

Comparison of The Distance Education Process Applied During the Covid-19 Pandemic and 6 February 2023 Earthquake Periods Using Multi-Group Structural Equation Model

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ABSTRACT

Innovations in information technology cause significant developments in various fields including healthcare, economy, business and education. These developments, especially within the realm of education, accelerate technological advancements and lead to the adoption of distance education systems as effective learning tools. Consequently, determining students' adaptation to the distance education system has become an important issue. In early 2020, Türkiye swiftly adopted a distance education system as a precautionary measure against the Covid-19 pandemic. Due to this situation, face-to-face education has been halted, and educational activities have continued via online platforms. Distance education was effective until the start of the 2021/2022 academic year. During this period, it became crucial for students to adapt to this new system and use technology effectively. On February 6, 2023, Türkiye experienced a major earthquake disaster centered in Kahramanmaraş. This earthquake negatively affected the entire country and necessitated another transition to distance education. For the 2022/2023 spring academic period, universities in Türkiye once again switched to distance education. This situation required examining the students' adaptation processes to the distance education system for the second time. This research aims to identify potential differences in university students' adaptation processes to distance education employed in response to the Covid -19 pandemic and the February 6, 2023 earthquake. For this purpose, a survey was administered to a total of 623 students who voluntarily participated in the research during both periods. To investigate students' adaptation to the distance education system, this study utilized the Technology Acceptance Model (TAM). Confirmatory factor analysis and multi-group structural equation modeling were employed to analyze survey data collected from university students in Konya. The results indicated that students' adaptation to distance education varied significantly between the Covid-19 pandemic and the aftermath of the February 6, 2023 earthquake.

Covid-19 Pandemisi ve 6 Şubat 2023 Deprem Dönemlerinde Uygulanan Uzaktan Eğitim Sürecinin Çok Gruplu Yapısal Eşitlik Modeli ile Kıyaslanması

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ÖZET

Bilgi teknolojisindeki yenilikler, sağlık, ekonomi, iş dünyası ve eğitim gibi birçok sektörde önemli gelişmelere yol açmaktadır. Bu gelişmeler, özellikle eğitim alanında, teknolojik ilerlemelerin hızlanmasına ve uzaktan eğitimin öğrenmede etkili bir araç olarak kabul edilmesine neden olmaktadır. Buna bağlı olarak öğrencilerin uzaktan eğitim sistemine adaptasyonlarının belirlenmesi önemli bir konu haline gelmiştir. Türkiye'de Covid-19 pandemisi tedbirleri kapsamında 2020 yılı başında ani bir şekilde uzaktan eğitim sistemine geçilmiştir. Bu geçiş, yüz yüze eğitimin durdurulması ve eğitim faaliyetlerinin online platformlar üzerinden devam etmesi anlamına gelmiştir. Uzaktan eğitim sistemi, 2021/2022 eğitim dönemi başlangıcına kadar etkin bir şekilde kullanılmıştır. Bu süreçte, öğrencilerin uzaktan eğitim sistemine uyum sağlamları ve teknolojiyi etkili bir şekilde kullanmaları büyük önem kazanmıştır. Türkiye 6 Şubat 2023 tarihinde Kahramanmaraş merkezli büyük bir deprem felaketi yaşamıştır. Bu deprem, tüm Türkiye'yi olumsuz etkilemiş ve eğitim sisteminde tekrar uzaktan eğitime geçişi zorunlu kılmıştır. 2022/2023 bahar eğitim dönemi için Türkiye'deki üniversitelerde yeniden uzaktan eğitime geçilmiştir. Bu durum, öğrencilerin uzaktan eğitim sistemine ikinci kez adaptasyon süreçlerini incelemeyi gerektirmiştir. Bu çalışma, üniversite öğrencilerinin Covid-19 salgını ve 6 Şubat 2023 deprem dönemlerinde kullanılan uzaktan eğitim sistemine uyum süreçlerindeki potansiyel farkları incelemeyi amaçlamaktadır. Bu amaç doğrultusunda, her iki dönemde de araştırmaya gönüllü olarak katılan toplam 623 öğrenciye anket uygulanmıştır. Öğrencilerin uzaktan eğitim sistemi kullanımına ilişkin adaptasyonlarını belirlemek için Teknoloji Kabul Modeli (TKM) kullanılmıştır. Konya'daki üniversite öğrencilerinden anket yöntemi ile toplanan veriler, doğrulayıcı faktör analizi ve çok gruplu yapısal eşitlik modeli kullanılarak incelenmiştir. Araştırma sonuçları, öğrencilerin uzaktan eğitim sistemine uyumlarının Covid-19 pandemisi ve 6 Şubat 2023 depremi dönemlerinde farklılık gösterdiğini ortaya koymuştur.

