IDENTIFYING FACTORS THAT AFFECT STUDENTS' ACCEPTANCE OF WEB-BASED ASSESSMENT TOOLS WITHIN THE CONTEXT OF HIGHER EDUCATION

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Approval of the Graduate School of Informatics

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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ABSTRACT

IDENTIFYING FACTORS THAT AFFECT STUDENTS' ACCEPTANCE OF WEB-BASED ASSESSMENT TOOLS WITHIN THE CONTEXT OF HIGHER EDUCATION

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The main aim of this thesis study is to identify the factors that affect higher education students' perceptions of computerized assessment for learning. This study additionally aims to help effective use of computers in assessment activities by guiding the teachers or educational organization by interpreting the factors that affect students' attitudes toward computer use in examinations.

Quantitative research design has been used in this study. When choosing the participants, nonprobability sampling strategy was used due to its convenience. A total number 332 student of Middle East Technical University participated in the study.

The data has been analyzed via Confirmatory Factor Analysis and interpreted by Structural Equation Modeling. The data loaded under 5 constructs: Perceived Ease of Use, Perceived Usefulness, Intention, Computer Attitude and Anxiety. By identifying

the relations between these constructs, a structural model was created to determine the intention of students' towards computerized assessment.

The findings of this study have revealed that "perceived usefulness" is the most important determinant in students' willingness to use computerized assessment. Additionally, if students have anxiety resulted from computer use, this affect their easiness perceptions negatively. Computer attitude is another factor that affects students' perceptions of easiness and their anxiety. Finally it is concluded that students' computer attitudes and anxiety affect their behaviors toward computerized assessment.

Keywords: E-assessment, Perceptions of students, Computer attitude, Structural Equation Modeling (SEM), Technology Acceptance Model (TAM)

ÖZ

YÜKSEKÖĞRETİM KAPSAMINDA ÖĞRENCİLERİN WEB TABANLI DEĞERLENDİRME ARAÇLARINI KABULÜNÜ ETKİLEYEN FAKTÖRLERİN BELİRLENMESİ

ALKIŞ, Nurcan
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Bu tez çalışmasının temel amacı, yüksek öğrenimdeki öğrencilerin bilgisayar tabanlı değerlendirmeye karşı algılarını etkileyen faktörleri belirlemektir. Ayrıca bu çalışmamacı öğrencilerin sınavlarda bilgisayar kullanımına karşı tutumlarını etkileyen faktörleri belirleyerek eğitim kurumlarını yönlendirmek ve bilgisayarların değerlendirme aktivitelerinde etkili kullanımına yardımcı olmaktır.

The main aim of this thesis study is to identify the factors that affect higher education students' perceptions of computerized assessment for learning. This study additionally aims to help effective use of computers in assessment activities by guiding the teachers or educational organization by interpreting the factors that affect students' attitudes toward computer use in examinations.

Bu çalışmadan nicel araştırma yöntemi kullanılmıştır. Örneklem grubu uygunluğu dolayısıyla tesadüfü olmayan örnekleme stratejisi ile seçilmiştir. Çalışmada, Orta Doğu Teknik Üniversitesi'nden toplam 332 öğrenci yer almıştır.

Toplanan veriler Doğrulayıcı Faktör Analizi ile analiz edilip, Yapısal Eşitlik Modeli temel alınarak yorumlanmıştır. Veriler 5 faktör altında toplanmıştır: Algılanan Kullanım Kolaylığı, Algılanan Fayda, Niyet, Bilgisayar Tutumu ve Kaygı. Bu faktörler arasındaki ilişkiler incelenerek, yüksek öğrenimdeki öğrencilerin bilgisayar tabanlı değerlendirmelere karşı niyetlerini belirleyen bir yapısal model oluşturulmuştur.

Bu çalışmanın sonuçlarına göre; "algılanan fayda" öğrencilerin bilgisayar tabanlı sınavlarını kullanmaya karşı isteklerini belirlemede en önemli faktördür. Ayrıca, öğrenciler bilgisayar kullanırken kaygı duyarlarsa, sınav araçlarına karşı kolaylık algıları negatif olarak etkilenmektedir. Diğer bir faktör olan bilgisayar tutumu öğrencilerin kolaylık algıları ile kaygılarını etkilemektedir. Sonuç olarak, öğrencilerin bilgisayar tutumları ve bilgisayar kullanımından kaynaklanan kaygıları, bilgisayar tabanlı sınavlara karşı davranışsal niyetlerini etkilemektedir.

Anahtar Kelimeler: e-değerlendirme, Öğrencilerin algıları, bilgisayar tutumu, Yapısal Eşitlik Modellemesi (YEM), Teknoloji Benimseme modeli (TAM)

This thesis is dedicated to:

To the memories of my father Arif Bektaş ALKIŞ

&

My Friend Duygu FINDIK

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LIST OF ABBREVIATIONS

ANX: Anxiety

CA: Computer Attitude

CFA: Confirmatory Factor Analysis

EFA: Exploratory Factor Analysis

INT: Intention

IS: Information Systems

IS100: Introduction to Information Technologies and Applications course

METU: Middle East Technical University

PEOU: Perceived Ease of Use

PU: Perceived Usefulness

SCT: Social Cognitive Theory

SE: Self-efficacy

TAM: Technology Acceptance Model

TRA: Theory of Reasoned Action

CHAPTER I

INTRODUCTION

The first chapter introduces background of the study, outline of the study, purpose of the study, research questions, significance of the study and important definitions or the terms within this thesis respectively.

1.1. Background of the study

Assessment, sometimes referred as evaluation, is one of the processes of learning which gives feedback about students learning as well as about teachers or educational organizations (Taras, 2005; Berry, 2009). Assessment for learning can be summative or formative which are different in applications and purposes. Summative assessment is applied at the end of learning process, while formative assessment is applied during learning process (Berry, 2009).

With the advances in information and communication technologies (ICT), technology has been used in educational activities; assessment for learning is one of the affected parts of education from the technology (Bennett, 2002). ICT has made changes the formats of assessment and provided opportunities for conducting exams in computer environment as well as for self-test, grading tests or exercises (Thelwall, 2000).

The use of computerized assessment in higher education has grown up rapidly with usage of Information and Communication Technologies (ICT) in education, however the number of studies that has researched students experience and perceptions of computer use in assessment, is not high (Walker, Topping, Rodrigues, 2008). In order to make effective use of computers in assessment activities, students' perceptions of such applications and the factors that affect their behaviors toward

such applications should be investigated. There are different models developed in the literature to investigate users' perceptions of technology from different aspects. Technology Acceptance Model (TAM) is one of the existing models to investigate end-users behavioral intention towards technology use.

TAM is one of the widely referred technology adoption models, which is used to investigate end-users behavioral intention toward technology use in different contexts like e-government, e-learning, internet, etc. This thesis study proposes an extended technology adoption model by taking TAM as the base theoretical model and adding two external factors: anxiety, computer attitude.

1.2. Purpose of the study

The purpose of the study is threefold; (1) to investigate higher education students' perceptions of e-assessment; (2) to investigate the effects individual differences on students' intention towards use of e-assessment tools; (3) to extend TAM by adding factors related to individual differences in the context of e-assessment and validating TAM with Structural Equation Modeling (SEM).

1.3. Research Questions

The following questions guided this research:

(1) What factors affect higher education students' intentions towards use of e-assessment?
(2) What are the key measures for the success of e-assessment tools?

In order to answer these research questions, the study has specified the purposes mentioned above.

1.4. Significance of the study

With the use of ICT in learning activities, computerized assessment use in examinations rises. However, in order to make effective use of computers in

assessment activities, students' adoption behaviors of such application should be investigated.

In information systems (IS) researches, Technology Acceptance Model (TAM) is one of the widely used theoretical model used to evaluate the intentions of end-users' towards actual system use.

In this study, two *belief* constructs from TAM; perceived ease of use, perceived usefulness, two constructs from *individual differences* perspective; anxiety and computer attitude were researched. The relations between these constructs and students' behavioral intention towards computer use in examination were analyzed with Structural Equation Modeling (SEM) and an extended technology adoption model was presented in the context of e-assessment.

The findings of this study will be useful for both the developers of e-assessment tools and for educational institutions by providing factors that facilitate the use of e-assessment among higher education students.

1.5. Design of the study

This study depended on quantitative research. Quantitative research uses statistical analysis of numerical data and objective measurement to explain the research problem related with relationships, causes and effects (Ary, Jacobs, & Razavieh, 2002). According to Ary et al. (2002) typical quantitative research includes literature review, instrument development & data collection, data analysis and conclusion stages. In this study, these crucial stages have been accomplished and the stages accomplished are shown in Figure 1.

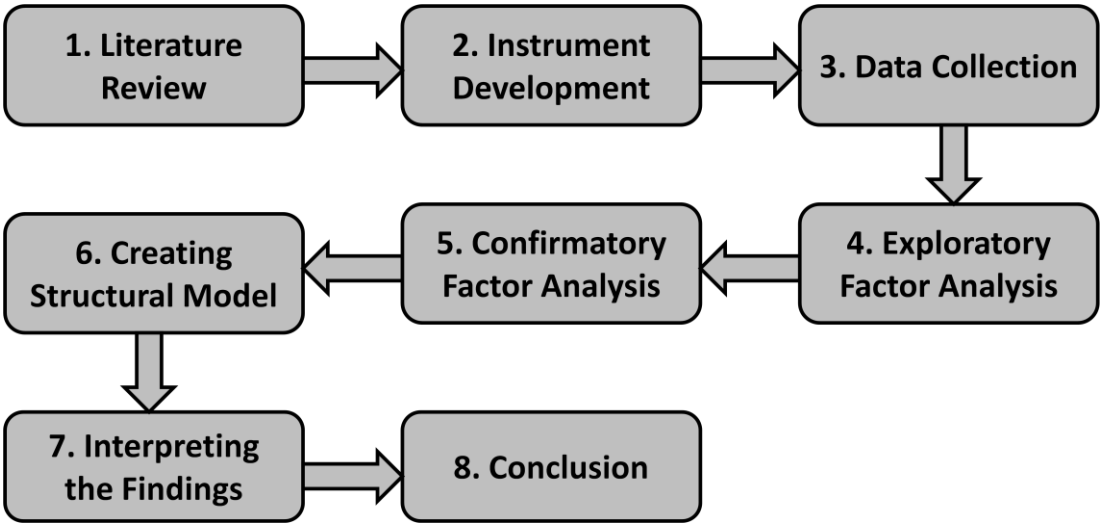

Figure 1 Stages of study

First the problem was identified. The problem is identifying the factors that affect students' adoption of e-assessment. During problem identification the literature related to students' perceptions of computerized assessment were reviewed, then the studies related to users technology behaviors was searched. TAM was taken as a theoretical model, since this model is one of the widely used models that examine behavioral intentions of users towards information technology and applications. After that, the studies conducted by taking TAM as a theoretical framework, were reviewed in e-learning context. Up to researcher's knowledge, in the literature, there are a few studies conducted to investigate students' behavioral intentions toward computerized examination by taking TAM as a theoretical framework. There were a few studies that investigated students' perceptions of e-assessment without referring TAM (Dermo, 2008; Ricketts & Wilks, 2002; Schneberger, Amoroso, & Durfee, 2007) and the study conducted by McDonald (2002) shows that individual factors affects students perception of e-assessment. Then the research problem was identified as investigating the factors that affect the behaviors of students towards computer usage in examinations by considering the individual differences between students. By reviewing the literature of TAM studies and other studies that searched students' perceptions of e-assessment; computer anxiety, self-efficacy and computer attitude were selected as external factors. By adding these external factors to original TAM, a theoretical research model was proposed. In order to design the research, a

survey instrument was developed by adapting scales from the existing literature. The required data was collected at Middle East Technical University (METU). Data was analyzed and a structural model for identifying students' behaviors was developed by conducting Structural Equation Modeling (SEM). SEM analysis was conducted with SmartPLS by conducting confirmatory factor analysis. Lastly, the results and their discussion were written.

1.6. Definitions of terms

Assessment for learning: Assessment is one of the processes in education. Berry (2009) defines assessment as "a deliberate and planned collection of the full range of information from students that helps them understand their knowledge, skills and abilities including strengths and weaknesses, values and attitudes". Assessment provides feedback about students' performance during learning process.

e-assessment: e-assessment refers to use of electronic technologies in assessment for learning activities (Ridgway et al., 2004). This type of assessment can include computer programs for testing.

Technology Acceptance Model (TAM): A model that proposes perceived ease of use, perceived usefulness, attitude constructs as determinants of behavioral intention towards actual use of technology.

Structural Equation Modeling (SEM): SEM is a statistical approach to test the relations between the latent and observed variables depending on confirmatory factor analysis.

CHAPTER II

LITERATURE REVIEW

This chapter gives information about assessment for learning, the previous studies conducted in computerized assessment, e-assessment and students perceptions of computerized assessment and technology adoption models. In the section 2.1 general concepts and definitions of assessment are given. In section 2.2 general information of computerized assessment is given. In section 2.3 the studies conducted to evaluate students' perceptions of computerized assessment are given. In section 2.4, general information of technology adoption models that are interested in end-users technology behaviors is given. In section 2.5 the studies of Technology Acceptance Model in learning context are summarized. Lastly, a short discussion of the literature review is given.

