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Examining the Augmented Reality Applications in Education with Technology Acceptance Model

Eğitimde Artırılmış Gerçeklik Uygulamalarının Teknoloji Kabul Modeli ile İncelenmesi

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Öz

Günümüzdeki teknolojik gelişmeler insanların gündelik yaşamları dahil her ortamda ilerlemeye ve gelişmeye devam etmektedir. Bu gelişmeler, insanlara çok daha farklı deneyimler ve imkanlar sunarak teknolojiden her zaman faydalanılması gerekliliğini vurgulamaktadır. Artırılmış gerçeklik (AG), dijital teknolojinin eğitim alanında sunduğu en yenilikçi uygulamalardan biridir. Çalışma, AG uygulamalarını Teknoloji Kabul Modeli (TKM) çerçevesinde incelemektedir. Çalışmada, Ardahan Üniversitesi Sağlık Bilimleri Fakültesi'ndeki 201 öğrenciden anket yoluyla veri toplanmış ve öğrencilerin AG'ye yönelik tutumları, kullanım kolaylığı, algılanan fayda ve zevk düzeyleri analiz edilmiştir. Kullanıcıların bu yeni teknolojiye nasıl yaklaştığı ve hangi faktörlerin kullanımı etkilediği TKM bileşenleri ile araştırılmıştır. Çalışmanın bulguları, TKM bileşenlerinin AG uygulamalarının benimsenmesinde kritik bir rol oynadığını göstermektedir. Algılanan fayda ve algılanan zevk, kullanıcıların davranışsal kullanım niyetini ve kullanım tutumunu pozitif yönde etkilerken; algılanan kullanım kolaylığı, öğrencilerin teknolojiye yönelik tutum ve niyetlerini şekillendirmede belirleyici bir faktör olarak öne çıkmıştır. Sonuçlar, eğitmenler için önemli bir rehber niteliği taşımakta ve AG'nin eğitimde daha yaygın bir şekilde uygulanması için somut öneriler sunmaktadır.

Anahtar Kelimeler: Artırılmış gerçeklik, eğitim, bilgi iletişim teknolojileri, sanal gerçeklik, teknoloji kabul modeli.

Abstract

Technological advancements in today's world continue to progress and evolve across all environments, including individuals' daily lives. These developments provide people with significantly different experiences and opportunities, emphasizing the necessity of consistently utilizing technology. Augmented Reality (AR) is one of the most innovative applications of digital technology in the field of education. This study examines AR applications within the framework of the Technology Acceptance Model (TAM). Data were collected through a survey conducted with 201 students from the Faculty of Health Sciences at Ardahan University, analyzing their attitudes toward AR, perceived ease of use, perceived usefulness, and level of enjoyment. The study

investigates how users approach this emerging technology and which factors influence its adoption based on the components of the Technology Acceptance Model. The findings indicate that TAM components play a crucial role in the adoption of AR applications. While perceived usefulness and perceived enjoyment positively affect users' behavioral intention and attitudes toward use, perceived ease of use emerges as a key determinant in shaping students' attitudes and intentions toward technology. The results serve as a valuable guide for instructors and provide concrete recommendations for the broader implementation of AR in education.

Keywords: Augmented reality, education, information communication technologies, virtual reality, technology acceptance model.

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Yazar Katkıları	Çalışmanın Tasarlanması / *Conceiving the Study:* ÜMC (%55), SSK (%35), NEB (%10) Veri Toplanması / *Data Collection:* ÜMC (%80), NEB (%20) Veri Analizi / Data Analysis: ÜMC (%15), NEB (%70), SSK (%15) Makalenin Yazımı / Writing up: ÜMC (%50), SSK (%25), NEB (%25) Makale Gönderimi ve Revizyonu / Submission and Revision: SSK (%60), NEB (%40)

1. Introduction

The advancement of technology has brought significant transformations in the field of education, with augmented reality (AR) emerging as an important tool to enhance learning experiences. AR creates alternative learning

environments that are different from traditional approaches by integrating virtual information into the real world. It offers new learning experiences and bringing an innovative perspective to education, making it a promising field. (Chang et al., 2022). However, the effective integration of AR technologies into education largely depends on their acceptance and adoption by both educators and students. In this regard, the Technology Acceptance Model (TAM) plays a significant role, providing a theoretical framework for analyzing the determinants influencing the acceptance of AR applications in educational settings. TAM has been established as a fundamental framework for understanding technology acceptance among users across various domains. Initially developed by Davis in 1989, TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are the primary determinants influencing users' intentions to adopt technology (Venkatesh - Davis, 2000). The model serves as a guiding tool for designers and researchers to overcome usage barriers, comprehend the technology adoption process, and enhance acceptance levels (Kurt, 2015).

