1	1	1	1	1	1	1	1	1	1	1	1
23	5	4	3	1	5	4	1	5	1	4	5	5	5	4	4	5	3	4	5	4	2	2	4	3	5	5	4	2	1	4
24	5	5	5	1	5	5	1	5	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1
25	1	1	1	5	4	4	3	4	5	3	3	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
26	3	1	2	3	4	4	2	4	2	3	3	3	2	4	2	3	4	2	1	1	3	1	1	3	2	3	3	2	2	2
27	3	3	3	4	3	4	2	4	2	3	3	3	3	3	4	4	4	4	3	4	3	3	3	4	3	2	2	3	3	3
28	2	1	1	4	4	4	1	3	3	5	2	2	2	2	2	5	2	3	1	1	1	1	1	4	1	1	3	5	5	5
29	3	5	3	4	5	4	4	3	5	2	4	2	4	1	2	4	5	3	5	1	3	3	1	1	2	1	5	4	5	5

ID	PRE-MAQ																														
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics				Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
30	1	1	1	5	3	3	3	3	4	1	1	1	1	1	3	2	4	2	1	1	2	1	2	2	2	4	3	4	4	4
31	1	5	1	1	1	1	5	1	5	3	2	2	2	2	4	3	4	4	2	2	2	1	1	3	3	1	1	1	1	1
32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33	3	5	4	3	1	1	1	1	2	1	2	1	2	1	1	1	1	1	1	3	1	2	3	1	3	1	5	5	5	5
34	3	3	3	3	3	3	3	1	2	3	3	3	3	3	4	4	4	4	5	5	5	5	5	5	4	3	4	4	3	3
35	1	1	1	1	1	1	5	1	5	1	1	1	1	1	5	5	3	4	1	4	2	2	1	4	5	1	5	5	5	5
36	2	2	1	2	1	2	3	3	3	3	1	3	3	3	3	2	1	2	3	2	1	3	1	2	4	2	3	1	2	1
37	2	2	2	4	4	3	3	3	3	3	1	1	2	1	2	1	2	4	2	1	2	1	1	2	1	2	4	5	5	5
38	2	3	2	4	4	2	4	3	1	3	3	4	4	4	4	5	5	5	3	3	4	2	3	3	4	2	4	3	4	2
39	1	2	2	2	1	1	1	2	1	2	2	2	1	1	1	2	3	2	1	2	2	2	1	1	2	3	2	1	1	2
40	3	3	2	4	4	3	3	3	3	5	3	5	3	3	5	5	5	5	5	5	5	3	2	5	3	3	4	4	3	3
41	3	3	2	3	4	3	2	4	2	3	2	3	2	2	1	2	2	1	2	2	2	1	2	1	2	2	4	5	4	5
42	1	2	1	2	1	1	2	1	2	2	2	2	2	1	1	2	3	2	1	1	2	2	2	1	1	2	2	3	4	5
43	2	3	1	2	3	2	2	3	2	3	3	3	2	3	4	3	3	4	4	4	4	2	2	3	2	2	3	2	3	3
44	1	1	1	4	3	2	4	2	3	1	1	2	2	1	3	2	3	3	1	1	1	1	2	5		1	4	4	3	4
45	2	3	2	3	3	2	2	2	1	2	2	1	2	2	1	2	2	3	3	3	2	1	2	2	1	5	5	4	4	4
46	2	4	3	4	5	4	1	4	1	3	2	3	3	3	4	4	5	3	4	4	5	3	4	4	4	4	1	1	1	1
47	3	3	1	2	3	2	1	3	4	5	1	3	3	2	4	4	3	4	5	3	4	1	3	5	5	4	5	3	3	4
48	1	2	2	1	2	2	2	3	2	1	1	3	4	2	1	2	1	2	1	2	2	1	1	2	2	2	5	5	5	5
49	2	4	3	3	2	2	3	4	3	3	1	3	1	1	5	4	4	4	4	4	4	3	1	5	3	3	3	3	4	5
50	1	1	1	5	1	1	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
51	1	2	1	1	1	1	1	2	1	1	2	3	1	1	1	2	2	3	2	2	1	2	2	1	2	2	3	2	1	1
52	2	3	2	4	5	5	1	5	1	4	3	4	3	2	5	5	4	5	3	3	5	3	4	4	4	4	2	2	2	2
53	1	2	2	1	2	1	2	2	1	1	2	2	2	1	1	1	2	2	1	1	1	2	2	2	1	1	3	3	3	3
54	1	2	1	4	4	3	3	3	1	5	1	3	1	1	5	4	2	4	1	1	5	1	1	3	3	4	5	5	5	3
55	5	5	3	4	5	4	4	5	3	5	3	4	5	1	5	4	5	5	4	5	4	5	5	4	4	4	3	3	5	5
56	3	4	4	3	4	4	2	5	2	5	4	4	4	5	4	5	5	4	2	5	1	2	1	1	1	1	4	4	4	4
57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
58	4	4	4	2		3	3	4	2	4	2	4	4	3	4	3	5	4	4	5	5	4	4	4	4	4	3	1	2	2
59	1	1	1	1	4	3	2	3	3	5	5	5	4	3	4	4	3	4	1	1	1	1	4	5	4	3	5	5	5	5
60	3	3	3	1	3	4	2	3	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	5	5	5	1	1	1	1
61	3	3	3	4	4	3	2	4	2	3	3	3	3	3	4	4	4	4	3	4	3	2	4	3	4	4	3	3	3	3
62	5	5	5	5	5	5	5	5	5	5	5	5	5	1	5	5	4	3	4	3	4	5	5	4	1	5	2	5	4	4
63	2	2	2	4	2	2	5	2	2	3	2	2	2	3	4	3	3	4	3	3	2	1	2	4	2	2	4	2	2	2
64	3	3	3	3	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	3	4	5	4	4	1	1	1	1

ID	PRE-MAQ																															
	Situational Interest					Importance of Physics				Physics self-efficacy					Achievement motivation in Physics				Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
65	3	3	3	4	4	4	3	3	3	3	2	3	3	2	4	4	4	4		3	4		3	3	3	3	2	2	2	2
66	3	3	3	4	4	3	4	3	3	3	4	3	3	3	4	4	4	4	3	3	3	2	3	3	2	3	2	4	3	3
67	5	5	5	5	5	5	5	5	3	4	4	3	4	4	5	5	4	3	4	4	5	4	5	4	5	5	3	5	5	5
68	3	4	4	2	4	4	4	3	1	5	4	4	4	5	4	4	4	5	5	5	5	4	4	5	5	5	1	1	1	1
69	5	4	5	5	5	5	4	4	5	5	5	4	4	5	5	4	4	4	4	4	4	4	4	5	5	5	3	3	3	3
70	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	5	5	1	1	1	1
71	4	2	3	1	4	4	4	2	1	4	4	3	4	4	3	4	4	4	1	2	4	1	3	3	4	3	5	1	1	1
72	2	2	2	3	5	5	1	5	1	4	1	3	3	1	5	5	5	1	1	2	4	3	5	1	2	5	3	4	1	1
73	2	3	2	3	1	4	2	3	2	3	2	4	2	2	4	4	4	4	2	3	3	3	2	3	3	3	4	3	3	4
74	3	2	2	5	3	2	3	2	4	3	3	2	2	3	3	4	3	3	2	3	4	2	2	1	3	1	5	5	5	5
75	3	4	3	4	4	4	3	4	3	3	3	3	3	3	4	4	4	4	3	3	4	2	4	4	4	3	3	3	3	3
76	3	3	3	3	4	4	2	3	2	3	3	3	3	5	5	4	5	4	4	3	3	3	3	5	4	4	3	2	2	2
77	3	4	3	4	4	4	2	4	2	4	3	4	3	2	4	3	3	4	2	4	4	2	3	4	3	3	2	2	2	3
78	3	2	1	4	3	2	4	3	3	4	5	4	3	5	5	4	3	4	3	4	3	3	4	4	4	3	2	4	3	4
79	5	5	5	5	5	4	4	5	5	4	5	5	5	4	5	3	4	5	4	4	4	5	4	5	4	2	1	1	2	1
80	4	5	4	4	5	5	1	5	1	5	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	1	1	1	1
81	3	2	2	5	3	2	3	2	4	3	3	2	2	3	3	4	3	3	2	3	4	2	2	1	3	1	5	5	5	5
82	1	2	1	5	3	2	4	2	3	4	1	4	2	1	4	2	3	4	2	3	1	1	1	5	2	1	5	4	4	4
83	4	4	3	3	4	2	4	3	2	4	5	5	5	5	5	5	4	5	3	3	4	2	3	4	3	3	2	2	2	3
84	4	3	4	4	3	3	4	3	3	2	2	3	4	4	3	3	4	4	3	3	4	4	4	3	3	3	4	4	3	3
85	3	3	3	4	4	3	3	3	4	4	4	4	4	4	4	4	4	4	3	2	3	2	3	4	4	4	3	3	3	3
86	1	2	1	4	4	4	1	4	2	4	4	4	4	3	4	2	4	4	2	3	4	2	2	2	2	2	4	2	2	2
87	4	3	2	2	5	5	5	5	2	4	4	3	4	3	5	5	5	4	4	4	5	3	5	5	4	5	5	5	4	5
88	1	2	2	4	5	5	3	4	3	4	1	3		3	4	2	3	4	4	3	2	1	1	1	1	1	3	3	2	2
89	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	2	1
90	3	3	3	3	3	3	4	4	4	4	3	3	3	3	2	3	4	3	3	2	4	3	3	3	3	3	4	3	2	3
91	5	4	3	2	3	3	2	4	2	4	4	5	4	3	5	4	5	4	4	5	5	4	5	5	5	4	2	2	2	2
92	2	2	2	3	2	2	2	3	2	2	2	2	3	2	4	3	2	4	3	3	3	3	2	5	2	2	3	4	3	2
93	5	3	3	2	4	3	4	4	3	3	2	3	3	3	3	3	4	4	3	3	3	2	3	5	4	5	3	3	2	2
94	5	5	5	5	3	4	4	4	4	2	2	2	2	2	2	2	2	2	4	2	2	4	4	4	4	2	2	2	4	2
95	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3
96	4	4	4	5	4	3	4	4	4	4	4	4	5	4	5	5	4	5	4	5	3	3	2		2	1	1	2	2	5
97	5	4	5	1	5	5	1	3	1	5	3	5	5	4	5	5	4	5	5	4	5	3	4	5	4	5	3	2	2	2
98	4	3	3	1	4	5	3	4	2	5	4	3	5	2	4	2	4	5	3	4	5	4	5	5	4	1	3	4	5	5
99	2	3	3	4	3	3	3	2	4	4	4	3	4	3	4	4	3	3	4	3	3	3	4	4	3	2	2	2	2	2

ID	PRE-MAQ																														
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics					Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
100	2	1	1	3	5	5	1	5	1	3	1	4	1	1	4	1	3	3	5	5	5	1	4	1	3	1	3	3	1	1
101	3	2	3	2	4	4	1	5	1	5	3	4	3	3	4	4	4		3	4	3	3	3	2	3	3	4	2	2	2
102	5	4	5	1	4	4	4	4	1	4	3	5	4	5	5	5	4	5	4	5	5	4	5	5	5	4	5	5	1	1
103	3	3	3	2	5	4	4	3	2	3	3	3	3	3	4	4	4	4	2	4	4	3	4	2	3	4	3	2	3	3
104	5	4	4		5	5		2	1	5	3	4	4	5	5	5	5	5	4	4	5	4	5	4	5	5	1	1	1	1
105	4	4	3	2	4	4	4	5	1	4	3	3	3	3	5	5	5	5	4	4	4	3	3	3	3	3	1	2	1	2
106	4	5	3	2	4	5	5	4	4	4	4	4	4	4	5	4	5	4	4	4	4	4	5	3	5	4	1	2	2	1
107	4	5	3	2	4	5	5	4	4	4	4	4	5	4	5	4	5	4	4	4	5	4	5	4	5	4	5	2	1	2
108	3	3	2	3	2	3	2	4	4	5	5	5	5	5	5	4	4	4	4	4	3	3	4	3	4	3	3	3	3	3
109	4	4	3	4	3	3	3	2	3	4	3	3	2	3	4	3	3	4	3	3	3	4	3	2	3	2	1	1	1	1
110	4	4	3	3	4	4	3	4	4	3	3	3	4	4	3	3	2	3	4	3	3	3	2	3	2	3	4	3	3	3
111	4	3	2	2	4	3	4	3	1	4	2	4	3	2	4	4	5	4	3	4	4	3	2	3	4	3	4	1	1	1
112	5	4	3	1	4	4	2	3	2	5	3	5	4	3	5	4	5	4	4	5	5	4	5	5	5	4	2	2	2	2
113	4	4	3	2	4	4	3	3	4	4	3	4	4	4	1	3	4	3	4	3	4	4	3	3	4	3	4	4	3	4
114	5	4	5	1	5	3	1	4	1	5	4	5	4	3	5	5	5	5	4	5	4	3	5	4	4	4	1	1	1	1
115	5	5	4	1	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	4	5	3	4	5	4	5	3	2	2	2
116	5	5	5	1	4	5	1	5	1	4	4	5	5	5	5	4	4	5	5	5	4	4	5	4	5	4	4	1	1	1
117	4	5		1	5	4	1	4	1	4	4	3	3	3	4	4	4	4	3	4	4	3	4	3	4	3	1	1	1	1
118	3	2	2	2	3	2	2	2	1	2	1	2	2	2	2	3	2	2	2	1	2	3	3	3	2	2	3	3	4	3
119	4	4	4	1	5	5	1	4	1	4	4	3	3	3	4	4	4	4	3	4	4	3	4	3	4	3	1	1	1	1
120	1	4	4	1	5	5	1	5	1	4	4	4	4	4	5	4	5	5	4	5	5	3	3	3	3	3	4	4	2	2
121	4	5	4	1	4	2	4	4	1	5	5	5	5	4	4	5	5	5	5	4	4	4	5	5	5	5	1	1	1	1
122	5	3	5	3	4	5	3	4	2	3	3	1	2	1	1	2	5	3	1	5	3	3	2	1	2	1	3	1	1	1
123	4	3	2	2	3	2	3	2	2	3	2	4	4	2	4	3	4	3	4	3	4	2	3	4	3	3	1	1	1	1
124	4	4	3	2	5	5	1	5	1	4	2	4	4	3	4	3	4	4	3	4	4	3	5	4	5	3	1	1	1	1
125	3	3	3	2	4	4	3	4	3	3	4	4	3	3	4	3	3	3	4	4	4	2	4	3	3	4	4	2	2	3
126	3	3	2	5	4	3	2	5	1	3	3	3	3	4	5	4	5	4	2	3	3	2	3	2	3	3	4	3	3	4
127	1	3	2	3	4	1	2	4	1	4	5	4	3	5	4	5	3	2	1	2	2	2	1	1	3	2	3	3	3	1
128	5	5	5	4	5	5	4	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4
129	4	4	3	2	5	5	5	5	2	3	5	3	3	5	4	4	4	4	4	3	5	5	3	3	3	3	2	2	2	2
130	1	1	2	2	1	1	2	2	2	5	5	2	2	2	5	5	2	5	2	2	5	2	2	2	2	2	5	5	5	5
131	4	2	4	2	3	1	4	2	4	2	4	1	3	1	2	3	3	4	1	3	5	2	3	4	2	3	4	2	3	1
132	5		5	3	5	5	5	4	4	5	4	5	4	4	4	4	4	4	4	4	4	3	4	5	4	3	3	2	2	2
133	4	3	3	3	4	4	4	4	4	3	3	3	3	3	4	3	3	3	4	4	4	3	3	2	3	4	4	4	4	4
134	3	1	2	3	3	5	4	3	4	3	1	4	1	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

