EVALUATING COGNITIVE ABSORPTION, TECHNOLOGY ACCEPTANCE, AND ONLINE EDUCATIONAL SOFTWARE USABILITY OF STUDENTS IN ONLINE PROGRAMMING COURSES

DİLBER CANSU TORAMAN

MEF UNIVERSITY

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Dilber Cansu TORAMAN

ORCID No: 0000-0001-5484-9948

Prof. Dr. Adem KARAHOCA

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ACADEMIC HONESTY PLEDGE

I declare that all the information in this study, is collected and presented in accordance with academic rules and ethical principles, and that all information and documents that are not original in the study are referenced in accordance with the citation standards, within the framework required by the rules and principles.

Name and Surname: Dilber Cansu TORAMAN

Signature:

ÖZET

ÇEVRİMİÇİ PROGRAMLAMA KURSLARINDA ÖĞRENCİLERİN BİLİŞSEL ÖZÜMLEME, TEKNOLOJİ KABUL VE ÇEVRİMİÇİ EĞİTİM YAZILIMLARININ KULLANILABİLİRLİĞİNİN DEĞERLENDİRİLMESİ

Dilber Cansu TORAMAN

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Bu çalışmada, çevrimiçi programlama derslerinde öğrencilerin çevrimiçi kendi kendine öğrenme, bilişsel özümseme ve teknoloji kabul modellerini incelenmektedir. Bu tez, çeşitli faktörlerin programlama öğrencilerinin öğrenimindeki rolü ve etkisini tartışmıştır. Comp 109 Programlamaya Giriş (Java) dersi, Comp 110 Nesne Yönelimli Programlama dersi ve Comp 210 Veri Yapıları ve Algoritmalar derslerinin eğitsel öğrenmeye dayalı çevrimiçi ders içeriğinin öğrenci başarısı üzerindeki etkisinin araştırılmasının yanı sıra, öğrencilerin bilişsel özümseme, eğitsel çevrimiçi öğrenme ortamlarının kabulü ve kullanılabilirliği üzerindeki etkileri tartışılmıştır.

Araştırmacı, belirtilmiş olan programlama derslerindeki yüz seksen bir öğrenciye anket araçlarının uygulamasını gerçekleştirmiştir. Anketlere dayalı olarak, bu araştırma, öğrencilerin bilişsel özümseme, teknoloji kabulü ve çevrimiçi eğitim yazılımı kullanılabilirliğinin programlama derslerindeki öğrencilerin öz düzenleme becerilerinin uzaktan eğitime uygun olup olmadığını incelemeyi amaçlamaktadır.

Bu çalışmada test ölçümlerinde sırasıyla şu ölçekler uygulanmıştır: Bilişsel özümseme ölçeği (on üç madde), teknoloji kabul modeli (on dört madde), çevrimiçi eğitim yazılımı kullanılabilirliği modeli (otuz dokuz madde). İlgili anket araştırması hazırlığı; etik onayı, anketin uygulanması ve data analizi kapsamında üç ay sürmüştür.

Bu anket çalışması, öğrencilerin çevrimiçi programlama derslerinde bilişsel özümseme, teknoloji kabulü ve online eğitim yazılım kullanılabilirliği ve online eğitime uygunluğunu değerlendirmektedir. Bu üç ölçeğin her biri, Cinsiyet, Ders Kodu, Bölüm, Yaş, Uzmanlık Alanı, İnternet Kullanım Sıklığı ve Teknolojiye İlgi olmak üzere yedi farklı açıdan incelenmiştir.

Bu ölçümlerinin karşılaştırılmasında ve değerlendirilmesinde Normallik testi, ANOVA, Bağımsız T testi, Mann-Whitney U Test ve Kruskal Wallis Test kullanılmıştır. Bu test ölçümlerinin yanında çoklu değişken analizi için ayrıca MANOVA testi de uygulanmıştır. MANOVA testi 4 farklı açıdan detaylı olarak yapılmıştır.

Bu ölçeklerin her birinin analizleri yedi farklı açıdan incelenmiş ve ilgili çalışmalarla karşılaştırılmıştır. Bunun sonucunda çevrimiçi programlama kurslarının bilişsel özümseme üzerindeki olumlu etkisi gösterilmiş oldu. Ancak, demografik değişkenler arasında anlamlı bir fark olmadığı da gösterildi. Bunlara uygun olarak her üç ölçek için tekrar literatür araştırması yapılıp tartışma yazıldı. Elde edilen tartışmaya ve analize göre de sonuçlar yazılmıştır.

Anahtar Kelimeler: Bilişsel Özümseme, Teknoloji Kabulü, Çevrimiçi Eğitim Yazılımı Kullanılabilirliği, Çevrimiçi Eğitim

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ABSTRACT

EVALUATING COGNITIVE ABSORPTION, TECHNOLOGY ACCEPTANCE, AND ONLINE EDUCATIONAL SOFTWARE USABILITY OF STUDENTS IN ONLINE PROGRAMMING COURSES

Dilber Cansu TORAMAN

M.Sc in Information Technologies

Thesis Advisor: Prof. Dr. Adem KARAHOCA

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This thesis examines the online self-learning, cognitive absorption, and technology acceptance models of students in online programming courses. This thesis discussed the role and impact of various factors on the learning of programming students. Besides investigating the effect of the educational learning-based online course content of Comp109 Introduction to Programming (Java), Comp110 Object Oriented Programming ve Comp210 Data Structures and Algorithms courses on student success, the effects of students' cognitive absorption, the acceptance, and usability of educational online learning environments were discussed.

The subjects of the research are a total of 181 online students in the student group. The researcher carried out the application of the questionnaire tools to the students in the programming courses. Based on the questionnaires, this research aims to examine the effect of students' cognitive absorption, technology acceptance, and online educational software usability on student success in programming courses.

In this study, the following scales were applied in the survey measurements, respectively: Cognitive absorption scale (13 items), technology acceptance model (14 items), online educational software usability (39 items). The preparation, ethical approval and implementation of the relevant survey and data analysis research took three months. This study evaluates students' cognitive assimilation, technology acceptance, and e-education software usability scale and suitability for online education in online programming courses. Each of these three scales was examined from seven different perspectives: Gender, Course Code, Department, Age, Expertise, Frequency of Internet use, and Interest in technology.

Normality test, ANOVA, Mann-Whitney U Test and Kruskal Wallis Test were used to compare and evaluate these measurements. In addition to these test measurements, the MANOVA test was also applied for multivariate analysis. MANOVA test was carried out in detail from 4 different perspectives.

The results of each of these scales were investigated from seven different perspectives and compared with related studies, and suggestions were presented based on the obtained results. In line with my findings, the positive effect of online programming courses on cognitive absorption has been demonstrated. However, it was also shown that there was no significant difference between demographic variables. In addition to these, a literature search was made for all three scales for discussion and a discussion was written. Results are written according to the discussion and analysis.

Keywords: Cognitive Absorption, Technology Acceptance, Online Educational Software Usability, Online Education

Numeric Code of the Field: 92432

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INTRODUCTION

Problem

In this section, the problem condition that is the subject of the study is described, and the structure of the thesis is stated.

With the growth of the Internet, emerging conditions of distance education can destroy the geographical and temporal divergence between two learners, and understanding can be transferred to all parts of the world through online education (Han and Sa, 2022). One of the crucial benefits of the Internet is that teaching is changed from teacher-centered to learner-centered. Distance education lets learners organize their time and progress more flexibly and select the time and place to learn. Thus, it also enhances the shortcomings of traditional learning environments, such as the inability to repeat learning, limited delivery interval, and lack of flexibility (Albayati et al., 2020). The online educational space is one of the most efficient and practical tools for teaching and learning. Using the Internet provides many opportunities to increase students' self-confidence and learning. Learning teaching has been a new culture in educational literature in recent years. This culture shows the interaction between the teacher, the student, the type of education, and the educational environment, which are affected by the learning environment. What becomes essential in many cases is the ability to solve problems, plan and finally make the right decision. This is considered the most important goal of education, which also includes different levels of education. Investigating the effects of various factors on the effectiveness and success of online education is one of the broadest fields of study. The spread of Covid-19 caused virtual (electronic) education to be considered a necessity in many countries. The importance of using and developing online education is one of the things that is discussed more after Covid-19 (Rulevy and Aprilianti, 2021).

Today's students are no longer the people for whom the modern education system was designed. They have complete access to digital technologies and are familiar with new technologies. These students are the new generation who produce and share digital content such as digital images and sounds, video files, and short messages. Therefore, considering the inadequacies of the current education system and traditional methods in the professional preparation of students and considering the urgent need of this group for modern knowledge, which includes an extensive collection of information,s-oriented, and self-directed educational methods should be investigated (Albayati et al., 2020).

Purpose

This thesis examines the online self-learning, cognitive absorption, and technology acceptance models of students in online programming courses. This thesis discussed the role and impact of various factors on the learning of programming students. The cognitive absorption scale (13 items), technology acceptance model (14 items), and online self-learning modeling scale (39 items) will be applied to students.

In this thesis, in chapter 2, the theoretical foundations of this research will be explained. Online education is the main field of this research. In the second chapter, Learning, Learner, Teacher, Technology, Cognitive absorption, Fundamentals of Cognitive Capture Theory, and TAM were discussed in detail. By reading the second chapter, the audience will be fully acquainted with the main topic of the research. The second chapter was about the background of the work done in this field. In chapter 3, the thesis method was explained, and the surveys used for the research were explained. In chapter 4, research findings were presented. In chapter 5, it summarized the contents of the research topic and the results. In this section, in addition to presenting the strengths and weaknesses of each of these methods and the challenges ahead in each of the methods, solutions for the development of research in this field will be presented.

1. LITERATURE REVIEW

1.1 Introduction

In the past decades, when the amount of information was more limited, the traditional educational method could easily cope with memorizing and linking information with each other and building new findings. However, now that the volume of information has reached its previous limits, traditional learning methods are not enough for the massive amount of information. Another factor that seems to be influential in changing the traditional way of learning is the expectation from the learner. In the past, the parrot-like memorization of the material was emphasized, but now the learner is expected to be able to understand and apply it in addition to memorizing knowledge. In other words, emphasis on higher cognitive abilities and efficient learning strategies is another factor of change in the learning method (Dumpit and Fernandez, 2017).

Today's society requires creative and new educational models to qualify students to face life problems and use their opportunities, capabilities, and imagination. Therefore, instead of memorizing, students need to learn the abilities to learn through thinking and deal with issues and problems in a scientific way. In order to achieve such goals, by using active teaching methods, students get involved in life issues and learn issues related to their real-life because innovative methods in line with life make educational reality more appealing and improve the desire and motivation of learners (Dutot et al., 2019). Modern education considers fast learning essential and takes help from many words and resources to facilitate students' learning and academic progress in various academic fields. Among these facilities are new media such as movies, lesson video tapes, CDs, and media that diversify the flow of education and increase students' interest and motivation to learn. Moreover, they make learning easy, deepening, and enjoyable to make the students focus, pay attention, and be careful about the topic and subject matter (Ibili et al., 2019).

The advancement of technology has changed teaching-learning activities from traditional and passive to active and integrated learning. With the explosion of videos and other visual media on the Internet, young people need to be able to create video files to share with their peers. Teachers should also teach the production of video content and visual and presentation software and provide opportunities for students to get feedback. Technology should be considered one of the elements of the classroom (Mpinganjira, 2019).

Today, the education world has turned its emphasis from teaching to learning. This change makes learning the center and basis of all educational programs and policies. It is necessary to realize the goals of such an approach according to the extensive knowledge of information technology and the efficiency of all the facilities and technologies available (van Bijsterveldt, 2020). Information and communication technology, which is increasingly expanding, can have a positive effect on education and transform its strategies and methods (Hookham et al., 2016). Supporting information and communication technology in education, including planning, compiling content and texts, and teaching-learning methods, are among the most important requirements to improve education and create quality learning (Scholtz et al., 2016).

One of the critical challenges of education today is how to train learners with the necessary preparation to face the changing society and the complexities of the age of information explosion (Salimon et al., 2021). Extensive scientific and technological advances, along with the rapid obsolescence of previous findings and information, require a type of education in which students are continuously involved in the process of learning and problem-solving and enjoy facing challenges. In fact, in the new world, there is a need for lifelong learners who can use different resources according to their needs and problems and solve them in the shortest possible time (Ramadhan et al., 2022). The fast development of science leads to the research findings and results becoming old and inevitably losing their credibility within less than a few years. In such a situation, it is challenging to create the necessary cognitive, and motivational fields in students to spontaneously experience and give meaning to these experiences through analysis and reflection (Marakarkandy et al., 2017). In the information and communication technology age, educational systems must rethink and restructure the curriculum to master the knowledge and revive and enrich the learning environment. Therefore, it is necessary to replace traditional methods with new methods to equip learners with cognitive skills. On the one hand, using information and communication technology to achieve high-quality teaching and learning goals is inevitable for everyone (Achmad and Raista, 2021). In general, methods should be chosen that stimulate the learners' academic motivation, improve the quality of learning and teaching, help them gain professional capabilities, and reduce the anxiety resulting from learning and exams (Bagci and Celik, 2018).