2.1. Assessment in Higher Education: Definitions and Concepts

2.1.1. What is Assessment?

Assessment for learning is a part of teaching and learning process; it refers to the process of gathering information about students to make judgments on their performance in this context (Taras, 2005). In the literature there are different terms used similar to assessment, which are "measurement", "test", "evaluation" (Berry, 2009). While "assessment" usually refers to "judgment of students' work", "evaluation" refers to "judgments regarding courses or course delivery or the process of making of such judgments" (Taras, 2005). However, these two terms are used interchangeably. Actually, assessment contains all of these terms, "measurement", "test", "evaluation" within its applications, since assessment includes tests, their

results (measurement), evaluation of results (evaluation) (Berry, 2009) . Berry (2009) defines assessment for learning as "a deliberate and planned collection of the full range of information from students that helps them understand their knowledge, skills and abilities including strengths and weaknesses, values and attitudes". According to this definition of assessment, students are the information provider and the teachers are the analyzer of the information collected.

Assessment takes places in the centre of education in order to evaluate the performance of students as well as to evaluate the success of schools and teachers (Ridgway, McCusker & Pead, 2004; Taras, 2005). For students, it provides further educational opportunities and for teachers and schools, it provides confirmation of their individual and organizational success (Ridgway et al., 2004). Moreover, according to Broadfoot & Black (2004) and Crisp (2007) assessment is proposed for several reasons, for example improving learning, feedback is taken from assessment for both students and teachers and it gives opportunity to grade students. According to Chetty (2000) assessment provides feedback about the performance of the students. Furthermore, with the help of assessment, the current teaching strategies are reviewed and can be improved, curricular programs are reviewed and can be improved and assessment provides data to the decision makers about their administration (Buzzetto-More, & Alade, 2006)

2.1.2. Types of Assessment

The type of assessment can change according to their functions, purposes or the process of application. Assessment is commonly categorized as summative and formative assessment according to its functions or its processes (Ridgway et al., 2004; Berry, 2009).

- **Summative Assessment:** Summative assessment is "conducted at the end of learning process" (Ridgway et al., 2004; Berry, 2009). Summative assessment summarizes the performance of students.
- **Formative Assessment:** Generally, formative assessment includes "series of actions conducted by the teachers and students during the learning process with the purpose of improving student learning" (Berry, 2009).

Formative assessment, different from summative assessment, tries to improve students' performance.

Assessment is also classified according to its formats, i.e. that the methods they use in the process of assessment:

- **Traditional format:** Traditional assessment is referred as paper-and-pencil based assessments and called as traditional since it has been used for a long time in order to evaluate students' performance (Berry, 2009). This type of assessment is generally used as summative assessment.
- **Alternative formats:** This type of assessment includes students' projects, portfolios, observations, simulation, etc and aims to prevent memorization. While traditional assessment format is suitable for summative assessment, this type of assessment is suitable for formative assessment since teachers can gather information about students during learning process before the end of learning process (Berry, 2009).

2.2. e-Assessment

Thanks to advances in information and communication technologies, technology has become centre to education: computers are used to conduct many educational activities like presenting course content to students or assessment by changing its formats and context (Bennett, 2002; Akdemir & Oğuz, 2008). According to Ridgway et al. (2004) e-assessment refers to use of electronic technologies in assessment for learning processes. According to Rozensky (1986), computer-based assessments includes computer programs for testing and simply these programs show questions on the monitor of the computer and the user enters his/her response to each question. Computerized assessment can be applied in both formative assessment and summative assessment in different contexts (Thelwall, 2000). Computerized assessment can be used for several purposes such as conducting exams, providing self-tests, grading tests exercises, etc. (Thelwall, 2000).

There are examples of technology based assessment implemented in reading, math, science, English and social studies in some states of United States like Virginia, Georgia etc. (Bennett, 2002). These states apply technology-based assessment in elementary and secondary schools and the tests they used generally include multiple choice question types (Bennett, 2002).

Web-based assessment provides easiness in Distance Education context (Chetty, 2000), especially when the teachers and the students are in different locations. Web-based assessment in e-learning environment improves the effectiveness of learning (Wang, 2010). Also web-based assessments have many advantages like reducing efforts needed to grade, marking, recording as well as they can be accessed anywhere and anytime (Ko & Cheng, 2008).

According to Crisp (2007) e-assessment can be categorized in application process as follows:

- **Diagnostic:** This type of assessment is applied at the beginning of learning activities in order to identify the current level of students in the specified subject so that learning activities can be designed accordingly to match students' needs.
- **Formative:** This type of assessment is applied during the process of learning simultaneously with learning activities in order to provide practice for students in the specified subject and aims to increase the level of understanding. For example Wang (2008) mentioned a web-based formative assessment which is like an online quiz game and this tool is used in e-learning environment when the students are the teacher are in different places.
- **Summative:** This type of assessment is applied at the end of learning process in order to grade students or make judgments about their understanding level of the subject matter.

According to Rozensky (1986), computer testing includes simple questions on monitor and the students just enter their response to these questions. However, since

1980s, the new advances in technology have revealed new methods to computerized assessment (Epstein & Klinkenberg, 2001). With these advances, new question types or e-assessment methods have been revealed such as bulletin board, email, hot spot, Likert scale, portfolios, simulations, etc. Crisp (2007).

2.3. Students' Perceptions of Computerized-Assessment

With the use of computers in assessment phase of education, student perceptions of e-assessment have attracted the interest of researchers. Table 1 summarizes these studies, which aimed to determine students' perceptions of e-assessment and their findings according to alphabetical order.

Table 1 Studies of students' perceptions of computerized assessment

Study Reference	**Findings**
Dermo, 2008	– Affective factors (students feelings in e-assessment process) – Validity (appropriateness of e-assessment with the task and university students) – Practicality (challenges and benefits) – Reliability and fairness (accuracy and reliability with respect to paper-based assessment) – Security (security to traditional assessment) – Pedagogy (affects on learning; positive or negative)
McDonald, 2002	– Computer experience and familiarity – Computer anxiety – Computer attitudes
Ogilvie, Trusk, & Blue, 1999	– Enjoyment – Time – Efficiency
Ricketts & Wilks, 2002	– Interface
Schneberger, Amoroso, & Durfee, 2007	– Level of support – Age / level in university – Perceived usefulness – Perceived ease of use – Attitude toward using – Level of skill expertise – Experience – Assessment performance – Pretest-posttest gap
Sheader, Gouldsborough, & Grady, 2006	From the perspective of students – Advantages o Being able to complete and submit work from home

	○ Easier to submit answers ○ Easier to edit answers ○ Neater presentation ○ Cannot lose assessment sheets ○ Saved paper ○ Could complete in own time – Disadvantages ○ Need access to internet ○ Possible computer glitches ○ No confirmation when submit answer ○ Dislike technology in general From the perspective of staff – Advantages ○ Reduces staff marking time ○ Reduces paperwork ○ Detects plagiarism ○ Potential for less variability between markers ○ Easy to administer anonymous marking – Disadvantages ○ Possibly need to tailor questions to the technology ○ Have to read answers and allocate marks onscreen ○ Have to sort out information technology problems of students ○ Quality of feedback to students ○ General lack of confidence in using computer for assessment
Walker, Topping, & Rodrigues, 2008	– Personal aims and drivers – The role of formative e-assessment within learning – Approaches to answering questions – Learning approaches and styles – Implications of assessment design – Use of feedback – Perceptions of e-assessment

Dermo (2009) researched the students' perceptions of e-assessment by breaking down the main concepts into six dimensions which are *affective factors, validity, practicality, reliability &fairness, security* and *pedagogy.* The study concluded that students have positive feelings toward e-assessment and they are enthusiastic to take part in e-assessment.

McDonald (2002) studied the reasons that affect the equivalence of computer-based and paper-and-pencil based assessments and investigated the individual differences.

McDonald reviewed *computer experience and familiarity, computer anxiety* and *computer attitudes* as individual differences that affect the equivalence of these two types of assessment and also affect the performance of computer based assessment.

Another study conducted by Ogilvie et al. (1999) in order to measure students' attitudes towards computer testing, resulted in that students have positive attitudes towards computer testing. Students found computer testing more enjoyable, less time consuming and more informative than paper based testing.

Schneberger et al. (2008) took TAM as a theoretical model and they proposed an extended model in order to identify the factors that affect performance of computer based assessment and training. They proposed level of support, age/level in university, perceived usefulness, perceived ease of use, attitude toward using, level of skill expertise, experience, and pretest-posttest gap as factors that affect performance of assessment directly or indirectly. As a result, they present a model which shows the factors affecting the performance of computer-based assessment.

Sheader et al. (2006) studied students and staff perceptions of computer-assisted assessment and they proposed the advantages and disadvantages of computer-assisted assessment from the perspective of students and staff. These advantages of computer-assisted assessment from the perspective of students and staff are given in table 1.

Walker et al. (2008) conducted a study that researched students' experiences and perceptions of e-assessment by considering their learning strategies. According to the results of this study, e-assessment improves the effectiveness of students learning.

Ricketts & Wilks (2002) investigated effects of user interface of a web-based assessment on students' performance and concluded that students are willing to accept web-based assessment, however the presentation of the questions affects their acceptance and the presentation of questions should be considered before delivering the exams via web-based tools.

2.4. Models for Determining Behavioral Intentions and Technology Adoption

In order to predict human behavior towards an object or to explain the behavior is a study of psychology. Various theoretical models have been developed to deal with this issue from the perspective of psychology. Theory of Reasoned Action is one of the mostly used theoretical models used in psychology in order to predict human behavior. Technology Acceptance Model is a modified version of TRA to specifically Information Technology context in order to investigate the behavioral intentions of end-users towards system use.

2.4.1. Theory of Reasoned Action (TRA)

TRA is a model studied in social psychology for dealing with determinants of the intended behaviors (Fishbein & Ajzen, 1975). The model tries to predict actual human behavior by explaining the casual linkages from beliefs, attitude, subjective norm, and behavioral intention to actual behavior (Sarver, 1983).

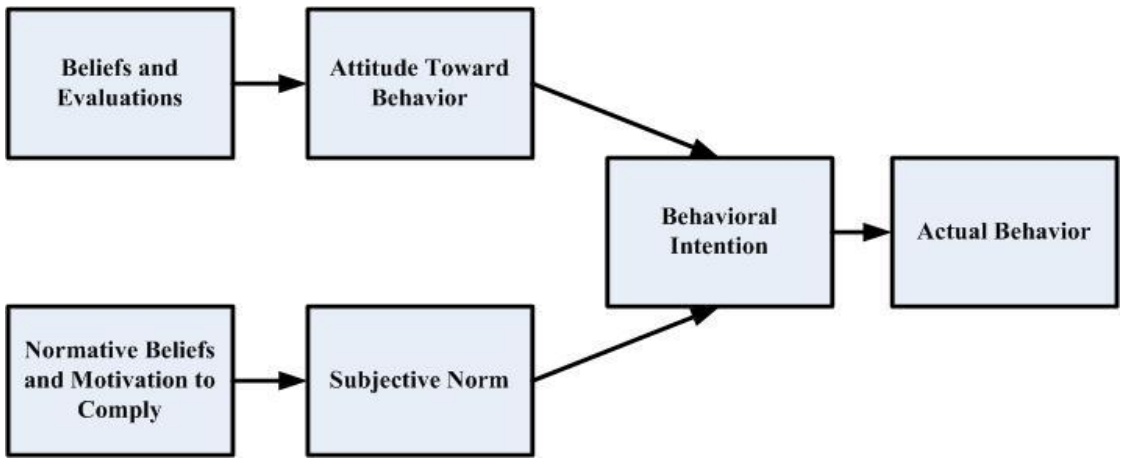

Figure 2 Theory of Reasoned Action, Source: Davis et al., 1989)

In this model Behavioral Intention (BI) refers to the measure of the strength of the intention toward performing a behavior (Fishbein & Ajzen, 1975; Davis et al., 1989). Attitude (ATT) is defined as the feelings about the target behavior: positive or negative evaluation of performing that behavior (Davis et al., 1989; Sarver, 1983)

and is defined as "predisposition to respond in a consistently favorable or unfavorable manner" (Fishbein & Ajzen, 1975). Subjective Norm (SN) is defined as the others expectations from the person about the performing the specific behavior (Fishbein & Ajzen, 1975; Davis et al., 1989). Actual Behavior is defined as a person's observable response (Fishbein & Ajzen, 1975). According to TRA, performing a specified behavior is determined by the person's behavioral intention which is determined by joining his attitude towards the specified behavior and subjective norm (see Figure 2).

TRA is suitable for determining behaviors, not outcomes or events that result from behaviors and the behaviors that are under a person's volitional control are the interest of this model (Sheppard, Hartwick & Warshaw, 1988). Also, since TRA is a general model, it lacks of explaining the beliefs that cause a specified behavior (Sheppard et al., 1988). When the researchers use TRA as a theoretical model to predict specific behaviors, they should investigate the beliefs which affect the subjects about the specified behavior (Davis et al., 1989).

2.4.2. Technology Acceptance Model (TAM)

User acceptance of computer systems took a great deal in order to explain why end users reject or accept technology. TRA is one of the models from social psychology which tries to explain the reasons behind human behaviors in various domains. Computer technology usage behavior can be a special case for TRA to predict the determinants of computer usage. Although TRA could be used for technology adoption researches, Davis introduced Technology Acceptance Model (TAM) in 1986 as an adaptation of TRA as a special model for computer usage which is not general like TRA. TAM is proposed to determine the factors, both internal beliefs and attitudes, which affect individuals' behavioral intention towards use of information systems (IS) (Davis et al., 1989). The main aim of TAM is to identify the factors that affect user acceptance of information systems or to explain why they resist accepting these systems.