TAM has been extensively validated through numerous empirical studies and has been widely utilized in educational research (Granić, 2023; Granić - Marangunić, 2019; Jang et al., 2021; Mugo et al., 2017). TAM suggests that PEOU and PU are critical determinants of technology acceptance, particularly in the context of AR applications in education (Buana - Linarti, 2021; Ghobadi et al., 2022). Research indicates that when students perceive AR as beneficial to their learning, they are more likely to engage with it (Cabero-Almenara, Barroso-Osuna, et al., 2019). Furthermore, studies highlight that the acceptance of AR technologies may vary significantly across different educational disciplines, emphasizing the importance of contextual factors in shaping user attitudes and behaviors (Cabero-Almenara, Barroso-Osuna, et al., 2019; Ghobadi et al., 2022). Understanding how these factors influence the acceptance of AR among educators and students is crucial for fostering an environment conducive to innovative teaching and learning practices.

AR and virtual reality (VR) technologies have significant potential in health sciences education, enriching students' learning processes and increasing the quality of education. The use of these technologies in the field of health sciences allows students to combine their theoretical knowledge with

practice, while also contributing to the development of patient safety and clinical skills. The aim of this study is to contribute to the literature by examining the factors related to the adoption of AR applications in the education of health management and emergency disaster and relief students within the framework of TAM. While existing studies focus on the use of AR and VR in the education of midwifery (Yurtsal - Hasdemir, 2023), medicine (Castrillon-Arias et al., 2023; Saat et al., 2024), and anatomy (García-Robles et al., 2024; Moro et al., 2017) students from health sciences departments; No studies have been found on Health Management and Emergency Aid and Disaster Management students. In this context, the study reveals the critical elements for effective adoption of AR in education by measuring variables such as perceived benefit, ease of use, fun factor and attitude. Thus, it aims to contribute to the theoretical and practical field in the literature by providing concrete data for more effective integration of AR technology for educational institutions and top managers. The research has been designed in alignment with these objectives:

- What is the level of students' levels of TAM variables (perceived enjoyment, perceived usefulness, perceived ease of use, attitude towards use and behavioral intention to use)?
- Does perceived enjoyment have a significant effect on perceived usefulness and perceived ease of use?
- Does perceived ease of use have a significant effect on perceived usefulness?
- Does perceived usefulness have a significant effect on attitudes towards use and behavioral intention to use?
- Does perceived ease of use have a significant effect on attitude towards use and behavioral intention to use?
- Does attitude towards use have a significant effect on behavioral intention to use?

2. Conceptual framework and literature review

2.1. Augmented reality and education

AR is a system that helps digital data seamlessly overlay and blend with the real world. With AR applications, in addition to the 2D and 3D objects that many users expect, video files, audio files, textual data, and even olfactory and

tactile data can be added to users' perceptions of the physical environment (Cankül et al., 2018). This added data helps users to understand the events around them more easily and serves the user to improve these perceptions (Cankül et al., 2018). The electronic beacons inherent in AR applications help users to perceive the real world as a single seamless environment with added digital data (Cankül et al., 2018). The versatility of AR has enabled its widespread adoption across various sectors, each benefiting from its unique featuresIn the The healthcare industry of applications of AR in extend to various domains, including emergency medicine, surgical planning, and tele-mentorship. Eckert et al. provide a systematic review of AR in medicine, highlighting its diverse applications, such as using tablets to visualize 3D information from medical imaging systems during surgeries (Eckert et al., 2019). Beyond education and healthcare, AR has made a substantial impact on the retail sector. Applications like IKEA Place enable customers to preview furniture in their homes before purchasing, minimizing uncertainty and increasing satisfaction (Javornik, 2016). The gaming industry, an early adopter of AR, like Pokémon GO exemplifies the potential of AR to attract and retain players. (Motsinger, 2017) highlights how the game supplements the real world with computer imagery, increasing players' emotional investment and encouraging physical activity.

AR applications are increasingly attracting attention with their transformative potential in the field of education. This improves both teaching methods and learning processes. Integrating AR into educational environments provides an interactive and immersive learning experience that is critical for modern pedagogical approaches. Research shows that AR significantly facilitates the understanding of abstract and complex concepts and provides impressive visualizations that close the gap between theoretical knowledge and practical application (Elmira et al., 2022; Kljun et al., 2020). AR encourages a more dynamic and engaging learning experience by allowing students to interact with virtual objects in real time. This hands-on interaction not only strengthens spatial visualization skills, but also enhances problem-solving abilities and allows students to develop a deeper, more intuitive understanding of abstract relationships (Ciloglu - Ustun, 2023; Omar et al., 2023). Especially in disciplines where spatial understanding is important, such as geometry and

biology, the interactive nature of AR has made the relationships between concepts much more understandable (Alzahrani, 2020; Omar et al., 2023). By giving students the ability to manipulate complex structures in a three-dimensional space, AR has overcome the limitations of traditional two-dimensional representations and made complex concepts more accessible and understandable (Nigam - PS, 2022).