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INTRODUCTION

In this century, the world is increasingly adopting technologies that lead to reforms in many areas of life, such as education, economy, and health. Among these technological advancements, the frequency of using information technologies has been steadily rising among societies for various reasons (Doğan and Sönmez, 2023). The Covid-19 outbreak, which quickly spread across the globe starting in late 2019, caused countries to take various measures for public health since the beginning of 2020. These measures involved mandatory mask-wearing, travel restrictions, the suspension of in-person education, and a shift to distance education. Different strategies have been adopted in the field of education, such as distance education and family-supported education.

The pandemic process has had negative effects in many areas such as health, economy and social life, as well as negative reflections on education. The unfavorable in education has been felt by all stakeholders, including teachers, students, parents, school administrators, and the wider community (Çoruk and Turhan, 2024).

Throughout human history, disasters have been observed and can be characterized as destructive events that occur in different forms today. These events can significantly impact social life and trigger social change processes. One of the most devastating types of disasters is earthquakes (Bozgedik et al., 2024). Türkiye experienced a major disaster on February 6, 2023, due to two major earthquakes centered in Kahramanmaraş, in which more than 50 thousand citizens lost their lives and thousands were injured. As a result of the earthquake, eleven provinces were extremely negatively affected in every respect. Due to this disaster, which deeply affected the whole of Turkey, universities transitioned to a distance education system and the 2022-2023 spring education period completed with the distance education system.

Distance education has become a powerful learning method, largely due to the incorporation of technology and the internet. The growing significance of distance learning, along with the diverse range of services offered through online courses, has led to a notable rise in the adoption of such systems. Consequently, it is crucial for distance education systems to be implemented effectively and used well to positively influence students (Altındağ, 2020).

The Technology Acceptance Model (TAM), introduced by Davis in 1989, is a widely recognized framework for evaluating how new technologies are adopted and used by individuals (Surendran, 2012). A method to determine when and how users adopt new technology is offered by this model (Davis, 1989). This model explains the acceptance of technology by considering external factors, social factors, cultural and political factors, in addition to factors like perceived usefulness and perceived ease of use (Surendran, 2012). The attitude towards using technology and the intention to use it are primarily influenced by the perceived usefulness and perceived ease of use. The main factor influencing actual system usage is the intention to behave consecutively. Reviewing the literature reveals that the Technology Acceptance Model (TAM) has been frequently employed in various studies to assess the perceived usefulness, intention to use, and ease of use of distance education systems. Researchers have enhanced this model by including external variables to better understand the factors that affect the acceptance and use of distance education systems, helping them to determine why a specific system may not be adopted and enabling them to take appropriate corrective measures (Davis et al., 1989).

Numerous studies have been conducted on online education, particularly after the Covid-19 pandemic. Karakaş and Sayan (2023) aimed to determine the relationship between university students' attitudes toward the use of online education during the Covid-19 pandemic and various demographic variables (gender, age, education level). The review article by Aygin and Gül (2023) aims to highlight the effects of the remote education process created by the pandemic on both educators and students, as