ID	PRE-MAQ																															
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics				Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
135	3	3	3	3	3	5	1	3	3	4	3	3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
136	4	4	3	2	3	3	5	3	4	2	3	4	3	3	3	4	3	4	3	4	3	4	3	4	3	4	3	4	5	3
137	5	5	5	5	5	5	5	5	5	5	4	4	4	4	5	4	5	5	5	5	5	5	4	3	5	5	5	5	5	5
138	4	4	2	3	4	4	1	4	1	3	2	2	2	2	3	2	3	3	3	3	3	3	3	3	3	3	2	3	2	2
139	5	3		1	4	4	4	4	3	4	2	5	4	5	5	5	5	5	5		3	4	3	1	2	3	3	3	4	5
140	3	4	3	3	4	3	2		4	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3	3
141	4	4	4	2	4	4	1	4	2	4	4	4	4	4	5	5	4	4	4	4	3	3	4	5	5	4	2	1	2	1
142	2	3	4	4	3	3	3	4	3	3	2	1	2	2	2	3	3	3	3	2	2	3	3	2	3	4	4	4	4	4
143	5	4	3	1	4	5	5	4	5	5	3	4	4	4	5	5	4	4	4	5	3	2	3	4	3	3	4	2	1	3
144	4	4	3	3	4	4	4	4	4	5	4	3	2	3	4	4	4	4	4	3	4	4	3	4	4	3	3	4	4	4
145	1	1	1	1	2	1	2	1	2	2	1	1	1	1	5	4	4	5	4	2	1	3	3	4	5	4	3	2	1	1
146	5	2	3	3	5	5	1	5	1	5	3	3	3	1	5	3	5	5	3	5	3	4	2	5	5	3	3	3	3	1
147	5	5	3	3	3	3	3	3	3	5	3	3	3	3	5	4	5	5	5	5	5	5	5	5	5	5	4	5	3	5
148	3	3	3	5	3	3	3	3	3	2	2	3	1	1	1	1	1	1	1	1	1	1	1	3	5	1	3	2	3	3
149	4	4	4	2	4	4	1	3	1	4	3	4	4	3	4	4	4	3	3	3	4	3	3	3	4	4	2	2	3	2
150	4	4	4	2	3	4	3	3	2	5	4	4	4	3	4	4	5	4	4	4	4	3	4	4	4	3	2	2	2	2
151	3	3	3	3	3	4	5	5	1	3	4	4	3	1	3	3	4	3	3	3	4	3	4	1	3	1	3	3	3	3
152	4	4	4	1	4	3	2	4	1	5	5	5	5	4	5	4	5	5	4	5	5	4	5	4	5	4	1	1	1	1
153	3	3	3	2	4	5	5	4	3	3	3	3	3	3	4	4	4	4	4	4	4	3	3	3	4	3	2	3	3	2
154	5	4	4	2	4	5	5	3	4	3	3	3	3	3	3	3	4	4	4	4	5	5	3	2	3	3	1	2	3	4
155	3	4	3	3	4	2	4	3	2	4	3	4	3	3	4	4	4	4	4	3	3	3	3	4	4	3	3	3	2	2
156	4	3	4	2	5	4	4	4	1	4	3	4	3	3	4	5	4	5	4	4	3	3	3	3	4	3	3	2	2	1
157	5	4	4	1	4	4	1	4	1	5	3	4	3	3	5	5	4	4	5	4	4	4	4	4	4		1			
158	4	3	3	2	5	4	5	4	1	4	4	4	5	3	3	4	5	4	3	4	3	3	3	3	4	3	4	3	2	1
159	3	4	3	4	4	2	4	5	3	3	2	4	3	4	4	5	3	2	4	3		4	2	2	1	1	1	3	2	3
160	3	4	2	3	5	5	1	5	1	3	2	2	4	2	5	4	4	5	2	5	5	2	3	4	4	3	2	1	3	2
161	5	5	5	1	5	5	5	4	1	5	4	5	5	4	5	4	5	4	4	5	4	4	5	5	5	4	1	1	2	1
162	5	4	4	1	5	4	4	4	1	5	4	5	4	4	5	4	5	5	4	5	5	4	5	5	5	5	4	1	1	1
163	4	4	3	3	3	5	4	3	3	3	3	3	3	2	4	4	3	4	4	3	3	3	4	3	3	3	3	3	3	3
164	3	3	2	2	2	2	3	3	3	1	1	2	2	2	2	2	2	1	1	1	2	2	2	3	3	4	4	5	5	5
165	3	2	2	4	3	4	2	3	1	3	2	3	2	3	4	3	4	4	2	3	4	4	2	5	4	4	4	4	3	4
166	3	3	3	3	5	5	5	4	2	3	1	4	3	3	4	4	3	5	2	3	2	1	1	4		4	1	2	1	1
167	3	5	4	3	3	4	5	5	2	4	4	4	3	3	5	2	5	5	2	5	5	2	5	5	5	5	3	2	2	2
168	5	5	4	2	4	3	4	3	2	5	3	5	3	2	5	3	4	4	3	4	3	3	5	4	4	5	2	1	1	2
169	5	5	5	1	3	1	5	2	2	3	1	4	2	5	4	3	3	5	4	5	5	4	4	4	3	3	5	5	3	4

ID	PRE-MAQ																														
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics					Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
170	1	1	1	2	2	3	4	2	2	4	3	4	3	3	2	2	2	2	2	2	2	3	3	3	3	5	5	5	5	5
171	3	3	3	3	5	3	1	3	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
172	1	1	1	5	3	5	1	1	2	5	5	5	5	5	5	3	4	5	1	1	4	1	5	5	5	5	1	1	1	1
173	4	5	4	2	5	3	3	4	1	5	5	5	4	5	5	4	5	5	5	5	5	4	4	5	4	4	5	1	1	1
174	1	1	1	5	1	1	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
175	3	3	3	4	3	4	4	4	2	4	1	3	3	2	4	3	4	3	3	3	4	3	3	3	4	3	4	3	4	3
176	3	3	4	2	5	5	2	4	1	3	4	4	3	4	4	4	3	3	1	3	4	2	3		4	3	3	3	3	3
177	1	2	2	4	5	4	4	4	4		3	5	5	3	5	1	1	5	5	5	4	3	3	4	4	4	5	1	1	3
178	5	5	5	1	5	4	5	5	5	5	4	5	5	5	5	3	5	5	5	5	4	4	5	5	5	4	1	1	1	1
179	3	4	3	1	4	3	1	5	1	3	2	2	1	1	4	5		4	1	3	3	2	1	3	3	3	5	2	1	4
180	4	3	2	2	5	4	4	3	2	5	4	5	5	5	4	5	4	5	5	4	4	1	2	1	2	3	1	2	2	2
181	4	3	2	2	4	3	3	2	2	4	4	4	4	3	4	4	4		3	3	3	2	3	5	3	4	2	1	1	1
182	4	3	2	2	1	2	1	1	1	5	4	1	3	5	5	3	5	5	4	2	5	5	4	3	4	5	1	2	1	1
183	4	4	3		5	5	4	3	4	5	4	3	4	4	3	4	5	3	4	5	5	5	4	5		3	3	4	5	4
184	2	2	2	4	3	2	4	2	1	4	3	4	3	1	5	3	2	5	3	3	3	3	2	3	4	3	4	4	2	5
185	4	5	4	3	3	4	2	4	3	4	4	4	3	3	5	4	3	4	3	4	2	3	4	3	2	1	2	3	4	3
186	5	5	3	2	5	4	1	5	1	5	5	5	5	4	5	5	5	5	3	5	5	4	4	5	5	3	4	2	1	1
187	4	5	4	2	4	4	3		4	4	3	4	4	2	5	4	4	3	4	5	2	4	5	3	4	3	4	3	4	3
188	1	1	1	5	1	1	1	1	1	1	1	1	1	1	5	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1
189	4	4	4	2	3	3	3	4	3	4	2	4	3	2	4	5	4	5	1	5	4	1	3	4	3	4	5	5	4	2
190	3	3	2	2	3	3	2	2	3	2	2	4	2	3	3	3	4	4	3	3	2	2	4	3	4	4	2	2	2	3
191	1	1	2	2	2	1	2	2	2	2	2	3	3	3	1	2	2	1	1	2	2	3	3	3	3	4	4	5	5	5

APPENDIX M2

RAW DATA of POST-MAQ

ID	POST-ACQ																													
	Situational Interest				Importance of Physics					Physics self-efficacy					Achievement motivation in Physics				Student motivation				Physics self-concept				Physics course anxiety			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	3	5	5	3	5	5	5	5	5	5	2	5	2	5	5	5	5	5	2	3	3	2	5	5	5	5	5	3	3	3
2	2	1	1	5	3	3	3	3	3	5	5	5	5	5	3	3	3	3	1	1	1	1	1	5	1	1	2	2	1	2
3	1	1	1	5	5	5	1	5	1	3	1	3	1	5	3	3	5	3	4	5	5	2	1	1	1	1	4	4	5	4
4	1	1	1	2	1	3	3	2	3	2	3	1	1	4	4	3	4	4	1		1	1	1	5	4	4	5	3	1	1
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6	3	4	4	3	4	3	3	4	3	4	4	4	4	5	4	4	4	4	4	4	5	4	4	4	4	4	2	3	3	3
7	1	1	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	4	3	1	5	3	1
8	3	3	4	4	4	4	4	5	5	5	5	4	4	4	4	1	1	1	2	2	1	1	2	2	1	1	1	1	1	1
9	4	5	4	5	4	5	4	5	4	5	4	5	4	5	4	1	1	1	3	2	1	2	3	1	1	1	1	3	2	1
10	1	1	2	1	2	1	2	1	1	1	1	2	1	2	1	3	1	1	1	2	1	1	1	1	1	2	1	3	1	1
11	1	1	1	5	1	1	5	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	2	1	2	2	2	1	2	1	1	1	1	2	1	2	2	2	1	1	1	2	1	2	2	1	1	1	1	2	2	4
13	3	3	3	3	4	4	5	2	3	4	1	2	4	5	4	4	3	3	4	3	4	3	5	3	2	3	1	2	1	4
14	1	1	1	5	1	1	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	1	1	5	5	5	5
15	1	1	1	1	1	2	3	2	1	2	1	1	1	1	1	5	1	1	1	1	1	1	2	1	1	2	1	1	2	1
16	4	4	3	3	4	4	4	4	5	5	4	4	4	4	4	5	4	5	4	5	5	5	5	5	5	5	5	3	3	3
17	5	4	4	3	5	4	3	3	2	3	2	3	2	2	2	2	2	2	2	3	1	1	1	1	1	2	1	1	1	1
18	1	2	3	3	4	3	2	3	2	2	2	3	2	1	1	1	2	1	1	2	2	3	2	2	3	2	1	3	2	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	5	5	5	5	5	5	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1
21	4	3	2	4	5	4	2	3	4	3	4	3	3	4	3	4	4	4	2	3	4	1	2	3	4	3	2	4	4	3
22	2	1	2	2	2	1	2	2	2	1	1	1	1	1	2	1	2	2	2	1	2	1	2	1	1	1	1	1	1	1
23	2	2	1	2	2	1	2	2	2	1	1	1	2	2	2	1	2	2	2	1	1	2	1	1	2	2	2	1	1	1
24	4	4	4	1	4	4	1	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1
25	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
26	1	1	1	5	3	2	3	1	3	3	1	4	1	2	3	3	4	3	1	2	3	1	1	3	1	1	5	5	5	5
27	3	3	2	3	3	4	2	4	2	3	3	3	3	3	5	5	5	5	4	3	3	3	2	3	3	2	4	3	3	3
28	1	1	1	5	1	1	5	1	5	3	1	1	1	1	5	1	1	1	1	1	1	1	1	1	1	3	5	5	5	5
29	1	1	1	5	2	3	4	1	3	3	1	1	2	3	5	2	1	3	2	1	5	1	3	4	1	5	2	4	2	5