The concept of digitalization in education can be defined as the transition from traditional classroom environments to learning environments enriched with digital technologies. This transformation enables the development of innovative teaching materials and methods that address different learning needs. For example, Sundari and colleagues emphasize that ARCS-based digital teaching materials are compatible with modern educational practices to increase student engagement and satisfaction (Sundari et al., 2023). Similarly, Ratnaningsih and Jayanta discuss the critical role that digital teaching modules play in engaging students and enhancing comprehension, revealing how digital tools enhance the learning experience (Ratnaningsih - Jayanta, 2023). Therefore, the education system needs to keep pace with this development and change in technology (Turan - Haşit, 2014). AR applications are a concept used to differentiate traditional education, to enrich learning environments by combining technology with education and to attract the attention of Gen Z (Akgün - Ustun, 2023). Somyürek (2014) thinks that AR applications attract more attention compared to other technological content because they provide advantages in influencing Gen Z and also respond to the effective environment-method connection to enrich and support teaching compared to traditional methods and techniques.

AR provides the learner with the opportunity to have an active role in his/her own learning performance with computer-aided technological materials to be developed or used for teaching abstract concepts with limited opportunities in laboratory and classroom environments, and provides the opportunity to easily visualize abstract concepts that are difficult to understand in their minds (Güntepe - Usta, 2022). Therefore, it is seen that the attention span of the learners increases in terms of the fact that the device and content used in the field of AR are digital, concretizing the abstract contents that are tried to be transferred to the learner and making it easier to comprehend

(Çetinkaya - Akçay, 2013). Güntepe - Usta (2022) think that with AR applications, it is possible to conduct experiments in a shorter time with long lessons in laboratories and classrooms and to repeat these lessons and experiments many times.

2.2. Technology acceptance model (TAM)

The Technology Acceptance Model (TAM) was developed by Davis (1989) as an extension of Ajzen and Fishbein's Theory of Reasoned Action (1980) (Musa et al., 2024). The model provides an approach to determining users' intentions to adopt technology by explaining the technology acceptance process through a series of factors (Davis, 1989). Recognized as one of the most popular models used to examine and understand the adoption of new technologies, TAM (Cengiz, 2018), conceptualizes individuals' intentions, behaviors, and attitudes toward the development and use of information technologies as indicators of whether they adopt or utilize such technologies (Özer et al., 2010). Fundamentally, TAM was developed to identify the preferences of users regarding new technologies, to reveal how they respond to change and innovation, to explain the reasons behind their resistance to using these technologies, and to predict their reactions to the development and transformation process (Kalyoncuoğlu, 2018).

Based on an analysis of the causal relationships among attitude toward use, BIU, and actual usage, TAM synthesizes users' personal characteristics in line with the components of PEOU and PU, which are influenced by external variables (Kalyoncuoğlu, 2018). The core variables of TAM—PU and PEOU—affect users' behavioral intentions toward technology use. The actual behavior resulting from users' behavioral intention is determined by their attitudes, which influence their intentions (Cengiz, 2018).

2.3. Literature review

There are various national and international studies that use AR applications and the TAM model together in education. Some of these studies can be summarized as follows.

Ibili et al. (2019), investigated mathematics teachers' acceptance levels and intentions to use the Augmented Reality Geometry Lesson System, a mobile AR

application aimed at improving students' three-dimensional geometric thinking skills. The application was shared with teachers and then the TAM survey was administered. The results showed that PEOU had a direct effect on PU. Kountromanos and Mikropoulos (2021), examined teachers' intention to use AR applications in teaching through the Mobile Augmented Reality Acceptance Model (MARAM), which includes perceived relative advantage, enjoyment, facilitating conditions, and mobile self-efficacy. The research result showed that intention is affected by attitude, PU, and facilitating conditions, while attitude is affected by PU and enjoyment.

In the study by Asiri (2022); TAM was used to reveal teachers' perceptions of the expected benefits and acceptance levels of AR applications in teaching. A descriptive approach was adopted and a six-dimensional scale based on the components of the model was developed and applied to 127 teachers in Najran, Saudi Arabia. The results of the study revealed a strong positive relationship between ease of use, attitude towards AR applications, and PU. In another study, Taha et al. (2022) aimed to examine the acceptance levels of social science students towards AR technology and the effects of variables such as gender, field of expertise or program on their attitudes towards AR. TAM was used to analyze these factors and the degree of acceptance, PU, ease of use and behavioral intention of the students were evaluated by survey method. The findings revealed that the students had a generally positive attitude towards AR and that gender, field of expertise and program level did not have a significant effect on their perceptions of AR integration.