One of the ways of working in this field is the use of new technologies and virtual education. The use of technology and virtual education raises important questions, including whether the use of technology and virtual education alone is sufficient, and if the answer is negative, what approach we should use, and what important factors we should consider. Some studies criticize fully virtual education due to the impossibility of establishing face-to-face communication and suggest blended education (Huang et al., 2019). Blended education uses both the advantages of traditional and face-to-face teaching and the capabilities of information and communication technology to enrich and improve the quality of learning (Nakisa et al., 2019).

Motivation is one of the main components of learning, but at the same time, it is not easy to measure. Psychologists consider motivation as an internal process that activates and directs behavior over time and maintain it (Yu and Huang, 2020). In simpler words, motivation is something that motivates the person and determines the path he/she should take. Motivations can be different in terms of intensity and direction. Motivation is not only important in the efficiency of students in academic activities but also determines how much the student learns from the activity he is involved in or the information he is facing. Achievement motivation is considered one of the necessities of learning, and it is something that gives intensity and direction to behavior and helps the learner maintain its continuity. Motivation gives the learner energy and guides his/her activities (Kemp et al., 2022).

Since academic motivation is directly related to the level of learning and academic progress of learners, it is necessary to pay more attention to this important issue to create a successful and dynamic educational system. Lack of attention to students' problems will undoubtedly cause the problems to become dense and entangled and cause various mental and educational disorders (Esteban-Millat et al., 2018). On the one hand, such negligence causes a waste of human resources, and it causes a decrease in the quality of human resources (Okcu et al., 2019). Sometimes a lesson seems so attractive and sweet to a student that he/she wants to learn it without any motivation. It is said that the subject of interest has enough internal motivation to motivate, but what should be learned in school is not attractive in itself and may not be motivational for most students in the short term (Park and Park, 2020). On average, each student should spend about 900 hours in class during the year, and it is not realistic to claim and expect that their interest and internal motivation alone can be the cause of learning (Kuciapski, 2019).

For this reason, schools use types of external motivation unrelated to the subject, such as grades, awards, and rewards (Chen et al., 2020).

1.2 Learning

In recent years, psychologists have developed learning definitions that refer to observable behavior changes. The most famous of these definitions is the one proposed by Kimble. According to Kimble, learning is a relatively stable change in potential behavior or behavioral capacity resulting from reinforced practice (Liao et al., 2022). Although this definition is famous, it is not accepted by all psychologists. In this definition, several points can be discussed; firstly, learning is a behavior change. In other words, learning results should always be transferable to observable behavior. After learning, the learner will be able to do something that he could not do before (Ozkale and Koc, 2020). Second, this behavioral shift is relatively steady; That is, it is neither temporary nor specified. Third, the shift in manners does not necessarily occur instantly after the understanding. Although, as a result of learning, the learner develops the potential ability to act differently, this ability may not immediately manifest itself in the behavior. Fourth, change in behavior or potential behavior results from practice or experience. Fifth, practice or experience should be reinforced (Al-Azawei et al., 2017). Also, learning means acquiring new things, modifying and improving existing knowledge, skills, behaviors, and values, and may include a combination of information (Hart and Sutcliffe, 2019).

One-way education, traditional and passive learning, as a common phenomenon in educational systems, often indicates the absolute sovereignty of the teacher in the classroom and the student's passivity in teaching-learning (Pribeanu et al., 2017). On the other hand, in active learning teaching approaches, students have the freedom to use different learning methods, use their different goals, learn together and use what they have learned in life (Kuciapski, 2017). Active learning is the desired result of using new and active teaching-learning methods and approaches; Therefore, to deal with the problem of educational systems that use passive and traditional teaching and learning methods, it is necessary to modify and improve teaching and learning strategies. The reason for this is that creating active learning and, consequently, activating students in the process of learning requires the use of appropriate teaching models and methods with appropriate and active teaching-learning methods, including cooperative learning methods that aim to increase interaction, cooperation, and camaraderie between students (Leong et al., 2018).

1.3 Cognitive Absorption

The scope of consumers is centered in the domain of technology and computer interaction, depending on the speed and diversity according to their size. This connection is investigated from a variety of angles, including how people perceive, accept, and engage with technology. Agarwal and Karahanna (2000) established the cognitive absorption hypothesis to explain how individuals engage with computers and technology. An example of cognitive grasping is a "strong dedication to experience with technology". There are five components that make up the "deep commitment state." These were utilized as the time, pleasure, control, and interest focal points.

1. Time: It is the condition of being unaware of the passage of time when using technology. This may manifest as the feeling that he spends more time than anticipated using technology or that the time goes by too quickly.

2. Curiosity: It is the attitude of being intrigued by technology while using it. People in this interaction process approach their persuasive and emotive encounters with increased curiosity.

3. Focus of attention: When using technology, emphasis is paid to a well-defined goal. It concentrates attention on one area while neglecting other attention because it is fascinated with what the mind is doing with its completion.

4. Pleasure: It is the attitude of taking pleasure in using technology. This condition might range from enjoying folks who have an impact on them to being a delight in and of itself.

5. Control: It is the perception that one has personal control over how they engage with technology. They consider people to be accountable for their interactions and experiences.

1.3.1 Fundamentals of Cognitive Capture Theory

The pillars of cognitive immersion are "Snap," "Flow," and "Cognitive absorption," three closely connected streams. According to the definition, capture is a personality trait in which an object of attention consumes all sources of attention (Tellegen and Atkinson, 1974). Tellegen and Atkinson (1974) created the snatching scale, which has nine content sets, in response to this tendency. Having the capacity to become engrossed in one's own thoughts and dreams, responding to related stimuli, responding to inductive stimuli, thinking about images, evoking vivid and meaningful images, having an evolving awareness, changing states of consciousness, and having the capacity to relive the past. When someone is in a state of flow, they are oblivious to anything else than that activity (Csikszentmihalyi, 1990). One of the most important factors in influencing how people behave and see the target technology is flow (Pace, 2003). Trevino and Webster (1992) explored flow in relation to information technology in 4 dimensions:

• Control dimension: The sense of control a person has when interacting with technology,

• Focus of attention: Attention is focused on a technology-related stimulus when it is presented,

• Curiosity: throughout the flow experience, there is an increase in both emotional interest and sensory pleasure,

• Intrinsic interest: Pleasure is increased by using technology and being interested in it..

Cognitive commitment describes a condition in which the person loses track of time and concentrates entirely on what he is doing. Although cognitive commitment is similar to flow theory in that it includes the dimensions of intrinsic interest, curiosity, and focus of attention, it excludes the control component, which is a Flow Theory dimension. According to this theory, learning settings that are designed and guided by the person are where cognitive commitment is most frequently observed. In fact, it was found that research on self-regulated learning also took cognitive commitment into account as a variable. It is stressed that motivation is intricately linked to mental processes, responses, and ideas and is therefore an essential variable for the beginning and maintenance of motivation connected to one's mental experience.

The curiosities, locus of control, and attention components of Flow Theory are included in Cognitive absorption Theory. The relative pleasure (Davis et al., 1992) and intrinsic interest (Webster et al., 1993) dimensions of flow theory were combined to create the pleasure dimension. The dimension of inner interest, which Trevino and Webster define as "being surrounded by pleasure and joy in action," exhibits the significant consequences of pleasure (1992). The Flow Theory, which was created with the help of Webster et al. (1997), shares many characteristics with the Cognitive Capture Theory, but it also has some significant differences. Despite the fact that time is an important element in Csikszentmihalyi's (1990) Flow Theory, time is not included in the definition of flow provided by Webster et al. (1997). It is clear that the Cognitive Capture Theory's aspects represent a synthesis of all these studies on human-computer interaction. This scale adaption study, the first of its kind on cognitive absorption in Turkey, is intended to further the field's understanding of technological experiences.

1.4 Technology Acceptance Model (TAM)

Decades ago, research related to new technologies has been focused on technological and technical development, but nowadays user-oriented research has been given attention. Despite spending huge costs and investments to produce, purchase and transfer technology, reports indicate that potential users do not use new technologies despite having access to them (Han and Sa, 2022). Understanding the technology acceptance factors and creating the environment in which information technology is accepted is one of the important research of information and communication technology. In other words, the issue of why people accept technologies and use them, or refuse to accept them and resist them, is an important topic in the field of information technology. The affecting factors for the different technologies' acceptance are different according to the desired technology for the users and the conditions (Albayati et al., 2020). Due to the importance of technology acceptance in recent decades, various models have been proposed in this field. In this part, models have been introduced, based on the evidence in the technology acceptance literature, these models are used as the basis of research.

Researchers have proposed several theories regarding the investigation of people's technology acceptance behavior, with the use of these theories, many pieces of research have been conducted regarding technology acceptance. Acceptance theories of individual innovations related to the examination of individual and cultural behaviors are discussed (Rulevy and Aprilianti, 2021). While the planned behavior theory deals with an individual's intention to adopt a behavior, the theory of diffusion and innovative behavior predicts the adoption of innovation (Dumpit and Fernandez, 2017). Researchers have found different factors affecting the acceptance or intention to use technology. In the table below, we will examine the individual and organizational technology acceptance models more fully.

Table 1.1: Theories related to technology acceptance

Main theorist and year of presentation	Theory	Acceptance level	
		Individual	Organizational
Rogers (2003, 1983, 1995)	Innovation Diffusion Theory	×	×
Moore and Benbest (1991)	Perceived characteristics of innovation	×	
Bandura (1986)	Social cognitive theory	×	
Davis (1989)	Technology acceptance model	×	
Venkatesh et al. (2003)	Secondary model of technology acceptance	×	
Ajzen (1991)	Theory of planned behavior	×	
Fishben and Ajzen (1975)	Theory of reasoned action	×	
Venkatesh et al. (2003)	Theory of Application technology and integrated acceptance	×	
Kwon and Zamud (1987)	Release and implementation model		×
Swanson (1994)	Three-core models		×
Dimitrou et al. (1990)	The framework of technology, organization, environment		×

According to the idea of reasoned action, a person's conduct is driven by behavioral aims, which depend on the person's attitude toward the activity and the subjective standards that surround its execution. The theory of reasoned action (TRA) is the foundation of the technology acceptance model (TAM), which explains individual acceptance behavior (Dutot et al., 2019). Davis (1989) made the initial TAM suggestion in his doctoral thesis. The Theory of Planned Behavior aids in understanding how to alter people's behavior. According to TPB, three factors—behavioral, normative, and control beliefs—influence human behavior. A few TAM-related parameters are included in TPB. TPB, however, does not specifically use information systems (IS). According to the Technology Acceptance Model, the perceived ease of use and utility aspects significantly affect how people use computers. In many different kinds of information systems, TAM has been extensively utilized to examine individual technology adoption behavior (Ibili et al., 2019).

Although the TAM model is tested with different situations and samples, and its validity has been confirmed in examining the use and acceptance of information systems, however, many developed models have been proposed for the TAM model. To explain how mental norms and cognitive processes affect perceived usefulness and attitude, the initial TAM technology acceptance model was developed as the TAM2 model. In this model, on the one hand, the items of the specified external variables, and on the other hand, the element of attitude have been removed from that model (Salimon et al., 2021). The reason for removing the attitude is that understanding the usefulness and understanding ease of using technology as behavioral beliefs in the basic model of technology acceptance leads to the creation of a positive or negative attitude in the individual. Therefore, in the secondary model of technology acceptance, where both factors exist and the presence of both is necessary to create an attitude, it is omitted to bring a separate variable called attitude. The TAM2 model tries to explain people's understanding of the usefulness of technology and the use intention regarding social effects and cognitive processes. The process of social influences such as subjective norm, optionality, mental image, and perceptual processes such as job relevance, output quality, provability of results, and perceived ease of use is significantly effective in the acceptance of technology by the user. It is also assumed that the impact of social processes on perceived usefulness and intention to use decreases with increasing user experience over time (Yu and Huang, 2020).