30	5	5	5	5	5	5	2	5	2	5	5	5	5	5	4	5	4	5	4	5	5	4	5	5	5	5	1	1	1	1
31	1	1	1	5	1	5	5	1	5	4	4	4	4	4	4	1	3	3	5	5	5	5	1	1	1	1	1	1	1	1
32	1	2	1	5	1	1	5	1	5	1	1	1	1	1	5	4	3	2	1	1	1	1	1	1	1	1	5	5	3	2
33	3	4	2	4	4	3	3	4	1	5	3	5	3	2	5	5	4	5	5	4	4	3	1	5	1	2	3	1	1	1
34	2	3	2	2	3	3	3	3	2	3	2	3	3	2	3	3	3	3	2	3	3	2	2	2	2	2	4	3	3	3
35	1	1	1	5	1	5	5	1	5	1	1	1	1	1	3	5	5	5	5	5	4	1	1	5	1	1	5	5	5	5
36	2	2	1	4	4	3	4	4	3	1	4	2	2	5	3	3	4	5	4	3	5	3	2	4	1	1	3	4	2	5
37	1	1	1	4	5	2	4	3	1	3	3	4	3	2	4	2	3	4	4	3	4	2	1	4	2	3	2	2	2	3
38	1	2	1	2	4	2	4	4	2	3	3	3	3	4	4	4	3	4	2	3	2	3	3	3	4	4	4	4	4	3
39	2	1	3	4	4	4	2	3	1	5	3	4	3	3	4	4	4	4	3	4	2	3	3	4	5	3	1	1	1	2
40	3	3	3	3	3	5	4	5	4	5	4	4	5	3	3	5	5	5	5	5	5	5	3	3	3	3	3	3	3	3
41	1	2	1	5	4	3	3	3	3	3	2	2	3	2	3	2	3	3	2	3	3	2	2	4	3	1	5	5	5	5
42	1	4	1	1	4	2	3	3	1	5	1	5	3	5	5	5	4	4	3	2	5	1	4	5	5	5	4	2	3	2
43	2	2	3	3	3	3	4	2	3	3	3	4	3	4	4	3	4	4	2	3	3	2	2	3	2	2	4	3	4	4
44	1	1	1	5	1	1	4	1	5	1	1	1	1	1	3	4	5	4	5	5	4	5	5	5	1	1	1	1	1	1
45	4	4	5	4	4	4	3	4	5	4	5	4	5	4	5	3	3	4	4	3	4	5	5	4	5	4	4	1	1	1
46	4	5	5	2	4	3	3	4	2	2	1	3	3	3	5	4	2	2	2	1	4	2	4	5	5	3	1	1	1	1
47	5	5	1	1	1	1	5	4	4	3	1	1	1	1	3	1	1	1	1	1	1	1	1	5	1	1	5	5	5	5
48		2	1	4	2	1	4	2	4	3	2	3	3	2	4	4	5	4	4	5	4	5	5	4	4	5	3	2	1	2
49	2	3	2	4	4	3	1	3	1	3	3	1	4	1	4	1	4	5	3	4	4	3	2	3	3	3	1	3	2	3
50	4	5	4	4	4	4	5	4	5	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1
51	4	4	3	2	5	5	1	5	1	5	4	4	3	5	5	4	4	4	5	5	5	5	5	4	4	5	1	1	1	1
52	4	3	3	1	4	4	2	4	2	4	4	4	4	4	4	5	5	4	4	4	4	3	4	4	4	3	2	1	1	2
53	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1
54	1	1	1	5	1	1	5	1	5	1	1	1	1	1	1	2	3	1	3	1	1	1	3	5	1	4	5	5	5	5
55	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	5	1	4	3	3	5	3	5	3	4	5	2
56	3	4	3	2	3	4	4	5	2	4	4	3	4	3	4	4	4	4	2	4	3	3	3	4	3	5	4	2	4	2
57	1	1	1	5	4	3	4	1	5	1	1	1	1	1	3	1	2	1	1	1	1	1	1	3	1	1	4	5	5	5
58	4	4	4	1	5	4	1	5	1	5	5	5	5	3	5	4	4	4	5	5	5	3	4	4	4	5	1	1	1	1
59	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
60	1	1	1	5	1	1	1	1	1	1	1	1	1	1	1	1	4	5	2	1	3	3	4	2	2	1	3	2	4	1
61	2	3	2	3	4	2	3	4	2	3	2	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	4	3	3	3
62	1	1	1	5	1	1	5	1	5	1	1	5	1	1	5	2	2	2	1	2	2	1	1	1	1	1	5	5	5	5
63	1	2	1	5	3	3	3	3	2	3	3	3	3	3	4	4	4	4	2	3	3	2	2	4	2	2	2	3	3	2
64	3	3	3	2	2	2	2	2	2	4	4	4	4	5	4	3	4	3	2	3	3	3	5	5	5	5	3	1	3	3
65	3	3	2	3	3	3	3	3	3	4	3	3	3	4	2	3	3	4	3	3	3	2	3	4	3	3	3	3	3	3
66	2	3	2	3	4	2	4	3	2	4	2	2	2	2	3	3	4	4	3	3	3	2	2	3	3	3	4	4	3	2
67	4	4	4	5	4	5	4	5	4	5	4	5	4	4	4	5	4	5	5	4	5	5	4	5	4	5	4	5	4	5
68	2	4	2	2	3	4	3	4	3	5	5	5	5	3	4	4	5	4	3	3	4	3	1	4	1	3	5	5	5	5
69	2	2	2	4	3	2	4	2	2	2	2	2	2	2	2	4	1	3	1	4	5	3	1	5	5	3	2	1	1	1
70	4	5	5	1	3	4	1	4	1	5	4	5	4	4	5	5	5	5	4	5	5	4	5	5	5	5	1	1	1	1
71	2	2	2	4	2	2	2	2	2	4	2	3	2	1	2	2	2	2	2	2	2	2	2	4	2	4	2	2	1	1
72	1	1	1	5	5	5	4	3	3	3	5	4	1	1	1	1	5	5	1	2	3	2	5	5	5	3	5	5	5	5
73	1	3	1	1	3	3	3	3	3	2	1	1	1	3	4	4	4	4	1	1	1	1	3	2	1	1	5	5	4	4

74	2	2	1	4	2	1	3	3	4	3	3	3	3	4	3	3	3	3	2	3	2	3	4	2	4	1	5	5	5	5
75	2	3	2	3	4	3	3	3	2	3	3	3	3	3	4	3	4	4	3	3	3	3	4	3	4	3	4	3	2	3
76	3	2	3	3	2	2	2	3	2	4	3	4	3	4	4	3	5	4	3	3	3	2	3	5	4	4	3	2	2	2
77	1	2	2	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	2	1	1	1	1	4	5	5	5
78	1	1	1	2	5	3	3	2	4	3	4	4	3	3	4	2	2	2	3	5	5	4	3	4	4	4	5	3	5	4
79	1	1	3	4	2	2	4	3	4	3	3	2	3	2	3	4	2	3	1	2	2	2	2	3	4	2	5	4	4	3
80	4	4	4	2	4	4	1	4	4	5	4	1	4	4	4	1	2	1	1	1	2	1	1	1	1	1	4	5	5	5
81	1	2	1	1	1	2	1	1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	2	1	2	4	4	5	4	4
82	1	1	1	5	1	1	1	1	5	5	1	5	2	1	5	1	1	5	1	1	1	1	1	5	1	1	5	4	5	3
83	3	1	2	3	1	1	4	2	3	1	1	2	2	5	3	3	3	4	2	2	2	2	1	5	2	3	3	3	4	4
84	1	1	3	4	2	1	5	1	2	3	3	3	3	3	3	4	3	3	1	1	1	1	2	4	3	2	2	2	2	2
85	3	2	2	4	3	2	5	2	4	4	3	4	4	3	4	4	4	4	3	3	3	1	3	4	3	3	4	3	3	3
86	1	1	1	4	4	3	3	3	2	4	3	3	3	3	4	2	2	3	2	2	4	1	2	2	4	2	2	2	3	3
87	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	4	5	5	5	4	4	3	5	5	5	1	5	5
88	1	1	1	5	1	5	5	1	5	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
89	3	2	1	4	4	2	2	3	2	4	1	4	3	2	3	3	2	3	1	3	4	2	3	2	3	2	2	3	4	5
90	2	3	3	2	2	3	2	3	2	3	2	3	2	3	2	3	3	2	3	2	3	2	3	2	3	4	3	2	3	4
91	3	3	4	3	3	3	2	3	3	4	3	4	4	4	3	3	3	4	3	2	3	3	3	4	3	2	2	3	4	3
92	4	4	4	4	5	4	4	4	5	5	4	4	4	5	5	4	4	4	4	5	5	4	4	5	4	4	3	2	1	2
93	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
94	2	3	4	4	3	3	4	3	2	3	3	4	3	3	4	1	2	1	1	2	1	2	1	1	1	2	3	4	4	4
95	3	4	1	2	2	2	3	3	5	4	1	3	3	1	5	3	4	3	1	3	3	3	3	3	3	3	3	3	3	3
96	1	2	1	2	2	1	2	2	2	2	1	1	2	2	2	2	2	1	2	2	1	2	2	2	1	2	1	4	4	4
97	4	3	3	3	4	3	3	4	4	4	3	3	4	4	4	3	3	4	3	3	3	2	3	3	4	3	3	2	2	2
98	4	3	4	3	4	4	3	4	3	4	3	2	3	4	3	4	3	4	3	4	3	3	4	4	3	4	3	2	1	2
99	2	2	1	2	2	1	2	1	2	1	1	1	2	1	2	1	2	1	2	1	1	1	1	2	3	3	3	4	4	4
100	2	4	3		1	4	2	5	2	3	1	3	4	1	4	2	4	5	2	2	3	1	4	5	3	3	2	3	4	4
101	2	1	1	2	2	2	2	2	2	2	1	2	2	1	1	2	2	2	2	1	2	2	2	1	2	4	3	3	3	3
102	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
103	1	2	1	2	2	2	1	1	2	2	1	2	3	3	3	1	2	2	2	1	1	2	2	1	2	2	2	3	3	3
104	2	3	2	2	2	3	2	2	2	3	2	3	3	2	2	2	2	2	3	3	2	3	3	3	2	3	4	3	3	3
105	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	3	2	2	2	3	3	4	3	2	1	2	3	3	4	4
106	2	2	2	3	3	3	3	2	2	2	2	3	3	1	2	3	3	2	2	2	2	3	2	1	2	3	4	4	4	4
107	1	2	2	3	3	3	3	3	3	2	2	3	3	3	2	2	2	2	3	2	2	2	2	3	3	3	2	3	4	3
108	5	5	5	5	4	5	5	5	5	5	5	4	3	4	4	5	5	5	5	4	4	4	5	5	5	5	1	1	1	1
109	1	2	2	1	2	2	2	2	3	3	2	3	3	2	2	2	2	1	2	2	2	1	2	1	2	3	3	3	3	2
110	2	2	2	2	2	3	3	3	2	3	2	3	2	3	2	4	4	4	4	4	4	3	4	5	4	4	3	3	3	3
111	2	2	2	2	2	2	2	1	2	2	1	1	1	1	2	1	2	2	2	2	1	2	2	2	2	3	3	2	2	4
112	2	2	2	3	2	2	3	3	2	2	3	3	2	2	2	3	3	3	2	3	2	3	3	4	3	3	2	3	3	4
113	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	2	1	2	3	3	2	2	3	4
114	2	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	2	1	2	1	2	2	1	2	2	2	1	2	3	4
115	2	3	2	2	2	1	2	2	2	2	3	3	3	2	2	2	3	3	2	2	3	3	2	1	2	1	1	3	4	4
116	3	3	2	2	2	3	2	2	3	2	2	3	3	3	3	2	2	2	2	3	3	3	3	2	3	3	2	4	4	3
117	2	2	1	1	1	2	2	2	3	3	3	3	2	2	2	3	3	3	2	2	2	3	3	3	3	2	2	2	3	4

118	3	3	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	5	5	5
119	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	3	3	3	3
120	1	1	1	2	2	2	2	2	2	3	3	3	3	2	2	2	2	2	2	3	3	3	3	2	2	2	3	3	3	3
121	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	1	1	1	2	3	3	4
122	3	3	2	3	2	2	1	1	2	1	1	2	2	1	1	2	2	1	1	1	2	2	1	2	2	3	3	4	4	4
123	2	2	2	2	1	1	1	1	1	2	2	2	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3	4	4
124	3	3	2	3	2	3	2	2	3	3	3	3	3	3	3	2	2	2	2	2	3	5	5	2	2	1	1	3	3	3
125	4	3	2	2	3	2	3	2	3	2	3	2	2	2	2	2	2	1	1	2	2	1	2	3	3	2	3	4	4	4
126	2	2	2	2	2	1	2	1	3	2	2	2	1	2	1	2	2	2	1	2	1	2	3	3	3	2	2	3	3	3
127	2	2	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	3	3	4	4	5
128	3	2	2	2	2	3	3	3	2	2	2	2	3	3	3	2	2	2	3	3	3	2	2	2	2	3	3	4	4	4
129	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	1	1	1	2	2	2	3	3	3	2	3	3
130	2	2	1	2	1	2	2	2	1	1	2	2	1	1	2	2	2	2	2	3	3	3	3	2	3	3	3	3	3	3
131	2	2	2	2	2	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3
132	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	2	2	2	2	2	3	3	3		4	4
133	3	3	3	3	2	2	1	1	1	2	2	2	3	4	5	1	1	2	2	1	1	2	2	1	1	2	3	3	3	3
134	3	4	2	2	2	1	1	2	2	1	2	3	2	3	1	2	2	1	2	2	2	3	1	1	1	1	1	1	1	1
135	1	2	1	2	1	2	2	2	2	1	1	1	1	2	2	1	1	1	1	2	2	2	2	2	1	1	2	3	3	3
136	2	2	2	3	3	2	2	1	1	2	2	3	3	3	3	2	2	3	3	2	1	2	3	4	5	3	3	3	4	5
137	3	3	2	2	1	1	2	2	2	3	3	2	3	4	1	2	2	2	3	3	3	4	4	3	3	2	3	4	3	4
138	2	2	2	2	2	2	3	2	3	2	3	3	3	3	2	2	2	3	2	2	3	2	3	3	3	3	3	2	3	4
139	2	2	3	3	3	2	3	1	1	1	1	2	2	2	2	1	1	1	2	2	2	2	2	2	1	1	1	1	3	3
140	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	3	2	3	3	3	2	3	3	2	3
141	2	2	2	3	3	3	1	1	1	2	2	2	2	2	3	3	3	3	3	2	2	2	2	1	2	3	3	4	4	4
142	5	3	5	4	5	5	1	5	1	5	5	5	5	3	5	5	4	5	3	5	5	3	5	5	5	5	3	3	3	3
143	1	2	2	2	1	2	2	2	2	3	3	3	3	2	2	2	3	3	3	3	3	3	2	2	3	3	3	4	2	2
144	2	2	2	2	3	3	3	3	2	2	2	2	3	3	2	3	2	3	3	3	3	3	2	2	3	3	4	3	4	5
145	3	3	2	2	3	2	2	2	2	3	3	2	3	3	2	3	3	2	2	2	3	3	3	4	4	4	4	3	3	3
146	2	2	3	2	1	1	2	2	2	3	3	2	2	2	1	2	1	1	2	2	3	3	2	3	4	3	2	2	2	3
147	2	2	3	3	2	2	3	3	3	2	2	3	3	3	2	2	3	2	2	2	2	3	1	2	4	3	3	3	2	4
148	3	2	4	4	2	2	2	3	3	3	3	2	3	4	2	2	2	3	3	2	2	3	3	2	3	3	4	4	3	5
149	2	3	3	2	2	2	3	2	1	3	4	4	3	3	2	2	3	3	4	5	5	4	3	2	2	1	3	4	2	4
150	2	3	2	2	2	3	2	4	3	2	3	3	2	3	2	3	2	2	3	3	3	3	2	3	4	3	3	4	3	2
151	2	2	2	3	3	3	2	2	2	1	2	3	4	4	1	2	2	2	1	2	3	3	4	4	5	4	4	3	4	3
152	1	2	1	1	2	2	2	3	3	3	2	2	2	2	3	3	2	2	2	3	3	3	2	3	4	3	3	3	4	2
153	1	1	1	1	2	2	2	2	3	3	3	4	4	4	3	2	2	3	3	3	3	2	2	1	1	1	3	2	3	2
154	2	3	3	3	2	2	2	1	1	1	2	3	4	5		2	3	3	3	4	4	4	3	3	3	2	2	1	2	3
155	2	2	1	2	1	2	2	1	1	1	2	2	2	2	2	2	1	1	2	2	2	3	2	1	2	3	4	5	3	2
156	2	1	1	1	2	2	2	2	3	3	3	2	2	2	3	2	2	1	1	1	2	2	2	3	3	3	2	2	2	2
157	4	5	5	5	5	4	4	5	5	4	4	5	5	5	4	5	4	5	5	5	5	5	5	5	4	4	3	2	2	2
158	4	4	5	5	5	4	4	5	5	4	4	5	5	5	4	4	4	4	5	5	5	4	3	4	5	5	5	2	2	2
159	4	4	5	5	4	4	4	5	5	4	4	4	5	5	5	4	4	3	3	4	5	5	5	5	5	4	3	3	3	2
160	4	5	4	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	5	5	4	4	4	4	3	3	2	2	2	2
161	4	4	5	5	5	5	5	5	5	4	5	4	5	5	5	4	4	5	5	5	4	4	5	5	4	3	2	1	1	1