Papakostas et al. (2023) examined behavioral intentions towards the use of mobile AR in education with the extended TAM. The model was extended with the variables of game outcome and quality outcome. The results show that AR usage intention is directly related to output quality, PU and ease of use, and indirectly positively related to game outcome.

In another study on the use of AR in Educational Technology, Granić (2023) examined technology acceptance in education and examined research to increase the predictive power of the TAM. The model was expanded with factors such as self-efficacy, subjective norm, PE, social influence, system quality and facilitating conditions. The study revealed that the most widely

accepted educational technology model is e-learning, followed by mobile learning. Alejandro Álvarez-Marín (2023), proposed a new acceptance model to determine the intention to use AR in cultural heritage sites. The study revealed that performance expectancy, facilitating conditions, and hedonic motivation positively affect behavioral intention. In addition, it was determined that confidence expectancy and technological innovation increase performance expectancy, while effort expectancy and computer anxiety negatively affect hedonic motivation.

Álvarez-Marín et al. (2023), evaluated the use of AR in engineering education in terms of technology optimism and technology innovation. An AR application that analyzes current in electrical circuits was developed, allowing students to calculate voltage and amperage values in resistive circuits and manipulate circuit elements. The findings show that subjective norms have a positive effect on technology optimism and innovation, and that attitudes toward use are moderately dependent on these factors.

3. Hypothesis

3.1 Perceived enjoyment (PE)

People often display particular behaviors when they find an activity enjoyable and engaging, indicating that if a technology is perceived as entertaining, individuals may be more likely to adopt it. PE plays a crucial role in the acceptance and utilization of AR technologies across multiple domains, such as education and consumer behavior (Yılmaz et al., 2020). Several studies have underscored the importance of enjoyment in influencing users' willingness to interact with AR applications. For example, research by Balog and Pribeanu (2010) identified PE as a primary factor shaping students' intentions to use AR-based learning platforms, emphasizing its role in fostering the acceptance of educational technologies. Furthermore, another study in the educational field, which associated PE with students' self-efficacy, suggests that enjoyment not only improves the learning process but also strengthens users' confidence in employing AR tools (Yulian et al., 2022).

Hypothesis 1: PE has been shown to positively influence PU in AR applications.

Hypothesis 2: PE positively affects PEOU in AR applications.

3.2. Perceived usefulness (PU)

PU refers to the degree to which a user believes that a particular system will enhance their performance by enabling them to complete tasks and solve problems effectively. It is defined as the user's perception that a system will provide significant benefits when used (Özer et al., 2010). Ghobadi et al. emphasized that PEOU does not significantly affect attitudes towards AR, but PU plays a vital role in shaping users' behaviors and attitudes (Ghobadi et al., 2022). Similarly, Kaya and Bicen highlighted the relationship between PU and attitudes in educational settings, stating that students' perceptions of the usefulness of AR applications directly affect their attitudes and thus their academic performance (Kaya - Bicen, 2019). Therefore, systems that are easier to use and demonstrate higher levels of usefulness tend to positively influence users' attitudes and intentions toward adopting them (Sabri Çelik et al., 2023).

Hypothesis 3: PU positively influences attitudes toward use in AR applications.

Hypothesis 4: PU positively affects behavioral intention in AR applications.

3.3. Perceived ease of use (PEOU)

PEOU refers to the belief that utilizing a newly designed system will not require significant mental or physical effort. This concept is defined as the user's perception that a new technology is easy to learn and use (Kalyoncuoğlu, 2018). Accordingly, the easier users perceive a technology to be, the more positive their attitude and intention toward its use will become. Furthermore, higher levels of PEOU are associated with an increased perception of benefit following usage (Turan - Haşit, 2014). Almenara et al. provided empirical evidence that PEOU and PU are important determinants of users' attitudes towards AR technology in educational contexts, thus supporting the idea that these perceptions are interconnected (Cabero-Almenara, Fernández-Batanero, et al., 2019). Findings from these studies highlight that increasing PEOU can lead to increased PU and ultimately increase user engagement and acceptance of AR applications in various domains, including education and cultural heritage (Cabero-Almenara, Fernández-Batanero, et al., 2019; Haugstvedt - Krogstie, 2012).

Hypothesis 5: PEOU positively affects attitudes toward the use of AR applications.

Hypothesis 6: PEOU positively influences PU in AR applications.

Hypothesis 7: PEOU positively impacts behavioral intention in AR applications.