well as to examine the advantages/conveniences and disadvantages/limitations associated with online learning. Taşabat et al. (2023) examined the impact of mandatory remote activities, particularly in higher education, when physical interactions are not possible. The study focused on whether distance education was adopted by university students and academics at Mimar Sinan Fine Arts University (MSGSÜ), whether there were any issues related to self-efficacy in using the system and identified the positive and negative aspects of remote learning. Karaman and Konyalılar (2024) aimed to identify the issues encountered in distance education provided to university students during the COVID-19 pandemic and to examine the impact of students' attitudes toward remote education on their satisfaction. The study employed correlation analysis to assess the relationship between students' perceptions of the system, department, and academics during the remote education process and their satisfaction. Furthermore, the study determined the effects of competencies and motivation, usability, and effectiveness on satisfaction. Aksoy and Özyürek (2024) aimed to examine distance education implemented with the onset of the Covid-19 pandemic from the perspectives of university students. Based on a descriptive survey model, the results of the study indicated that university students identified the primary barriers to remote education as issues related to internet or electricity connection disruptions and certain negative situations within the family.

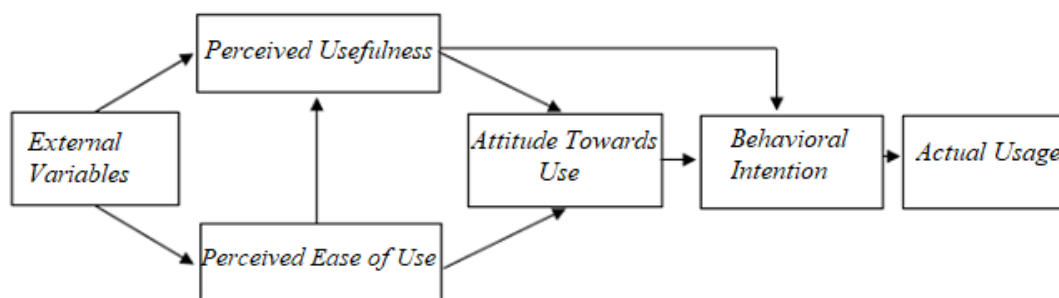
In this study, it has been considered to compare the remote education system with the effects of the February 2023 earthquakes in addition to the previous research. This paper aims to examine the differences in university students' adaptation levels to distance education systems implemented during the COVID-19 pandemic and in response to the February 6, 2023, earthquake. For the scope of this investigation, research was conducted on students studying at Necmettin Erbakan and Selçuk Universities. Data for the COVID-19 period were sourced from Altındağ's (2020) study involving 345 participants. For the February 6, 2023, earthquake, data were collected through an online survey completed by 278 students from different departments in October and November 2023. The data collected from these participating students constitute the dataset for the study. The study utilized multigroup structural equation modeling (MGSEM) to analyze the data.

TECHNOLOGY ACCEPTANCE MODEL (TAM)

The imperative of technological integration in diverse life domains, especially in education, is bringing the issue of individuals' acceptance of technology into discussion (Özkan et al., 2024). Although adapting to technology has become easier for people thanks to advancing technology, sometimes, due to their preconceptions, it has led to certain difficulties. While some readily embrace new technology, others remain distant from it due to their negative perceptions. There can be various reasons for this, such as a lack of openness to innovations, the belief that developments are not suitable for them, a bias against using new technology, and their attitude towards computer usage. To address these reasons, theoretical models that reveal how technology acceptance occurs are used.

Originally developed by Davis in 1986, TAM is grounded in perceived usefulness and ease of use. The principal aim of TAM is to provide an explanation for user behavior in the context of computer technologies and user populations. Furthermore, it aims to offer a solid and theoretically justified explanation. TAM has evolved through various adaptations aligned with the fundamental Theory of Reasoned Action (TRA) approach, supported by existing theories and evidence. TAM serves as a valuable model not only for prediction but also for explanation, allowing researchers to determine why a specific system may not be accepted and take appropriate actions (Davis, 1989).

Figure 1.
TAM Diagram



TAM consists of the following sub-dimensions:

Perceived Ease of Use (PEOU): PEOU expresses the ease with that a potential user perceives the use of the target system without exerting much effort. Users who experience no difficulties with a technology tend to find it user-friendly and are more likely to adopt it.