Although many theories and models have been presented and tested to measure the amount of use and factors affecting the acceptance or non-acceptance of information technology, still, one of the most reliable models is the Information Technology Acceptance Model (TAM) by Davis (1989). Based on this model, two categories of structures lead to the acceptance of information technology by users, which are (Figure 1):

- Internal constructs: the usefulness of use, ease of use, intention to use, attitude towards use, and actual use
- External structures: the support of the organization's managers, the appropriateness of the task of the technology, individual factors, social factors, organizational factors, computer systems characteristics, such as the type of software and hardware, the way of training, the complexity of the system, the optionality of users' experience and the like.

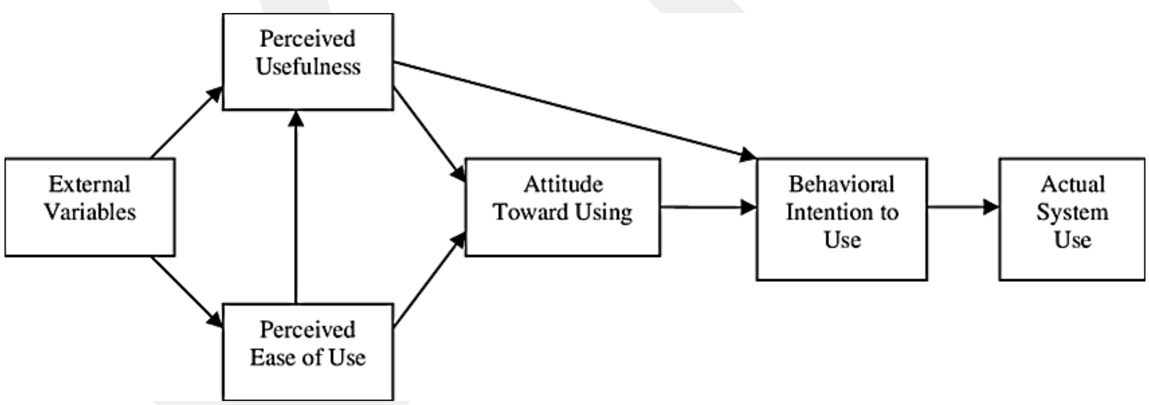

Figure 1.1: Conceptual Model Technology Acceptance Model (TAM)

This model is investigated and supported by various studies, and it has been proven that it can investigate how people accept new technologies in information systems. The main aspects of the TAM model are perceived usefulness and ease of use, two of the most important technology usage habits. Davis believes using a unique application system is enhanced through perceived usefulness, which is the subjective possibility that can improve the user's personal or work performance. Perceived ease of use (EOU) is defined as the extent to which the user can anticipate that working with the system does not require much effort (Okcu et al., 2019). According to this model, perceived usefulness and ease of use are the two main factors affecting the user's use of technology systems. Various external elements, such as social, political, and cultural, can affect these two main elements. Enabling conditions, talent, and language are influential social elements. Political crises and tendencies can also be external factors affecting the two main elements. Attitude towards the use of an information system application covers the user's evaluation of the suitability of using that application. This indicator is the behavioral intention, which predicts the user's use of that application (Park and Park, 2020).

The main use of TAM for researchers has been to investigate how users perceive different information systems. For example, Shafeek (2011) attempted to gauge instructors' acceptability of eLearning technologies. Pikkarainen et al. (2004) developed a model to understand the acceptability of online banking in Finland and examine its perceived usefulness. In their model, Hsu and Chiu examined the key factors in attracting e-services and considered the acceptance pattern and online self-efficacy as the most important factors. Zhou et al. (2010) created the online shopping acceptance model (OSAM) based on the TAM to study online shopping behavior. Pavlou (2003) included perceived risk and trust variables to create a model to predict the acceptance of e-commerce. Based on TAM and TPB models, Ervasti and Helaakoski (2010) developed a model for mobile phone services in which perceived usefulness was the most important acceptance factor.

1.5 Online Education

Incorporating technology for education, diversity, globalization, and novel conceptualizations standards of teaching are just a few of the new trends that have emerged in the higher education sector throughout the world. One of the factors for the evolution of teaching and learning has been technology. Both teachers and students often use networking media in both personal and professional settings. They investigate novel teaching and learning approaches. Meanwhile, increasingly tech-savvy generations of educators and students have adopted and benefited from teaching and learning management systems like Moodle and Blackboard. Online communication for academic purposes is not a kind of innovation anymore; rather, it has become the standard and a fact of life. Globalization and super-diversity are two other trends in higher education. This can be seen in how universities are becoming more globalized, where there are more interdisciplinary cross-campus courses, and students from different cultures connect via different networks, becoming more mobile between the real and virtual worlds. Most super-diversity and globalization-related issues have to do with language and culture, such as which language(s) are considered the common language for communication or instruction and how to handle cross-cultural communication in educational environments with super-diverse faculty members and students who are a part of communities of practice. New ideas on how to teach and learn effectively have also been developed. Traditional viewpoints emphasize explicit classroom learning and the teacher-student transfer of knowledge. In the past, teacher-centered "aims" and "goals" were prioritized over student-centered learning "outcomes" in the curriculum. People now view learning and teaching as continuing, sustainable, and lifelong relationships between instructors and students as a result of advancements in educational technologies and the increased contact between many languages and cultures. Implicit learning, mixed teaching and learning, and student- and class-centered teaching have all received more attention. Implicit learning is defined as a skill that "takes place every day without aim or conscious knowledge and has the main role in shaping our abilities, perceptions, and behavior" (Kaufman et al., 2010, p. 321). While face-to-face interaction and classroom instruction still predominate in the university setting, there is another "front" where technology and language collide in that teachers and students use different learning management system features, like those in Moodle and Blackboard, to provide a teaching environment and improve learning outcomes by collaboratively creating subject-matter knowledge.

The revolution of education across disciplines, from the social sciences and humanities to science and engineering, has been fueled in part by technology. Online teaching and learning has received funding and resource allocation from governments and education administrations. According to the central government and individual institutions in Turkey, information technologies and computers are integrated into education in all fields, including foreign language teaching, to provide better learning opportunities and modern learning environments for learners (Öztürk, 2012). The majority of the research now available on online education focuses on distance education and the growingly popular Massive Online Open Courses (MOOCs). Additionally, there is literature on computer-mediated communication (CMC) and blended or hybrid training that uses both face-to-face (FTF) methods.

2. METHODOLOGY

2.1 Research Model

Within the scope of this thesis study, the relationship between the demographic characteristics of the participants (gender, age, course code, expertise level, internet usage frequency, and interest in new technology) and the three scales (Cognitive absorption scale, Technology acceptance model, and Online self-learning modeling scale) we used in the study are examined.

2.2 Data Collection Tools

The subjects of the research are a total of 181 online students in the student group. The researcher carried out the application of the questionnaire tools to the students in the programming courses. There are 3 courses; Comp109 Introduction to Programming (Java), Comp110 Object Oriented Programming ve Comp210 Data Structures and Algorithms courses. Based on the questionnaires, this research aims to examine the effect of students' cognitive absorption, technology acceptance, and online educational software usability on student success in programming courses.

In this study, the following scales were applied in the survey measurements, respectively: Cognitive absorption scale (13 items), technology acceptance model (14 items), online educational software usability (39 items).

2.2.1 Cognitive Absorption Scale

Five factors (time, curiosity, pleasure, control, and focus of interest) and 13 items were taken into account in the cognitive involvement scale (Usluel & Vural; Agarwal & Karahanna, 2000). The items we used do not include some items in the cognitive capacity scale. The scale, adapted to Turkish by Usluel and Vural (2009), was carried out with 181 students. Factors with a low contribution to the model were excluded from the scale. Therefore, the remaining factors: Time (6 items), curiosity (2 items), the focus of attention (3 items), pleasure (1 item), and control (1 item), were included in the study.

In our research, a 13-item Turkishized scale was taken into account, and the evaluation on a 5-point Likert scale; It was expressed as "Strongly Agree (5)", "Agree (4)", "Undecided (3)", "Disagree (2)" and "Strongly Disagree (1)". The items of the cognitive involvement scale are presented in the Appendix.

2.2.2 Technology Acceptance Model

When it first appeared, the technology acceptance scale included the essential elements in terms of technology acceptance; It has been noted that there are perceived practicality, perceived ease of use, and behavioral purpose in technology use. With the addition of different factors, the technology acceptance scale continued its contribution to the literature under names such as TAM2 and TAM3 (Davis, 1989; Venkatesh, 2000, 2003). The researcher created the Technology Acceptance scale to a 14-item scale with the factors of perceived practicality of the online learning environment (7 items), ease of use (5 items), and intention to use (2 items). It was expressed as "Strongly Agree (5)", "Agree (4)", "Undecided (3)", "Disagree (2)," and "Strongly Disagree (1)". The items of the scale of the Technology Acceptance Model are presented in the Appendix.

2.2.3 Online Self-Learning Modeling Scale

The usability scale of online courses, developed by Koohang in 2004 for online learning environments, consists of 39 items. Nineteen factors determined by Koohang were interpreted from two different perspectives. For example, simplicity is questioned with the item "Online courses are not complicated." Similarly, the importance of simplicity is the "Simple use is important to me in the online course system." item is being measured. The 19 factors of the online learning educational software usability scale are presented in the Table. 5-point Likert scale evaluation; It was expressed as "Strongly Agree (5)", "Agree (4)", "Undecided (3)", "Disagree (2)", and "Strongly Disagree (1)". The items of the scale of the Technology Acceptance Model are presented in the Appendix.

2.3 Method of Data Analysis

The mean, median, mode, number, percent, and standard deviation were calculated to describe the essential characteristics of the data. The results are shown in the tables in the finding section.

A t-test was performed to decide whether or not the results were statistically significant. Analysis was made in SPSS 22.0 program. *Parametric* ANOVA, *parametric* Independent t-test, *non-parametric* Mann Whitney U test, *non-parametric Kruskal Wallis Test*, and Manova tests were used as difference tests.

3. DATA ANALYSIS

In this chapter, we will examine the results based on each of the studied variables.

3.1 Demographic Information

Table 3.1: Gender Distribution of Participants

Variable	Groups	f	%
Gender	Male	112	61.9
	Female	69	38.1

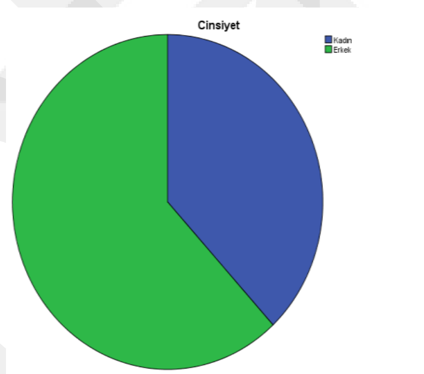

Figure 3.1: Gender Distribution of Participants

While 61.9% (112) of the participants are male, 38.1% (69) are female. Accordingly, it is possible to state that the research sample consists mainly of male participants.

Table 3.2: Age Distribution of Participants

Variable	Groups	f	%
Age	18	11	6.1
	19	33	18.2
	20	71	39.2
	21	45	24.9
	22	14	7.7
	23+	7	3.9

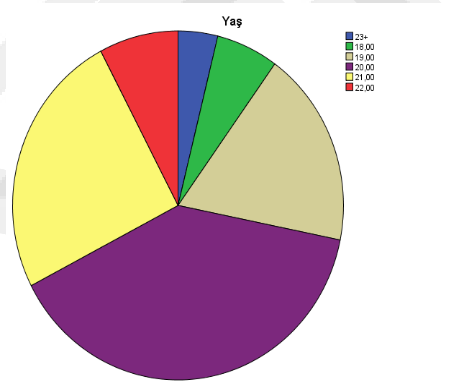

Figure 3.2: Age Distribution of Participants

While 39.2% (71) of the participants are 20 years old, 24.9% (45) are 21, 18.2% (33) are 19, 7.7% (14) are 22, 6.1% (11) are 18, and 3.9% (7) are 23 years old or older. While the largest group of participants is 20 years old, the lowest group of participants belongs to the age of 23 and above.

Table 3.3: Course Code Distribution of Participants

Variable	Groups	f	%
Course Code	COMP 109	78	43.1
	COMP 110	36	19.9
	COMP 201	67	37.0

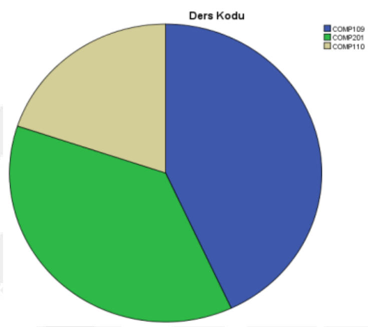

Figure 3.3: Course Code Distribution of Participants

While 43.1% (78) of the participants had the COMP 109 course code, 37% (67) had COMP 201, and 19.9% (36) had the COMP 110 course code.