The main rationale behind the TAM is to determine the impacts of external factors that may affect internal beliefs, attitudes and intentions, and it uses TRA as a theoretical model to create the casual linkages among the factors which are perceived ease of use (PEOU), perceived usefulness (PU), user attitudes (ATT), user behavioral intentions (BI) and actual system usages (Davis et al., 1989). Actually TAM takes the linkages among belief, attitude, intention and behavior. The relations between TAM's variables are shown in Figure 3. TAM tries to explain the relations among perceived ease of use, perceived usefulness, user attitudes, behavioral intention and actual system use (Szajna, 1996). According to TAM, user intention predicts whether people will use the system or not. User behavioral intention towards actual system usage of information systems is determined by his/her attitude and perceived usefulness. Perceived ease of use and perceived usefulness jointly determine the attitude. Also perceived ease of use affects perceived usefulness (Szajna, 1996). In addition to these relations, there may be external factors that can affect internal beliefs such as system features, documentation etc. (Chau, 1996).

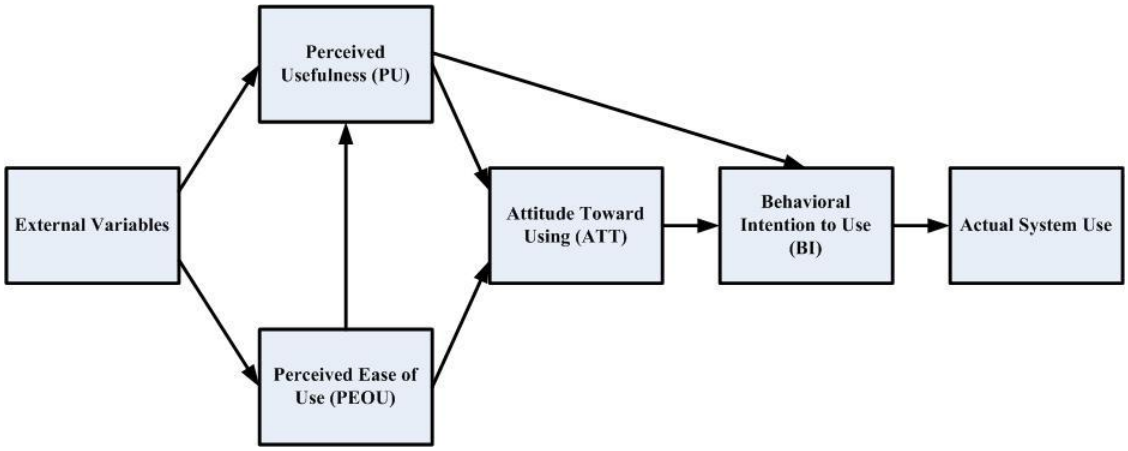

Figure 3 Technology Acceptance Model, Source: Davis et al., 1989)

TAM mainly presents two important variables that affect the intention of user towards using computer related systems or applications which are "perceived ease of use" and "perceived usefulness" (Figure 3). Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). Perceived usefulness is defined as "the degree to which a

person believes that using a particular system would enhance his or her job performance" (Davis, 1989). Attitude is defines as "an individual's evaluative judgment of the target behavior on some dimension (e.g. good/bad, harmful/ beneficial, pleasant/unpleasant)" (Holden & Karsh, 2010).

2.5. Prior studies of Technology Acceptance Model (TAM) in e-learning Context

TAM is the one of the mostly used technology adoption model in e-learning context that measures user's intention toward the use of technology of information systems in learning. There are researches that take different aspect of e-learning applications or methods.

Table 1 summarizes the studies conducted by TAM researches in e-learning context by giving reference to the study, study sample and the constructs that are proposed in research models and affect user intention (directly or indirectly).

Table 2 TAM studies in e-learning context

Study Reference	**Sample**	**Constructs**
Park, 2009	university students at Konkuk University, Seoul	e-Learning Self-Efficacy, Subjective Norm, System Accessibility, Organizational Factor, Perceived Usefulness, Perceived Ease of Use e-Learning Attitude, Intention to Use
Hsu, Wang, & Chiu, 2009	Online MBA Students	Statistical Anxiety, Statistical Software Self-Efficacy, Computer Attitude, Perceived Usefulness, Perceived Ease of Use, Behavioral Intentions
Raaij & Schepers, 2008	Executive MBA program participants	Social Norms, Personal Innovativeness in the Domain of IT, Computer Anxiety, Perceived Usefulness, Perceived Ease of Use, System Usage
Wang & Wang, 2009	University Students in Taiwan	Information Quality, System Quality, Service Quality, Perceived Usefulness, Perceived Ease of Use, Subjective Norm, Intention to Use, Self-Efficacy System Use
Yi & Hwang, 2003	University Students	Enjoyment, Usefulness, Learning Goal Orientation, Perceived Usefulness, Perceived Ease of Use, Application Specific Self-Efficacy, Behavioral

		Intention, Use
Lee, Cheung & Chen, 2005	Undergraduate Students	Perceived Usefulness, Perceived Ease of Use, Perceived Enjoyment, Attitude Behavioral Intention
Chang & Tung, 2008	Undergraduate Students	Compatibility, Perceived Usefulness Perceived Ease of Use, Perceived System Quality, Computer Self-Efficacy, Behavioral Intention to Use
Saadé & Bahli, 2005	Undergraduate Students	Perceived Usefulness, Perceived Ease of Use, Intention to Use, Temporal Dissociation, Focused Immersion, Heightened Enjoyment
Yuen & Ma, 2008	In-Service teachers	Perceived Usefulness, Perceived Ease of Use, Intention, Subjective Norm, Efficacy
Lee & Lee, 2009	Undergraduate Students	Perceived Usefulness, Perceived Ease of Use, Instructor Characteristics, Teaching Materials, Design of Learning Contents, Playfulness
Lee, 2008	Students	Perceived Usefulness, Perceived Ease of Use, Internal Computing Support, Internal Computing Training, Internal Equipment Accessibility, External Computing Support, External Computing Training, External Equipment Accessibility
Roca, Chiu & Martínez, 2006	Graduates	Perceived Usefulness, Perceived Ease of Use, Perceived Cognitive Absorption, Perceived Internet Self-Efficacy, Perceived Computer Self-Efficacy, Interpersonal Influence, External Influence, Information Quality, Service Quality, System Quality, Confirmation, Satisfaction, Continuance Intention
Cho, Cheng, & Lai	Students	Perceived Functionality, Perceived User-Interface Design , Perceived System Support, Perceived Usefulness, Perceived Ease of Use
Martínez-Torres, Garcia, Vázquez, Olivia, & Torres, 2008	Students	Perceived Usefulness, Perceived Ease of Use, Intention to Use, Enjoyment, Diffusion, User Tools, Methodology, feedback , Format, Communicativeness, User Adaptation Interactivity and Control, Accessibility, Use

2.6. Discussion of the Literature Review

TAM is one of the widely used technology adoption model to investigate the reasons behind users' adoption of rejection of technology use. There are too many studies conducted in e-learning context that took TAM as a theoretical model to investigate students' or instructors' technology usage behaviors. With the advances in information technology, computer use in education has increased. There are different reasons that affect students' perceptions of computerized assessment. These reasons should be investigated and explored to make effective use of computers in assessment process of education. TAM seems to be a suitable model to examine students' behaviors towards computerized assessment, since TAM related studies in e-learning context give opportunity to determine the possible factors which might affect students' behaviors. In Table 2, TAM studies in e-learning context are given and as seen from the table, there are different factors studied in this context that affect students' behaviors towards technology use in learning. By examining these factors, students' perceptions of computerized assessment might be investigated by considering their perceptions of e-learning.

CHAPTER III

RESEARCH MODEL

In this chapter, the proposed model of the study is explained by mentioning the base-theory. The main objective of this study is to investigate students' perceptions of computerized exams by determining the reasons behind their adoption or rejection of computer use in exams. TAM is one of the widely used technology adoption model, especially for IS researchers. This study proposes a model by taking TAM as a theoretical framework and considering the individual differences among students in order to investigate students' adoption of computerized assessment. The details of the proposed research model are given in the following sub sections.

3.1. A new model for students adoption of computerized assessments

The study aims to identify the factors that may affect students' behaviors towards computer usage in examinations. In order to identify those factors, the related literature about technology adoption was investigated and Technology Acceptance Model (Davis, 1989) was decided to be taken as the theoretical model, since it is one of the mostly used technology adoption model studied. After that, the possible factors were examined that may affect students' usefulness and easiness perceptions and behavioral intention towards e-assessment.

In this study, a model is proposed as an extension to TAM in order to investigate behavioral intentions of students towards computerized assessment by taking into account the validated relations from literature. The proposed model is presented in

Figure 4. In this figure, the constructs investigated and the relations between them are illustrated.

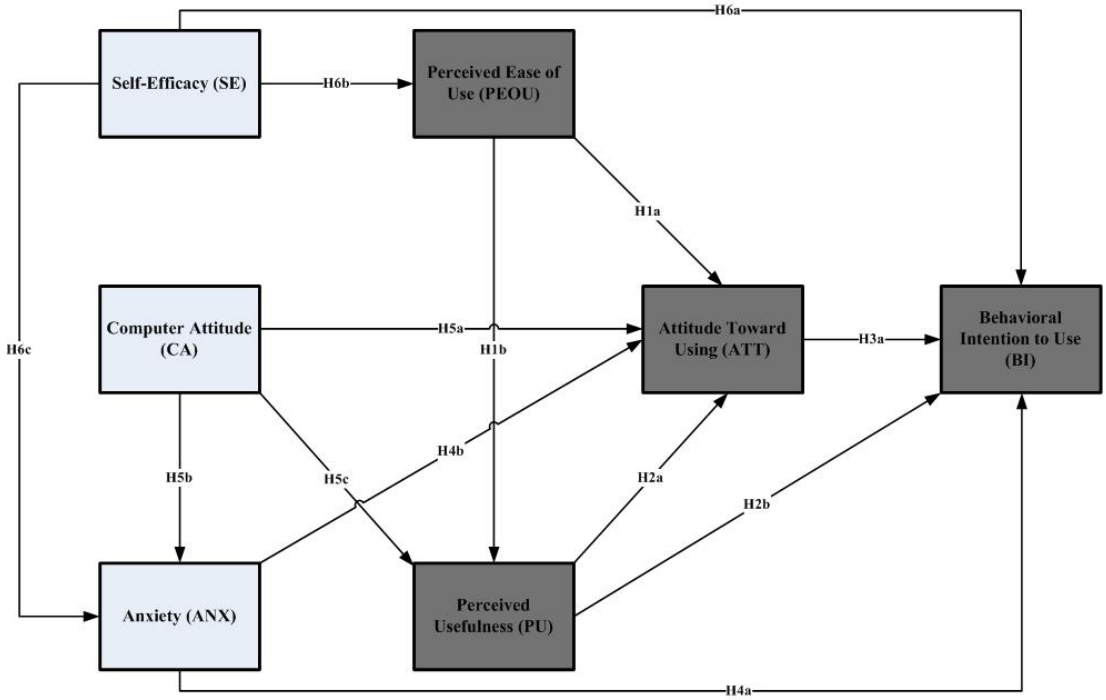

Figure 4 Proposed Research Model (Original TAM constructs are depicted in dark gray & external factors are depicted in light gray)

The proposed model includes two dimensions: (1) original TAM constructs that is *belief constructs*, and (2) *individual differences constructs* added to original TAM as external variables which are determinants of belief constructs and behavioral intention.

3.1.1. Technology Acceptance Model Constructs in the Proposed Model

TAM proposes *perceived ease of use, perceived usefulness,* and *attitude* constructs to measure the usage intention of end-users towards an information system. The details of this model have been given in Section 2.4.2. of Chapter 2. In the proposed model, PU and PEOU are main belief constructs to predict the behavioral intention of students' towards computerized assessment.

- PEOU is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). This construct is related with the easiness of the systems which will be a predictor of users'

attitude and usefulness of the system. In this study, it refers to perceived ease of use of web-based assessment tools which students take exams via computers and tries to identify whether students find web-based assessment tools easy or not. The studies Liu et al. (2009) and Park (2009) found significant relation between PEOU and ATT. Also the studies Saadé & Bahli (2005), Raaij & Schepers (2008), Park (2009), Liu et al. (2009), Chatzoglou et al. (2009), Lee (2008) and Hsu et al. (2009) found significant relation between PEOU and PU. The hypotheses related with this construct are as follows:

H1a: PEOU is positively related to Attitude

H1b: PEOU is positively related to PU

- PU refers to "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). If the end users think that the system will enhance their job performance then this will be predictor of their attitude and behavioral intention towards the given information system. Here, this construct is related with usefulness of web-based assessment tools in comparing to traditional paper-pencil-based assessments. The studies Park (2009) and Liu et al. (2009) presented significant relation between PU and ATT. The relation between PU and INT was validated in the studies Saadé & Bahli (2005), Liu et al. (2009), Chatzoglou et al. (2009), Lee (2008) and Hsu et al. (2009). According to the previous studies the hypotheses related to PU is proposed as follows:

  H2a: PU is positively related to Attitude

  H2b: PU is positively related to INT

- Attitude is "an individual's evaluative judgment of the target behavior on some dimension (e.g. good/bad, harmful/ beneficial, pleasant/unpleasant)" (Holden & Karsh, 2010). According to this definition attitude is related with the users' thoughts of the web-based assessment system which will be predictor of their intention towards the given system. In the previous studies it was validated that ATT affects INT (Park, 2009; Liu et al., 2009). So that the following hypothesis is proposed related to this construct:

  H3a: Attitude is positively related to INT

Figure 4 shows the proposed relations and hypotheses from TAM.