162	4	4	5	5	5	4	4	5	5	5	4	4	5	5	5	4	4	4	5	5	4	4	4	5	5	5	3	2	2	2
163	4	4	4	5	5	5	4	4	5	5	5	5	4	4	4	5	5	5	4	4	5	5	4	4	4	3	3	2	1	1
164	4	4	5	5	5	5	5	5	5	4	4	4	4	4	5	5	5	5	4	4	4	5	5	5	4	4	3	2	1	1
165	4	4	4	5	5	5	5	5	4	4	5	5	5	5	4	4	4	5	5	5	4	5	5	4	4	4	3	3	1	1
166	5	5	5	4	4	4	4	4	4	4	4	4	5	5	5	4	4	4	5	5	5	5	5	5	5	4	3	3	2	2
167	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	
168	4	4	4	5	5	5	5	5	5	5	5	5	5	5	4	5	4	4	5	5	4	4	4	4	4	4	2	1	2	2
169	4	4	4	4	5	5	5	4	4	5	5	5	5	4	4	4	5	4	4	5	5	4	4	4	3	4	1	1	1	1
170	4	4	4	4	4	4	5	5	5	5	5	4	4	5	5	4	4	4	4	5	5	5	4	3	3	3	2	2	2	2
171	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	5	5	5	5	5	5	5	5	2	2	2	2
172	5	5	5	5	5	5	5	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	4	4	3	4	1	1	1	1
173	4	4	4	4	5	5	5	4	4	5	5	5	4	4	4	4	4		5	5	4	4	3		3	4	1	1	1	1
174	4	4	4	4	5	5	5	5	5	4	4	4	4	4	4	5	5	5	4	4	4	5	4	4	4	3	3	1	1	1
175	4	4	5	5	5	5	5	5	4	4	4	3	3	5	5	4	4	5	5	5	5	4	4	4	3	3	2	2	2	2
176	5	5	5	4	4	4	4	5	5	5	5	5	5	4	4	4	4	5	5	5	4	4	5	5	4	4	3	1	1	1
177	4	4	4	5	5	5	4	3	3	4	5	5	4	4	3	5	5	5	4	4	4	4	5	5	3	3	2	2	2	2
178	3	5	5	5	4	4	4	5	5	5	4	4	4	3	3	4	4	4	5	5	5	4	4	4	3	5	2	2	2	2
179	5	5	5	5	5	4	4	4	4	4	3	3	3	5	5	5	5	5	4	4	3	3	3	5	5	5	1	1	2	1
180	4	4	3	3	4	4	3	4	5	5	5	4	4	4	4	5	5	5	5	4	4	5	4	4	3	3	2	1	1	2
181	4	4	4	4	4	5	5	5	5	5	5	4	4	5	5	4	4	5	5	5	5	4	4	3	3	5	1	1	1	1
182	4	4	4	4	4	4	5	5	5	5	5	5	4	4	4	5	5	5	5	5	4	4	3	5	5	3	3	1	1	1
183	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	3	3	3	3	3	4	4	4	5	5	5	1	1	2	2
184	5	5	4	4	4	4	3	3	5	5	5	5	4	4	4	3	3	4	4	4	5	5	5	2	2	5	1	1	1	1
185	4	4	4	4	5	5	5	5	4	4	4	5	5	5	5	5	5	4	4	4	3	3	3	5	5	5	2	1	1	1
186	4	5	5	5	4	5	5	5	5	5	4	4	5	5	5	5	4	4	5	5	5	4	4	5	5	5	1	1	1	1
187	3	3	4	4	4	5	5	4	4	4	5	5	5	5	3	3	4	4	4	5	5	5	4	4	4	3	1	2	2	2
188	4	4	4	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	4	4	4	2	2	1	1	1	1	1
189	4	4	4	4	4	3	5	5	5	5	5	5	5	5	4	4	4	5	5	5	5	5	4	4	5	5	3	4	3	2
190	5	4	3	3	4	4	2	3	2	4	4	5	3	3	4	4	4	4	5	4	3	2	4	4	4	5	3	2	3	3
191	4	4	4	5	5	5	4	4	4	5	4	4	5	5	4	4	4	5	5	3	3	4	4	3	3	4	4	2	2	2

APPENDIX N

RAW DATA OF SQET SCORES

	Enjoyment level														Contribution into their learning												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14
30	2	5	4	4	3	5	5	3	5	4	5	5	5	5	4	5	5	5	5	5	5	3	5	4	5	5	5	5
31	3	5	2	3	2	2	2	5	2	1	5				4	4	5	4	5	4	4	5	4	5	4			
32	5	3	3	4	3	3	4	5	4	5	5				4	3	5	5	2	4	4	5	2	4	5			
33	4	4	3	3	5	3	4	4	4	5	4				5	4	3	3	5	4	4	5	4	3	4			
34	4	3	3	5	5	3	5	4	4	2	3				4	4	3	4	5	3	4	4	3	3	3			
35	4	5	3	4	3	4	5	2	2	1	5				5	5	3	4	3	3	5	1	4	1	5			
36	4	3	4	4	2	4	1	2	1	4	4				5	1	1	2	4	3	1	2	1	4	3			
37	5	5	4	4	1	3	4	5	5	5	5				4	5	5	5	5	3	3	5	5	4	5			
38	5	3	3	4	4	2	5	5	3	4	5				5	3	4	1	2	4	5	1	5	5	5			
39	5	4	5	5	5	5	5	5	5	5	5				5	4	5	4	5	5	5	5	5	5	4			
40	5	4	3	4	4	3	2	3	4	2	5				5	4	2	5	4	3	3	4	3	5	4			
41	5	4	5	5	5	5	5	5	5	5	5				5	4	5	4	5	5	5	5	5	5	4			
42	5	2	3	2	2	3	3	4	4	2	4				4	4	5	4	3	5	4	5	5	5	5			
43	5	4	3	4	3	4	4	5	3	2	5				5	4	5	5	5	5	5	5	3	2	5			
44	4	4	5	5	4	4	4	5	5	4	5				5	4	5	5	4	5	5	4	4	5	5			
45	5	4	5	5	5	4	5	5	4	4	4				4	5	5	5	4	5	4	5	5	5	5			
46	5	4	5	4	5	4	5	4	5	4	5				4	5	4	5	4	5	4	5	4	5	4			
47	4	5	4	5	4	5	4	5	5	5	4				5	4	5	5	4	5	4	5	4	5	4			
48	5	3	4	4	4	3	3	3	4	4	5				5	4	5	3	3	4	4	5	4	4	4			
49	5	4	3	4	5	2	3	5	4	1	5				5	4	5	5	3	5	5	5	5	5	5			
50	4	4	4	5	4	5	5	5	4	4	5				4	4	3	3	3	3	3	4	4	3	4			
51	3	3	4	5	3	4	4	4	5	5	3				2	5	4	4	5	3	4	4	3	4	4			
52	5	4	5	4	4	5	5	4	4	5	5				3	4	4	4	4	4	4	4	5	4	5			
53	4	4	4	5	5	5	4	5	4	5	5				5	5	4	4	4	4	5	4	4	4	5			
54	4	5	4	5	5	4	4	5	5	4	5				4	4	5	4	5	5	4	5	4	4	4			
55	4	5	4	5	3	5	3	5	4	5	5				4	3	5	4	5	4	3	5	4	3	5			
56	5	4	4	4	5	5	5	4	5	5	4				4	4	4	4	5	5	4	5	5	4	5			
57	5	4	5	4	5	4	5	4	4	5	5				4	4	5	4	5	4	4	3	4	5	5			
58	5	5	4	5	5	5	5	4	5	4	5				5	4	5	5	4	4	4	5	5	4	5			
59	4	4	3	3	2	3	4	3	4	2	5				4	4	3	3	2	3	4	3	4	2	5			
157	4	3	2	5	3	1	2	4	3	3	1				4	3	2	5	2	1	2	4	3	3	1			
158	3	4	3	2	2	4	4	5	3	4	5				5	4	2	2	5	4	4	5	2	3	5			
159	5	5	2	5	3	2	5	5	1	5	3				5	5	1	5	3	1	5	5	1	5	4			
160	2	1	1	1	2	2	1	5	3	3	5				5	5	5	5	3	1	1	5	1	1	5			
161	5	4	2	5	3	2	2	3	2	1	4				5	4	3	5	3		2	3	2	1				
162	4	3	5	2	3	5	4	5	5	1	1				3	4	1	3	3	2	1	2	4	3	5			

	Enjoyment level														Contribution into their learning											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
163	4	3	2	4	5	1	4	1	3	1	5				5	2	1	3	4	1	4	1	3	1	5			
164	3	4	2	4	1	5	5	3	2	3	4				4	2	1	4	1	5	5	3	2	3	4			
165	5	2	3	5	5	5	2	4	2	5	1				5	3	4	5	3	3	4	5	2	5	3	5		
166	5	3	3	5	4	1	4	5	2	4	5				3	5	4	3	5	3	4	5	3	4	5			
167	2	3	4	5	4	2	3	5	1	4	5				5	5	5	5	5	5	4	5	5	5	5			
168	2	2	4	3	2	1	1	3	1	1	3				2	1	1	3	1	1	1	2	1	1	4			
169	4	4	3	3	2	2	3	4	3	2	4	4	4		3	3	2	2	2	2	4	3	2	4	3			
170	5	5	3	4	5	5	5	4	4	5	5				5	5	4	3	5	4	5	4	4	5	4			
171	5	1	4	5	2	5	5	5	1	3	5				5	5	3	2	5	5	5	2	1	3	5			
172	5	5	4	5	2	2	3	4	3	4	5				3	4	4	4	2	3	3	5	2	1	5			
173	5	4	5	3	5	2	4	2	3	5	5				5	4	5	3	5	2	4	2	3	5	5			
174	5	1	2	5	1	1	2	5	1		1				1	2	2	5	1	3	1	5	1	1	1			
175	5	3	3	4	4	1	2	1	1	1	3				3	2	2	3	2	2	1	3	3	2	2			
176	5	5	5	5	5	5	5	5	5	5	5				5	5	5	5	5	5	4	5	5	5	5			
177	4	5	1	2	3	3	4	2	1	3	1				5	5	2	4	4	5	4	3	3	5	1			
178	2	3	1	3	3	3	3	3	3	3	3				2	3	3	1	3	3	3	3	3	3	3			
179	5	5	5	5	3	5	5	5	5	2	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5			
180	3	4	3	4	3	1	1	3	2	2	5				5	2	2	4	3	5	5	3	5	5	3			
181	5	5	4	3	2	3	4	4	4	5	5	4	4	4	4	4	4	2	2	4	4	5	5	5	5			
182	5	5	5	5	5	5	5	5	5	5	5				4	4	1	1	1	4	5	3	4	1	5			
183	3	4	1	2	4	1	1	4	2	2	5				4	5	1	2	5	4	1	5	4	5	5			
184	5	1	1	1	3	1	4	4	1	4	4				4	1	2	2	4	1	2	4	2	4	3			
185	5	3	2	1	1	1	1	3	3	1	5				5	5	5	2	1	2	1	1	1	1	1			
186	4	1	4	4	5	3	3	5	3	3	5				4	4	3	1	1	4	4	5	1	5	5			
187	1	2	5	4	1	2	3	2	1	5	3				2	1	5	3	1	1	1	1	2	4	4			
188	4	5	2	1	3	2	4	4	1	2	3				4	2	3	2	4	3	4	1	3	3	1			
189	5	3	1	1	3	5	5	5	5	5	5				5	3	1	3	1	5	3	4	1	1				
190	3	5	3	4	5	4	4	5	2	4	5	5	5	5	4	5	5	4	5	4	5	5	5	3	5	5	5	5
191	3	5	5	3	4	4		3	2	2		3			3	4	4	4	3	4	4	4	2	2	4	2		

APPENDIX O

RAW DATA OF WIHIC SCORES

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
1	35	14	29	26	26	39	31	200	19	9	19	13	12	9	10	91
2	36	19	32	27	34	25	28	201	31	11	17	14	29	18	21	141
3	30	19	20	26	28	20	22	165	30	18	20	26	28	20	22	164
4	28	15	22	34	35	18	28	180	28	15	22	34	37	18	30	184
5	20	22	24	20	23	24	19	152	20	22	20	20	21	24	19	146
6	40	40	40	40	40	40	40	280	40	40	40	40	40	40	40	280
7	27	31	19	24	24	24	24	173	15	17	18	20	15	24	35	144
8	39	26	33	32	32	29	32	223	22	14	17	24	24	23	19	143
9	38	10	27	14	12	16	26	143	38	10	27	14	12	16	26	143
10	23	26	27	24	24	24	24	172	22	23	27	24	24	24	24	168
11	29	8	18	10	28	36	16	145	29	8	17	10	28	36	16	144
12	31	8	20	14	33	23	11	140	31	8	20	14	31	23	11	138
13	15	25	19	22	20	23	22	146	17	24	15	23	22	21	14	136
14	15	15	14	12	18	14	15	103	12	12	13	11	14	11	15	88
15	29	28	28	24	27	21	27	184	21	15	12	16	18	15	15	112
16	33	28	29	31	26	30	34	211	18	16	17	20	20	17	22	130
17	36	30	35	28	35	29	29	222	24	19	19	20	20	19	14	135
18	36	27	33	28	29	36	28	217	19	14	14	19	12	14	15	107
19	19	10	10	9	12	8	8	76	19	9	8	9	11	8	8	72
20	32	36	37	40	40	40	40	265	32	36	37	40	40	40	40	265
21	28	32	28	31	31	27	29	206	19	20	16	21	18	18	21	133
22	33	33	36	33	31	34	31	231	33	33	36	33	31	34	31	231
23	31	23	20	28	14	24	25	165	31	23	20	28	14	24	25	165
24	40	32	36	40	40	40	40	268	40	32	36	40	40	40	40	268
25	32	32	32	32	32	32	32	224	32	32	32	32	32	32	32	224
26	28	28	31	23	29	24	24	187	28	28	31	23	29	24	24	187
27	31	16	30	40	40	40	40	237	31	16	30	40	40	40	40	237
28	32	24	31	25	35	34	14	195	32	24	31	25	35	34	14	195
29	25	12	14	17	14	19	27	128	25	12	12	17	16	22	19	123
60	33	12	27	22	23	20	30	167	33	34	27	22	23	20	30	189
61	28	25	30	32	35	28	37	215	29	25	31	32	35	28	36	216