3.4. Attitude towards use (ATU)

Attitude is the affective-cognitive approach that individuals exhibit toward a behavior, shaped by their experiences and data (Sabri Çelik et al., 2023). Attitude can also be defined as a user's tendency to react positively or negatively to a system (Özer et al., 2010). Obeidy et al. emphasize that users' attitudes, shaped by PEOU and PU, have a direct impact on their behavioral intentions to use AR technologies (Obeidy et al., 2018). This finding is in line with the TAM, which assumes that positive attitudes towards a technology increase the likelihood of its adoption. Furthermore, Shin and Jeong's study on travelers' motivations to adopt AR applications in tourism shows that positive attitudes lead to a higher intention to use these applications, especially when users perceive enjoyment and fun in their interactions with AR (Shin - Jeong, 2021). İsrafil Çelik (2019) stated that ATU, as a key component of TAM, directly influences BIU and suggests that users effectively evaluate the costs and benefits of the system.

Hypothesis 8: Attitude toward using an AR application positively affects the BIU the application.

3.5. Behavioral intention to use (BIU)

Intention refers to the sensory and cognitive decision-making process individuals experience while performing a behavior, as well as the effort directed toward that behavior. Behavioral intention specifically denotes individuals' predictions about their future behaviors and the effects of these predictions, shaped by their experiences or attitudes (Sabri Çelik et al., 2023). Within this scope, intention, defined as a subjective evaluation of the likelihood of engaging in a particular behavior, can be described as an individual's level of inclination or motivation to perform that behavior. In this context, intention

may also reflect the readiness of an individual to undertake a specific action. TAM posits that the intention to use information technologies is a fundamental determinant in the process of accepting or rejecting such technologies (Kalyoncuoğlu, 2018). Intention, as a critical motivator for individuals to adopt certain behaviors, is regulated by their attitudes toward that behavior. A positive or negative attitude directly influences the corresponding intention. Therefore, when individuals exhibit a positive attitude toward a given subject, their intention aligns accordingly in a positive direction (Özer et al., 2010). Moreover, BIU drives the adoption of new technologies. It is also directly linked to factors such as attitude toward use and PU. Additionally, BIU is indirectly influenced by PEOU (İsrafil Çelik, 2019).

4. Method

The model, sample, data collection tools, analysis and findings related to the variables examined in the research will be discussed in this section.

4.1 Sample of the study

The population of the study was selected as all students studying at Ardahan University Faculty of Health Sciences. After the questionnaire form was created, permission was obtained from Ardahan University Ethics Committee on 21.11.2023. The sample of the participants in the study was determined according to the convenience sampling method and the questionnaires were collected electronically using Google Forms. There are a total of 345 students in Ardahan University Faculty of Health Sciences, which constitutes the research population. In this research population, the sample size to be selected was calculated as 180 by estimating a 5% margin of error within 95% reliability limits (http://www.surveysystem.com/sscalc.htm). In this context, 220 students were surveyed and 201 surveys were evaluated. This sample size is considered to be sufficient for the Structural Equation Model (Kline, 2023). The demographic structure of the participants is given in the Table 1.

Table 1. Demographic Characteristics of the Students Participating in the Study

Characteristics		F	%
Gender	Male	70	34.8
	Woman	131	65.2
Age	18-20	95	47.3
	21-23	95	47.3
	24 years and older	11	5.4
Grade Level	1st grade	112	55.7
	2nd grade	49	24.4
	3rd grade	4	2.0
	4th grade	36	17.9
Department	Emergency Aid and Disaster Management	103	51.2
	Health Management	98	48.8
Do you know anything about AG before?	Yes	74	37
	No	126	63

4.2. Data collection tools of the research

In the study, a questionnaire form consisting of two parts was applied to the participants as a data collection tool. In the first part of the questionnaire; there is a personal information form about the participants' gender, age, grade level, department of study and information about AR applications. In the second part of the questionnaire; there are a total of 15 questions about the variables of PE, PU, PEOU, ATU and BIU AR applications. The ATU and BIU scales were taken from Papanaktos et al. (2023), while the PE, PU and PEOU scales were taken from Cabero-Almenara, Barroso-Osuna, et al (2019). The scale was translated from English to Turkish by researchers and then back into English by three language experts. After ensuring a literal translation, the scale was presented to five academics specializing in Education and Management. Their feedback was gathered, consensus was reached, and the scale was finalized for implementation. The scales were graded using a 5-point Likert

scale (1- Strongly disagree, 2- Disagree, 3- Undecided, 4- Agree, 5- Strongly agree).

4.3 Data analysis

Within the scope of the research, confirmatory factor analysis and structural equation modeling were used to analyze the measurement items. The findings obtained in this context will be evaluated at 5% significance level at 95% confidence interval and Jamovi and Amos programs were used for the analysis.