3.1.2. Individuals Differences

According to students' perceptions of e-assessment literature, given in section …, there are a few studies that examined individual differences among students that would be predictor of their perceptions of computerized assessment however there is not any study that investigate TAM and individual differences together to investigate students' adoption of web-based assessment tool. Yi, Wu, & Tung (2006) In this study individual differences related with computer usage are considered in order to determine students' acceptance of computerized assessments by taking TAM as theoretical model.

In this section, individual factors that would affect the main constructs of TAM are discussed. In the proposed model there are three constructs which are related with the end-users computer experiences and they refer to individual differences between students. There are 3 constructs;

- *Anxiety (ANX)* refers to "the fear experienced when interacting with a computer or anticipating an interaction" (McDonald, 2002) and in this study anxiety is related with the fear of making mistakes during interaction with the web-based assessment tool. Anxiety is viewed as a negative emotion. In the literature there are studies that investigated the relations of ANX with the constructs PU, PEOU and INT. In the studies conducted by Raaij & Schepers (2008), Chatzoglou et al. (2009) and Hsu et al. (2009) there are significant relations between ANX and PEOU. Also Hsu et al. (2009) proposed significant relation between ANX and PU, INT. In this study, the following hypotheses were proposed with the construct ANX.

  H4a: ANX is negatively related to the behavioral intention toward web-based assessment.

  H4b: ANX is negatively related to attitude.
- *Computer Attitude (CA):* Attitude is defined as "an index of the degree to which a person likes or dislikes about the object" by Azjen and Fishbein (1980). CA can be defined as users' thoughts about computers and their

perceptions of computers. Since, the opinions of students about computers would affect their opinions in use of computers in assessment. So, CA can affect user's behavioral intention toward computer use in examinations as well as CA will affect their usefulness perceptions. the following hypotheses are proposed related with this construct:

H5a: CA is positively related to the attitude of students

H5b: CA is positively related to computer anxiety.

H5c: CA is positively related to perceived usefulness.

- *Self-efficacy (SE):* SE refers to "the belief an individual has in his/her ability to successfully perform a certain behavior" and this concept is a key factor in Social Cognitive Theory (SCT) (Fagan et al., 2004). According to SCT, SE affects directly the choice of a specified task or conducting the specified behavior. Here SE is the students' belief of their ability to use web-based assessment tools successfully or not. In the previous studies SE have significant relations with INT, PU, PEOU and ANX (Park, 2009; Wang & Wang, 2009; Chatzoglou et al., 2009;). The proposed hypotheses related with this construct are as follows:

  H6a: SE is positively related to the BI

  H6b: SE is positively related to PEOU

  H6c: SE is negatively related to the ANX

CHAPTER IV

RESEARCH METHODOLOGY

In this chapter, the research methodology of the study is given. First of all the study, setting is described, then the instrument used in the study and the sample properties are given. Then, Data collection process is described and lastly the statistical method used in the study, Structural Equation Modeling, is explained.

4.1. Study Setting

The study was conducted at Middle East Technical University (METU) which is one of the leading universities in Turkey. All of the participants of the survey were undergraduate students at METU. And, they took the course "Introduction to Information Technologies and Applications" (IS100) which was the prerequisite to participate in the survey, since midterm, final and exemption exams of this course are given via a web-based assessment tool. The course IS100 is a must course to all departments (Except CEIT and ARCH departments) at METU.

The exams of the course are conducted at computer laboratories via a web-based assessment tool. Students access the exam page by typing the URL addresses of the exam page. Students log in the tool by entering username and password they are given. In figure 5, the login page of the exam is given.

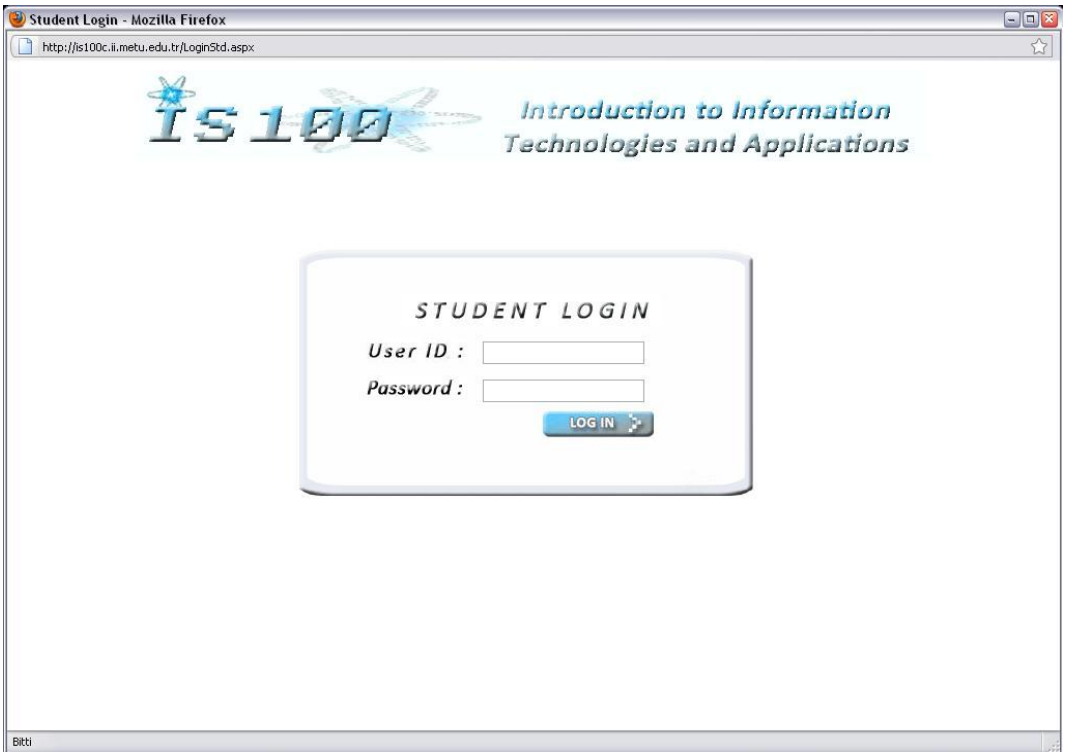

Figure 5 Log in screen

After logging into the system, the questions of the exam are appeared on the screen. Students answer each question by clicking the appropriate answers and submitting it. The exams include multiple-choice, true-false and simulations type questions. Example print screen of true-false and multiple-choice questions are shown in Figure 6 and 7. When they finish the exam, they see their grades.

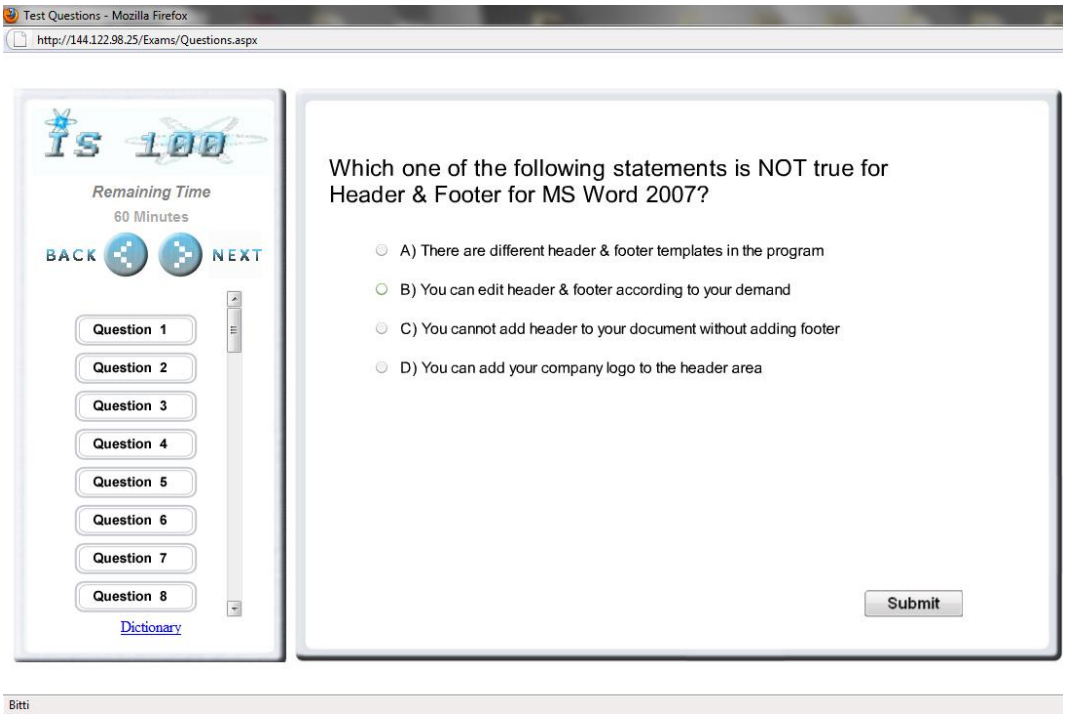

Figure 6 Multiple choice question example

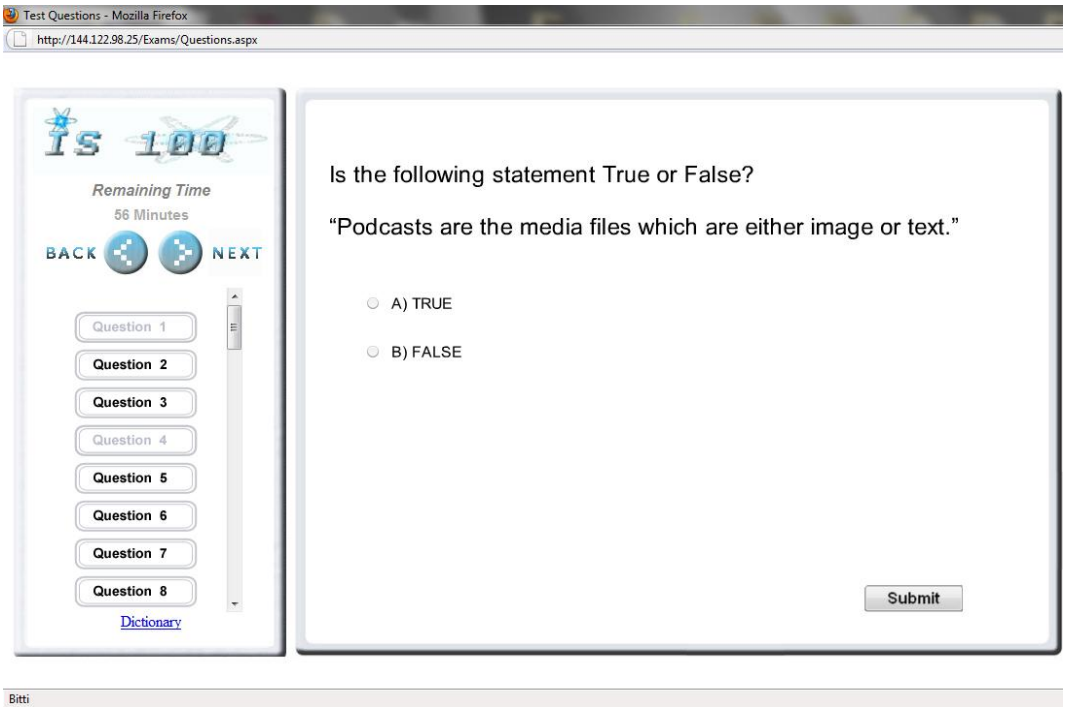

Figure 7 True/False Question example

4.2. Instrument Development

This is a quantitative study and, survey method is used to collect data. At the beginning of the study, questionnaire was developed as a research instrument. In order to develop the instrument first the related literature was searched to learn how to prepare a questionnaire and find out the related studies with the theoretical background of the study. In instrument development stage, the following steps are conducted in orderly:

- The related literature was searched and initially an item pool is generated including 50 items.
- A 5-point scale was chosen for answers from "1" - "Strongly Disagree" to "5" - "Strongly Agree", since Likert scale is used to assess attitudes towards a behavior or a topic by presenting some conditions about the topic and taking respondents' agreement situation of these conditions (Ary et al., 2002).
- Items were developed in English. A group of 5 students reviewed the items for clear understanding and necessary revisions were made. English was selected as the language of the survey, since the medium of the existing literature was English as well as the medium of METU and the course IS100 is English.
- After the revisions, 37 out of 50 items were selected and by adding 10 questions for demographics information the pilot study was conducted.
- In pilot study, total 58 participants took place and the results were only analyzed for reliability.
- After pilot study, the main study was conducted with 332 students.

Demographic questions of the questionnaire are given in Appendix A. The main questions are given in Appendix B by giving the reference to original questions in the literature. Questions taken from the existing literature and were adapted according to study setting.

4.3. Study sample

A sample is defined as "a portion of a population" and there are two types of sampling: probability and nonprobability sampling (Ary et al., 2002). In this study nonprobablity sampling procedures was used because of its convenience and economy (Ary et al., 2002). There are two independent samples in this study: one for pilot study and one for the main study. The general characteristics of these samples are as follows:

Pilot study sample: This sample consists of 58 undergraduate students at METU in Turkey. 39 of these students were female and the 18 was male. The general characteristics of these students were that all of them took at least one exam of IS100 in which web-based assessment tool used to deliver the exams.

Main study Sample: The study sample included 332 undergraduate students, 175 were female and 157 were male. The general characteristics of these students were that all of them have taken one of the exams; midterm, final or exemptions exams, via web based tool within the IS100 course, "Introduction to Information Technologies and Applications". This was a prerequisite to fill the survey.