Table 3.4: Distribution of Participants by Department

Variable	Groups	f	%
Department	Industrial Engineering	79	43.6
	Computer engineering	83	45.9
	Electric/Electronics Engineering	19	10.5

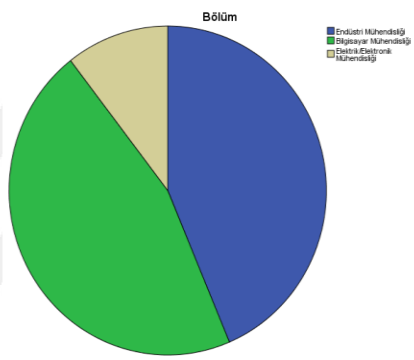

Figure 3.4: Distribution of Participants by Department

While 43.6% (83) of the participants study computer engineering, 43.6% (79) study industrial engineering, and 10.5% (19) study electric/electronic engineering.

Table 3.5: Distribution of Participants' Computer Expertise

Variable	Groups	f	%
Expertise Level	No Experience	11	6.1
	Novice	48	26.5
	Neutral	77	42.5
	Skilled	39	21.5
	Expert	6	3.3

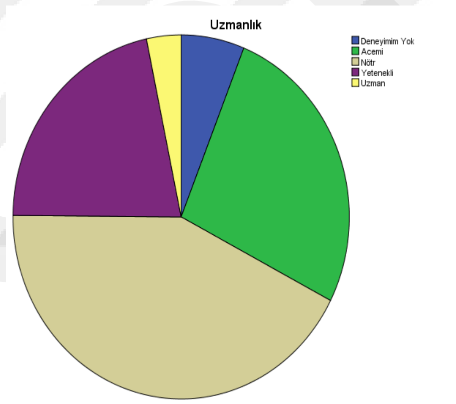

Figure 3.5: Distribution of Participants' Computer Expertise

While 42.5% (77) of the participants describe the level of expertise as neutral, 26.5% (48) are novice, 21.5% (39) are skilled, 6.1% (11) have no experience, and 3.3% (6) are experts.

Table 3.6: Frequency of Internet Use by Participants

Variable	**Groups**	**f**	**%**
Internet Usage Frequency	Rarely/Almost Never	1	0.6
	Occasionally/Sometimes	2	1.1
	Often	127	70.2
	Almost Always	51	28.2

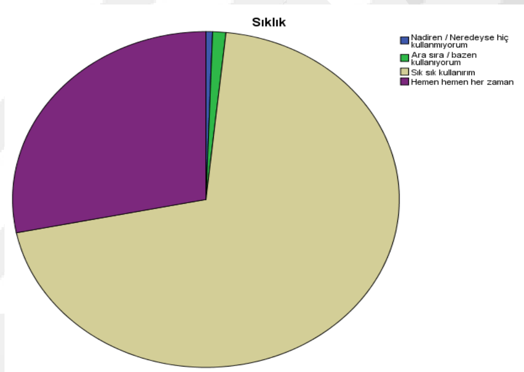

Figure 3.6: Frequency of Internet Use by Participants

While 70.2% (127) of the participants stated the frequency of internet use frequently, 28.2% (51) stated it almost always, 1.1% (2) occasionally/sometimes, and 0.6% (1) rarely/almost never.

Table 3.7: Distribution of Participants' Interest in New Technology

Variable	**Groups**	**f**	**%**
Interest in New Technology	Very low	3	1.7
	Below Average	2	1.1
	Average	31	17.1
	Above Average	89	49.2
	Very High	56	30.9

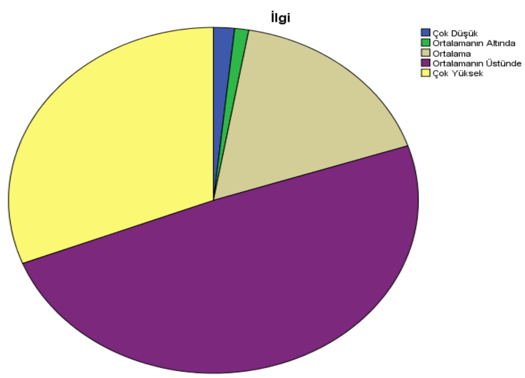

Figure 3.7: Distribution of Participants' Interest in New Technology

Finally, when distributions of the participants' interest in new technology are examined, it is seen that 49.2% (89) is above the average, 30.9% (56) is very high, 17.1% (31) has average, 1.7% (3) has very low, and 1.1% (2) has below average interest in new technology.

3.2 Normality Test

Table 3.8: Test of Normality

Scale	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	**df**	**Sig.**	**Statistics**	**df**	**Sig.**
Technology Acceptance	.081	180	.004	.966	180	.000
Online Education Software	.081	180	.004	.978	180	.004
Cognitive Access	.046	180	.200	.992	180	.432

H_0The series has a normal distribution at a 95% confidence level.

H_A: The series is not normally distributed at a 95% confidence level.

As a result of the normality test, it is concluded that since the significant values are less than 0.05 for the "technology acceptance" and "online education software" scales, H_0 is rejected, and they do not have a normal distribution at a confidence level of 95%. Non-parametric tests will be used in the different analyses in this direction. In the case of the "cognitive capability" scale, since the significant value is greater than 0.05, it is concluded that the H_0 cannot be rejected, and the series has a normal distribution at a 95% confidence level. Parametric tests will be used in the different analyses in this direction.

3.3 Gender Relationships

3.3.1 Relationship Between The Technological Acceptance Scale and Gender

Table 3.9: Technological Acceptance Scale Difference Test by Gender

Variable	N	Mean	Std. Deviation	F	Sig.
Female	69	3.95	.70	.069	.064
Male	112	3.75	.70		

H_0: There is no statistically significant difference in the answers of the participants by gender.

H_A: There is a statistically significant difference in the answers of the participants by gender.

A non-parametric Mann-Whitney U Test was used after the normality test. In this test, the Technological acceptance scale scores of females and males were compared. On average, the female (Mean = 3.95) were more than males (Mean = 3.75); however, the Mann-Whitney U test indicated that this difference was not statistically significant, U(female=69, male=112)=.069, p=.064. Since the sig value was greater than 0.05 at the 95% confidence level, the H_0 could not be rejected, and there was no statistically significant difference in the responses of the participants according to gender.

3.3.2 Relationship Between The E-education Software Usability Scale and Gender

Table 3.10: E-education software usability scale Difference Test by Gender

Variable	N	Mean	Std. Deviation	F	Sig.
Female	69	4.22	.43	.409	.066
Male	112	4.09	.47		

H_0: There is no statistically significant difference in the answers of the participants by gender.
H_A: There is a statistically significant difference in the answers of the participants by gender.

A non-parametric Mann-Whitney U Test was used after the normality test. In this test, the E-education software usability scale scores of females and males were compared. On average, the female (Mean = 4.22) were more than males (Mean = 4.09); however, the Mann-Whitney U test indicated that this difference was not statistically significant, U(female=69, male=112)=.409, p=.066. Since the sig value was greater than 0.05 at the 95% confidence level, the H_0 could not be rejected, and there was no statistically significant difference in the responses of the participants according to gender.

3.3.3 Relationship Between The Cognitive Absorption Scale and Gender

Table 3.11 Cognitive absorption Scale Difference Test by Gender

Variable	N	Mean	Std. Deviation	F	Sig.
Female	69	3.37	.65	.002	.169
Male	112	3.24	.67		

H_0: There is no statistically significant difference in the answers of the participants by gender.

H_A: There is a statistically significant difference in the answers of the participants by gender.

A parametric Independent t-test was used after the normality test. This test compared the cognitive absorption scale of females and males. On average, Females (Mean = 3.37, SD = 0.65) scored higher than Males (Mean = 3.24, SD = 0.67). An independent t-test indicated this difference, 1.00, 95%CI was not statistically significant, t = 0.002, p=.169. Since the sig value was greater than 0.05 at the 95% confidence level, the H_0 could not be rejected, and there was no statistically significant difference in the responses of the participants according to gender.

3.4 Course Relationships

3.4.1 Relationship Between Technological Acceptance Scale and Course Code

Table 3.12 Technological Acceptance Scale Difference Test by Course Code

Variable	N	Mean	Std. Deviation	F	Sig
COMP 109	78	4.01	.66		
COMP 201	67	3.71	.69	4.893	.009
COMP 110	36	3.65	.75		

H_0: There is no statistically significant difference in the answers of the participants according to the course code.

H_A: There is a statistically significant difference in the answers of the participants according to the course code.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the Technological Acceptance Scale Test scores of three groups (COMP 109, COMP 201, and COMP 110). On average, COMP 109 (Mean Rank = 4.01) scored higher than COMP 201 (Mean Rank = 3.71) and COMP 110 (Mean Rank = 3.65). A Kruskal-Wallis Test indicated there was a significant difference between the three groups, H = 4.893, p = .009. It was concluded that there is a statistically significant difference in the responses of the participants according to the course code. Therefore, H_0 is rejected since the sig value is less than 0.05 at the 95% confidence level. The examination determined that the technological acceptance levels of the participants with the COMP 109 course code were higher than the other participants.

3.4.2 Relationship Between E-education Software Usability Scale and Course Code

Table 3.13 E-education software usability scale Difference Test by Course Code

Variable	N	Mean	Std. Deviation	F	Sig
COMP 109	78	4.16	.48		
COMP 201	67	4.17	.43	.802	.450
COMP 110	36	4.05	.47		

H_0: There is no statistically significant difference in the answers of the participants according to the course code.

H_A: There is a statistically significant difference in the answers of the participants according to the course code.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the E-education software usability scale scores of three groups (COMP 109, COMP 201, and COMP 110). On average, COMP 109 (Mean Rank = 4.16) scored lower than COMP 201 (Mean Rank = 4.17) but higher than COMP 110 (Mean Rank = 4.05). A Kruskal-Wallis Test indicated no significant difference between the three groups, H = .802, p = .450. It was concluded that there is no statistically significant difference in the responses of the participants according to the course code. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to the course code.

3.4.3 Relationship Between Cognitive Absorption Scale and Course Code

Table 3.14 Cognitive absorption Scale Difference Test by Course Code

Variable	N	Mean	Std. Deviation	F	Sig
COMP 109	78	3.40	.68		
COMP 201	67	3.25	.68	2.285	.105
COMP 110	36	3.12	.57		

H_0: There is no statistically significant difference in the answers of the participants according to the course code.

H_A: There is a statistically significant difference in the answers of the participants according to the course code.

A parametric ANOVA Test was used after the normality test. This test compared the cognitive absorption scale test scores of three groups (COMP 109, COMP 201, and COMP 110). On average, COMP 109 (Mean Rank = 3.40) scored higher than COMP 201 (Mean Rank = 3.25) and COMP 110 (Mean Rank = 3.12). The test indicated no significant difference between the three groups, H = 2.285, p = .105. It was concluded that there is no statistically significant difference in the responses of the participants according to the course code. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to the course code.

3.5 Department Relationships

3.5.1 Relationship Between Technological Acceptance Scale and Department

Table 3.15 Technological Acceptance Scale Difference Test by Department

Variable	**N**	**Mean**	**Std. Deviation**	**F**	**Sig**
Industrial Engineering	79	4.01	.66		
Computer engineering	83	3.63	.73	6.426	.002
Electrical engineering	19	3.92	.58		

H_0: There is no statistically significant difference in the answers of the participants according to the department.
H_A: There is a statistically significant difference in the answers of the participants according to the department.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the Technological Acceptance Scale test scores of three groups (Industrial Engineering, Computer engineering, and Electrical engineering). On average, Computer engineering (Mean Rank = 3.63) scored higher than the other departments. Kruskal-Wallis Test indicated there was a significant difference between the three groups, H = 6.426, p = .002. Therefore, H_0 is rejected since the sig value is less than 0.05 at the 95% confidence level. The examination determined that the technological acceptance levels of the Computer engineering department were higher than the other participants.

3.5.2 Relationship Between E-education Software Usability Scale and Department

Table 3.16 E-education software usability scale Difference Test by Department

Variable	N	Mean	Std. Deviation	F	Sig
Industrial Engineering	79	4.16	.48		
Computer engineering	83	4.15	.44	.480	.619
Electrical engineering	19	4.04	.50		

H_0: There is no statistically significant difference in the answers of the participants according to the department.
H_A: There is a statistically significant difference in the answers of the participants according to the department.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the E-education software usability scale test scores of three groups (Industrial Engineering, Computer engineering, and Electrical engineering). A Kruskal-Wallis Test indicated no significant difference between the three groups, H = .480, p = .619. As a result of the test, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level and that there is no statistically significant difference in the responses of the participants according to the department.