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
62	25	19	17	20	26	20	24	151	25	19	18	22	29	21	23	157
63	26	22	24	24	24	24	24	168	24	24	24	24	24	24	24	168
64	28	17	17	19	25	17	32	155	28	17	17	19	25	17	32	155
65	20	16	18	19	26	17	36	152	20	16	18	19	28	17	36	154
66	30	24	29	32	33	36	38	222	30	24	31	32	30	36	38	221
67	34	27	37	35	36	38	32	239	34	27	37	34	39	38	40	249
68	27	8	24	25	35	23	21	163	27	8	24	25	35	23	21	163
69	24	24	24	24	24	24	24	168	24	24	24	24	24	24	24	168
70	36	23	31	25	24	22	23	184	25	22	20	23	30	24	25	169
71	29	18	25	10	24	12	35	153	29	18	25	10	24	12	35	153
72	32	15	30	30	30	17	17	171	34	25	39	28	36	35	37	234
73	40	40	36	16	16	20	27	195	8	8	16	34	32	27	21	146
74	25	11	13	23	33	18	18	141	24	11	12	20	27	22	14	130
75	23	20	24	26	26	30	27	176	27	21	24	30	23	24	23	172
76	29	17	21	12	30	14	29	152	29	18	21	12	30	13	29	152
77	27	11	25	23	31	13	28	158	26	11	25	23	30	13	28	156
78	30	19	19	19	26	27	26	166	30	18	20	20	25	26	26	165
79	24	32	16	24	16	24	16	152	16	24	8	16	16	8	8	96
80	33	11	16	8	26	12	25	131	33	10	14	8	29	8	26	128
81	31	33	29	30	32	31	33	219	34	33	31	30	30	29	31	218
82	34	36	36	24	16	32	16	194	36	34	34	24	16	16	16	176
83	16	8	24	16	24	24	16	128	16	8	24	16	16	16	16	112
84	24	16	32	16	24	24	16	152	16	16	16	16	16	24	16	120
85	32	24	16	24	16	8	24	144	16	16	8	16	16	8	24	104
86	26	15	16	12	25	8	32	134	18	14	16	12	26	8	32	126
87	24	24	24	24	24	24	24	168	24	24	24	24	24	24	24	168
88	29	8	12	8	17	8	32	114	23	8	12	8	21	8	32	112
89	16	16	16	16	16	16	16	112	16	16	16	16	16	16	16	112
30	40	14	22	33	27	38	24	198	40	17	21	32	27	36	21	194
31	12	11	13	14	13	13	16	92	35	24	26	24	29	24	36	198
32	33	26	32	33	35	21	32	212	33	25	32	33	35	21	28	207
33	33	17	17	33	36	29	22	187	33	17	17	33	36	29	22	187
34	26	16	21	24	22	20	12	141	25	21	21	24	16	18	24	149
35	31	9	16	9	8	10	14	97	34	9	16	13	8	11	18	109
36	27	20	12	23	23	22	20	147	29	36	26	29	26	30	34	210
37	28	23	25	29	31	27	31	194	28	25	27	29	32	27	32	200
38	22	8	13	16	24	24	24	131	25	28	22	26	24	24	19	168
39	17	22	21	22	19	19	19	139	33	33	37	36	34	36	30	239

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
40	34	28	24	14	36	30	32	198	34	28	25	14	36	30	32	199
41	33	8	20	29	34	40	14	178	33	8	20	29	34	40	14	178
42	35	8	28	13	36	17	29	166	36	8	33	24	36	17	28	182
43	27	24	24	17	29	28	23	172	32	24	23	13	27	27	23	169
44	26	23	27	24	28	25	26	179	34	31	37	39	32	34	34	241
45	32	27	25	23	25	21	27	180	40	35	32	34	37	33	38	249
46	34	28	24	14	36	30	32	198	34	28	24	14	36	30	32	198
47	40	8	22	16	20	21	30	157	35	8	29	32	34	34	33	205
48	35	11	25	17	24	23	30	165	35	8	30	32	33	35	33	206
49	34	10	22	29	38	29	35	197	34	10	22	29	38	29	35	197
50	35	11	17	14	17	17	18	129	36	22	18	33	34	32	33	208
51	34	29	34	39	38	21	35	230	34	29	33	39	38	22	35	230
52	36	38	38	36	38	39	38	263	36	38	38	36	38	39	38	263
53	16	16	16	16	16	16	16	112	40	40	40	40	40	40	40	280
54	35	10	19	27	27	29	11	158	33	10	19	29	25	29	11	156
55	19	18	20	8	8	8	8	89	16	20	30	40	40	40	40	226
56	33	9	24	30	34	34	37	201	33	9	24	30	34	34	37	201
57	35	18	26	21	27	31	32	190	35	18	26	21	27	31	32	190
58	24	24	24	24	24	24	24	168	24	24	24	24	24	24	24	168
59	8	8	8	8	8	8	8	56	40	40	40	40	40	40	40	280
90	31	10	10	12	8	8	8	87	31	10	9	8	8	9	9	84
91	20	13	14	16	18	16	13	110	19	13	15	15	27	16	16	121
92	27	24	8	8	8	8	8	91	27	27	9	20	15	12	19	129
93	39	8	8	36	40	12	28	171	39	8	8	40	40	16	28	179
94	35	18	23	29	34	36	20	195	35	18	23	29	34	36	20	195
95	39	40	40	40	40	40	40	279	38	39	40	40	40	40	40	277
96	35	34	36	35	35	34	37	246	38	32	31	34	38	27	34	234
97	19	19	15	16	20	19	20	128	18	19	16	16	20	18	19	126
98	24	20	16	29	29	33	32	183	24	19	16	27	29	33	32	180
99	25	22	28	27	22	27	27	178	25	22	27	27	20	23	27	171
100	33	36	37	34	33	37	29	239	33	36	34	34	35	35	37	244
101	20	21	18	23	27	19	17	145	23	22	14	23	27	17	15	141
102	22	18	25	23	22	23	37	170	29	24	25	40	40	40	40	238
103	40	38	40	40	38	40	40	276	40	40	40	40	40	40	40	280
104	25	26	23	28	23	22	14	161	22	27	31	22	25	23	23	173
105	40	40	40	40	40	40	40	280	40	40	40	40	40	40	40	280
106	31	23	32	30	27	29	28	200	31	30	33	23	19	23	23	182
107	31	31	36	34	35	34	36	237	32	30	30	34	34	31	34	225

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
108	27	27	23	18	22	27	21	165	30	24	20	20	20	14	23	151
109	36	39	40	40	40	36	38	269	36	39	40	40	40	36	38	269
110	34	32	39	35	40	30	36	246	34	32	39	35	40	30	36	246
111	35	30	40	40	36	31	36	248	35	27	40	40	32	35	34	243
112	25	36	26	18	33	20	36	194	34	35	27	18	33	23	40	210
113	36	39	40	40	40	36	37	268	36	39	40	40	40	36	37	268
114	20	21	26	30	33	27	26	183	27	23	28	37	33	30	35	213
115	40	40	25	32	33	26	32	228	8	8	8	8	8	17	20	77
116	37	32	36	32	26	31	35	229	33	30	30	29	32	31	32	217
117	32	32	32	32	32	32	32	224	32	32	32	32	32	32	32	224
118	31	31	33	26	22	27	24	194	26	18	28	27	25	28	24	176
119	8	8	8	23	26	28	25	126	29	14	33	40	40	40	30	226
120	32	24	40	24	32	40	24	216	24	24	32	32	32	24	24	192
121	24	32	24	32	32	32	16	192	24	16	24	24	24	24	16	152
122	32	32	32	24	24	24	32	200	24	24	24	16	16	16	32	152
123	32	24	24	32	32	32	16	192	24	16	16	24	24	24	16	144
124	32	24	16	24	16	32	24	168	24	24	16	24	16	24	16	144
125	40	40	40	40	40	40	40	280	21	17	30	27	23	22	27	167
126	17	26	20	40	40	40	22	205	25	20	39	34	39	32	32	221
127	16	36	25	32	32	32	26	199	32	25	25	24	24	24	24	178
128	40	35	38	36	40	38	39	266	16	16	13	24	24	24	24	141
129	28	8	24	24	32	31	40	187	28	8	24	24	32	31	40	187
130	29	21	21	18	20	17	20	146	29	21	20	8	8	8	8	102
131	35	36	35	34	26	30	22	218	19	18	25	34	22	21	20	159
132	40	40	36	8	8	8	13	153	24	24	22	8	8	8	8	102
133	26	38	40	40	40	40	40	264	26	38	40	40	40	40	40	264
134	31	32	32	32	32	32	32	223	33	32	32	32	32	32	32	225
135	28	21	16	20	19	18	21	143	28	21	17	20	20	18	21	145
136	25	31	23	19	21	18	26	163	23	23	27	25	29	29	28	184
137	38	31	26	38	32	38	40	243	40	36	35	32	32	36	35	246
138	24	10	15	24	24	24	24	145	24	10	17	24	24	24	24	147
139	24	32	16	32	24	16	32	176	24	24	16	24	24	16	24	152
140	28	8	20	18	16	13	19	122	16	8	16	8	16	8	8	80
141	8	27	20	27	40	8	32	162	8	23	20	27	40	8	32	158
142	19	30	19	16	11	8	8	111	30	25	20	16	16	16	16	139
143	27	26	29	29	30	31	34	206	20	22	20	21	21	28	26	158
144	37	28	29	28	28	25	32	207	34	35	30	31	30	32	32	224
145	27	32	28	28	20	25	9	169	16	16	16	16	16	16	16	112

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
146	32	32	32	32	32	32	32	224	35	22	28	24	29	26	26	190
147	27	27	28	29	30	27	27	195	18	16	16	16	16	16	16	114
148	25	19	23	16	28	11	20	142	28	30	26	27	20	23	21	175
149	32	32	32	32	32	32	32	224	22	32	24	24	24	21	22	169
150	25	26	37	30	32	18	32	200	25	23	33	27	32	18	32	190
151	32	22	23	16	16	16	16	141	32	22	23	16	16	16	16	141
152	8	27	20	27	40	8	32	162	8	27	20	27	40	8	32	162
153	31	14	15	21	20	22	18	141	8	8	8	8	8	8	8	56
154	25	22	24	23	26	20	29	169	16	16	16	16	16	16	16	112
155	27	15	21	25	26	25	26	165	27	15	21	25	26	25	26	165
156	24	32	16	24	32	40	24	192	24	24	16	16	24	32	24	160
157	34	21	26	26	35	33	36	211	34	21	26	27	30	32	32	202
158	38	36	33	40	39	36	39	261	39	36	36	40	38	37	39	265
159	32	24	29	22	26	22	23	178	40	33	40	36	37	35	27	248
160	26	23	22	22	23	19	23	158	36	32	31	34	33	34	33	233
161	35	30	37	33	37	34	37	243	30	32	39	37	38	39	40	255
162	40	32	38	39	40	36	39	264	40	32	38	39	40	36	39	264
163	38	36	33	10	11	16	9	153	37	36	32	39	35	29	21	229
164	11	20	18	16	14	28	27	134	11	30	22	23	27	25	21	159
165	22	38	35	13	21	28	14	171	40	40	40	40	40	40	40	280
166	36	29	37	24	36	36	19	217	36	29	37	24	36	36	23	221
167	40	40	40	40	40	40	40	280	40	40	40	40	40	40	40	280
168	35	31	30	24	25	28	18	191	35	31	30	24	25	28	18	191
169	24	8	18	8	16	16	20	110	24	8	20	8	16	16	20	112
170	33	18	22	27	24	27	24	175	36	23	27	31	33	31	30	211
171	26	25	24	29	16	27	23	170	26	31	24	33	17	23	17	171
172	30	31	32	32	28	37	26	216	26	26	23	22	25	25	28	175
173	19	21	20	28	35	25	25	173	36	37	38	36	36	29	34	246
174	27	26	28	29	27	18	17	172	27	29	23	29	26	23	24	181
175	35	32	36	32	37	36	34	242	34	32	36	32	37	30	34	235
176	22	27	32	31	31	33	29	205	22	23	28	23	24	27	27	174
177	32	32	32	32	32	32	32	224	40	40	40	40	40	40	40	280
178	24	32	16	32	40	16	24	184	32	40	24	32	40	24	32	224
179	40	40	40	40	40	40	40	280	40	40	40	40	40	40	40	280
180	26	24	34	22	24	20	32	182	32	28	36	26	32	26	32	212
181	32	32	32	24	24	24	8	176	40	40	40	32	32	32	16	232
182	24	24	32	32	16	16	32	176	32	32	40	40	24	24	32	224
183	36	19	26	18	32	30	33	194	37	16	21	13	13	22	19	141

ID	PRE-WIHIC								POST-WIHIC							
	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL	Student Cohesiveness	Teacher Support	Involvement	Investigation	Task Orientation	Cooperation	Equity	TOTAL
184	38	28	36	33	35	37	38	245	38	25	37	32	39	40	39	250
185	22	24	26	20	28	18	32	170	24	28	26	28	36	26	32	200
186	24	24	24	24	24	24	24	168	24	24	24	24	24	24	24	168
187	16	16	32	32	16	16	24	152	32	32	40	40	32	32	40	248
188	32	32	32	24	24	24	24	192	32	32	32	24	24	24	24	192
189	22	26	25	26	27	27	28	181	27	24	26	28	30	28	30	193
190	35	27	26	24	32	21	27	192	38	34	31	31	38	26	35	233
191	24	24	24	26	30	31	31	190	34	37	39	30	37	29	35	241