In addition the students were from different academic departments, since the course IS100 is a compulsory course to whole departments at METU. There were different 37 departments in the sample. The sample was not selected according to department; only department information was required in the survey.

4.4. Data collection

The data needed for this study was collected from university students at METU. The survey was conducted in two ways. First, the instrument was administered on-line for one month. The web link of the instrument was sent to students via their students' mail account. Second the instrument was distributed in paper-pencil format. A total number of 332 participants took place in the survey, 77 of which were on-line, 255 of which were in-person. All of the participants consisted of undergraduate students,

from prep class to senior students at METU. The web link of the on-line instrument was sent by e-mail to the students who were enrolled with the IS100 course online. In-person instrument was administered in face to face classes of IS100 and at dormitories in the campus of METU. Participation to the survey was totally voluntary.

4.5. Ethical Clearance

This study included human participants. In order to collect data from the participants, it was needed to take permission from *Research Center for Applied Ethics* at METU to conduct the survey with human participants. The survey was approved by Research Center for Applied Ethics (Appendix C).

4.6. Data Analysis

4.6.1. Preliminary Analysis

After data collection process, the data should be checked to apply Exploratory and Confirmatory Factor Analysis. For that, the data was checked out for the missing part in the dataset. Moreover, the outliers in the dataset were examined. Then the data distribution shape was checked whether it was normal or not. The detailed results for these controls are given in chapter 5.

4.6.2. Exploratory Factor Analysis (EFA)

In social sciences, the researchers usually investigate things that cannot be measured directly, so that they researches different aspects of the researched unobserved construct by forming a questionnaire including questions about the unobserved construct and then they apply factor analysis in order to reduce the questions in a manageable size (Field, 2005). Also factor analysis provides opportunity for forming unobserved factors (sometimes referred as Latent Variables) from observed variables (also called Manifest Variable). Exploratory Factor Analysis (EFA) is one of the mostly used applied statistical techniques used in social sciences (Costello & Osborne, 2005). In factor analysis the researcher identify a number for the factors that are investigated through observed variables (Agresti & Finlay, 1997). There are

different methods to determine the factors in a dataset. Maximum likelihood and principal factor analysis are two of these methods.

There are some issues that should be considered before conducting factor analysis. First of all the sample size of the dataset is important. Some researchers suggest that 10 cases for each item is suitable for factor analysis, however some researchers suggest 5 cases for each item (Pallant, 2001). Factors loadings are one of the considerations in factor analysis. Although, generally researchers take greater loadings than .3 significantly (Field, 2005), the factor loadings significance depends on the sample size of the dataset. According to Stevens (1992) mentioned in Field (2005), some critical values are produced for significance of factor loadings: for a sample size of 50, the significance of factor loading is .722; for a sample size of 100 the factor loading greater than .512 is accepted as significant; for 200 sample size the loading score should be greater than .364 to become significant and for a sample size 300, it should be greater than .298. Kaiser-Meyer-Olkin (KMO) and Bartlett' test of sphericity measure of the sampling are other considerations for checking the appropriateness of the dataset to factor analysis. The score of the KMO should be greater than .5 to apply factor analysis appropriately (Field, 2005). The p value in Bartlett's test of sphericity should be smaller than .05 to be significant (Pallant, 2001)

In SEM, studies EFA is used for Construct Validity. EFA can be conducted by PASW Statistics 18.

4.6.3. Confirmatory Factor Analysis (CFA)

CFA is a theory based analysis method used to validate hypotheses for predefined factor structures and it is a special application of SEM (Albright & Park, 2009). In the following part SEM is explained.

4.6.4. Structural Equation Modeling (SEM)

Before starting to explain what SEM is, the following terms and definitions should be given to make clear understanding of the method:

- **Direct effect:** "a directional relation between two variables" (Hoyle, 1995)
- **Endogenous variable:** Independent latent variable
- **Exogenous variable:** Dependent latent variable
- **Indirect effect:** the effect of an independent variable on a dependent variable through one or more variables.
- **Latent variable:** Theoretical constructs that cannot be observed directly. Also latent variable is called as factors. Latent variables are explained by manifest variables (Tenenhaus et al., 2004)
- **Manifest variable:** Manifest variable refers measured scores which are also called as observed variable. These are the indicators of the constructs. There are different names for these variables like "measures", "indicators" or "proxies" (Bollen, 1989)
- **Measurement model:** Measurement model represents the links between the latent variables and their underlying measured scores.
- **Model:** The basic concept in SEM studies which SEM aims to prove (Şimşek, 2007).
- **Structural model:** Structural model represents the links between the latent variables
- **Total effect:** sum of direct and indirect effect of an independent variable.

Theories are the explanations of the correlation between variables and most theories in social sciences use these correlations to propose hypotheses about the casual relations between variables (Kelloway, 1998). Structural Equation Modeling (SEM) is a statistical method to test the relations between latent and observed variables (Hoyle, 1995) and it depends on confirmatory analysis (Byrne, 1998). SEM is mostly used in behavioral sciences (Gefen, Straub, & Boudreau, 2000). SEM has 5 basic steps in its applications which are *Model Specification, Identification,*

Estimation, Testing Fit, Respecification. The details of the 5 basic steps in SEM are as follows:

- **Model Specification:** Model specification is the essential part of SEM in order to propose the model that will be estimated (Hoyle, 1995). The model should take its origins from existing literature and its aim is to explain why variables are correlated in the specified domain (Kelloway, 1998). Models can be presented as diagrams.
- **Identification:** Identification is related with the uniqueness of the solution to the model and according to solution uniqueness the model can be *just identified, over indentified or under identified* according to obtained value of free parameters (Kelloway, 1998).
- **Estimation:** After the model specification, estimates of free parameters from observed variables are conducted. There are different methods for estimation like single-stage least square, maximum likelihood or generalized least square (Hoyle, 1995).
- **Testing Fit:** In this stage there are two types of assessment fit: absolute and comparative. Absolute fit is tested by the ability of reproducing the correlation or covariance matrix, while comparative fit is tested by comparison of the investigated model by others models (Kelloway, 1998).
- **Respecification:** In this stage, the researcher modifies the model by adding new paths or removing non-significant paths from the model tested (Kelloway, 1998).

SEM has two types of approaches: Covariance based SEM and Component based SEM (Gefen et al., 2000). Covariance based SEM is conducted with LISREL, EQS, AMOS, SEPATH, RAMONA, MX, CALIS, meanwhile component based SEM is performed with PLS-PC, PLS Graph, which is also called as Partial-Least-Squares-Based SEM. These two approaches change in their objectives, assumptions in the analysis and fit statistics.

- *Partial Least Square based SEM:* This type of SEM tries to explain the model with high R^2 (Variance) and significant t-values. This method does not accept null hypothesis.
- *Covariance based SEM:* This type of SEM is used to confirm the proposed model by the dataset. In this method, the covariance structure fit of the proposed model is compared to a better fit covariance structure (Gefen et al., 2000).

In this study Partial Least Square based SEM was conducted with SmartPLS, since the aim of the study is to predict students' behavioral intentions towards e-assessment.

4.6.7. PLS Path Model

A measurement and a structural model are used to describe PLS path model. A measurement model shows the relations between latent variables and manifest variables, while a structural model represents the relations between latent variables (Chatelin, Vinzi & Tenenhaus, 2002). For measurement model, to validate factors, convergent and discriminant validity are conducted. In order to validate the convergence, each item should load its latent variable with a significant t-value (Gefen&Straub, 2005). Discriminant validity is shown when by analyzing Average Variance Extracted (AVE) score; the square root of AVE score for each latent variable should be larger than correlation of any pair of latent variables (Gefen & Straub, 2005).

In this study, to design measurement and structural models SmartPLS is used. SmartPLS is a free tool to design SEM (Ringle, Wende, Will, 2005). The models created in SmartPLS are measured with Partial Least Square analysis (Hansmann & Ringle, 2004).

CHAPTER V

DATA ANALYSIS AND RESULTS

In this chapter, the results of the statistical analysis are given. First preliminary analyses are explained, then exploratory and confirmatory factor analysis results presented.

5.1. Data Analysis

In data analysis part, PASW Statistics 18, MS Excel 2007 and SmartPLS were used. MS Excel 2007 was used to organize the online data for PASW Statistics 18. PASW Statistics 18 was used to prepare the data ready for SEM analysis to import SmartPLS. In this program, missing data & outliers' detection, reliability and normality tests were conducted. SmartPLS was used to evaluate measurement model via confirmatory factor analysis and structural model via SEM.

5.2. Preliminary analysis

First, the descriptive statistics of the sample was revealed from the dataset. Then the data was analyzed to be used in SEM according to requirements of SEM: the data was explored for missing parts and the outliers: the distribution shape of the data was examined: Exploratory factor analysis was conducted. The detailed results of these stages are given in the following subsections.

5.2.1. Sample Demographics Results

The study sample was composed of 332 undergraduate students. In the sample, the male and female students' frequencies are shown in Table 3. There are 175 female and 157 male students in the sample.

Table 3 Gender percentages of the sample

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	175	52,7	52,7	52,7
	Male	157	47,3	47,3	100,0
	Total	332	100,0	100,0	

The students were in different academic fields and in the questionnaire their department information was required. According to descriptive statistics of department information shown in Appendix D, there were students from 37 different departments in the sample.

The grade level of the students is shown in Table 4. There are students from different grade level, the majority are freshman with 42 %, since the course IS100 is aimed at this level.

Table 4 Grade levels of the sample

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Prep Class	41	12,3	12,3	12,3
	Freshman	140	42,2	42,2	54,5
	Sophomore	49	14,8	14,8	69,3
	Junior	60	18,1	18,1	87,3
	Senior	35	10,5	10,5	97,9
	Fifth class	2	,6	,6	98,5
	Missing	5	1,5	1,5	100,0
	Total	332	100,0	100,0	

Also, in demographics questions the students were required to prefer paper-based or computer-based assessment and 140 (42 %) students preferred computer-based assessment, while 192 (58 %) of the sample preferred the traditional method pencil-paper-based assessment.

5.2.2. Checking for the missing data

Missing data refers to any missing part of the data set and missing data should be analyzed before starting to other statistical analysis. Missing data could be for variety of reasons, such as; participants of long questionnaires can miss out some questions or participants can be annoyed from some questions and they may not answer them, however some missing parts in the data set does not show that it is useless (Field, 2005). The missing data in a dataset should be handled before starting to conduct other statistical analysis.

There are approaches to deal with the missing data (Field, 2005):

- Listwise deletion: In this approaches PASW Statistics 18 (new version of SPSS) excludes the subject, which has missing data, from whole analysis.
- Pairwise deletion: In this approach, if a subject has missing data for a variable, then PASW excludes this subject from the analysis for only this variable.
- Replacing missing score with the average score: In this approach, missing data is replaced with the average score then included in the whole analysis.

When the missing data in a dataset does not exceed 10 %, then one of these approaches is used to handle missing data. Otherwise there are other approaches to deal with the missing data such as regression substitution or multiple imputation (Howell, 2009). In this study, the frequency of the missing scores is given Appendix E and the percentages of missing data among items does not exceed 10 %, so that replacing missing score with mean method was used to handle missing data.

5.2.3. Outlier detection

Outlier is defined as "cases with values well above or well below the majority of other cases" by Pallant (2001). Outliers should be detected in order to prevent problems like outliers can create skewness in the data which can cause problems for the researchers (Huck, 2004). There are some methods to detect outliers which are box plot, trimmed means (Walfish, 2006). Box plots show data diffusion graphically. Trimmed means refers to the mean "calculating by discarding certain percentage of the lowest and highest scores in the data set" and mean and the trimmed mean can be compared to see the outliers' effects on the mean. (Walfish, 2006). In this study outliers were checked by comparing mean and trimmed mean. Appendix F shows the mean and %5 trimmed mean of all items and it has been observed that within this study's data set, there are not too extreme differences between mean and trimmed mean for all items.

5.2.4. Distribution of data: Normality

In the shape of the distribution, normality refers to a bell-shaped curve in which the scores are clustered near a middle observed score and there is symmetrical decrease in frequency from both sides of the middle score (Huck, 2004).

Many of the statistical techniques are performed with normally distributed data of dependent variables (Pallant, 2001). In order to perform the statistical analysis on the data, the data was checked for normality. One of the ways to check the normality of the data is checking the normality from menu options of PASW Statistics 18, Analyze, Descriptive Statistics, Explore and then normality plots with test options. Also normality can be assessed by obtaining skewness and kurtosis values (Pallant, 2001).

From PASW Statistic 18, a normality table presented showing the Kolmogorov-Smirnov statistics results which is used to assess the normality of the distribution. According to these results, the Sig value should be more than 0.05 to accept the distribution as normal (Pallant, 2001). In this study the result of Kolmogorov-Smirnov statistics is given in Appendix G.

According to the results of Kolmogorov-Smirnov statistics the sig value is 0 for all items which shows that the data is not normally distributed. Since the data is not normal according to these results, the skewness and kurtosis values were checked. According to skewness and kurtosis values, the normality of the data set can be assessed. If the values of skewness and kurtosis are equal to 0, it is said that the distribution is normal (Pallant, 2001). However the skewness value between -1.0 and +1.0 is not considered too extreme (Huck, 2004). The results of the skewness and kurtosis scores are given Appendix H.

According to the results of skewness and the kurtosis scores one item is problematic which is item06 having scores out of the range -1.0 and +1.0.