3.5.3 Relationship between Cognitive absorption Scale and Department

Table 3.17 Cognitive Absorption Scale Difference Test by Department

Variable	N	Mean	Std. Deviation	F	Sig
Industrial Engineering	79	3.39	.67		
Computer engineering	83	3.19	.64	1.880	.156
Electrical engineering	19	3.31	.70		

H_0: There is no statistically significant difference in the answers of the participants according to the department.
H_A: There is a statistically significant difference in the answers of the participants according to the department.

A parametric ANOVA Test was used after the normality test. This test compared the cognitive absorption scale test scores of three (Industrial Engineering, Computer engineering, and Electrical engineering). The test indicated no significant difference between the three groups, H = 1.880, p = .156. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to the department.

3.6 Age Relationships

3.6.1 Relationship between Technological Acceptance Scale and Age

Table 3.18 Technological Acceptance Scale Difference Test by Age

Variable	N	Mean	Std. Deviation	F	Sig
18	11	4.09	.68		
19	33	3.86	.70		
20	71	3.85	.78		
21	45	3.64	.67	1.655	.148
22	14	4.13	.42		
23+	7	3.58	.53		

H_0: There is no statistically significant difference in the responses of the participants by age.

H_A: There is a statistically significant difference in the responses of the participants according to age.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the Technological Acceptance Scale test scores of age groups (18,19,20,21,22,23+). The test indicated no significant difference between the three groups, H = 1.655, p = .148. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the Technological Acceptance Scale according to age.

3.6.2 Relationship Between E-education Software Usability Scale and Age

Table 3.19 E-education software usability scale Difference Test by Age

Variable	N	Mean	Std. Deviation	F	Sig
18	11	4.26	.44		
19	33	4.17	.39		
20	71	4.11	.53		
21	45	4.11	.37	.703	.622
22	14	4.11	.37		
23+	7	4.04	.63		

H_0: There is no statistically significant difference in the responses of the participants by age.

H_A: There is a statistically significant difference in the responses of the participants according to age.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the e-education software usability scale test scores of age groups (18,19,20,21,22,23+). The test indicated no significant difference between the three groups, H = .703, p = .622. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the Technological Acceptance Scale according to age.

3.6.3 Relationship Between Cognitive Absorption Scale and Age

Table 3.20 Cognitive absorption Scale Difference Test by Age

Variable	N	Mean	Std. Deviation	F	Sig
18	11	3.29	.78		
19	33	3.35	.60		
20	71	3.31	.68		
21	45	3.22	.69	.755	.584
22	14	3.45	.63		
23+	7	2.92	.52		

H_0: There is no statistically significant difference in the responses of the participants by age.

H_A: There is a statistically significant difference in the responses of the participants according to age.

A parametric ANOVA Test was used after the normality test. This test compared the cognitive absorption scale test scores of age groups (18,19,20,21,22,23+). The test indicated no significant difference between the groups, H = .755, p = .584. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to their ages.

3.7 Expertise Relationships

3.7.1 Relationship Between Technological Acceptance Scale and Expertise

Table 3.21 Technological Acceptance Scale Difference Test by Expertise

Variable	N	Mean	Std. Deviation	F	Sig
No Experience	11	3.87	.72		
Novice	48	3.96	.56		
Neutral	77	3.80	.68	.812	.519
Skilled	39	3.69	.90		
Expert	6	3.92	.75		

H_0: There is no statistically significant difference in the answers of the participants according to the expertise.
H_A: There is a statistically significant difference in the answers of the participants according to the expertise.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the technological acceptance scale scores of expertise groups (No Experience, Novice, Neutral, Skilled, Expert). The test indicated no significant difference between the groups, H = .812, p = .519. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the Technological Acceptance Scale according to their expertise.

3.7.2 Relationship Between E-education Software Usability Scale and Expertise

Table 3.22 E-education software usability scale Difference Test by Expertise

Variable	N	Mean	Std. Deviation	F	Sig
No Experience	11	4.27	.47		
Novice	48	4.16	.44		
Neutral	77	4.09	.46	.736	.569
Skilled	39	4.20	.46		
Expert	6	4.03	.62		

H_0: There is no statistically significant difference in the answers of the participants according to the expertise.
H_A: There is a statistically significant difference in the answers of the participants according to the expertise.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the e-education software usability scale scores of expertise groups (No Experience, Novice, Neutral, Skilled, Expert). The test indicated no significant difference between the groups, H = .736, p = .569. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the Technological Acceptance Scale according to their expertise.

3.7.3 Relationship Between Cognitive Absorption Scale and Expertise

Table 3.23 Cognitive absorption Scale Difference Test by Expertise

Variable	N	Mean	Std. Deviation	F	Sig
No Experience	11	3.32	.71		
Novice	48	3.25	.68		
Neutral	77	3.26	.60	.240	.916
Skilled	39	3.36	.80		
Expert	6	3.43	.41		

H_0: There is no statistically significant difference in the answers of the participants according to the expertise.
H_A: There is a statistically significant difference in the answers of the participants according to the expertise.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the Cognitive absorption Scale scores of expertise groups (No Experience, Novice, Neutral, Skilled, Expert). The test indicated no significant difference between the groups, H = .736, p = .569. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the Cognitive absorption Scale according to their expertise.

3.8 Frequency of Internet Use Relationships

3.8.1 Relationship Between Technological Acceptance Scale and Frequency of Internet Use

Table 3.24 Technological Acceptance Scale Difference Test by Frequency of Internet Use

Variable	N	Mean	Std. Deviation	F	Sig
Rarely/Almost Never	1	3.00	-		
Occasionally/Sometimes	2	3.60	.35	.562	.641
Often	127	.382	.71		
Almost Always	51	3.86	.71		

H_0: There is no statistically significant difference in the answers of the participants according to the frequency of internet use.
H_A: There is a statistically significant difference in the answers of the participants according to the frequency of internet use.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the technological acceptance scale scores of expertise groups (No Experience, Novice, Neutral, Skilled, Expert). The test indicated no significant difference between the groups, H = .562, p = .641. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the technological acceptance scale according to their frequency of internet use.

3.8.2 Relationship Between E-education Software Usability Scale and Frequency of Internet Use

Table 3.25 E-education software usability scale Difference Test by Frequency of Internet Use

Variable	N	Mean	Std. Deviation	F	Sig
Rarely/Almost Never	1	3.00	-		
Occasionally/Sometimes	2	3.64	.36	2.936	.065
Often	127	4.15	.45		
Almost Always	51	4.15	.46		

H_0: There is no statistically significant difference in the answers of the participants according to the frequency of internet use.

H_A: There is a statistically significant difference in the answers of the participants according to the frequency of internet use.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the technological acceptance scale scores of frequency of internet usage groups (Rarely/Almost Never, Occasionally/Sometimes, Often, Almost Always). The test indicated no significant difference between the groups, H = .2.936, p = .065. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the technological acceptance scale according to their expertise.

3.8.3 Relationship Between Cognitive Absorption Scale and Frequency of Internet Use

Table 3.26 Cognitive absorption Scale Difference Test According to Frequency of Internet Use

Variable	**N**	**Mean**	**Std. Deviation**	**F**	**Sig**
Rarely/Almost Never	1	3.00	-		
Occasionally/Sometimes	2	3.38	.10	.224	.879
Often	127	3.31	.66		
Almost Always	51	3.23	.70		

H_0: There is no statistically significant difference in the answers of the participants according to the frequency of internet use.
H_A: There is a statistically significant difference in the answers of the participants according to the frequency of internet use.

A parametric ANOVA Test was used after the normality test. This test compared the cognitive absorption scale test scores of the frequency of internet use groups (Rarely/Almost Never, Occasionally/Sometimes, Often, Almost Always). The test indicated no significant difference between the groups, H = .224, p = .879. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to their frequency of Internet use.

3.9 Interest in Technology Relationships

3.9.1 Relationship Between Technological Acceptance Scale and Interest in Technology

Table 3.27 Technological Acceptance Scale Difference Test According to Interest in Technology

Variable	N	Mean	Std. Deviation	F	Sig
Very low	3	3.11	.60		
Below Average	2	3.92	1.41		
Average	31	3.94	.68	1.013	.402
Above Average	89	3.83	.64		
Very High	56	3.79	.80		

H_0: There is no statistically significant difference in the answers of the participants according to the interest in technology.
H_A: There is a statistically significant difference in the answers of the participants according to the interest in technology.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the technological acceptance scale scores of interest in technology groups (Very low, Below Average, Average, Above Average, Very High). The test indicated no significant difference between the groups, H = 1.013, p = .402. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the technological acceptance scale according to their interest in technology.

3.9.2 Relationship Between E-education Software Usability Scale and Interest in Technology

Table 3.28 E-education software usability scale Difference Test According to Interest in Technology

Variable	N	Mean	Std. Deviation	F	Sig
Very low	3	3.77	.23		
Below Average	2	4.43	.39		
Average	31	4.16	.49	.669	.615
Above Average	89	4.14	.42		
Very High	56	4.14	.52		

H_0: There is no statistically significant difference in the answers of the participants according to the interest in technology.
H_A: There is a statistically significant difference in the answers of the participants according to the interest in technology.

A non-parametric Kruskal Wallis Test was used after the normality test. This test compared the e-education software usability scale scores of interest in technology groups (Very low, Below Average, Average, Above Average, Very High). The test indicated no significant difference between the groups, H = .669, p = .615. Therefore, it was concluded that H_0 could not be rejected because the sig value is greater than 0.05 at the 95% confidence level, and there is no statistically significant difference in the responses of the participants to the e-education software usability scale according to their interest in technology.

3.9.3 Relationship Between Cognitive Absorption Scale and Interest in Technology

Table 3.29 Cognitive absorption Scale Difference Test According to Interest in Technology

Variable	N	Mean	Std. Deviation	F	Sig
Very low	3	2.84	.53		
Below Average	2	2.53	.21		
Average	31	3.14	.64	1.975	.100
Above Average	89	3.29	.63		
Very High	56	3.42	.72		

H_0: There is no statistically significant difference in the answers of the participants according to the interest in technology.
H_A: There is a statistically significant difference in the answers of the participants according to the interest in technology.

A parametric ANOVA Test was used after the normality test. This test compared the cognitive absorption scale test scores of the interest in technology groups (Very low, Below Average, Average, Above Average, Very High). The test indicated no significant difference between the groups, H = 1.975, p = .100. Therefore, H_0 cannot be rejected because the sig value is greater than 0.05, and there is no statistically significant difference in the answers of the participants according to their interest in technology

3.10 Manova Test of Gender, Department, and Computer Expertise

3.10.1 Manova Test by Gender

Table 3.30 Manova Test by Gender

Box's Test of Equality of Covariance Matrices[a]

Box's M	2.433
F	.397
df1	6
df2	132868.358
Sig .	.881

multivariate test [b]

Effect		value	F	Hypothesis df	error df	Sig.	Partial Eta squared
intercept	Pillai's trace	.987	4552.526 [a]	3.000	176.000	.000	.987
	Wilks ' Lambda	.013	4552.526 [a]	3.000	176.000	.000	.987
	Hotelling's trace	77.600	4552.526 [a]	3.000	176.000	.000	.987
	Roy's largest root	77.600	4552.526 [a]	3.000	176.000	.000	.987
Gender	Pillai's trace	.026	1.568 [a]	3.000	176.000	.199	.026
	Wilks ' Lambda	.974	1.568 [a]	3.000	176.000	.199	.026
	Hotelling's trace	.027	1.568 [a]	3.000	176.000	.199	.026

	Roy's largest root	.027	1.568 [a]	3.000	176.000	.199	.026

a . Exact statistic

b . Design: Intercept + Gender

As a result of the test, it is concluded that the assumption that the variances are evenly distributed is met because the sig value in the first table is higher than 0.05, and the findings obtained as a result of the analysis are concluded to be reliable. When the sig values in the second table are examined, it is concluded that there is no statistically significant difference in the groups according to the change in gender since the sig value of Wilks' Lambda is greater than 0.05.