APPENDIX P

RAW DATA OF SQCI SCORES

	About Blind Student												About Classmates												About himself/herself											
	Before Motion						During Motion						Before Motion						During Motion						Before Motion						During Motion					
	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
1													5	2	5	3	5	5	3	3	3	2	5	5	3	2	2	3	5	5	2	4	4	4	5	5
2													3	3	2	3	1	2	3	3	2	2	1	2	3	2	3	2	2	1	3	2	1	1	1	1
3													3	3	4	1	4	3	2	2	4	3	3	4	2	4	3	2	3	4	2	2	1	2	1	5
4													2	4	3	3	2	5	2	4	3	3	1	5	1	2	1	1	1	1	1	2	1	1	1	1
5													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6													4	5	4	4	4	4	4	5	4	4	4	4	4	4	3	3	1	1	4	4	3	3	1	1
7													3	4	2	3	2	4	2	3	2	2	2	3	4	3	3	3	2	3	3	2	2	2	1	2
8													3	3	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9													5	2	2	5	5	2	5	2	2	5	5	2	5	2	2	3	5	5	5	2	2	3	5	5
10													4	4	4	4	3	4	3	3	3	3	2	3	4	4	4	4	4	4	2	2	2	2	2	2
11													3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12													4	2	1	4	2	3	5	1	3	1	1	2	1	3	2	4	1	3	1	3	2	4	1	2
13													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14													2	3	2	4	5	3	2	3	2	4	4	3	3	2	2	2	2	2	2	2	2	2	2	2
15													3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	3	3	2	2	2	2	3
16													3	3	3	3	2	3	3	3	3	3	2	3	3	2	3	2	3	3	3	2	3	2	3	3
17													2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	3	3	4	4	4	4	3	3
18													3	3	2	2	2	3	2	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1
19													2	1	1	1	2	1	2	1	1	1	1	1	2	2	2	1	1	2	2	2	2	2	2	2
20													2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	2	4	4	4	4	2	2
21													3	4	2	3	2	2	3	4	2	3	2	2	3	2	2	1	2	2	3	2	2	1	2	2
22													2	3	2	1	1	1	3	4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23													4	3	3	1	1	1	4	3	3	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1
24													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
25													2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
26													2	3	2	2	1	2	2	3	2	2	1	2	1	2	1	1	1	5	1	2	1	1	1	5
27													3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
28													3	3	2	2	2	3	3	3	2	2	2	3	1	1	2	2	2	2	1	1	2	2	2	2
29													3	4	3	2	2	4	2	4	3	1	1	4	4	3	5	4	5	5	4	3	5	4	5	5
30													3	4	3	3	4	5	3	4	3	3	4	5	2	2	2	2	4	4	3	3	3	3	3	3
31	1	1	1	1	1	1	4	4	4	3	4	4	1	1	1	1	1	1	4	4	4	4	4	4	1	1	1	1	1	1	4	3	3	3	3	3

	About Blind Student												About Classmates												About himself/herself											
	Before Motion						During Motion						Before Motion						During Motion						Before Motion						During Motion					
32	4	3	4	4	3	4	5	4	4	4	5	5	4	4	4	4	3	3	4	4	4	4	5	5	5	4	5	4	4	4	5	5	5	5	5	5
33	4	3	3	3	4	4	4	3	5	4	4	4	3	4	2	2	2	3	3	2	5	3	3	4	4	4	4	4	2	2	4	4	4	4	2	2
34	2	2	2	1	2	2	4	4	4	3	4	4	2	2	2	2	2	2	5	5	5	5	5	5	3	3	3	3	1	1	3	3	3	3	3	3
35	5	3	2	2	5	2	5	3	2	1	4	3	1	2	2	2	2	4	2	4	3	3	3	4	1	2	2	1	3	2	1	2	2	1	3	2
36	5	4	3	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2	1	1	2	2	4	3	3	3	4	3
37	1	1	1	1	1	1	4	4	4	5	5	5	3	3	3	3	3	3	5	4	4	5	5	4	3	3	3	3	3	3	4	4	5	5	4	5
38	3	3	4	3	4	4	3	3	4	4	4	4	4	3	4	3	4	2	5	4	5	4	5	4	3	2	3	2	2	2	4	3	4	3	3	3
39	5	1	1	5	5	1	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
40	2	2		1	1	2	4	4	5	4	4	4	3	2	2	3	3	3	5	4	4	5	4	4	3	2	2	3	3	3	5	4	4	5	4	4
41	3	3	2	4	4	3	3	3	4	4	4	3	3	2	1	1	2	1	3	2	1	1	2	1	3	2	1	1	2	1	3	2	1	1	2	1
42	1	1		2	1	1	3	4		4	1	1	2	1	2	2	5	5	5	1	1	5	5	5	4	3	2	5	5	5	5	2	4	5	5	5
43	4	4	4	4	4	2	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4	4	4	4	2	3	4	4	4	4	4	3	4	4	4	4
44	2	2	2	2	2	2	4	3	4	4	3	4	3	3	2	3	2	2	4	4	3	3	4	3	2	3	3	2	2	3	4	4	3	4	3	3
45	3	2	3	2	3	2	4	3	4	3	4	3	4	3	4	3	4	3	4	5	5	4	5	4	4	3	4	3	4	3	5	5	4	5	5	5
46	2	2	2	1	2	2	4	4	4	4	5	4	3	3	3	4	2	3	4	4	5	4	5	4	3	4	3	4	3	4	4	4	4	5	4	4
47	2	3	1	2	1	2	4	4	5	4	5	5	3	2	3	2	3	2	4	5	4	5	4	5	3	3	3	3	3	3	4	4	4	4	4	4
48	5	4	5	5	5	3	3	4	3	4	4	2	3	5	4	4	5	5	3	4	3	4	4	3	3	4	3	4	2	5	4	4	3	5	4	3
49	1	1	1	1	2	1	5	4	3	4	5	5	2	1	2	1	2	1	4	3	5	4	5	4	2	1	2	2	1	2	4	4	5	4	4	5
50	3	3	3	3	3	3	4	4	4	4	4	4	2	1	2	3	1	4	3	1	3	5	1	2	1	1	1	1	1	1	2	2	2	2	2	2
51	3	3	3	3	3	3	4	4	3	4	4	3	3	3	3	3	3	3	4	4	4	3	3	4	3	3	3	3	3	3	4	4	4	4	2	2
52	5	5	5	4	3	4	5	5	5	4	3	4	5	2	2	3	3	3	4	2	2	3	3	3	4	4	4	5	3	4	4	4	4	5	3	4
53	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
54	3	3	3	3	2	4	3	3	3	3	2	4	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3	2	2	3	3	3	3	3	2
55	2	2	5	4	1	5	5	2	2	5	1	5	3	4	3	3	3	3	3	3	4	4	4	4	2	3	3	3	4	3	4	4	5	5	5	5
56	2	2	3	2	3	3	5	4	5	5	4	4	2	3	3	2	2	3	5	4	4	5	5	4	1	2	2	1	1	2	3	2	3	3	2	3
57	4	5	5	5	5	5	4	5	5	5	5	5	3	2	2	3	3	3	3	2	2	3	3	3	2	1	2	1	1	2	2	1	2	1	1	2
58	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
59	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
60													5	2	2	2	2	3	5	2	2	2	2	3	3	3	3	2	2	2	3	3	3	2	2	2
61													4	4	4	4	3	4	4	4	4	4	3	4	3	2	4	3	2	3	3	2	4	3	2	3
62													4	4	4	4	3	4	4	4	5	4	3	4	3	2	4	3	2	3	3	2	4	3	2	3
63													3	4	2	4	3	3	3	3	3	4	2	3	3	5	5	4	5	5	4	4	4	5	5	5
64													4	4	4	4	4	4	3	3	3	3	3	3	5	5	5	5	5	5	3	3	3	3	3	3
65													4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
66													4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
67													3	3	4	3	3		3	3	4	3	3		4	4	4	4	4	4	4	4	4	4	4	4
68													5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1
69													2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
70													2	4	4	2	3	4	2	4	4	3	2	4	2	4	3	4	3	5	3	2	4	3	4	5
71													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
72													2	2	1	5	3	1	4	5	5	5	4	5	2	2	2	2	2	1	2	2	2	2	2	1
73													1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4	5	4	4	4	4	4	5

	About Blind Student												About Classmates												About himself/herself											
	Before Motion						During Motion						Before Motion						During Motion						Before Motion						During Motion					
74													2	3	2	4	3	2	3	2	4	3	2	3	5	4	3	4	1	5	5	5	5	5	5	5
75													4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
76													5	5	5	5	5	5	5	5	5	5	5	5	2	2	2	2	1	1	1	1	1	1	1	1
77													4	4	5	5	3	4	3	4	4	3	4	5	4	5	5	4	3	4	5	5	4	4	3	5
78													5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5	3	3	3	4	3	4
79													2	3	2	2	2	3	1	1	1	1	1	1	3	1	2	1	1	1	1	1	1	1	1	1
80													3	3	3	3	3	3	3	3	3	3	3	3	2	2	1	1	1	1	2	2	1	1	1	1
81													4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
82													3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
83													3	2	3	2	3	3	2	1	2	2	1	1	3	2	3	2	2	2	2	2	2	2	2	2
84													3	3	3	3	3	3	2	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2
85													2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	1	1	1	1	1	1
86													3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5	5
87													3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
88													4	3	3	2	3	3	4	3	3	2	3	3	5	5	5	5	5	5	5	5	5	5	5	5
89													3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
90													3	2	3	4	1	2	3	2	3		1	2	3	5	2	4	1	1	3	4	2	4	1	1
91													4	4	4	4	4	4	4	4	4	4	4	4	3	4	5	5	5	3	4	4	4	4	4	4
92													5	3		4	4		5	2			1	5	2	1	1	2	1	3	2	1	1	2	1	3
93													5	5	5	4		5	4	4	3	4	3	5	2	2	2	2		5	2	4	3	5	4	5
94													4	4	1	1	1	4	4	3	1	1	1	4	2	2	1	1	1	4	2	1	1	1	1	4
95													2	5	5	5	4	4	1	5	5	5	4	4	5	4	3	3	4	3	5	4	3	3	4	3
96													5	4	2	1		2	5	4	2	1		2	4	3	1	2		2	4	2	1	2		4
97													5	4	5	5	5	5	5	5	4	5	5	4	4	4	4	4	5	4	5	4	5	5	4	4
98													5	5	4	5	3	5	5	5	4	1	1	5	5	4	3	4	2	5	5	4	3	4	2	5
99													4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
100													2	3	4	2	1	1	2	3	4	2	1	1	4	4	5	5	5	5	4	4	5	5	5	5
101													2	3	4	2	1	3	2	3	4	3	2	3	3	4	4	2	1	3	4	4	4	3	2	2
102													5	4	5	5	4	5	5	4	4	4	4	4	4	5	4	5	5	5	5	5	5	4	5	5
103													2		4		3	2	2	4	4	3	4	3	4	4	3	4	3	4	4	3	4	4	3	4
104													3	4	5	3	1	1	3	4	5	3	1	1	4	4	4	4	2	4	4	4	4	4	2	4
105													5	4	5	5	4	5	5	4	5	5	3	5	4	3	4	5	3	5	4	3	4	5	3	5
106													4	4	4	4	4	4	5	4	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5
107													3	3	3	3	3	3	3	3	4	5	3	4	4	4	4	4	4	4	2	4	3	4	3	4
108													5	2	4	4	3	5	4	3	5	5	5	5	2	2	4	3	1	2	5	5	5	5	2	5
109													5	5	4	5	5	4	5	5	4	5	5	4	5	5	5	5	5	1	5	5	5	5	5	1
110													4	2	5	5	5	5	4	4	1	1	1	1	2	2	5	5	5	5	4	4	1	1	1	1
111													2	3	2	1	2	2	3	3	4	5	2	3	3	3	3	3	3	3	3	3	3	3	3	3
112													5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	5	5	5	5	5	5
113													4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
114													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
115													5	5	5	2	5	5	5	3	1	3	1	1	5	5	5	3	3	1	3	2	1	1	1	1

	About Blind Student												About Classmates												About himself/herself											
	Before Motion						During Motion						Before Motion						During Motion						Before Motion						During Motion					
116													2	4	3	1	1	4	1	1	1	1	1	1	5	3	4	1	5	1	1	1	1	1	1	1
117													5	5	5	5	5	5	5	5	5	5	5	5	3	4	4	3	4	4	3	4	4	4	4	4
118													5	4	4	3	3	3	4	4	4	4	3	3	4	4	4	5	2	5	3	4	3	3	2	5
119													5	5	5	5	5	1	5	5	5	5	5	1	1	1	1	1	5	1	1	1	1	1	5	1
120													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
121													4	4	4	4	4	4	2	2	2	2	2	2	4	3	4	3	4	3	2	1	2	1	2	1
122													4	5	4	3	4	4	3	3	3	3	3	3	4	4	3	3	3	3	2	2	3	2	2	2
123													4	4	3	3	4	2	2	3	2	3	2	2	3	3	2	4	3	2	2	2	3	2	2	1
124													4	4	3	3	2	2	2	2	2	2	2	2	3	3	4	3	2	2	2	2	2	2	1	1
125													5	5	5	5	5	5	2		1	3	2	3	5	5	5	5	5	5	3	2	2	2	3	5
126													5	5	5	5	5	5	5	5	4	4	5	4	5	1	3	4	4	4	5			5	5	4
127													4	4	4	4	4	4	3	3	2	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2
128													4	4	4	4	4	4	2	2	2	2	2	2	5	5	3	5	5	4	2	2	2	2	2	2
129													4	2	3	3	2	5	4	2	3	3	2	5	4	3	4	4	4	4	4	3	4	4	4	4
130													3	1	2	1	1	1	3	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1
131													4	4	4	4	4	4	3	3	3	3	3	3	4	4	4	4	4	4	2	2	2	2	2	2
132													5	5	5	5	5	5	3	3	3	3	3	3	5	5	5	5	5	5	3	3	3	3	3	3
133													5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
134													4	3	3	4	3	3	3	3	2	3	3	2	4	3	4	3	3	3	3	3	3	3	3	3
135													3	2	1	1	1	2	3	2	1	1	1	2	2	2	2	2	1	3	2	2	2	2	1	3
136													4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
137													4	4	4	4	4	4	3	3	3	3	3	3	5	5	5	5	5	5	1	5	5	5	1	1
138													3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
139													2	2	1	2	1	4	1	1	1	1	1	1	2	2	4	1	1	2	1	1	1	1	1	1
140													2	2	3	3	1	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2
141													2	2	2	2	2	2		2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5
142													4	4	3	5	4	3	3	3	3	3	3	3	3	4	3	2	2	5	2	2	2	2	2	2
143													5	3	5	5	5	5	5		5	4	3	5	5	5	5	5	5	5	3	2	2	3	1	5
144													3	3	4	4	3	4	4	4	3	5	4	4	3	4	4	4	3	4	3	4	4	3	4	3
145													4	4	4	4	4	4	2	2	2	2	2	2	4	4	4	4	4	4	2	2	2	2	2	2
146													4	4	3	3	4	3	4	4	3	3	4	3	3	3	4	4	3	3	3	3	4	4	3	3
147													3	3	3	3	3	3	3	2	3	2	3	2	4	4	4	4	4	4	3	3	3	3	3	3
148													4	4	4	4	4	4	2	2	2	2	2	3	4	3	4	3	4	5	2	2	2	2	3	3
149													4	4	4	4	4	4	3	3	2	2	2	4	3	5	4	4	5	5	3	2	2	2	2	5
150													1	1	1	1	1	1	1	1	1	1	1	1	4	4	4	4	4	3	4	4	4	4	4	4
151													5	5	5	5	5	5	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2
152													2	2	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5
153													4	2	2	3	4	4	3	3	3	3	3	3	2	2	2	2	1	5	3	3	3	3	3	3
154													5	4	4	5	5	5	2	3	2	2	1	1	5	4	5	5	5	5	2	2	1	1	2	2
155													2	2	2	2	2	2	1	1	1	1	1	1	3	3	3	3	3	3	1	1	1	1	1	1
156													4	4	4	4	3	3	2	2	2	2	2	2	3	3	3	3	3	5	2	2	2	2	2	2
157	3	2	5	4	5	4	1	1	2	2	1	1	5	4	3	4	4	5	1	2	3	2	2	2	4	5	4	3	5	5	2	2	2	3	3	3