5.2.5. Reliability

Reliability analysis is conducted for internal consistency to understand consistency of an instrument measures with whatever it measures (Ary et al., 2002). One of the methods for assessing internal consistency is *coefficient alpha,* or *Cronbach's alpha* (Ary et al., 2002; Huck, 2004; Pallant 2001;) which is versatile for instruments like 5 point Likert scale.

Table 5 Cronbach's Alpha score for all items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,917	,920	37

According to the results of reliability (given in Appendix I), there are items that decrease the Cronabach's Alpha score; however the decrease is not too extreme and the total score shown in table 5 is enough, these items were not eliminated from the analysis at this point.

5.3. Exploratory Factor Analysis (EFA)

In order to conduct factor analysis, there are some considerations. First of all, sample size is important. Field (2005) suggests 300 cases for factor analysis. Some researchers suggest that 10 cases for each item is suitable for factor analysis, however some researchers suggest 5 cases for each item (Pallant, 2001). This study's sample includes 332 subjects which is enough to conduct EFA.

Table 6 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,941
Bartlett's Test of Sphericity	Approx. Chi-Square	4576,936
	df	406
	Sig.	,000

Second the Kaiser-Meyer-Olkin measure should be greater than 0.5, otherwise the sample is not adequate. The Table 6 shows the KMO and Bartlett's Test results. The KMO measure is .941 (given in table 6) which is greater than the required value. Also the p value of Bartlett's test of sphericity is considered and this value should be smaller than .05; p (Sig.) value is .000 for this study (given in Table 6) which is consistent with the required value. According to KMO and Bartlett's test, the data set is suitable for EFA.

EFA was conducted in PASW Statistics 18 with Maximum likelihood estimation and direct oblimin rotation. The pattern matrix is given in Table 7.

According to the results reached from pattern matrix, the items did not load any of the factors were extracted from the data to be used in confirmatory factor analysis (CFA). Also the items having factor load samller than .4 were extracted from further analysis.

Table 7 The results of EFA

Pattern Matrix					
	Factor				
	1	2	3	4	5
item01	,730				
item03	,726				
item10	,687				
item30	,571				
item34	,554				
item11**	,484			-,418	
item04	,471				
item08**	,444			-,400	
item17	,421				
item09	,384				
item22**					
item21		-,741			
item23		-,667			
item27		-,603			
item14		-,552			
item29		-,543			
item16**					
item19			,717		
item12			,658		
item25			,579		
item05			,418		
item28				-,646	
item18				-,604	
item15				-,530	
item13					-,794
item06					-,642
item26					-,489
item20**					
item07**					
Extraction Method: Maximum Likelihood. Rotation Method: Oblimin with Kaiser Normalization.					
** Problematic items in the matrix					

After interpreting the pattern matrix, the factors were given name according to the literature. Then each factor' Cronbach's alpha value was checked for reliability. The results of reliability are given in Table 8. The minimum required Cronbach's alpha value is .7. Accept the factor computer attitude (CA), other factors met the required value. The Cronbach's Alpha value of CA is not extremely different from the required value, so it is included in the further analysis.

Table 8 Reliability Results according to constructs

Construct	Cronbach's Alpha	Item Text	Item Code	New Item Code	Cronbach's Alpha if Item Deleted
PU	,799	Using web based assessment system increased my productivity in the exams.	item15	PU1	,699
		I wish I used the web based assessment system for other courses as well.	item18	PU2	,741
		Using web based assessment system enhanced my effectiveness in the course	item28	PU3	,738
PEOU	,824	I was able to use the web based assessment system even if there was no one around show me how to use it.	item14	PEOU1	,807
		I was confident that I had adequate ability to operate the web based assessment system.	item21	PEOU2	,777
		I found the web based assessment system easy to use.	item23	PEOU3	,778
		I was confident that I could use the web based assessment system even if I had no prior experience on similar systems.	item27	PEOU4	,800
		It was easy to navigate through the web based assessment system.	item29	PEOU5	,785
CA	,698	Computers are bringing us into a bright new era.	item06	CA1	,618
		The use of computers is enhancing our standard of living.	item13	CA2	,499
		Computers are responsible for many of the good things we enjoy.	item26	CA3	,693
ANX	,716	The web based assessment system was somewhat intimidating to me (Reverse).	item05	ANX1	,734

		I hesitated to use the web based assessment system for fear of making mistakes that I couldn't correct (Reverse).	item12	ANX2	,670
		I felt anxious about using the web based assessment system (Reverse).	item19	ANX3	,593
		Working with the web based assessment system made me nervous (Reverse).	item25	ANX4	,597
INT	,885	By using the web based assessment system in the exams, I was able to answer the questions more quickly compared to a paper-based exam.	item01	INT1	,877
		Using the web based assessment system to take exams was a good idea.	item03	INT2	,860
		I intend to take courses that use the web based assessment in the future.	item04	INT3	,875
		Using the web based assessment system to take exams was a wise idea.	item10	INT4	,864
		I liked the idea of using the web based assessment system.	item17	INT5	,864
		The web based assessment system provided an attractive exam environment.	item30	INT6	,864
		Web based assessment system enabled me to take exams easily.	item34	INT7	,870

5.4. Confirmatory Factor Analysis (CFA)

CFA is performed to validate the measurement model. Measurement model can be assessed with convergent validity and discriminant validity. In order to verify the convergent validity Factor Loadings, Composite Reliability and Average variance Extracted values were considered.

Measurement Model: In order to create the measurement model, SmartPLS was used. By running PLS algorithm the measurement model in Figure 8 was created.

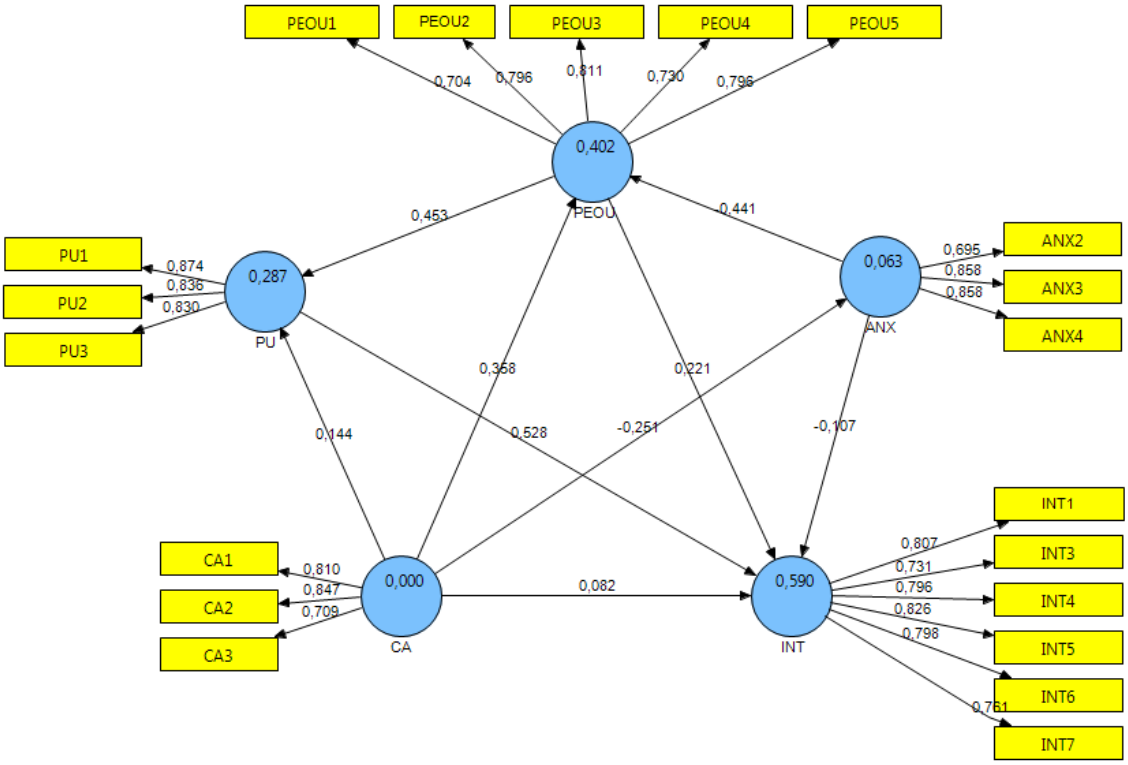

Figure 8 Measurement Model

5.4.1. Convergent validity

Factor loadings: Factor loadings should be higher than 0.7 for convergent validity. The results of confirmatory factor analysis factor loadings are given in table ANX1 and INT1 items did not match this requirement so these items were extracted from the data set for further analyses**.**

Table 9 Factor loadings

	ANX	CA	INT	PEOU	PU
ANX1	0,475289				
ANX2	0,694205				
ANX3	0,848726				
ANX4	0,850580				
CA1		0,810463			
CA2		0,847502			
CA3		0,708271			
INT1			0,693410		
INT2			0,815066		
INT3			0,721036		
INT4			0,793561		
INT5			0,813337		
INT6			0,795302		
INT7			0,751976		
PEOU1				0,704281	
PEOU2				0,795860	
PEOU3				0,810843	
PEOU4				0,729548	
PEOU5				0,795759	
PU1					0,873374
PU2					0,837645
PU3					0,829331

The items ANX1 and INT1 were extracted since they had small factor loadings then PLS algorithm was again run and the new scores for factor loadings attained shown in table 10.

Table 10 Final items included in analysis and their factor loadings

	ANX	CA	INT	PEOU	PU
ANX2	0,705329				
ANX3	0,858171				
ANX4	0,852178				
CA1		0,810064			
CA2		0,847013			
CA3		0,709388			
INT2			0,806543		
INT3			0,731498		
INT4			0,796085		
INT5			0,826387		
INT6			0,797823		
INT7			0,761143		
PEOU1				0,703564	
PEOU2				0,795527	
PEOU3				0,811080	
PEOU4				0,730347	
PEOU5				0,795680	
PU1					0,872690
PU2					0,837367
PU3					0,830414

Composite Reliability: Composite reliability should be higher than 0.7. As seen in Table 11, all contracts matched this requirement for an adequate convergent validity.

Table 11 Convergent Validity Scores

	AVE	Composite Reliability	R Square	Cronbachs Alpha
ANX	0,653385	0,848757	0,062103	0,737844
CA	0,625622	0,832949		0,699454
INT	0,619688	0,907072	0,589338	0,877077
PEOU	0,590446	0,877848	0,400963	0,826414
PU	0,717453	0,883911	0,304872	0,803312

AVE: Average variance Extracted should be higher than 0.5. AVE value of the constructs exceeds the required value and the results are given in table 11.

5.4.2. Discriminant Validity

Discriminant validity was performed to show that all of the constructs were different from each other. Fornell & Larcker (1981); Gefen & Straub (2005) stated that discriminant validity is evaluated by considering the correlation among the constructs. Square root of AVE values of each constructs should higher than all of the correlation values of constructs. The table 12 shows that the all of the constructs were different from each other. The diagonal shows the square root of AVE values of each constructs and these values were higher than the other correlation values among the constructs.

Table 12 Discriminant validity of the constructs

	ANX	**CA**	**INT**	**PEOU**	**PU**
ANX	**0,808**				
CA	-0,249205	**0,790**			
INT	-0,449733	0,400709	**0,787**		
PEOU	-0,529038	0,468828	0,591588	**0,768**	
PU	-0,390554	0,355606	0,714348	0,519987	**0,847**

Structural Model:

After validating the measurement model via convergent and discriminant validity, PLS bootstrapping (BT) algorithm was run to find out the t values to investigate the relations between latent variables. The Figure 9 shows the path coefficients and t scores over the arrows meanwhile showing the significant and non-significant relations. Also near the latent variables code, the total variance explained information is also shown.

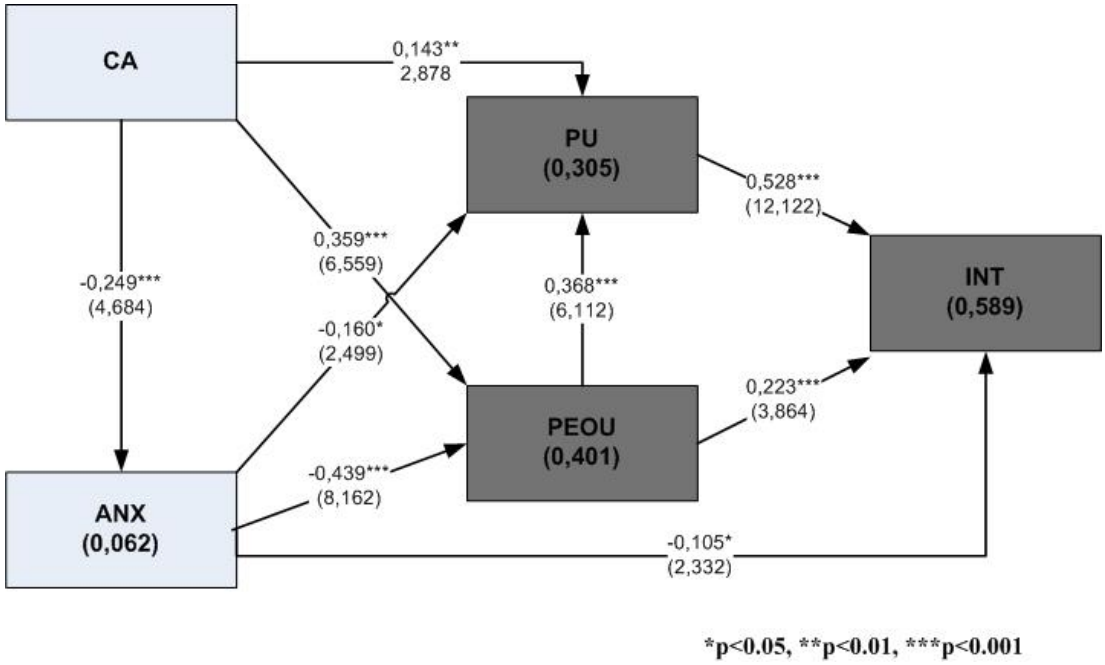

Figure 9 Structural Model

5.5. Interpreting the Results of CFA and Hypotheses Testing

The results of the relations and the hypotheses test are given Table 13. According to the results of explanatory factor analysis any item did not clustered under ATT and SE constructs. For these reasons, the hypotheses (H1a, H2a, H3a, H4b, H5a, H6a, H6b, H6c) related with these two constructs could not be measured. In addition, any relation was not rejected.