3.10.2 Manova Test by Gender and Department

Table 3.31 Manova Test by Gender and Department

Box's Test of Equality of Covariance Matrices [a]

Box's M	50.078
F	1.440
df1	30
df2	1161.666
Sig .	.060

multivariate test [c]

Effect		value	F	Hypothesis df	error df	Sig.	Partial Eta squared
intercept	Pillai's trace	.975	2205.254[a]	3.000	172.000	.000	.975
	Wilks ' Lambda	.025	2205.254[a]	3.000	172.000	.000	.975
	Hotelling's trace	38.464	2205.254[a]	3.000	172.000	.000	.975
	Roy's largest root	38.464	2205.254[a]	3.000	172.000	.000	.975
Gender	Pillai's trace	.027	1.593 [a]	3.000	172.000	.193	.027
	Wilks ' Lambda	.973	1.593 [a]	3.000	172.000	.193	.027

	Hotelling's trace	.028	1.593 [a]	3.000	172.000	.193	.027
	Roy's largest root	.028	1.593 [a]	3.000	172.000	.193	.027
Department	Pillai's trace	.103	3.126	6.000	346.000	.005	.051
	Wilks ' Lambda	.898	3.183 [a]	6.000	344.000	.005	.053
	Hotelling's trace	.114	3.239	6.000	342.000	.004	.054
	Roy's largest root	.110	6.318 [b]	3.000	173.000	.000	.099
Gender * Department	Pillai's trace	.030	.885	6.000	346.000	.506	.015
	Wilks ' Lambda	.970	.884 [a]	6.000	344.000	.507	.015
	Hotelling's trace	.031	.882	6.000	342.000	.508	.015
	Roy's largest root	.027	1.566 [b]	3.000	173.000	.199	.026

a . Exact statistic

b . the statistic is an upper bound on F that yields a lower bound on the significance level

c . Design: Intercept + Gender + Department + Gender * Department

As a result of the test, it is concluded that the assumption that the variances are evenly distributed is met because the sig value in the first table is higher than 0.05, and the findings obtained as a result of the analysis are concluded to be reliable. When the sig values in the second table are examined, it is concluded that since the sig value of Wilks' Lambda is greater than 0.05, there is no statistically significant difference in the groups according to the change in gender and department.

3.10.3 Manova Test by Gender, Department and Computer Expertise

Table 3.32 Manova Test by Gender, Department, and Computer Expertise

Box's Test of Equality of Covariance Matrices [a]

Box's M	171.166
F	1.620
df1	84
df2	3206.118
Sig .	.000

multivariate test [c]

Effect		value	F	Hypothesis df	error df	Sig.	Partial Eta squared
intercept	Pillai's trace	.961	1283.954 [a]	3.000	155.000	.000	.961
	Wilks ' Lambda	.039	1283.954 [a]	3.000	155.000	.000	.961
	Hotelling's trace	24.851	1283.954 [a]	3.000	155.000	.000	.961
	Roy's largest root	24.851	1283.954 [a]	3.000	155.000	.000	.961
Gender	Pillai's trace	.015	.780 [a]	3.000	155.000	.507	.015
	Wilks ' Lambda	.985	.780 [a]	3.000	155.000	.507	.015

	Hotelling's trace	.015	.780 [a]	3.000	155.000	.507	.015
	Roy's largest root	.015	.780 [a]	3.000	155.000	.507	.015
Department	Pillai's trace	.125	3.458	6.000	312.000	.003	.062
	Wilks ' Lambda	.876	3.535 [a]	6.000	310.000	.002	.064
	Hotelling's trace	.141	3.611	6.000	308.000	.002	.066
	Roy's largest root	.135	6.997 [b]	3.000	156.000	.000	.119
Expertise	Pillai's trace	.108	1.471	12.000	471.000	.131	.036
	Wilks ' Lambda	.893	1.489	12.000	410.383	.125	.037
	Hotelling's trace	.117	1.503	12.000	461.000	.119	.038
	Roy's largest root	.097	3.818 [b]	4.000	157.000	.005	.089
Gender * Department	Pillai's trace	.019	.499	6.000	312.000	.809	.010
	Wilks ' Lambda	.981	.498 [a]	6.000	310.000	.810	.010
	Hotelling's trace	.019	.496	6.000	308.000	.811	.010
	Roy's largest root	.017	.892b –	3.000	156.000	.447	.017
Gender * Expertise	Pillai's trace	.119	1.627	12.000	471.000	.081	.040
	Wilks ' Lambda	.883	1.647	12.000	410.383	.076	.041

	Hotelling's trace	.130	1.662	12.000	461.000	.072	.041
	Roy's largest root	.104	4.091 [b]	4.000	157.000	.004	.094
Department * Expertise	Pillai's trace	.107	.969	18.000	471.000	.494	.036
	Wilks ' Lambda	.896	.968	18.000	438.891	.496	.036
	Hotelling's trace	.113	.967	18.000	461.000	.497	.036
	Roy's largest root	.072	1.886 [b]	6.000	157.000	.086	.067
Gender * Department * Expertise	Pillai's trace	.038	.670	9.000	471.000	.736	.013
	Wilks ' Lambda	.962	.667	9.000	377.380	.739	.013
	Hotelling's trace	.039	.664	9.000	461.000	.741	.013
	Roy's largest root	.031	1.616 [b]	3.000	157.000	.188	.030

a . Exact statistic

b . The statistic is an upper bound on F that yields a lower bound on the significance level.

c . Design: Intercept + Gender + Division + Expertise + Gender * Division + Gender * Expertise + Division * Expertise + Gender * Division * Expertise

As a result of the test, it is concluded that since the sig value in the first table is less than 0.05, the assumption that the variances are evenly distributed is not met, and it is concluded that there are doubts about the reliability of the findings obtained as a result of the analysis. When the sig values in the second table are examined, it is concluded that since the sig value of Pillai's Trace is greater than 0.05, there is no statistically significant difference in the groups according to the change in gender, department, and computer expertise.

4. RESULTS AND DISCUSSION

Private schools and institutions, universities and higher education institutions, are institutions that fulfill their mission and goals to achieve excellence and are responsible for the leadership of the educated class of society on a wider level. Since the end of December 2019, the world has faced a huge challenge called COVID-19, which has resulted in challenging the economic, industrial, health, and educational systems of countries (Chen et al., 2020). However, with the schools and educational centers closure, the educational system of the communities was affected by these conditions. In the meantime, communication technologies were used as helpful tools to enhance the efficiency and quality of education. It can be said that virtual classes have had many positive aspects, but considering the prevalence of this disease, it is logical to conclude that online education has been an immediate need (Almazova et al., 2020).

Various studies have confirmed the significant role of e-learning for educational and learning activities during the period of the Covid-19 crisis and showed that various applications such as Zoom, Teams, Google Classroom, and many others applications help learners and students to study at home during the Covid-19 crisis (Almazova et al., 2020, Alam, 2020). Qazi et al. (2020) stated that before the spread of Covid-19, many countries have been using e-learning in emergency situations for a long time. But following the spread of Covid-19, many countries have changed their methods from traditional face-to-face methods to electronic education in schools and higher education institutions due to the new emergency conditions. However, there is a difference between distance education in normal circumstances and in emergencies which are usually not planned in advance because, after the emergency, everything is supposed to go back to normal. In addition, teachers have to work under very stressful conditions without knowing when the crisis will end. However, post-coronavirus crisis, e-learning will be completely different, especially in developing countries. Education leaders and policymakers need to examine new experiences about education in crisis time to improve online learning systems.

This study evaluates students' cognitive absorption, technology acceptance, and e-education software usability scale in online programming courses. Each of these three scales was examined from seven different perspectives: Gender, Course Code, Department, Age, Expertise, Frequency of Internet use, and Interest in technology. In the following, the results of each of these scales are presented from these perspectives, compared with related studies, and suggestions are presented based on the obtained results.

4.1 Cognitive Absorption

The present study investigated participants' cognitive absorption levels in online programming classes. The results obtained are as follows:

- There was no significant difference between male and female participants in the amount of cognitive absorption.
- There was no significant difference between the participants of different courses in the amount of cognitive absorption.
- There was no significant difference between the participants' department and the level of cognitive absorption.
- There was no significant difference between the age of the participants and the amount of cognitive absorption.
- There was no significant difference between the expertise of the participants and the amount of cognitive absorption.
- There was no significant difference between the participants' Internet use and the amount of cognitive absorption.
- There was no significant difference between participants' interest in technology and cognitive absorption.

One of the most influential and fundamental variables in the perceived learning of learners in virtual environments is cognitive absorption. Agarwal (1997) introduced the construct of cognitive absorption to study technology use behavior in individuals. Based on this, cognitive absorption expresses a type of internal motivation and occurs where the behavior is intrinsically attractive and pleasurable, and the person does not expect external rewards from performing that behavior. Our results showed that cognitive absorption in classrooms is a concept of involvement and interaction between the learner and the learning environment, which can provide experiences for the learner during an educational intervention. Cognitive absorption in teaching and learning is a vital and fundamental thing because it plays a fundamental role as a motivational lever in achieving educational goals. The students express this experience as a positive and enjoyable experience, and when a user is immersed in the virtual learning space interacting with technology, which is characterized by full involvement, a sense of control and a sense of pleasure is created, and the learner does not understand the passage of time. In this regard, our results are consistent with other studies. Ouertani and Alhudhud (2019) showed in their studies that cognitive absorption is an intrinsic motivation that is very important in the study of technology adoption and usage behavior because it plays a role in the background of implicit beliefs about information technology. Therefore, cognitive absorption is mainly considered in examining the behavior patterns of technology use, such as how learners' beliefs are formed and the desire to use technology in educational environments and its use. Rodrigues et al. (2016) have pointed out that five dimensions manifest cognitive absorption: time segregation, referring to the user's inability to record how time is spent interacting with technology; Focused immersion, referring to the user's experience of full engagement where attention to other matters is excluded; infinite pleasure, attention to the desirable aspects of technology; control the user's understanding of mutual responsibility in cyberspace; and curiosity, which is the experience of individual sensory stimulation and cognitive curiosity. The positive cognitive absorption effect on perceived usefulness is explained by cognitive dissonance. Cognitive dissonance is a condition that occurs when there are abnormal and inappropriate relationships among cognitive elements. Dutot et al. (2019) and Tcha-Tokey et al. (2016) slightly modified this definition so that cognitive absorption is the deep involvement or comprehensive experience that a person experience with information technology. Balakrishnan and Dwivedi (2021) define cognitive absorption as a mode of engagement with technology.

The spread of the Covid-19 disease in these years can also have an impact on obtaining these results. Butnaru et al. (2021) conducted a study by collecting data from structured questionnaires to 200 respondents consisting of teachers, students, parents, and policymakers selected from different countries. This study showed the negative effects of Covid-19 on education, including reduced access to educational facilities learning disorders, job loss, and increased student debt. Their results show that many students and educators relied on technology to ensure continued online learning during the coronavirus pandemic. However, poor digital skills and poor infrastructure such as network access and lack of access, have hindered online education. Oducado (2020) investigated the creation of a quarantine period curriculum to strengthen education during the outbreak of Covid-19. This study concluded that the Covid-19 crisis can be a valuable experience for teachers and students to practice teamwork and joint learning and be able to use this experience well in the future. Also, creating a separate online curriculum has many strengths. This program empowers learners to participate according to their time and ability. This method creates virtual communities of learners.

Pokhrel and Chhetri (2021) stated in this study that the Polytechnic University of Turin, Italy, established virtual teaching after the closure of all universities, and from February 25, 2020, held about 600 virtual classes daily and served more than 16,000 students daily. They also reported an image of a sudden change in traffic on the Polytechnic University network up to 1.5 gigabytes per second due to the outbreak of Covid-19. Because of restrictions on people's movement, holidays, and social distancing, remote work solutions, online collaboration, and electronic learning grew. Also, people used the Internet to perform entertainment activities such as games and downloads, and thus the volume of international traffic increased by about 40%, and this caused the download performance to decline and the resilience of the Internet to be questioned. However, in the end, they pointed out that the Internet has proven that it is possible to successfully deal with the challenges while maintaining and continuing the university's operations.

Peimani and Kamalipour (2021) reffered to UNESCO's estimates about the closure of higher education institutions in 114 countries and about 890 million students staying at home around the world. The researchers stated that the crisis caused by the Covid-19 virus has changed the schedule of conferences, sports events, and many institutions, and has caused the cancellation of face-to-face classes and turning them into online sessions, forcing universities and higher education institutions to take preventive measures to maintain the health of students. They claimed that anxiety and depression, which are aggravated by the uncertainty and ambiguity of the flow of information, will grow widely. Also, the negative physiological consequences of stress will be revealed, and loneliness, which is increased under these conditions, will have a negative impact on education and, subsequently, on mental pain and suffering.

Most of the empirical research related to cognitive absorption has focused on the effects that cognitive absorption has on user beliefs, such as perceived ease of use and perceived usefulness. In our study, while no significant difference was observed between the demographic information of the respondents and their cognitive absorption scores, they all had high scores in cognitive absorption in online classes. These findings were consistent with previous studies. For example, Han and Sa (2022), Albayati et al. (2020), and Rulevy and Aprilianti (2021) have all recognized the positive effect of cognitive absorption on perceived ease of use and perceived usefulness. Various studies have investigated the effect of cognitive absorption in the use of social networks in education (Butt et al., 2022), mobile learning environments (Zhong et al., 2021),3D education environments (Pakaja and Wafa, 2021), and online learning environments (Kunz and Santomier, 2019). Our study was one of the first to focus on cognitive absorption in the context of programming online classes.