In addition to descriptive statistics, Pearson correlation analysis, confirmatory factor analysis, structural equation modeling (SEM), internal consistency reliability (Cronbach's Alpha Composite Reliability-CR) and convergent validity (Average Extracted Variance-AVE) were used in data analysis.

5. Findings

In this section of the study, reliability analyses, construct validity of the scales, descriptive (frequency) statistics, correlation and structural equation model analysis results for testing the hypotheses are given.

5.1. Descriptive findings and measurement model

The mean value, standard deviation, skewness and kurtosis values and reliability coefficients of the variables included in the study are given in Table 2.

Table 2. Descriptive Statistics

Variables	Mean	Std. Deviation	Skewness	Kurtosis
Perceived Enjoyment	4.07	0.78	-1.13	1.63
Perceived Usefulness	4.06	0.75	-1.10	1.69
Perceived Ease of Use	3.58	0.70	-0.74	1.73
Attitude Towards Use	3.97	0.74	-0.69	0.43
Behavioral Intention to Use	3.84	0.79	-0.64	0.45

According to the table 2, the lowest mean belongs to the PEOU scale (3.58±0.70) and the highest mean belongs to the PE scale (4.07±0.78). Before testing the research hypotheses, correlation analysis was used to test whether there is a significant relationship between the dimensions. When the findings in the table are examined, it is seen that there are significant positive relationships between all dimensions at p<.001 level. In addition, it is seen in the Table that the skewness and kurtosis values are between -2 and +2 in order to test the normality assumption of the factors. These results indicate that the data are normally distributed and therefore parametric analysis techniques were applied (Mallery - George, 2000).

Confirmatory Factor Analysis (CFA) was used to evaluate the measurement model and test the relationships between measurement items and factors. According to CFA, it was determined that the scale consisting of 5 factors was related to a unidimensional scale structure. The reliability of the measurement model was tested by looking at the average variance explained (AVE) and composite reliability (CR) values. The results of the analysis are shown in Table 3.

Table 3. Confirmatory Factor Analysis of Technology Acceptance Model

Factor	Item	Faktor Loading	Standard Error	t	p	AVE	CR
Perceived Enjoyment α=0,808	**PE1**	0.764	-	-	-	0.58	0.70
	PE2	0.722	0.089	10.164	***		
	PE3	0.798	0.094	11.323	***		
Perceived Usefulness α=0,864	**PU1**	0.864	-	-	-	0.62	0.87
	PU2	0.772	0.065	12.999	***		
	PU3	0.776	0.056	13.107	***		
	PU4	0.734	0.064	12.051	***		

Perceived Ease of Use α=0,779	**PEU1**	0.709	-	-	-	0.55	0.68
	PEU2	0.678	0.109	8.184	***		
	PEU3	0.827	0.133	8.903	***		
Attitude Towards Use α=0,774	**ATU1**	0.795	-	-	-	0.54	0.67
	ATU2	0.756	0.082	10.658	***		
	ATU3	0.647	0.082	8.988	***		
Behavioral Intention to Use α=0,794	**BIU1**	0.732	-	-	-	0.57	0.69
	BIU2	0.769	0.099	9.783	***		
	BIU3	0.755	0.105	9.641	***		

	χ2/DF	**CFI**	**NFI**	**TLI**	**GFI**	**AGFI**	**RMSEA**	**SRMR**
TAM	1.86	0.95	0.90	0.94	0.90	0.85	0.066	0.048
Acceptable Compliance *	≤ 3	≥ .90	≥ .90	≥ .90	≥ .90	≥ .85	≥ .08	≥ .08
Perfect Fit *	≤ 2	≥ .95	≥ .95	≥ .95	≥ .95	≥ .90	≥ .05	≥ .05

* İlhan and Çetin, 2014; Gürbüz and Şahin, 2018

As seen in Table 3, the loadings of the factors forming the model are higher than 0.70, AVE values are higher than 0.50, CR values are higher than 0.60 and Cronbach's alpha values are higher than 0.70 (Fornell - Larcker, 1981). Since these values are above acceptable levels, it can be stated that the internal consistency reliability and convergent validity of the model are ensured. The CFA analysis fit index values for the model are also shown in Table 3. Accordingly, it is seen that the Chi-Square Fit Test (χ2/DF) and Comparative Fit Index (CFI) values are within the limits of perfect fit, and the Normed Fit Index (NFI), Tucker-Lewis Fit Index (TLI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Error (SRMR)

values are within acceptable limits. Therefore, it is seen that the proposed TQM is compatible and acceptable with the data.