Perceived Usefulness (PU): PU is a potential user's perception of how a specific application system can positively or negatively impact organizational performance in different situations. In other words, PU in a technology is associated with its ability to provide ease of access. If a person finds that they are getting more productivity from the technology they are using than they expected, it will create the perception that the technology is beneficial, and they are likely to continue using it.

Attitude Towards Use (ATU): Attitude serves as a unifying factor between individuals' beliefs, behaviors, and intentions. It represents the way a person might behave in the face of a particular situation, event, or phenomenon. A user's attitude towards a technology significantly influences its adoption rate.

Behavioral Intention (BI): Intention is defined as the sum of desire and effort a person feels for a behavior they are about to exhibit. According to Davis (1989), it is a concept determined through power and attitude with the aim of showing the expected behavior.

Actual Usage (AU): AU is a concept used in TAM to observe the impact of attitude and intention on behavior. If a user exhibits a positive intention and attitude towards a technology, it is expected that they will adopt the technology with a positive impact.

The TAM method is widely used in literature to evaluate distance education system adoption. Chang et al. (2017) conducted an empirical investigation utilizing the General Extended TAM for distance education, which was developed by Abdullah and Ward in 2016. This research aimed to identify the factors affecting the behavior of undergraduate students when using an e-learning system in Azerbaijan. Eren and Kaya (2017) researched the effects of the distance education system on students using the TAM method. The study was conducted with 156 students at Yüzüncü Yıl University Gevaş Vocational School. Çelik (2018) examined the determinants of user loyalty to the distance education system through a survey involving 1029 distance education students from four university in Ankara. Ali et al. (2018) applied a theoretical framework derived from the Technology Acceptance Model (TAM), which they further extended using insights from prior experimental research, within the setting of a distance education system. Granić and Marangunić (2019) provided a comprehensive review of contemporary research focused on the application of TAM in various learning domains and technologies, as well as for different user types in the context of learning and teaching. Revythi and Tselios (2019) explored the technology acceptance and the behavioral intention to utilize distance education systems, aiming to determine whether students ultimately accepted technologies like e-classrooms and the influence of behavioral intention on their decisions to engage with them. The study

included 345 university students. Özüçelik (2019) examined the integration of the UKEY system with Uludağ University's face-to-face education systems through the framework of the TAM, involving a sample of 250 students. Al-Fraihat et al. (2020) aimed to determine the factors influencing the success of distance education and address system-related issues by utilizing the TAM method. AlHamad (2020) conducted a TAM-based study to reveal the factors influencing students' acceptance of distance education and how students' purposes for using distance education were determined by these factors. The study was applied to 366 university students actively using distance education systems. Baby and Kannammal (2020) obtained an improved version of the TAM model. This version was developed for the user-centered framework design of the distance education system. Bergdahl and Nouri (2020) is one of the first studies to investigate the transition from traditional to distance education in Swedish schools throughout the Covid-19 pandemic. Findings revealed that schools were primarily prepared technically, whereas teachers lacked essential pedagogical strategies for the emerging distance learning environment. Pregowska et al. (2021) presented a historical perspective on distance education, taking into consideration the viewpoints of teachers and students. Casacchia et al. (2021) aimed to evaluate the impact of remote learning used in the 2020 Italian national quarantine for teachers and examine the relationship between distance education and emotional intelligence. Co et al. (2022) evaluated the impact of remote learning on anatomy and surgery education. Turan et al. (2022) investigated university students' views on flexibility, self-regulated effort, and satisfaction within the context of distance education. Di Malta et al. (2022) aimed to investigate the relationships between mental health, connectedness, and academic efficiency of students using distance education throughout the Covid-19. Garlinska et al. (2023) provide information on new technologies used in remote learning in their study. This research focused on the efficiency and psychological impact of distance education on users. The study also has a research property on the development of effective distance education techniques. Hietanen et al. (2023) explore challenges faced by higher education faculty during the abrupt shift to distance education in spring 2020 due to the COVID-19 pandemic. The study identifies primary obstacles and provides insights into teaching, supervision, and examination methods.