On the other hand, related studies have shown that cognitive engagement plays a decisive role in learning, especially perceived learning in virtual environments (Mousa et al., 2020). Cognitive engagement refers to a person's voluntary effort to understand and master challenging tasks. Cognitive engagement is the level of psychological investment required by the learning goal and the difficulty of prioritizing the task (Hornbæk and Hertzum, 2017). Numerous studies have shown that learners who are more cognitively involved in learning and learning tasks can pay great attention to achieving cognitive and behavioral goals (Scarpin et al., 2018, Wirtz and Göttel, 2016).

Dumpit and Fernandez (2017) found that engagement in virtual environments leads to a tendency to use them more. In addition, virtual environments cause users' practical involvement in searching widely for information, a new environment for more involvement and interaction with the virtual environment, and this can reflect the level of motivation of the user in using virtual environments.

The direct effect of the components of cognitive absorption in the current research is consistent with Mpinganjira (2019), van Bijsterveldt (2020), and Hookham et al. (2016), and is contrary to the research result of Scholtz et al. (2016). According to the obtained results, it can be argued that the more the learner interacts with virtual environments, the deeper the learning becomes effective, and it was shown that using virtual environments in learning improves academic performance.

4.2 Technology Acceptance Model

The present study investigated participants' technology acceptance levels in online programming classes. The results obtained are as follows:

- There was no significant difference between male and female participants in the amount of technology acceptance.
- There was a significant difference between the participants of different courses in the amount of technology acceptance. The technological acceptance levels of the COMP 109 course code participants were higher than the other participants.
- There was a significant difference between the participants' departments and the level of technology acceptance. The technological acceptance levels of the Computer engineering department were higher than the other participants.
- There was no significant difference between the age of the participants and the amount of technology acceptance.
- There was no significant difference between the expertise of the participants and the amount of technology acceptance.
- There was no significant difference between the participants' Internet use and the amount of technology acceptance.

- There was no significant difference between participants' interest in technology and technology acceptance.

Our examinations showed that technology acceptance is significantly higher in the COMP 109 or Java course group and the Computer Engineering Department. The data analysis showed that the structural model of technology acceptance of the computer engineering department had a good fit with respect to the goodness of fit indices and the relationships between all the variables of this model were positive and significant. However, the structural model of technology acceptance of other groups did not fit well and had weak path coefficients. The results of this research are consistent with the results of Salimon et al. (2021) and Ramadhan et al. (2022) regarding the relationships between the variables of the technology acceptance model and learning departments.

Related studies have shown that according to the significant impact of different departments' mental perception of the usefulness of information technology on the attitude of learners. This issue is especially true for teachers because they welcome technologies that are recognized for education will be helpful. For example, saving time and facilitating education are important factors of the usefulness of technologies. Based on the significant effect of different departments' subjective perception of ease of use on the student's attitude toward the structural model of the computer engineering group and the lack of significance of the same path in the structural model of other groups, many students of other departments were worried about the difficulty of using today's technologies. They were willing to use older facilities rather than deal with the rigors of working with technology. However, studies have shown that there was no anxiety in using new technologies in trained people (RAHMAN et al., 2019).

Therefore, according to the role of the variables of subjective perception of ease of use and subjective perception of usefulness and their positive effect on the attitude of learners, it is suggested to the managers of information technology-related systems to purchase and design systems that suit the educational needs of learners and are useful in their learning process and easy to use. For example, they should use more graphical options instead of commands. In this case, the subjective perception of usefulness will positively affect the intention to use information technology, which was also obtained in a positive and meaningful structural model (Ahmed, 2016).

The spread of the Covid-19 disease in these years can also have an impact on obtaining these results. Paudel (2021) examined support for continuing education and learning during the Covid-19 pandemic. Their results showed that the epidemic of the Covid-19 virus is a constructive and irreversible challenge for teachers, for which no textbook contains appropriate answers and necessary guidance; Therefore, educational leaders must quickly design the necessary responses, taking into account specific contexts. Adnan and Anwar (2020) evaluated the psychological impact of the COVID-19 epidemic on dental students in Saudi Arabia by studying 697 dental students in Saudi Arabia. This study concluded that the long-term implementation of the online education system can greatly affect academic performance and have negative effects on students' mental health. Dental students may struggle with various aspects of their studies, such as clinical requirements and examination patterns, creating more stress for these students. This study has shown that dental students in Saudi Arabia experience significant stress, depression, and anxiety after online classes during their academic years. Chakraborty et al. (2021) investigated the possible impact of Covid-19 on education. They are of the opinion that estimates made in France, Italy, and Germany show that students suffer between 0.82 standard deviations of learning loss during weekly school closures. Such a loss is reflected in the reduction of students' test scores due to the less time they have spent on education compared to the time they spend learning in school and face to face.

Referring to the Covid-19 pandemic, Hussein Hakeem Barzani (2021) investigated the management methods of the Romanian society to face the challenges in the field of education, and to collect data, they distributed a questionnaire with 19 questions among 200 undergraduate and graduate students of Petros University. The results of the research showed that students quickly adapted to virtual education, and between March and May, 87% of them participated in online courses; Email was used as an exam tool at the level of 33 to 44 percent and WhatsApp at the level of 6 to 12 percent. The online test ranged from 45 to 52 percent, and the most used equipment was a smartphone, and 42 percent of students participated in online courses through a smartphone; Only 50% of the courses were conducted online and only 30% of the courses were conducted by video conference, which indicates that both equipment and skills are needed to increase this amount. In the end, they suggested that for the accurate implementation of the virtual education platform, the university should hire at least two IT experts to manage the common platform, virtual library, and virtual classes. In addition, it should provide the necessary training for uploading courses, creating virtual classes and designing electronic content and electronic tests, and supporting instructors.

Doyumgaç et al. (2021) confirmed that the speed of transition to online education was successful and the experience gained can be used in the future. It can even be useful and fruitful for other countries that have not yet found ways to transfer from the current education system to online education. In the end, they suggested that the Covid-19 epidemic made us learn that there is a need to formulate new rules and regulations, to create new platforms and solutions for future cases, so that countries, governments, and people are more prepared than today.

So far, there have been many studies on the use of information technology media in learning based on the technology acceptance model (Ntoa et al., 2017, Fakhri et al., 2022), which according to the model, shows the development of this type of learning and its acceptance by the two main variables of subjective perception of usefulness and subjective perception of E-learning is easy to use in educational environments. Therefore, considering that many researchers have confirmed the importance and necessity of e-learning, in order to use any new technology, it is necessary to prepare the grounds for accepting this technology. Designing, setting up, and maintaining electronic learning environments requires various knowledge and skills in technical, educational, and managerial fields (Al-Shaikhli et al., 2022). Due to the newness of virtual education in the country and the deficiencies in the implementation, specialized planning, and technical support of this type of education, virtual education looks pretty fragile. Fixing this deficiency requires scientific and principled planning and studies to remove the obstacles and provide practical plans with sustainable effectiveness in this environment. The first step for implementing e-learning in the university is to check the facilities, limitations, and infrastructure on the one hand and check the readiness of the university professors and students on the other hand (Leong et al., 2018).

In the present study, the data analysis showed that the structural model of acceptance of electronic educational technology is suitable and usable in the academic community regarding the goodness of fit indicators. The results of the present study are consistent with the findings of Marakarkandy et al. (2017), Achmad and Raista (2021), and Bagci and Celik (2018) about the application of information technology in learning based on the technology acceptance model. The analysis of the findings of the structural part indicated the significant impact of the department and the course of the participants on the adoption of electronic education technology as influential factors. The results of this research are consistent with the findings of Yu and Huang (2020), Kemp et al. (2022), Esteban-Millat et al. (2018), and Okcu et al. (2019). In these studies, concerning the positive and significant effect of the department on the learners' mental perception of the usefulness of e-learning and its ease of use, the areas of knowledge level, student acceptance, cultural factors, technology factors, and access were among the most influential factors, respectively.

With the creation and increase of electronic education, the volume of university activities in various educational research fields and the responsibility of academic staff members in educating learners has become increasingly important (Ouertani and Alhudhud, 2019). In the preparation of academic staff members, in line with the organizational mission of the university to improve the quality of education and learning, it is imperative to pay attention to the need for professional empowerment of academic staff members as executive agents of virtual education. In this regard, it is possible to design and launch a continuous education system through the Internet, and the programs of this system can be developed in cooperation with academic staff members of other universities in such a way that the educational programs of the site include interactive text programs, problem solving-based programs (PBL) and audio and video clips (Rodrigues et al., 2016). Moreover, in developing site programs, several learning paths should be designed so that learning can be done individually for each user according to his/her information. The importance of the professor's factor can be in terms of creating an interactive communication bridge between the professor or the student, the student with the student, and the professor with all the students (Tcha-Tokey et al., 2016).

4.3 E-education Software Usability Scale

The present study investigated participants' E-education software usability scale in online programming classes. The results obtained are as follows:

- There was no significant difference between male and female participants in the e-education software usability scale.
- There was no significant difference between the participants of different courses in the e-education software usability scale.
- There was no significant difference between the participants' department and the level of e-education software usability scale.
- There was no significant difference between the age of the participants and the e-education software usability scale.
- There was no significant difference between the expertise of the participants and the e-education software usability scale.
- There was no significant difference between the participants' Internet use and the e-education software usability scale.
- There was no significant difference between participants' interest in technology and e-education software usability scale

Our results did not find any significant relationship between the demographic variables of the users and the usability of the online education software. However, there were also significant results. For example, the highest usability score was associated with the lowest age group. These findings were consistent with the findings of Chen et al. (2020), Peñarroja et al. (2019), and Liao et al. (2022). Also, the score of female participants was higher than males. The usability test of the online training software also showed that people with higher expertise, more internet usage, and more interest in technology found more usability in the online education software than other groups.

These findings are consistent with the findings of previous studies (Kuciapski, 2017, Leong et al., 2018, Ouertani and Alhudhud, 2019). The recommendation of many of these studies is that curriculum design strategies should be made so that the student can be a producer and builder of knowledge and apply what he/she has learned in a new and actual situation. In order to increase the level of students' motivation towards learning different subjects, the teacher should try to improve the learning conditions and increase the quality of the teaching method so that the students achieve success and academic progress. Academic progress is the final product of the active learning process that is carried out with the help of education and educational activities. According to the many studies that have been done on the use of computers and software in teaching and creativity and academic progress of students, it can be said that educational software, when used alongside the traditional teaching method in the classroom, probably improves learning outcomes, and this improvement increases with greater usability (Ozkale and Koc, 2020, Al-Azawei et al., 2017, Hart and Sutcliffe, 2019).

The spread of the Covid-19 disease in these years can also have an impact on obtaining these results. Budur et al. (2021) investigated the teachers' lived experience of the opportunities and challenges of online teaching. In this research, an in-depth analysis of teachers' views led to the identification and classification of ten opportunities and challenges regarding the use of online educational networks. Considering these challenges and opportunities, it can be said that the online educational network can be used as a supplement to face-to-face education when schools reopen. With these unwanted school holidays and the continuation of 100% of formal school education in cyberspace, it seems that distance learning or electronic learning will be an important element in future educational systems, and the development of this method is a definite and undeniable necessity for governments.

Chen et al. (2020) emphasized the online education importance and the future implications of integrating virtual simulation technologies in medical education for the learning and assessment of clinical skills and suggested that we need new innovative strategies to use the medical education system to support continuous education and assessment. Considering the advantages of virtual reality and simulation-based technologies, managers of medical sciences universities should invest in simulation-based virtual educational products so that training and clinical evaluation can flow competently.

Based on the studies (Peñarroja et al., 2019, Liao et al., 2022), the motivation to apply usability during software system development is to increase efficiency, satisfaction, and productivity, as a result. The purpose of usability is to help users of systems to perform their tasks. Usability is also helpful for users who cannot spend much time getting to know the system and have less computer background. These results are consistent with our findings, as individuals with less computer expertise found usability more valuable than other groups. Since meeting user requirements is the primary goal of software development, usability is key to ensuring the success of an online education system (Chen et al., 2020). Therefore, the system development organization will lose the market if it fails to provide adequate software usability. Software systems are based on graphical interfaces and power related to communication and expression of executive functions. Therefore, today usability is recognized as an essential aspect of educational software quality and has gained its place more than traditional attitudes such as performance, robustness, and security (Park and Park, 2020).