	About Blind Student												About Classmates												About himself/herself											
	Before Motion						During Motion						Before Motion						During Motion						Before Motion						During Motion					
158	5	4	4	4	5	5	5	4	4	4	5	5	5	5	5	5	5	4	5	5	5	5	5	4	5	5	4	5	4	4	5	5	4	5	4	4
159	5	5	3	3	2	4	5	5	3	3	2	4	5	5	4	5	4	4	5	5	4	5	4	3	5	5	4	5	3	5	5	5	3	5	3	5
160	3	2	2	2	3	2	4	5	5	4	5	5	4	3	2	3	3	3	4	4	4	5	4	4	2	3	2	2	3	4	5	4	4	5	4	4
161	5	3	5	5	3	5	5	3	5	5	3	5	3	3	5	5	5	5	3	3	5	5	5	5	5	5	5	5	4	4	5	5	5	5	4	4
162	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	4	4	4	5	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5
163	5	4	5	4	3	5	5	4	4	4	4	5	5	4	3	5	5	5	4	4	4	5	5	4	4	5	4	4	5	5	5	4	4	4	5	4
164	5	3	5	5	5	4	5	3	5	5	5	4	4	5	5	5	5	4	5	4	4	4	5	4	3	4	3	3	4	5	4	4	5	4	4	5
165	4	1	1	1	3	1	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5	4	4	4	4	4	4	5	5	5	5	5	5
166	5	5	5	5	5	5	5	5	5	5	5	5	3	3	4	4	3	4	4	4	4	4	4	5	4	4	4	5	5	5	4	5	4	4	5	4
167	5	4	4	5	4	5	5	4	4	5	4	5	3	2	4	3	4	3	2	3	4	5	3	4	2	3	4	4	3	5	2	3	4	3	4	5
168	5	5	5	5	5	4	5	5	5	5	5	4	5	4	4	4	5	5	5	4	4	4	5	5	4	4	4	5	4	5	4	4	4	5	4	5
169	5	5	4	4	5	4	5	5	4	4	5	4	3	4	4	4	5	5	5	4	5	5	5	5	5	5	5	5	4	4	5	5	5	5	4	4
170	3	4	2	4	4	4	5	5	5	5	5	5	5	5	4	5	4	5	4	4	4	4	4	4	5	4	4	5	4	4	4	5	5	4	5	4
171	4	3		2	4	4	2		3	2	4	5	3	4	5	4	3	4	5	4		5		4	5		4	3	4	3	5	3	5			5
172	3	2	2	1	4	5	4	4	4	4	4	4	4	5	4	3	3	4	4	4	4	2	4	2	4	4	2	4	1	3	5	5	4	4	3	5
173	5	5	4	4	5	4	5	5	4	5	5	5	4	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
174	5	3	5	4	1	5	5	3	5	4	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2	3	5	5	5	5	4	5	5
175	1	5	4	5	5	5	1	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	4	4	5	1	5	5	5	5	5	5
176	3	3	3	3	3	3	5	5	5	5	5	5	5	5	3	5	1	2	5	5	5	5	4	5	2	1	2	1	1	2	4	5	5	4	5	5
177	5	5	5	4	4	1	5	5	5	4	4	1	1	3	5	5	5	5	1	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
178	1	1	5	1	1	2	4	1	5	1	5	5	5	5	5	5	1	2	5	5	5	5	1	2	5	5	5	5	5	3	5	5	5	5	5	3
179	3	2	3	2	3	3	4	4	5	5	4	3	4	2	3	2	3	3	4	4	3	4	4	4	4	2	3	4	3	2	5	5	4	5	4	5
180	3	3	1	1	3	2	3	4	4	4	3	4	3	2	2	1	1	1	3	3	4	4	4	3	3	3	3	2	2	2	4	4	3	4	4	4
181	3	3	3	3	3	3	4	4	4	4	4	4	2	2	2	2	2	2	4	4	4	4	4	4	3	3	3	3	3	3	5	5	5	5	5	5
182	3	3	3	3	3	3	4	4	4	4	4	4	2	2	2	2	2	2	4	4	4	4	4	4	4	3	2	3	4	5	4	4	4	4	4	4
183	3	3	2	3	2	3	4	3	4	4	3	3	3	3	2	2	3	4	3	2	4	4	3	3	3	3	2	3	2	2	4	3	3	4	3	3
184	3	3	2	2	4	4	3	4	4	5	4	4	3	3	2	2	4	4	3	4	4	5	4	3	3	3	2	2	4	4	4	4	5	5	4	4
185	3	4	3	2	3	3	4	4	3	4	4	4	4	4	3	3	4	4	4	4	3	3	3	4	4	3	3	4	3	3	3	3	4	4	4	4
186	3	3	4	4	3	3	4	4	4	4	4	4	4	4	5	5	4	4	4	4	4	4	4	4	1	2	2	1	1	2	3	3	2	3	3	3
187	3	3	4	4	3	3	4	4	4	4	4	4	3	2	2	3	4	4	3	4	4	4	3	3	3	3	3	3	3	4	4	5	5	5	5	
188	3	3	2	2	4	5	4	4	5	5	4	5	4	3	3	4	4	3	4	5	5	4	5	5												
189	3	3	4	4	4	4	5	5	4	4	4	4	3	3	4	4	5	5	4	4	5	5	5	5	4	3	3	4	4	4	5	5	4	5	4	5
190													3	3	3	3	3	5	4	3	3	4	5	5	3	3	3	4	3	3	5	4	4	4	5	5
191	3	3	4	3	2	2	4	3	4	4	5	5	3	2	2	3	3	4	3	4	4	4	5	5	4	3	3	2	2	3	4	4	5	5	5	5

APPENDIX R1

OCLI SCHEDULE

Date	Number	Minutes	Observation way			Cases	
			1st Observer	2nd Observer	Camera	A	B
12.11.2012	1	32	x				x
	2	32		x			x
	3	31	x				x
	4	31		x			x
13.11.2012	31	35		x		x	
	32	35	x			x	
	33	35		x		x	
	34	35	x			x	
19.11.2012	5	32	x				x
	6	33	x				x
20.11.2012	35	34	x			x	
	36	35	x			x	
27.11.2012	37	35	x			x	
	38	35			x	x	
	39	35	x			x	
	40	35			x	x	
28.11.2012	7	32	x				x
	8	32			x		x
	9	32	x				x
	10	32			x		x
04.12.2012	41	34	x			x	
	42	33	x			x	
05.12.2012	11	32	x				x
	12	32	x				x
11.12.2012	43*	34	x			x	
	44*	34	x			x	
12.12.2012	13*	30	x				x
	14*	30	x				x
15.12.2012	15*	31	x				x
	16*	31		x			x
	17*	31		x			x
	18*	31	x				x

Date	Number	Minutes	Observation way			Cases	
			1st Observer	2nd Observer	Camera	A	B
18.12.2012	45*	30	x			x	
	46*	30		x		x	
	47*	33	x			x	
	48*	33		x		x	
25.12.2012	49*	31	x			x	
	50*	31			x	x	
	51*	34	x			x	
	52*	34			x	x	
26.12.2012	19*	31	x				x
	20*	31			x		x
	21*	31	x				x
	22*	31			x		x
02.01.2013	23	35	x				x
	24	30	x				x
08.01.2013	53	31	x			x	
	54	34	x			x	
09.01.2013	25	29	x				x
	26	35	x				x
15.01.2013	55	33		x		x	
	56	33	x			x	
	57	34		x		x	
	58	34	x			x	
16.01.2013	27	32			x		x
	28	32	x				x
	29	29	x				x
	30	29			x		x

* This observasion was done during the treatment.

APPENDIX R2

RAW DATA of OCLI

Dakika	Bilşsel			Fiziksel		Bilşsel			Fiziksel	
	Nasıl	Kiminle	İçerik	Nasıl	Neyle	Nasıl	Kiminle	İçerik	Nasıl	Neyle
	1					3				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	2	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	2	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	3	2	4	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3					
	5					6				

1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	2	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	2	0	0	0	1	3
10	3	2	4	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	2
15	0	0	0	1	3	0	0	0	1	2
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	2
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	3	2	4	1	3
32	0	0	0	1	3	0	0	0	1	2
7						9				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	2
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	3	2	4	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	2	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3

12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	2
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
11						12				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	2	0	0	0	1	3
7	0	0	0	1	2	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	2	1	2	4	1	3
10	0	0	0	1	3	3	2	4	1	3
11	0	0	0	1	3	3	2	4	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3

23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
13						14				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	3	1	3	1	1	0	0	0	1	3
4	0	0	0	1	1	3	1	2	1	1
5	1	1	3	1	1	1	2	1	1	1
6	1	1	2	1	1	0	0	0	1	2
7	0	0	0	2	1	1	2	3	1	1
8	0	0	0	2	1	0	0	0	1	1
9	3	2	2	2	1	2	1	2	1	3
10	3	2	3	1	3	0	0	0	1	3
11	2	1	3	1	3	0	0	0	1	3
12	0	0	0	1	3	1	2	1	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	1	0	0	0	1	1
16	1	2	1	1	1	0	0	0	1	1
17	0	0	0	1	1	0	0	0	1	2
18	0	0	0	1	1	1	2	3	1	1
19	3	2	1	1	1	3	1	2	1	1
20	3	2	2	1	1	0	0	0	1	3
21	0	0	0	1	1	4	1	3	1	3
22	0	0	0	1	3	0	0	0	1	1
23	0	0	0	1	3	0	0	0	1	1
24	1	2	3	1	3	2	2	2	1	1
25	3	2	2	1	3	0	0	0	1	1
26	0	0	0	1	3	0	0	0	1	2
27	0	0	0	1	1	3	1	1	1	3
28	3	2	3	1	1	0	0	0	1	3
29	0	0	0	1	3	3	2	3	1	3
30	0	0	0	1	3	0	0	0	1	3
15						18				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	3	1	2	1	3

3	2	1	2	1	3	0	0	0	1	1
4	0	0	0	1	2	4	2	1	1	1
5	4	2	1	1	1	0	0	0	1	1
6	0	0	0	1	1	2	2	4	1	3
7	0	0	0	1	3	3	2	2	1	1
8	0	0	0	1	3	0	0	0	1	2
9	3	1	3	2	1	0	0	0	1	1
10	0	0	0	2	1	4	2	2	1	3
11	0	0	0	2	1	1	1	3	1	3
12	0	0	0	2	1	0	0	0	1	3
13	3	2	2	2	1	3	1	1	1	3
14	1	2	3	2	1	0	0	0	1	3
15	0	0	0	2	1	0	0	0	1	3
16	0	0	0	2	1	3	2	3	1	1
17	1	1	1	2	1	0	0	0	1	1
18	0	0	0	2	1	0	0	0	1	1
19	0	0	0	2	1	3	2	1	1	3
20	0	0	0	2	1	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	1
22	0	0	0	1	3	1	1	2	1	1
23	3	2	4	1	1	0	0	0	1	3
24	0	0	0	1	1	3	1	1	1	3
25	3	2	2	1	1	0	0	0	1	3
26	0	0	0	1	2	0	0	0	1	1
27	0	0	0	1	3	2	2	3	1	1
28	0	0	0	1	3	0	0	0	1	1
29	0	0	0	1	1	3	1	2	1	3
30	3	2	3	1	2	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
19						21				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	1	3	2	1	1	1
3	3	2	0	1	1	0	0	0	1	1
4	0	0	0	1	1	0	0	0	1	1
5	0	0	0	1	1	0	0	0	1	1
6	3	2	2	1	1	3	2	3	1	1
7	0	0	0	1	1	0	0	0	1	1
8	1	2	3	1	1	4	2	2	1	3
9	0	0	0	1	1	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	1	3	2	3	1	1
12	0	0	0	1	1	3	2	3	1	1
13	3	2	3	1	1	2	1	2	1	1
14	3	2	3	1	1	0	0	0	1	1

15	0	0	0	1	1	0	0	0	1	1
16	0	0	0	1	3	3	1	1	1	1
17	0	0	0	1	1	3	2	2	1	1
18	4	1	2	1	1	0	0	0	1	1
19	0	0	0	1	1	0	0	0	1	1
20	1	1	3	1	1	0	0	0	1	1
21	0	0	0	1	3	3	2	3	1	1
22	3	2	4	1	1	3	2	3	1	2
23	0	0	0	1	1	0	0	0	1	3
24	1	2	1	1	1	0	0	0	1	1
25	0	0	0	1	2	3	2	2	1	1
26	3	2	3	1	1	0	0	0	1	1
27	0	0	0	1	1	1	1	3	1	1
28	0	0	0	1	1	3	2	3	1	1
29	3	1	2	1	1	3	2	3	1	1
30	0	0	0	1	1	0	0	0	1	2
31	0	0	0	1	1	0	0	0	1	3
23						24				
1	0	0	0	1	3	3	2	4	1	3
2	0	0	0	1	1	0	0	0	1	3
3	0	0	0	1	1	0	0	0	1	3
4	0	0	0	1	1	0	0	0	1	3
5	0	0	0	1	1	0	0	0	1	3
6	0	0	0	1	1	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	2	1	3	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	3	2	3	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	2	1	3	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	2	0	0	0	1	3
22	0	0	0	1	2	0	0	0	1	3
23	0	0	0	1	2	0	0	0	1	3
24	0	0	0	1	2	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3

27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3					
32	0	0	0	1	3					
33	0	0	0	1	3					
34	0	0	0	1	3					
25						26				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	2	0	0	0	1	3
4	0	0	0	1	2	3	2	4	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	2
24	0	0	0	1	3	0	0	0	1	2
25	0	0	0	1	3	0	0	0	1	2
26	0	0	0	1	3	0	0	0	1	2
27	0	0	0	1	3	0	0	0	1	2
28	0	0	0	1	3	0	0	0	1	2
29	0	0	0	1	3	0	0	0	1	2
30						0	0	0	1	2
31						0	0	0	1	3
32						0	0	0	1	3
33						0	0	0	1	3
34						0	0	0	1	3
35						0	0	0	1	3

28						29				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	2
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	2	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	2
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	2	0	0	0	1	3
21	0	0	0	1	2	3	2	3	1	3
22	0	0	0	1	2	0	0	0	1	3
23	0	0	0	1	2	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	2
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3					
31	0	0	0	1	3					
32	0	0	0	1	3					
32						34				
1	0	0	0	1	2	0	0	0	1	3
2	0	0	0	1	2	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3