5.2. Hypothesis test

In order to test the hypotheses in our research and to determine the relationship between PE, PU, PEOU, ATU and BIU, correlation analysis was first used. The results of the correlation analysis are presented in the Table 4.

Table 4. Correlation Analysis Results

Factor	$\bar{x}$	SD	1	2	3	4	5
1- Perceived enjoyment	4.07	0.781	1				
2- Perceived usefulness	4.06	0.753	.741***	1			
3- Perceived ease of use	3.58	0.698	.416***	.450***	1		
4- Attitude towards use	3.97	0.738	.672***	.698***	.394***	1	
5- Behavioral intention to use	3.84	0.789	.625***	.664***	.392***	.572***	1

$\bar{x}$=Mean; **SD**= Standard Deviation; N=201; *** p<.001

If the correlation coefficient value is zero, there is no linear relationship between the variables. If the coefficient is between .01-.29, it is said to be weak, between .30-.70, moderate, between .71-.99, strong and 1.00, perfect correlation (Gürbüz - Şahin, 2018). Considering the findings, it is concluded that there is a moderate correlation between all three scales. When the table 4 is examined, it is seen that there is a moderate and strong relationship between each scale.

In order to test the hypotheses of the research, the Structural Model analysis of the model created to examine the effects of independent variables on dependent variables is shown in Table 5.

Table 5. Structural Model Analysis Findings

H	Path	β	SE	CR	p
H1	Perceived EnjoymentàPerceived Usefulness	0.869	.110	9.320	***
H2	Perceived EnjoymentàPerceived Ease of Use	0.532	.079	5.496	***
H3	Perceived UsefulnessàAttitude Towards Use	0.804	.082	8.870	***
H4	Perceived UsefulnessàBehavioral Intention to Use	0.723	.153	4.055	***
H5	Perceived Ease of UseàAttitude Towards Use	0.099	.105	1.231	.218
H6	Perceived Ease of Useà Perceived Usefulness	0.098	.101	1.392	.164
H7	Perceived Ease of UseàBehavioral Intention to Use	0.016	.104	.190	.849
H8	Attitude Towards UseàBehavioral Intention to Use	0.095	.166	.543	.587

*N= 201; *** p<0.001; β: Standardized regression coefficient*
Perceived Usefulness (R^2=0.86), Perceived Ease of Use (R^2=0.28), Attitude Towards Use (R^2=0.75), Behavioral Intention to Use (R^2=0.67)

	χ2/DF	CFI	NFI	TLI	GFI	AGFI	RMSEA	SRMR
Model	1.90	0.95	0.90	0.94	0.90	0.85	0.07	0.05
Acceptable Compliance*	≤ 3	≥ .90	≥ .90	≥ .90	≥ .90	≥ .85	≥ .08	≥ .08
Perfect Fit*	≤ 2	≥ .95	≥ .95	≥ .95	≥ .95	≥ .90	≥ .05	≥ .05

* İlhan and Çetin, 2014

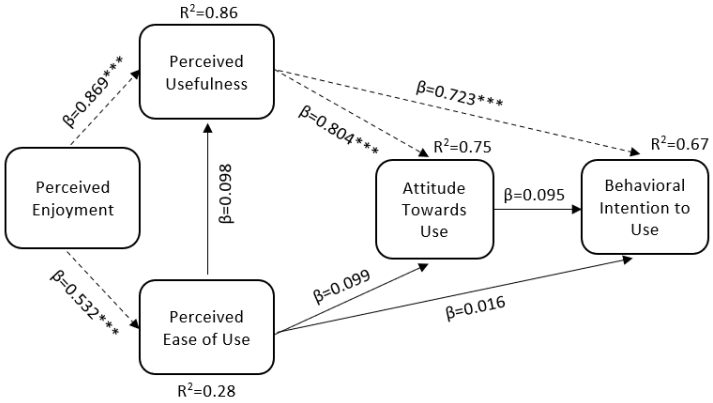
When Table 5 is examined, it is seen that perceived enjoyment predicts PU (β=0.87, p<0.001) and PEOU (β=0.53, p<0.001), and perceived benefit predicts ATU (β=0.80, p<0.001) and BIU (β=0.72, p<0.001). PEOU predicts ATU, PU and BIU, while ATU does not predict BIU. In this context, while H1, H2, H3 and H4 hypotheses of the study are accepted; H5, H6, H7 and H8 hypotheses are rejected. In addition to these results, according to Table 5, the fit index values of the model (χ2=182, df=96, χ2/df=1.90, CFI=0.95, NFI=0.90, TLI=0.94,

GFI=0.90, AGFI=0.85, RMSEA=0.07 and SRMR=0.05) are within acceptable limits and therefore the model is valid.