METHODOLOGY

A survey was conducted among university students at Necmettin Erbakan University (NEÜ) and Selçuk University to compare students' perspectives on distance education during the COVID-19 pandemic and the after 6 February 2023 earthquake period. Data obtained from the study titled "Investigation of Structural Equation Modeling of University Students' Behaviors Regarding Distance Education in the Covid-19 Pandemic" (Altındağ, 2020) were used for the Covid-19 period. For the earthquake period, survey data collected in July 2023 were used. In both studies, the survey form was distributed to Necmettin Erbakan University and Selçuk University students via social media to ensure randomness in data collection. The survey was divided into two parts. The first part collected demographic data from participants, while the second part consisted of the study's measurement items.

The Technology Acceptance Model (TAM), developed by Davis in 1986, is based on the concepts of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). The primary objective of TAM is to provide a framework that explains the interaction between computer technologies and users, as well as user behavior, both theoretically and empirically. TAM serves not only as a tool for predicting user behavior but also as a mechanism for explaining the underlying reasons behind such behaviors. In this context, researchers can identify why a particular system is not being adopted and take the necessary steps to address these issues (Altındağ and Üzümcü, 2020; Davis, 1989). TAM is a method that maintains its validity and popularity due to its robust framework, which enables both theoretical and empirical explanations of user behavior, its simple and expandable structure, and its effectiveness in identifying the underlying reasons for system acceptance. For these reasons, it has been chosen for this

study. The TAM scale utilized for this study is composed of five sub-dimensions.

Research Sample and Data Collection Tool

The research population comprises students from Necmettin Erbakan University and Selçuk University who are enrolled in Konya. In order to examine the COVID-19 period, the present study employed survey data gathered by Altındağ (2020) from a sample of 345 students enrolled in the spring semester of the 2019-2020 academic year. As the second group, 278 data collected online in October 2023 were used to measure the distance education period after the earthquake disaster on February 6, 2023.

The demographic information gathered from university students who participated in the survey is present in Table 1.

Table 1
Demographic Information of University Students

	Covid-19 Pandemic Period (2020-2022)		After 6 February 2023 Earthquake Period (2022-2023 Spring Semester)	
	N	%	N	%
Gender				
Female	223	64.6	195	70.1
Male	122	35.4	83	29.9
University	N	%	N	%
Selçuk University	198	57.4	153	55
Necmettin Erbakan University	147	42.6	125	45
Class	N	%	N	%
1	50	14.5	47.00	16.9
2	94	27.2	75.00	27
3	79	22.9	49.00	17.6
4	78	22.6	77.00	27.70
4 and above	44	12.8	30.00	10.8
Daily Internet Usage Time	N	%	N	%
Less than 1 hour	9	2.6	4	1.4
1-3 hour	92	26.7	69	24.8
3-5 hour	130	37.7	108	38.9
More than 5 hours	114	33	97	34.9
Total	345	100	278	100

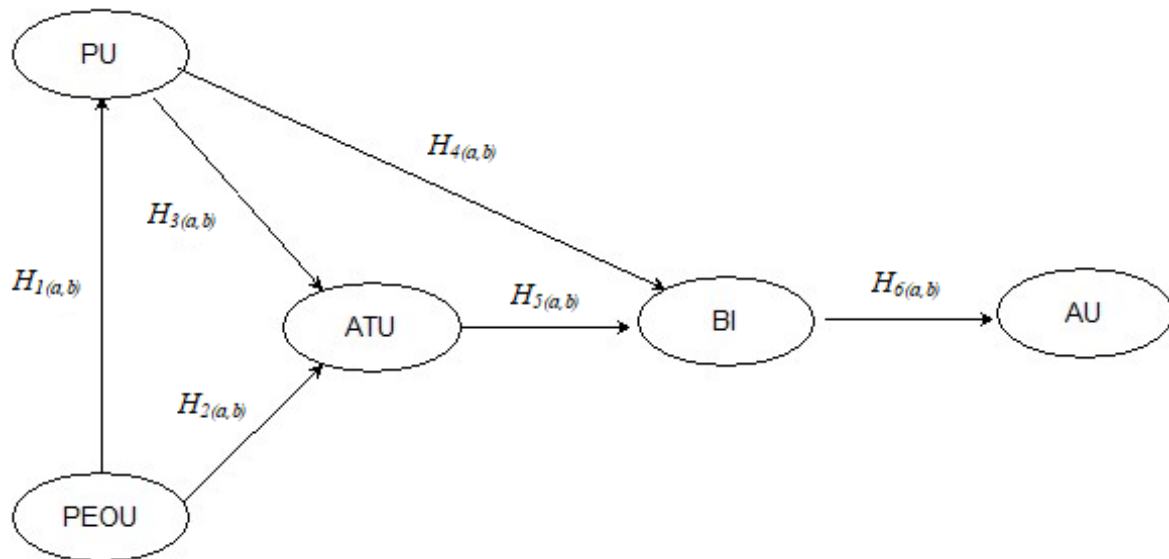
In this study, as a result of examining the sources related to TAM as a data collection tool, a research scale for distance education was created by adapting the scale items (Çelik et al., 2010; Efiloğlu Kurt, 2015; Çelik, 2018; Kalyoncuoğlu, 2018; Bektaş, 2019; Altındağ, 2020; Yıldırım et al., 2020). All items in the scale consist of 5-point Likert-style attitude expressions such as "5: Totally Agree, 1: Totally Disagree".