11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	3	2	4	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	3	2	4	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
33	0	0	0	1	3	0	0	0	1	3
34	0	0	0	1	3	0	0	0	1	3
35	0	0	0	1	3	0	0	0	1	3
35						36				
1	0	0	0	1	1	0	0	0	1	3
2	0	0	0	1	1	0	0	0	1	3
3	0	0	0	1	1	0	0	0	1	3
4	0	0	0	1	1	0	0	0	1	3
5	0	0	0	1	1	0	0	0	1	3
6	0	0	0	1	1	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3

19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	2	0	0	0	1	3
27	0	0	0	1	2	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
33	0	0	0	1	3	0	0	0	1	3
34	0	0	0	1	3	0	0	0	1	3
35						0	0	0	1	3
37						39				
1	0	0	0	1	3	1	2	4	1	3
2	0	0	0	1	3	3	2	4	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	2
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	2
14	0	0	0	1	3	0	0	0	1	2
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3

27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
33	0	0	0	1	3	0	0	0	1	3
34	0	0	0	1	3	0	0	0	1	3
35	0	0	0	1	3	0	0	0	1	3
41						42				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	3	2	4	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	2	0	0	0	1	3
7	0	0	0	1	2	0	0	0	1	3
8	0	0	0	1	2	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	2
13	0	0	0	1	3	0	0	0	1	2
14	0	0	0	1	3	0	0	0	1	2
15	0	0	0	1	2	0	0	0	1	3
16	0	0	0	1	2	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	3	2	4	1	3
31	0	0	0	1	3	3	2	4	1	3
32	0	0	0	1	3	0	0	0	1	3
33	0	0	0	1	3	0	0	0	1	3
34	0	0	0	1	3					

43						44				
1	0	0	0	1	1	0	0	0	1	3
2	0	0	0	1	1	0	0	0	1	3
3	0	0	0	1	1	0	0	0	1	3
4	0	0	0	1	1	3	1	3	2	1
5	0	0	0	1	3	3	1	3	2	1
6	0	0	0	1	3	1	2	3	2	1
7	1	2	1	1	3	0	0	0	2	1
8	3	2	3	1	3	0	0	0	2	1
9	0	0	0	1	3	4	1	3	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	2	1	2	1	3	0	0	0	1	3
13	0	0	0	1	3	3	2	4	1	3
14	0	0	0	1	1	0	0	0	1	3
15	0	0	0	1	1	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	1
17	0	0	0	1	3	0	0	0	1	1
18	1	2	3	1	1	3	2	4	1	1
19	3	2	4	1	1	0	0	0	1	3
20	0	0	0	1	1	0	0	0	1	3
21	1	1	1	1	1	0	0	0	1	3
22	0	0	0	1	1	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	3	2	2	1	1
26	0	0	0	1	3	3	2	2	1	1
27	1	1	1	1	1	0	0	0	1	1
28	3	1	3	1	1	0	0	0	1	1
29	3	2	4	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	1	1	3	1	1	0	0	0	1	3
32	3	2	3	1	3	3	1	4	1	3
33	0	0	0	1	3	0	0	0	1	3
34	0	0	0	1	3	0	0	0	1	3
45						47				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	4	1	1	1	1
3	3	2	1	1	1	0	0	0	1	1
4	0	0	0	1	1	0	0	0	1	3
5	1	2	2	1	1	1	2	2	1	3
6	0	0	0	1	1	0	0	0	1	1
7	3	2	3	1	1	3	1	1	1	1
8	0	0	0	1	1	0	0	0	1	1

9	0	0	0	1	1	0	0	0	1	1
10	2	2	1	1	3	0	0	0	1	1
11	3	2	2	1	3	3	1	3	1	2
12	0	0	0	1	2	0	0	0	1	3
13	0	0	0	1	2	2	2	2	1	3
14	0	0	0	2	1	0	0	0	1	1
15	4	2	1	2	1	0	0	0	1	1
16	0	0	0	2	1	0	0	0	1	1
17	0	0	0	2	1	0	0	0	1	1
18	0	0	0	2	1	3	1	1	1	3
19	0	0	0	2	1	0	0	0	1	3
20	1	2	1	2	1	0	0	0	1	1
21	3	2	3	2	1	0	0	0	1	1
22	0	0	0	2	1	1	2	2	1	1
23	0	0	0	2	1	0	0	0	1	1
24	0	0	0	2	1	0	0	0	1	2
25	2	1	1	1	3	0	0	0	1	3
26	3	2	3	1	3	0	0	0	1	1
27	3	2	2	1	3	0	0	0	1	1
28	0	0	0	1	3	0	0	0	1	1
29	0	0	0	1	3	3	1	2	1	1
30	0	0	0	1	3	0	0	0	1	1
31						0	0	0	1	3
32						0	0	0	1	3
33						0	0	0	1	3
49						51				
1	0	0	0	1	3	0	0	0	1	3
2	1	1	2	1	1	3	1	1	1	1
3	0	0	0	1	1	3	2	3	1	1
4	0	0	0	1	1	0	0	0	1	3
5	2	1	3	1	1	0	0	0	1	2
6	0	0	0	1	3	1	2	2	1	1
7	3	2	1	1	2	4	2	2	1	1
8	0	0	0	1	3	0	0	0	1	1
9	1	2	2	1	1	3	2	3	1	1
10	0	0	0	1	1	0	0	0	1	1
11	0	0	0	1	3	0	0	0	1	3
12	0	0	0	1	3	0	0	0	1	3
13	4	2	3	1	2	0	0	0	1	2
14	0	0	0	1	3	0	0	0	1	1
15	3	2	2	1	3	0	0	0	1	1
16	0	0	0	1	1	0	0	0	1	3
17	0	0	0	1	1	1	1	1	1	3
18	3	2	1	1	1	3	2	2	1	1

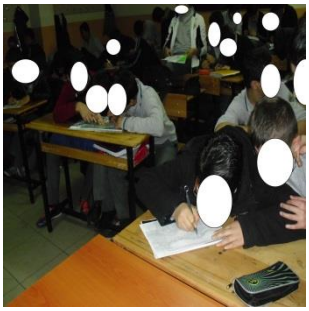
19	0	0	0	1	1	0	0	0	1	1
20	0	0	0	1	1	0	0	0	1	1
21	1	2	4	1	1	0	0	0	1	1
22	0	0	0	1	3	3	1	3	1	1
23	1	2	3	1	3	0	0	0	1	3
24	3	2	2	1	3	0	0	0	1	2
25	3	2	3	1	3	0	0	0	1	3
26	0	0	0	1	1	2	2	1	1	1
27	0	0	0	1	1	3	2	2	1	1
28	1	2	1	1	3	0	0	0	1	1
29	2	2	3	1	3	0	0	0	1	1
30	0	0	0	1	2	0	0	0	1	1
31	0	0	0	1	2	0	0	0	1	1
32						3	2	3	1	3
33						0	0	0	1	3
34						0	0	0	1	3
35						0	0	0	1	3
53						54				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	1	0	0	0	1	3
3	0	0	0	1	1	0	0	0	1	3
4	2	1	3	1	1	0	0	0	1	1
5	0	0	0	1	3	0	0	0	1	1
6	0	0	0	1	3	3	2	4	1	3
7	0	0	0	1	3	3	2	3	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	3	0	0	0	1	3
11	0	0	0	1	3	0	0	0	1	3
12	3	2	4	1	2	0	0	0	1	3
13	0	0	0	1	2	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	2
17	0	0	0	1	3	0	0	0	1	2
18	0	0	0	1	3	0	0	0	1	2
19	0	0	0	1	1	0	0	0	1	3
20	0	0	0	1	1	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3

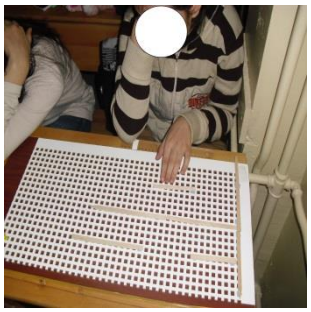
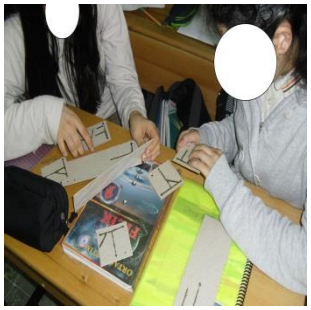
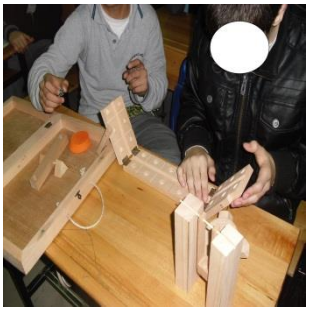
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	2
31	0	0	0	1	3	0	0	0	1	3
32						0	0	0	1	3
33						0	0	0	1	3
34						0	0	0	1	3
56						58				
1	0	0	0	1	3	0	0	0	1	3
2	0	0	0	1	3	0	0	0	1	3
3	0	0	0	1	3	0	0	0	1	3
4	0	0	0	1	3	0	0	0	1	3
5	0	0	0	1	3	0	0	0	1	3
6	0	0	0	1	3	0	0	0	1	3
7	0	0	0	1	3	0	0	0	1	3
8	0	0	0	1	3	0	0	0	1	3
9	0	0	0	1	3	0	0	0	1	3
10	0	0	0	1	2	0	0	0	1	3
11	0	0	0	1	2	0	0	0	1	3
12	0	0	0	1	2	0	0	0	1	3
13	0	0	0	1	3	0	0	0	1	3
14	0	0	0	1	3	0	0	0	1	3
15	0	0	0	1	3	0	0	0	1	3
16	0	0	0	1	3	0	0	0	1	3
17	0	0	0	1	3	0	0	0	1	3
18	0	0	0	1	3	0	0	0	1	3
19	0	0	0	1	3	0	0	0	1	3
20	0	0	0	1	3	0	0	0	1	3
21	0	0	0	1	3	0	0	0	1	3
22	0	0	0	1	3	0	0	0	1	3
23	0	0	0	1	3	0	0	0	1	3
24	0	0	0	1	3	0	0	0	1	3
25	0	0	0	1	3	0	0	0	1	3
26	0	0	0	1	3	0	0	0	1	3
27	0	0	0	1	3	0	0	0	1	3
28	0	0	0	1	3	0	0	0	1	3
29	0	0	0	1	3	0	0	0	1	3
30	0	0	0	1	3	0	0	0	1	3
31	0	0	0	1	3	0	0	0	1	3
32	0	0	0	1	3	0	0	0	1	3
33	0	0	0	1	3	0	0	0	1	3
34						0	0	0	1	3

APPENDIX S

USING THE ENRICHED COURSE MATERIALS IN DIFFERENT CASES

ECM	Case A	Case B
1		
2	    	  

3		
4		
5		
6		
7		

8		
9	 	 
10		
11		

APPENDIX T

THE FORMULA OF RELATIVE EFFECT SIZE WITH FOUR and EIGHT GROUPS

THE FORMULA OF RELATIVE EFFECT SIZE WITH FOUR GROUP

Starting with
Mean change, SD difference, N, in each group, Pre/Post Corr

Standardized difference in means
** Option to standardize by Change SD **

MeanChange(1) = Group 1 mean difference
MeanChange(2) = Group 2 mean difference
RawDiff = MeanChange(1) - MeanChange(2)

SDChange(1) = Sqr(SDPre(1) ^ 2 + SDPost(1) ^ 2 - 2 * CorrPrePost * SDPre(1) * SDPost(1))
SDChange(2) = Sqr(SDPre(2) ^ 2 + SDPost(2) ^ 2 - 2 * CorrPrePost * SDPre(2) * SDPost(2))
SDChangePooled = Sqr((((n(1) - 1) * SDChange(1) ^ 2 + (n(2) - 1) * SDChange(2) ^ 2) / (n(1) + n(2) - 2)))

StdChangeDiff = RawDiff / SDChangePooled
StdChangeDiffSE = Sqr(1 / n(1) + 1 / n(2) + StdChangeDiff ^ 2 / (2 * (n(1) + n(2))))

THE FORMULA OF RELATIVE EFFECT SIZE WITH EIGHT GROUP

MeanChange(1) = Group 1 mean difference
MeanChange(2) = Group 2 mean difference
MeanChange(3) = Group 3 mean difference
MeanChange(4) = Group 4 mean difference
RawDiff = ((MeanChange(1) - MeanChange(2))- (MeanChange(3) - MeanChange(4)))
SDChange(1) = Sqr(SDPre(1) ^ 2 + SDPost(1) ^ 2 - 2 * CorrPrePost * SDPre(1) * SDPost(1))
SDChange(2) = Sqr(SDPre(2) ^ 2 + SDPost(2) ^ 2 - 2 * CorrPrePost * SDPre(2) * SDPost(2))
SDChange(3) = Sqr(SDPre(3) ^ 2 + SDPost(3) ^ 2 - 2 * CorrPrePost * SDPre(3) * SDPost(3))
SDChange(4) = Sqr(SDPre(4) ^ 2 + SDPost(4) ^ 2 - 2 * CorrPrePost * SDPre(4) * SDPost(4))
SDChangePooled (A)= Sqr((((n(1) - 1) * SDChange(1) ^ 2 + (n(2) - 1) * SDChange(2) ^ 2) / (n(1) + n(2) - 2)))
SDChangePooled (B)= Sqr((((n(3) - 1) * SDChange(3) ^ 2 + (n(4) - 1) * SDChange(4) ^ 2) / (n(3) + n(4) - 2)))
StdChangeDiff = RawDiff / ((SDChangePooled(A) + SDChangePooled(B))/2)

CURRICULUM VITAE

PERSONAL INFORMATION
Surname, Name: Bülbül, Mustafa Şahin
Nationality: Turkish (TC)
Date and Place of Birth: 12 March 1980, Karaman
Marital Status: Married
Phone: +90 312 210 75 03
Fax: +90 312 210 22 91
email: msahinBülbül@gmail.com

EDUCATION

Degree	**Institution**	**Year of Graduation**
MS	Kafkas Uni. High Energy	2004
BS	Kafkas Uni. Physics	2002
High School	İçel Anatolian High School, Mersin	1998

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2005- Present	Research asisstant	
2003-2005	Physics Teacher in Ministery of National Education	

FOREIGN LANGUAGE
English

PUBLICATIONS

1. Bülbül, M. Ş., Eryurt, K., Mhaiskar, V., & Gupta, A. (2013). In touch with distance and displacement. *Physics Education, 48*(3), 1–2. Retrieved from http://iopscience.iop.org/0031-9120

2. Bülbül, M. Ş. (2007). *Kaos ve Eğitim* (p. 160). Ankara: Beyaz Kalem. Retrieved from http://books.google.com/books/about/Kaos_ve_Eğitim.html?hl=tr&id=0mos0i1T0p8C

3. Bülbül, M. Ş. (2012). *Drama, Creativity and Chaos in Physics Education*. (E. Alexei, Ed.). Saarbrücken, Deutschland: Lambert Academic Publishing.