Figure 1 presents a summary of the results of the hypothesis tests in the light of the current findings.

In line with the information given in Table 1, 34.8% of the students participating in the study were male, while 65.2% were female. Looking at the age ranges of the participants, it is observed that the 18-20 age range and the 21-23 age range have the same number of participants. The ages showed a homogeneous distribution between 18-23. It is also observed that the number of participants aged 24 and above is quite low. When the class levels of the participants are analyzed, it is seen that 55.7% of the participants are at the 1st grade level. This rate shows that more than half of the participants are 1st graders. This is followed by 2nd graders with 24.4%, 4th graders with 17.9% and 3rd graders with the lowest rate of 2%. Students from the Department of Emergency Aid and Disaster Management participated in the study with 51.2%, while students from the Department of Health Management participated with 48.8%. Finally, it is emphasized that 37% of the participants have knowledge about AR.

Figure 1. Results of Hypothesis Tests



***p<0.001; **Note:** Unstandardized beta coefficient values are reported. Dashed lines represent significant relationships

6. Conclusion and Discussion

This study aimed to examine the AR applications used by students of the Faculty of Health Sciences at Ardahan University through the lens of the TAM and to measure their BIU based on identified factors. According to the results of the path analysis conducted to test the first hypothesis of the study, it was found that PE had a positive effect on PU ($\beta=0.869$, $p<0.05$) as reported by the participants. Technologies deemed enjoyable and engaging motivate students, fostering more active participation in the learning process. This allows students to better perceive the benefits of AR applications and adopt the technology more easily. Furthermore, the enjoyable and engaging experience provided by AR applications contributes to the development of a positive attitude toward this technology among students. Such a positive attitude may lead to greater awareness of the benefits of AR applications. A study by Papakostas et al. (2023) similarly found that external variables such as enjoyment significantly affect PU. Likewise, Kountromanos and Mikropoulos (2021) concluded that PE positively influences PU.

The path analysis results for the second hypothesis indicated that PE has a positive effect on PEOU ($\beta=0.532$, $p<0.05$). Fun and gamified learning environments help reduce students' stress levels, enabling them to focus more comfortably on the learning process. A related study also found that external variables such as enjoyment significantly influence PEOU (Papakostas et al., 2023). For the third hypothesis, the analysis revealed that PU positively affects attitudes toward use ($\beta=0.804$, $p<0.05$). When students believe that AR applications assist their learning, make lessons more engaging, and enhance their performance, they become more willing to use the technology. A similar study by Kountromanos and Mikropoulos (2021) examining mobile AR applications in teaching using the TAM model also found that attitude positively affects PU.

The results of the fourth hypothesis test showed that PU has a significant impact on BIU ($\beta=0.723$, $p<0.05$). Students' perception that AR applications enrich their learning experience and help them acquire new skills serves as a motivating factor for adopting and using the technology. Students who realistically perceive the benefits of AR applications develop a more positive

attitude toward the technology, which increases their intention to use AR applications. Similar findings were observed in a study by Asiri (2022), which demonstrated a positive relationship between PU, attitudes toward use, and the intention to use AR applications in education. In conclusion, strategies aimed at enhancing PU, ease of use, and enjoyment are critical for the adoption of AR applications in educational settings. The finding hat such applications enrich students' learning experiences and improve their performance highlights the importance of broader implementation of this technology. Studies suggest that AR technologies play a crucial role in enhancing educational experiences by boosting student motivation, engagement, and overall learning outcomes. Research highlights that the integration of AR in academic settings positively influences key factors such as academic success, attitude, motivation, and attention (Assem et al., 2022; Yildiz, 2021).This is consistent with the TAM, which emphasizes PU as a critical factor in technology adoption. By incorporating AR into educational curricula, instructors can design interactive and immersive learning environments that promote a deeper comprehension of complex subjects (Jamali et al., 2015; Nechypurenko et al., 2020). The interactive nature of AR fosters a more engaging learning experience, ultimately contributing to higher academic performance and improved retention of knowledge (Iatsyshyn et al., 2020; Özerbaş, 2019).

A limitation of the study is that the sample was drawn solely from one faculty. Future research could benefit from collecting data from the entire university, other universities, professions, or sectors that currently use or are likely to adopt AR, to generalize the findings. Since data collection in this study was cross-sectional and reflected only the participants' current psychological states and perceptions, future studies should collect data both before and after the use of AR glasses to provide a more comprehensive examination of students' perceptions on this topic.

The study results also have implications for policymakers. To promote the wider use of AR applications in education, it is recommended that decision-makers adapt course content to AR applications, ensure the applications are simple and user-friendly, allocate necessary budgets for the development of these applications, train educators for integration, and improve the supporting infrastructure.

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