Research Model and Hypotheses

Based on the TAM approach, the research model, hypotheses, and data collection instrument were improved. A visual representation of the proposed research model is provided in below.

Figure 2

Research Model



The hypotheses determined based on the research model are as follows.

H_{1a} : PEOU positively influences PU on Covid-19 pandemic period.

H_{1b} : PEOU positively influences PU on after 6 February 2023 earthquake period.

H_{2a} : PEOU positively influences the ATU on Covid-19 pandemic period.

H_{2b} : PEOU positively influences the ATU on after 6 February 2023 earthquake period.

H_{3a} : PU positively influences the ATU on Covid-19 pandemic period.

H_{3b} : PU positively influences the ATU on after 6 February 2023 earthquake period.

H_{4a} : PU positively influences BI on Covid-19 pandemic period.

H_{4b} : PU positively influences BI on after 6 February 2023 earthquake period.

H_{5a} : ATU positively influences BI on Covid-19 pandemic period.

H_{5b} : ATU positively influences BI on after 6 February 2023 earthquake period.

H_{6a} : BI positively influences AU on Covid-19 pandemic period.

H_{6b} : BI positively influences AU on after 6 February 2023 earthquake period.

Analytical procedure

In this study, we initially conducted confirmatory factor analysis (CFA) to verify the validity of the constructs. Subsequently, we employed MGSEM analysis to identify the statistical differences in university students' distance education usage behavior during the Covid-19 period and after the earthquake on February 6, 2023.

Test of metric invariance

Multi-group measurement invariance was employed to examine changes in student distance education behavior between two periods. The equality of covariance structures across groups was tested by comparing an unconstrained model with a model imposing equality constraint. The invariance of factor loadings was subsequently examined by imposing constraints to ensure consistency across groups.

Table 2 presents the results of the metric invariance test, which facilitates the comparison of β and γ in the structural model.

Table 2

Measurement invariance analysis results

	χ^2	<i>sd</i>	$\Delta\chi^2$	Δsd	<i>RMSEA</i>	<i>CFI</i>	<i>p</i>
Configural invariance	439.518	194			0.045	0.959	<.001
Metric invariance	476.372	205	36.854	11	0.046	0.954	<.001
Structural Weights	631.425	227	191.907	33	0.054	0.932	<.001
Scalar invariance	627.262	221	187.744	27	0.054	0.932	<.001
Error Variance invariance	591.043	233	299.32	55	0.045	0.940	<.001

The configural invariance value tests only configural invariance, which tests the unconstrained model across groups. Configuration invariance determines whether the factor structure is suitable for both groups. Configural invariance demonstrates a good fit, as shown in Table 2 ($\chi^2/sd = 2.266$, *RMSEA*=0.045, *CFI*=0.959). This result demonstrates that the factor structure is a good fit for each group (Collier, 2020).