Several significant relations were found over p<0.001 level. Positive strong relations were found between PEOU -> PU, PU -> INT, CA -> PEOU and PEOU -> INT. Therefore H1b and H2b were accepted. Also, negative strong relations were found between CA -> ANX and ANX -> PEOU relations. Therefore, H5b was validated with the result of the relation between CA and ANX. Among these relations ANX -> PEOU, CA -> PEOU and PEOU -> INT were not hypothesized and these significant relations were found during the structural model evaluation. Moreover, a positive significant relation was found between CA and PU p<0.01 level; so H5c was supported. Furthermore, negative strong relations were found between ANX -> INT and ANX -> PU at p<0.05 level. Among these relations ANX -> PU was not

hypothesized when the model was proposed. As a result of the significant relation between ANX and INT, H4a was supported.

Table 13 Relations and their loadings

Relations	Hypotheses	T-Values	Standardized Loadings	Supported
PEOU -> ATT	H1a	-	-	Can not be measured
PEOU -> PU	H1b	5,806845	0,368***	Yes
PU -> ATT	H2a	-	-	Can not be measured
PU -> INT	H2b	12,187623	0,528***	Yes
ATT -> INT	H3a	-	-	Can not be measured
ANX -> INT	H4a	2,414937	-0,105*	Yes
ANX -> ATT	H4b	-	-	Can not be measured
CA -> ATT	H5a	-	-	Can not be measured
CA -> ANX	H5b	4,542272	-0,249***	Yes
CA -> PU	H5c	2,902438	0,143**	Yes
SE -> BI	H6a	-	-	Can not be measured
SE -> PEOU	H6b	-	-	Can not be measured
SE -> ANX	H6c	-	-	Can not be measured
ANX -> PEOU	ART	8,097622	-0,439***	Additional tested relation
ANX -> PU	ART	2,344085	-0,160*	Additional tested relation
CA -> PEOU	ART	6,623584	0,359***	Additional tested relation
PEOU -> INT	ART	3,829511	0,222***	Additional tested relation

***p<0.05; **p<0.01; ***p<0.001**

CHAPTER VI

DISCUSSION AND CONCLUSION

This chapter presents the discussion of the results found at the end of empirical analysis, the conclusion of the study and gives recommendations for future research.

6.1. Discussion

In the literature, there are studies researched to investigate the factors affecting students' behaviors towards e-assessment and their perceptions of such technologies; however most of these studies did not take TAM as a framework although TAM is a widely used model to determine technology use and perceptions of end users. Although, there are studies researching students' perceptions of e-learning or computer use in learning, there are only few studies investigating perceptions of e-assessment by taking TAM as a theoretical model. By adding external factors to original TAM constructs, this study presents a measurement and a structural model to investigate the behaviors of student in higher education toward computer use in assessment for learning.

This study was motivated to understand the underlying drivers of student adoption of e-assessment. Original TAM was extended by considering the individual differences of students that derived from their attitude and emotion towards computers and computer use. In this empirical study, the factors affecting students' adoption of e-assessment were examined in two dimensions: *belief* constructs: perceived usefulness, perceived ease of use (come from original TAM) and *individual* factors: computer attitude and anxiety.

First the relations between individual differences factors and belief factor were examined, and then the relations between these constructs and intention towards e-assessment were analyzed. Proposed hypotheses were tested and the results of this testing are shown in table 14. In addition to the proposed hypotheses, some additional relations were tested during model modification in SEM and their results are also shown in table 14.

Table 14 Summary of findings of the hypotheses

	Independent Variable	**Dependent Variable**	**Supported**
H1b	PEOU	PU	Yes
H2b	PU	INT	Yes
H4a	ANX	INT	Yes
H5b	CA	ANX	Yes
H5c	CA	PU	Yes
Additional relations tested	CA	PEOU	Yes
	ANX	PEOU	Yes
	ANX	PU	Yes
	PEOU	INT	Yes
Note that: PEOU: perceived ease of use, PU: perceived usefulness, ANX: Anxiety, CA: computer attitude, INT: intention.			

The empirical results show that perceived ease of use positively and significantly influenced perceived usefulness and intention towards e-assessment. The significant effects of perceived ease of use over perceived usefulness is a similar result to findings of Park (2009), Chatzoglou et al. (2009), Hsu et al. (2009), Lee et al. (2005) and the original TAM (Davis et al., 1989). This significance relation between perceived ease of use and perceived usefulness implies that when the e-assessment tool is easy to use, then the users are likely to have higher usefulness perceptions of such applications. The positive influence of perceived ease of use over intention is a parallel result with the findings of Lee et al. (2009), Hsu et al. (2009), Chatzoglou et al. (2009), Ong et al. (2004) and Yi & Hwang (2003). With this significant relation,

perceived ease of use seems to be a determinant of behavioral intention towards actual use. When the users find the tool easy to use, their behavioral intention towards that tool increases positively.

According to empirical results perceived usefulness affected intention of students towards e-assessment positively and significantly. This result is similar the results of Lee et al. (2005) and similar with original TAM (Davis et al., 1989). Davis et al. (1989) proposed perceived usefulness as the major determinant of users' intention to use and this validated in this study too which shows that when users find the tool useful that affect their intentions positively.

Anxiety influenced intention, perceived ease of use and perceived usefulness negatively. The influence of anxiety over perceived ease of use is similar the result with Raaij & Schepers (2008). Anxiety is a negative emotion towards the use of technology, in this study computers and e-assessment. According to Venkatesh (2000), computer anxiety is one of the determinants of perceived ease of use; the empirical result of this study is parallel with the conclusion of Venkatesh. This result shows that when the users have anxiety while using the tool, this affect their easiness perceptions negatively. Also, a significant and negative relation between anxiety and perceived usefulness was validated, which implies that if the users have anxiety while using e-assessment, their usefulness perceptions are affected negatively from their anxiety. This study also shows that, anxiety affects users' intention towards e-assessment use negatively with validated negative relation between anxiety and intention constructs. If the users do not have anxiety resulted from technology use, their intention towards use of e-assessment is affected positively.

The empirical results show that computer attitude affected students' usefulness perception of e-assessment positively and significantly which is parallel with the results of Hsu et al. (2009). Moreover, computer attitude influenced anxiety negatively and significantly. This shows that when the users have positive attitudes towards computers, this affect their anxiety resulting from computer use negatively. Furthermore this empirical study shows that students computer attitude affect their

easiness perceptions of e-assessment implying that when students have positive attitude toward computer, they find e-assessment easy.

6.2. Conclusion

The significant effects of computer attitude and anxiety over original TAM, give evidence that in addition to TAM constructs other factors should be considered while investigating users' adoption of technology. This study extended TAM by adding two external factors which refers to individual differences among students, since anxiety is related with the emotions and computer attitude is related with users' general attitudes towards computer use.

The findings of the study have implications for practice of e-assessment applications or related application. In order to use computers effectively in assessment for learning, the students' intentions should be taken into account. Computerized assessment has many advantages when compared to traditional paper-pencil assessment; however students' perceptions of e-assessment tools are important in using these tools effectively. This study investigated students' perceptions of e-assessment tools in two dimension; belief and individual differences.

Belief includes perceptions of easiness and usefulness, whereas individual differences include computer attitude and anxiety. According to validated structural model, these factors influenced students' behavioral intention towards e-assessment directly or indirectly.

6.3. Contribution of the Study

With the advances in computer technology, computers are used in education for different purposes. Use of computer in assessment activities is one of its uses in education. In order to make effective use of computers in assessment activities for learning, students' adoption of such application should be investigated.

This study contributes to e-learning literature by identifying how individual factors affect students' adoption of *computerized exams*. In addition the study proved once again that TAM is well applicable models to determine users' adoption of

technology. In this study, TAM is extended by adding two constructs to TAM and their relations over TAM constructs are validated. The results give evidence for the effects of computers attitudes and anxiety adoption of web-based assessment tools.

6.4. Limitations and Further Research

There are several limitations of this research. The first limitation of the study was that in the proposed model, two additional construct (Self-efficacy & Attitude) were proposed, however in factor analysis no item clustered under them and the relations of these constructs over INT and other constructs could not be measured. It is recommended that future studies investigate these relations.

The second limitation is related with the e-assessment tool that the sample group had used. The sample group only used a specified e-assessment tool and they did not know and have never used other e-assessment tools. This prevents the generalization of the findings, since the easiness of the tools may vary.

The third limitation is related with the gender. This study did not examine the gender differences in the sample. The attitudes of students towards computers may vary between females and males. In future researches, the gender differences may be investigated.

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APPENDICES

Appendix A: Demographic Questions

Item Text	**Options**
Gender	F / M
Age	-
Department	-
Academic Year	Prep Class to Senior
How many hours do you spend on using internet in a week	• Less than 3 hours • Between 3-4 hours • Between 6-8 hours • More than 8 hours
What activity do you do most during using web? (You can select more than one choice)	• Surfing the web for personal reasons (facebook, news, blogs..etc) • Surfing the web for educational reasons • Communication (chatting, e-mail) • Game playing • Watching videos
Indicate your overall computer literacy	1 (Very bad) to 5 (very good)
How many years ago did you first begin using computer?	-
How knowledgeable are you about computers and software?	1 (very bad) to 5 (very good)
What type of exam do you prefer?	• Web-based Interactive Exams • Paper-based Traditional Exams

Appendix B: Items used in the survey

Item Code	Text	Adapted From
Item01	By using the web based assessment system in the exams, I was able to answer the questions more quickly compared to a paper-based exam.	Davis, 1989
Item02	Using web based assessment system improved my performance in the exams.	Davis, 1989
Item03	Using web based assessment system increased my productivity in the exams.	Davis, 1989
Item04	I found the web based assessment system useful.	Davis, 1989
Item05	Using web based assessment system enhanced my effectiveness in the course.	Davis, 1989
Item06	Web based assessment system enabled me to take exams easily.	Davis, 1989
Item07	I think the web based assessment system was useful in the course "IS100".	Davis, 1989
Item08	Learning to use the web based assessment system was hard for me.	Davis, 1989
Item09	My interaction with the web based system was clear and understandable.	Davis, 1989
Item10	My interaction with the web based assessment system did not require a lot of mental effort.	Lee, 2008
Item11	I found the web based assessment system easy to use.	Davis, 1989
Item12	It was easy to navigate through the web based assessment system.	Saadé & Bahli, 2005
Item13	Using the web based assessment system to take exams was a good idea.	Park, 2009;
Item14	Using the web based assessment system to take exams was a wise idea.	Park, 2009;
Item15	I liked the idea of using the web based assessment system.	Lee, Cheung & Chen, 2005
Item16	Using the web based assessment system was pleasant.	Lee, Cheung & Chen, 2005
Item17	The web based assessment system provided an attractive exam environment.	Liu, Liao & Pratt, 2008
Item18	I found using the web based assessment system enjoyable	Lee, Cheung & Chen, 2005
Item19	In general, I was positive toward web based assessment system	Park, 2009;
Item20	I intend to take courses that use the web based assessment in the future.	Saadé & Bahli, 2005
Item21	If I am offered, I intend to take all exams with the web based assessment system.	Ong & Lai, 2006
Item22	I wish I used the web based assessment system for	Lee, Yoon, & Lee,

	other courses as well.	2009
Item23	The web based assessment system was somewhat intimidating to me.	Chatzoglou et al., 2009
Item24	I hesitated to use the web based assessment system for fear of making mistakes that I couldn't correct.	Computer attitude, statistics anxiety and self-efficacy on statistical software adoption behavior: An empirical study of online MBS learners. et al., 2009
Item25	I felt anxious about using the web based assessment system.	Venkatesh, 2000
Item26	Working with the web based assessment system made me nervous.	Venkatesh, 2000
Item27	It was comfortable to work with the web based assessment system.	Venkatesh, 2000
Item28	Computers are bringing us into a bright new era.	Hsu, Wang, & Chiu 2009
Item29	The use of computers is enhancing our standard of living.	Hsu, Wang, & Chiu 2009
Item30	There are unlimited possibilities of computer applications that have not even been thought of yet.	Hsu, Wang, & Chiu 2009
Item31	Computers are responsible for many of the good things we enjoy.	Hsu, Wang, & Chiu 2009)
Item32	Working with computers is an enjoyable experience.	Hsu, Wang, & Chiu 2009
Item33	I felt comfortable when using the web based assessment system on my own.	Liaw, 2008
Item34	I was able to use the web based assessment system even if there was no one around show me how to use it.	Compeau, Higgins, 1995
Item35	I was confident that I had adequate ability to operate the web based assessment system.	Wang, Wang (2009)
Item36	I was confident that I could use the web based assessment system even if I had no prior experience on similar systems.	Wang, Wang (2009), Chatzoglou et al. (2009) Roca et al.(2006)
Item37	I could use the web based assessment system if an assistant showed me how to do it first.	Compeau, Higgins, 1995

Appendix C: Ethical Clearance

1956

Orta Doğu Teknik Üniversitesi
Middle East Technical University

Öğrenci İşleri Dairesi
Başkanlığı
Registrar's Office

06531 Ankara, Türkiye
Phone: +90 (312) 2103417
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www.oidb.metu.edu.tr

B.30.2.ODT.72.00.00 400-371-51

22/01/2010

ENFORMATİK ENSTİTÜSÜ MÜDÜRLÜĞÜNE

İlgi: 13/01/2010 tarih ve 27- 574 sayılı yazınız.