In our results, as in other studies (Liao et al., 2022, Ozkale and Koc, 2020, Al-Azawei et al., 2017), satisfaction is the most cited perception of usability, while usefulness is usually overlooked. Various studies in recent years have shown that software usability is one of the main criteria for software quality. The presented models for applicability lack comprehensiveness and cannot cover all aspects of applicability. Despite providing many definitions and models for software usability, there is still no official and comprehensive definition and model for it. On the other hand, there has been a growing demand for usability in software in recent years. This is basically to change the view of the users from software systems, and the increase in recognition of software usability by users is evident in different quality models in recent years. Studies show that usability is a crucial component of the software product's overall quality (Pribeanu et al., 2017, Kuciapski, 2017).

Despite the many usability definitions, researchers have not yet agreed on a comprehensive and complete definition. Kuciapski (2017) explains that a usable system is effective, learnable, flexible, and mentally satisfying. In the FURPS qualitative model, the concept of "usability" includes aesthetics, human criteria, context-sensitive and online assistance, self-completion of complex tasks employing simple answers and their factors, user documentation, stability in the user interface, and educational materials. Scholtz et al. (2016) consider the ability to learn, efficiency, memorability, errors, and satisfaction as the most important usability attitudes. Dumpit and Fernandez (2017) have considered a classification that includes safety, effectiveness, efficiency, and enjoyment. Al-Azawei et al. (2017) showed usability as the ability to learn flexibility and robustness. The QUIS model describes usability in ten criteria, which are listed as efficiency, effectiveness, productivity, satisfaction, learnability, safety, reliability, accessibility, universality, and usefulness.

Several different standards and models have been proposed to evaluate and quantify usability in the past few decades. In this study, we used the E-education software usability scale model. The review of similar studies using this scale showed that in some cases, such as gender and age, this study's findings are consistent with those of previous studies. However, no significant difference was found between the demographic groups of the present study.

CONCLUSION

Although in the past cyberspace was considered a great realm of communication, there is a difference between virtual and distance education in normal conditions and in the new emergency situation caused by the Covid-19 crisis that was not planned in advance. Considering the current conditions and the new requirements, it became important to transfer many things to the virtual space as a definite matter (Almazova et al., 2020). Also, governments have recognized the growing importance of online learning in this dynamic world, and thus, the influence of virtual space in the field of education has expanded in this era. Also, the professors and lecturers were forced to change the way of teaching and attended the virtual class instead of the physical class, and thus the compensations worked relatively. The reason for the relativity of the mechanism of using education and learning in the context of virtual space is that these methods, despite various advantages, face various implementation obstacles, especially in developing or underdeveloped countries (Alam, 2020). Among the advantages of this method are being attractive and flexible, the accessibility of rural and remote areas to education, reducing the overall cost of learning, and a relatively cheaper educational method with the lowest cost of transportation, not being limited by time, increasing the length of learning time from 6 to 8 hours to 24 hours, increasing the self-control of learners and the possibility of planning and managing time by the learner, creating responsibility, the possibility of more reasonable and rational use of learning through virtual space, the possibility of improving the quality of blended learning by combining face-to-face lectures with technology, increasing the learning potential in the virtual environment, and acquiring new technological skills (Qazi et al., 2020, Butnaru et al., 2021, Oducado, 2020, Pokhrel and Chhetri, 2021, Peimani and Kamalipour, 2021, Paudel, 2021).

On the other hand, developing countries are facing obstacles and challenges in the implementation of distance education and e-learning, such as network infrastructure, weak lack of knowledge of information and communication technology, weak content development, and so on (Adnan and Anwar, 2020, Chakraborty et al., 2021). The audience's need for computer literacy in non-native language education, the issue of issuing and validating certificates, the need for special standards to evaluate learners' learning and educational programs, and the need to use special tools and equipment are among the obstacles that exist in this method. Also, according to some critics, learning is a social process, and interaction in a specific place and time is one of the fundamentals of a successful educational experience. The main concern of critics is the impossibility of in-depth learning of course materials due to the lack of specific time and place interaction and doubts about the efficiency of e-learning (Hussein Hakeem Barzani, 2021, Doyumgaç et al., 2021).

This study investigated the effect of the educational learning-based online course content of computer courses on student success and the effects of students' cognitive absorption, acceptance, and usability. The researcher carried out the application of the questionnaire tools to the students in the programming courses. Based on the questionnaires, this research examined the effect of students' cognitive absorption, technology acceptance, and online educational software usability on student success in programming courses. The subjects of the research were a total of 192 online students in three different departments. In this study, the following scales were applied in the survey test measurements, respectively: Cognitive absorption scale (13 items), technology acceptance model (14 items), and online educational software usability (39 items). Each of these three scales was examined from seven different perspectives: Gender, Course Code, Department, Age, Expertise, Frequency of Internet use, and Interest in technology. The results of each of these scales are investigated from these perspectives and compared with related studies, and suggestions were presented based on the obtained results.

Our findings showed the positive effect of online programming courses on cognitive absorption. However, no significant differences were shown between demographic variables. Acceptance of technology was also higher among women and younger age groups than other groups, but this difference was not significant. Our results showed that computer departments and Java courses had significantly higher technology acceptance than other departments and courses. Finally, the usability test of the online training software showed that people with higher expertise, more internet usage, and more interest in technology found more usability in the online education software than other groups. However, these differences were not significant.

Conducting any research definitely has limitations in its implementation, and the present research is not exempt from this and has limitations. The pre-test may have created an unwanted preparation for the students to participate in the post-test. Because this research was conducted on a group of students from a specific region, caution should be taken in generalizing the results to larger communities. According to the findings of this research, the use of online programming educational software has a positive effect on students' academic progress, so it is suggested that the education authorities spend more time teaching students through the relevant software. Considering the new educational policies and the increase of smart schools in order to increase the creativity and academic progress of students, especially in the programming course, it is suggested that they put the development of such applicable software on their agenda to provide sufficient motivation for the further expansion of such classes in the country.

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APPENDIXES

Survey Questions

Survey was prepared in Turkish in Google forms.

General Informations Questions;

1. Adınız ve Soyadınız
2. Öğrenci Numaranız
3. Ders kodunuz
4. Cinsiyetiniz
5. Bölümünüz Nedir?
6. Kaç Yaşındasınız ?
7. Bilgisiyar uzmanlık düzeyiniz tahmini nedir ?
8. İnterneti kullandığınız araçlar nelerdir ?
9. İnterneti kullanma sıklığınız nedir?
10. Yeni teknolojilere karşı duyduğunuz ilgi düzeyi nedir?

TAM (Technology Acceptance Modeling) Scales Questions;

1-Ters-Yüz Eğitim Modeli, dersteki başarımı arttıracaktır.
2-Ters-Yüz Eğitim Modeli, üniversitedeki diğer derslerin verilmesinde de kullanılabilir.
3-Ters-Yüz Eğitim Modelini kullanmak dersteki performansımı arttırmaktadır.
4-Blackboard üzerinden verilen ödevleri, bonus soruları ve projeleri yapıp göndermek normalden daha kolay.
5-Ters-Yüz Eğitim Modelini kullanarak ihtiyacım olan bilgiye erişebiliyorum.
6-Ters-Yüz Eğitim Modelini kullanmak, yaratıcılığımı arttırmaktadır.
7-Ters-Yüz Eğitim Modeli, öğrenme sürecinin denetlenebilmesini sağlar.
8-Ters-Yüz Eğitim Modeliyle öğrenme performansımı arttı.
9-Ters-Yüz Eğitim Modeli, kullanımı basit, anlaşılır ve açık bir öğrenim modelidir.
10- Blackboard sisteminde dolaşmak kolay.
11-Ters-Yüz Eğitim Modelini kullanarak ileride başka dersler de almak isterim.
12-Ters-Yüz Eğitim Modelinin sistemini (Blackboard) kullanmayı kolay buluyorum.
13-Ters-Yüz Eğitim Modelini diğer arkadaşlarıma tavsiye ederim.
14-Ters-Yüz Eğitim Modeline (Flipped Learning) adaptasyon sürecim sorunsuzdu.

Cognitive Absorption Scale Questions;

1-Blackboarda girdiğimde, çoğu zaman planladığımdan daha fazla zaman harcarım.
2-Ders metaryellerini incelerken, sıklıkla amaçladığımdan daha fazla zaman harcarım.
3-Ders metaryellerini Blackboardda kullanırken bazen zaman kavramını yitiririm.
4-Ders metaryelleri kullanırken zaman akıp gider.

5-Blackboard da sunuları ve dökümanları kullanmak merakımı arttırır.
6-Blackboard da videolu materyalleri kullanmak merakımı arttırır.
7-Blackboard da sunuları ve dökümanları kullanırken zaman çok hızlı geçer.
8-Blackboard da videolu materyalleri kullanırken zaman çok hızlı geçer.
9-Metaryelleri incelerken dikkatim kolay kolay dağılmaz.
10-Metaryelleri incelerken dikkatimi kolaylıkla toplayabilirim.
11-Metaryelleri incelerken zihnim tamamiyle yaptığım işle meşguldür.
12-Blackboardu kullanmaktan hoşlanıyorum.
13-Sistem üzerinden hoca ile olan iletişimimde hiç bir kontrolüm olmuyor.

Online Educational Software Usability Scale (5- Likert)

1. Online dersler karmaşık değildir.
2. Online olarak verilen çeşitli materyalleri kullanırken kendimi rahat hissediyorum.
3. Blackboardu kullanmak kolaydır.
4. Blackboardu kullanırken ne yaptığımı biliyorum.
5. Blackboardu kullanırken istediğim yere kolayca erişiyorum.
6. Blackboardu kullanırken sayfaların yüklenmesi için fazla beklemiyorum.
7. Blackbordda sunulan konuların dilini anlama ile ilgili sıkıntı çekmiyorum.
8. Blackbordda sunulan materyallerin içerdiği bilgiler yeterlidir.
9. Blackbordda yazı ve zemin rengi uyumludur.
10. Blackbordda yazı tipleri ve boyutları okunaklıdır
11. Sayfalardaki bilgiler iyi düzenlenmiştir.
12. Blackboardun altyapısı göze hitap etmektedir.
13. Blackboard da sunulan konuların anafikirlerini kolaylıkla anlayabiliyorum
14. Blackboardda sunulan bilgiler benim öğrenmek istediklerim ile örtüşüyor.
15. Blackboard daki sunumlarda konu özet ve açık şeklinde verilmektedir.
16. Blackboardun görünüm, terimler, kelimeler ve diğer davranışlarında tutarlılık vardır.
17. Blackboardda aktivitelerde ve ödevlerde geri bildirim verilmektedir
18. Verilen quizlerde, etkileşimde bulunurken eğlenirim.
19. Verilen quizleri yaparken zorluk çekmiyorum.
20. Blackboardda sistemi kullanırken verilen yönergeler ihtiyacımı karşılar.
21. Benim için online ders sisteminde BASİT KULLANIM önemlidir.
22. Benim için online ders sisteminde RAHAT olmak önemlidir.
23. Benim için online ders sisteminde KULLANIM KOLAYLIĞI önemlidir.
24. Benim için online ders sisteminde ETKİN KONROL önemlidir.
25. Benim için online ders sisteminde rahat GEZİNMEK önemlidir.
26. Benim için online ders sisteminde sayfaların YÜKLENME SÜRESİ önemlidir.
27. Benim için online ders sisteminde bilgilerin OKUNABİLİR-ANLAŞILABİLİR olması önemlidir.
28. Benim için online ders sisteminde YETERLİ BİLGİ/GÖREV EŞLEŞMESİ önemlidir.
29. Benim için online ders sisteminde BAĞLANTILARIN FARKEDİLMESİ önemlidir.

30. Benim için online ders sisteminde YAZI VE ZEMİNDE RENK UYUMU önemlidir.
31. Benim için online ders sisteminde YAZI TİPİ VE BOYUTU önemlidir.
32. Benim için online ders sisteminde DÜZEN önemlidir.
33. Benim için online ders sisteminde GÖRSEL SUNUM önemlidir.
34. Benim için online ders sisteminde konulardaki önemli noktalardaki ALGILAMA önemlidir.
35. Benim için online ders sisteminde İÇERİKLERİN İLGİNÇ olması önemlidir.
36. Benim için online ders sisteminde ÖZET VE AÇIK BİLGİ önemlidir.
37. Benim için online ders sisteminde görünüm, terimler, kelimeler ve diğer davranışlarında TUTARLILIK önemlidir.
38. Benim için online ders sisteminde GERİBİLDİRİM önemlidir.
39. Benim için online ders sisteminde YÖNERGELER önemlidir.