The subsequent model for evaluation is metric invariance, which is the part where invariance across groups is tested. According to the Metric invariance test results, the p value is determined to be significant (<0.001). Based on Structural Weight test results, p-value is statistically significant (0.021<0.001). These results indicate a significant overall difference in university students' attitudes toward the distance education system implemented during the COVID-19 and post-February 6 earthquake periods. It is necessary to determine which structural equation coefficient or coefficients this difference arises from. For this purpose, all structural equation coefficients between groups are required to be tested.

Measure validity

The confirmatory factor analysis, as presented in Table 3, indicates that all items, with exception of one item, demonstrated significant loadings on their hypothesized latent constructs across both groups. In this context, 16 items were identified among the 17 items that represented a high item-total correlation, indicating their ability to measure the examined constructs. Cronbach's alpha coefficients for all scales surpassed the 0.70 criterion, indicating acceptable internal consistency in both groups.

Table 3 presents the final validity and reliability indices for the scale's dimensions.

Table 3

Validity and reliability indices for constructs.

Covid-19 Pandemic Period (2020-2022)					After 6 February 2023 Earthquake Period (2022-2023 Spring Semester)			
Item	Std Estimate	S.E.	t value	Cronbach Alpha	Std Estimate	S.E.	t value	Cronbach Alpha
PEOU1	0.84			0.873	0.788			0.867
PEOU2	0.841	0.059	17.907		0.771	0.071	13.262	
PEOU3	0.676	0.059	13.592		0.772	0.07	13.222	
PEOU4	0.822	0.059	16.63		0.816	0.078	13.48	
PU1	0.890			0.83	0.891			0.797
PU2	0.942	0.044	24.556		0.953	0.052	21.743	
PU3	0.570	0.059	11.631		0.446	0.053	7.75	
ATU1	0.480			0.734	0.478			0.768
ATU2	0.663	0.168	7.987		0.716	0.3	7.497	
ATU3	0.519	0.137	6.979		0.571	0.253	6.643	
ATU4	0.815	0.182	8.733		0.859	0.319	8.014	
BI1	0.853			0.702	0.853			0.736
BI2	0.655	0.05	12.847		0.694	0.061	12.803	
AU1	0.846			0.911	0.828			0.889
AU2	0.939	0.051	22.489		0.943	0.063	17.742	
AU3	0.859	0.052	20.093		0.789	0.06	15.261	

The obtained Composite Reliability (CR) and Average Variance Extracted (AVE) values evaluated the convergent validity (coefficients for the Covid-19 period are presented in Table 4, while coefficients for the after February 6, 2023 Earthquake period are presented in Table 5); both indicators are above the threshold values (CR > 0.7; AVE > 0.5; Fornell and Larcker, 1981).

Table 4

Correlation matrix and Fornell and Larcker criterion – Covid-19 period.

	AVE	CR	Correlation matrix					
			PEOU	PU	ATU	BI	AU	
PEOU	0.637	0.874	PEOU	1				
PU	0.668	0.853	PU	0.554	1			
ATU	0.501	0.719	ATU	0.533	0.778	1		
BI	0.579	0.729	BI	0.528	0.784	0.97	1	
AU	0.779	0.886	AU	0.363	0.54	0.668	0.689	1

Table 5

Correlation matrix and Fornell and Larcker criterion – After 6 February 2023 Earthquake Period