Bilgisayar Sistemleri

Üniversitemiz Bilişsel Bilimler Anabilim Dalı Yüksek Lisans öğrencisi Nurcan Alkış'ın, Ocak- Şubat 2010 tarihleri arasında tezi ile ilgili *"Yüksek Eğitimdeki Öğrencilerin E-Öğrenmedeki Ağ Tabanlı Değerlendirmeyi Kabul Etmelerini Etkileyen Faktörlerin Belirlenmesi"* başlıklı araştırma çalışmasına ilişkin olarak üniversite öğrencilerine uygulama yapmak için, öğrencinin isteği doğrultusunda görevlendirilmesi Etik Komite onayı ile uygun görülmüştür.

Gereğini bilgilerinize arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

Ekler:
İAEK Başvuru Kontrol Listesi
İAEK Başvuru Formu
İAEK Başvuru Formu Proje Bilgi Formu

BD

1956

Orta Doğu Teknik Üniversitesi
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13/08/2010

ENFORMATİK ENSTİTÜSÜ MÜDÜRLÜĞÜNE

İlgi: a) 13/01/2010 tarih ve 27- 574 sayılı yazınız.
b) 22/01/2010 tarih ve 400-371-51 sayılı yazımız.

Başkanlığımız tarafından yazılan ilgi (b) yazımızda Nurcan Alkış'ın Anabilim Dalı sehven Bilişsel Bilimler olarak belirtilmiştir. Adı geçenin Anabilim Dalı Bilişim Sistemleri'dir.

Bilgilerinize arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

HA

Appendix D: Sample Department information

		Frequency	Percent	Valid Percent	Cumulative Percent
BA	Business Administration	18	5,4	5,4	5,4
PSYC	Psychology	9	2,7	2,7	8,1
FDE	Food Engineering	8	2,4	2,4	10,5
AEE	Aerospace Engineering	8	2,4	2,4	13,0
ADM	Political Science and Public Administration	12	3,6	3,6	16,6
ARCH	Architecture	1	,3	,3	16,9
METE	Metallurgical & Materials Engineering	7	2,1	2,1	19,0
ESE	Early Science Education	6	1,8	1,8	20,8
CE	Civil Engineering	10	3,0	3,0	23,8
ID	Industrial Design	4	1,2	1,2	25,0
MATH	Mathematics	10	3,0	3,0	28,0
ECON	Economics	12	3,6	3,6	31,6
ME	Mechanical Engineering	23	6,9	6,9	38,6
IR	International Relations	12	3,6	3,6	42,2
EE	Electric & Electronic Engineering	18	5,4	5,4	47,6
HIST	History	10	3,0	3,0	50,6
PHYS	Physics	10	3,0	3,0	53,6
BIO	Biology	9	2,7	2,7	56,3
IE	Industrial Engineering	5	1,5	1,5	57,8
PHIL	Philosophy	5	1,5	1,5	59,3
GENE	Molecular Biology and Genetics	6	1,8	1,8	61,1
FLE	Foreign Language Education	30	9,0	9,0	70,2
PHED	Physics Education	4	1,2	1,2	71,4
CHED	chemistry Education	1	,3	,3	71,7
STAT	Statistics	8	2,4	2,4	74,1
ENVE	Environmental Engineering	6	1,8	1,8	75,9
GEOE	Geological Engineering	5	1,5	1,5	77,4
CHE	Chemical Engineering	14	4,2	4,2	81,6
MINE	Mining Engineering	5	1,5	1,5	83,1
SOC	Sociology	8	2,4	2,4	85,5
CRP	City and Regional Planning	4	1,2	1,2	86,7
CENG	Computer Engineering	7	2,1	2,1	88,9
CEIT	Computer Education and Instructional Technology	5	1,5	1,5	90,4
EME	Early Math Education	13	3,9	3,9	94,3
CHEM	Chemistry Education	11	3,3	3,3	97,6
ECE	Early Child Education	3	,9	,9	98,5
PETE	Petroleum & Natural Gas Engineering	1	,3	,3	98,8
Missing		4	1,2	1,2	100,0
Total		332	100,0	100,0	

Appendix E: Missing data percentages

	N	Mean	Std. Deviation	Missing	
				Count	Percent
item01	332	3,26	1,116	0	,0
item02	331	3,59	,994	1	,3
item03	322	3,35	1,012	10	3,0
item04	332	3,22	,995	0	,0
item05	316	2,85	,935	16	4,8
item06	330	4,03	,873	2	,6
item07	328	3,71	,924	4	1,2
item08	331	3,11	,996	1	,3
item09	330	3,64	,868	2	,6
item10	330	3,33	1,015	2	,6
item11	332	2,71	1,130	0	,0
item12	328	3,04	1,143	4	1,2
item13	329	3,92	,887	3	,9
item14	332	3,42	1,023	0	,0
item15	332	3,05	,928	0	,0
item16	332	3,23	,953	0	,0
item17	325	3,38	1,011	7	2,1
item18	331	3,01	1,112	1	,3
item19	328	2,72	1,017	4	1,2
item20	329	3,77	,852	3	,9
item21	330	3,52	,923	2	,6
item22	332	3,65	,861	0	,0
item23	328	3,54	,901	4	1,2
item24	331	3,51	,909	1	,3
item25	329	2,64	1,085	3	,9
item26	327	3,87	,923	5	1,5
item27	331	3,33	,955	1	,3
item28	332	3,23	,921	0	,0
item29	329	3,49	,901	3	,9
item30	330	3,21	1,061	2	,6
item31	330	3,46	,980	2	,6
item32	332	3,79	,942	0	,0
item33	329	2,59	1,056	3	,9
item34	331	3,21	1,021	1	,3
item35	331	3,50	,983	1	,3
item36	332	3,85	1,068	0	,0
item37	331	3,57	1,046	1	,3

Appendix F: Mean and 5% Trimmed Mean Scores

	N	Mean	% 5 Trimmed Mean
item01	332	3,26	3,29
item02	331	3,59	3,62
item03	322	3,35	3,36
item04	332	3,22	3,23
item05	316	2,85	2,86
item06	330	4,03	4,11
item07	328	3,71	3,75
item08	331	3,11	3,09
item09	330	3,64	3,67
item10	330	3,33	3,35
item11	332	2,71	2,68
item12	328	3,04	3,04
item13	329	3,92	3,98
item14	332	3,42	3,45
item15	332	3,05	3,04
item16	332	3,23	3,23
item17	325	3,38	3,40
item18	331	3,01	3,01
item19	328	2,72	2,72
item20	329	3,77	3,81
item21	330	3,52	3,54
item22	332	3,65	3,69
item23	328	3,54	3,56
item24	331	3,51	3,54
item25	329	2,64	2,61
item26	327	3,87	3,93
item27	331	3,33	3,34
item28	332	3,23	3,22
item29	329	3,49	3,50
item30	330	3,21	3,23
item31	330	3,46	3,48
item32	332	3,79	3,83
item33	329	2,59	2,56
item34	331	3,21	3,22
item35	331	3,50	3,53
item36	332	3,85	3,94
item37	331	3,57	3,62

Appendix G: Test of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
item01	,219	332	,000	,905	332	,000
item02	,258	332	,000	,884	332	,000
item03	,222	332	,000	,902	332	,000
item04	,201	332	,000	,904	332	,000
item05	,235	332	,000	,887	332	,000
item06	,304	332	,000	,804	332	,000
item07	,276	332	,000	,867	332	,000
item08	,214	332	,000	,898	332	,000
item09	,276	332	,000	,866	332	,000
item10	,237	332	,000	,896	332	,000
item11	,250	332	,000	,891	332	,000
item12	,220	332	,000	,897	332	,000
item13	,280	332	,000	,839	332	,000
item14	,243	332	,000	,894	332	,000
item15	,195	332	,000	,896	332	,000
item16	,234	332	,000	,887	332	,000
item17	,252	332	,000	,888	332	,000
item18	,199	332	,000	,905	332	,000
item19	,201	332	,000	,903	332	,000
item20	,248	332	,000	,870	332	,000
item21	,243	332	,000	,887	332	,000
item22	,307	332	,000	,845	332	,000
item23	,281	332	,000	,868	332	,000
item24	,252	332	,000	,881	332	,000
item25	,231	332	,000	,898	332	,000
item26	,265	332	,000	,854	332	,000
item27	,229	332	,000	,894	332	,000
item28	,216	332	,000	,896	332	,000
item29	,250	332	,000	,884	332	,000
item30	,206	332	,000	,907	332	,000
item31	,271	332	,000	,878	332	,000
item32	,292	332	,000	,854	332	,000
item33	,283	332	,000	,871	332	,000
item34	,192	332	,000	,908	332	,000
item35	,235	332	,000	,893	332	,000
item36	,254	332	,000	,845	332	,000
item37	,238	332	,000	,890	332	,000
a. Lilliefors Significance Correction						

Appendix H: Skewness and Kurtosis Scores

	N		Skewness	Std. Error of Skewness	Kurtosis	Std. Error of Kurtosis
	Valid	Missing				
item01	332	0	-,282	,134	-,736	,267
item02	332	0	-,473	,134	-,363	,267
item03	332	0	-,254	,134	-,600	,267
item04	332	0	-,144	,134	-,579	,267
item05	332	0	-,131	,134	,120	,267
**item06	332	0	-1,061	,134	1,308	,267
item07	332	0	-,622	,134	,127	,267
item08	332	0	,231	,134	-,569	,267
item09	332	0	-,549	,134	,296	,267
item10	332	0	-,348	,134	-,510	,267
item11	332	0	,417	,134	-,704	,267
item12	332	0	-,221	,134	-,932	,267
item13	332	0	-,851	,134	,850	,267
item14	332	0	-,392	,134	-,468	,267
item15	332	0	,018	,134	-,520	,267
item16	332	0	-,261	,134	-,600	,267
item17	332	0	-,363	,134	-,597	,267
item18	332	0	,069	,134	-,917	,267
item19	332	0	,076	,134	-,754	,267
item20	332	0	-,321	,134	-,305	,267
item21	332	0	-,407	,134	-,072	,267
item22	332	0	-,727	,134	,609	,267
item23	332	0	-,526	,134	-,073	,267
item24	332	0	-,443	,134	,006	,267
item25	332	0	,262	,134	-,808	,267
item26	332	0	-,695	,134	,118	,267
item27	332	0	-,281	,134	-,429	,267
item28	332	0	,021	,134	-,459	,267
item29	332	0	-,363	,134	-,194	,267
item30	332	0	-,181	,134	-,705	,267
item31	332	0	-,457	,134	-,425	,267
item32	332	0	-,717	,134	,154	,267
item33	332	0	,515	,134	-,554	,267
item34	332	0	-,094	,134	-,643	,267
item35	332	0	-,420	,134	-,208	,267
item36	332	0	-,914	,134	,400	,267
item37	332	0	-,526	,134	-,241	,267
** Problematic item						

Appendix I: Reliability results (Cronbach's Alpha) for all items

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
item01	121,03	307,390	,540	,472	,914
item02	120,71	315,542	,375	,504	,916
item03	120,94	305,093	,679	,627	,912
item04	121,07	307,432	,612	,497	,913
**item05	121,44	333,200	-,128	,249	,921
item06	120,26	314,935	,455	,477	,915
item07	120,58	309,611	,597	,437	,913
item08	121,19	306,334	,644	,595	,912
item09	120,65	310,171	,618	,539	,913
item10	120,96	305,527	,656	,581	,912
item11	121,58	303,483	,635	,643	,912
**item12	121,25	339,515	-,264	,387	,925
item13	120,37	313,912	,482	,506	,914
item14	120,88	311,146	,486	,437	,914
item15	121,24	306,653	,684	,648	,912
item16	121,06	315,196	,403	,262	,915
item17	120,91	302,323	,760	,691	,911
item18	121,28	305,390	,596	,582	,913
**item19	121,57	345,539	-,447	,506	,926
item20	120,52	319,037	,330	,275	,916
item21	120,78	311,674	,530	,525	,914
item22	120,64	308,494	,679	,607	,912
item23	120,75	308,583	,647	,615	,912
item24	120,78	305,890	,726	,649	,912
**item25	121,66	348,460	-,493	,574	,927
item26	120,42	316,776	,372	,345	,916
item27	120,96	311,751	,508	,415	,914
item28	121,06	309,353	,604	,546	,913
item29	120,80	308,605	,646	,531	,913
item30	121,08	303,147	,692	,607	,911
item31	120,83	303,633	,739	,620	,911
item32	120,51	307,775	,638	,536	,912
**item33	121,70	330,496	-,048	,171	,921
item34	121,09	306,579	,620	,528	,913
item35	120,79	303,765	,732	,662	,911
item36	120,44	312,205	,435	,322	,915
item37	120,72	302,416	,723	,664	,911
** Problematic item					