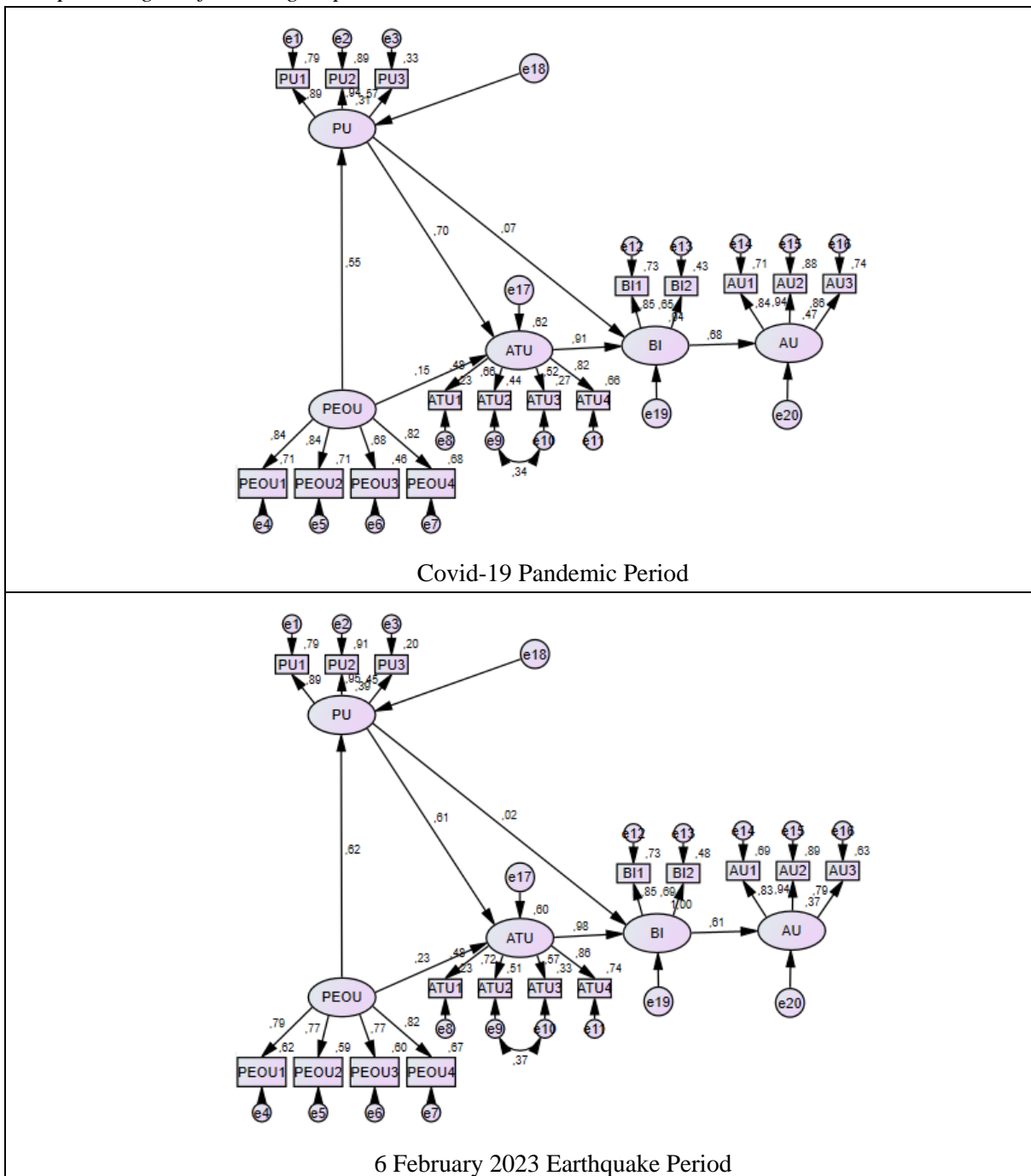
	AVE	CR	Correlation matrix					
			PEOU	PU	ATU	BI	AU	
PEOU	0.619	0.867	PEOU	1				
PU	0.634	0.827	PU	0.621	1			
ATU	0.552	0.758	ATU	0.609	0.751	1		
BI	0.605	0.752	BI	0.611	0.758	0.998	1	
AU	0.732	0.877	AU	0.366	0.454	0.598	0.599	1

Model fit indexes

According to the analysis results, the multigroup structural equation model was calculated as $\chi^2/df = 2.265$. The Root Mean Square Error of Approximation (RMSEA) value is 0.045, the Standardized Root Mean Square Residual (SRMR) value is 0.0440, Goodness-of-Fit Index (GFI) value is 0.911 and the Comparative Fit Index (CFI) is calculated as 0.959. When the fit indices of the measurement model are examined: GFI = 0.914 and CFI = 0.951, it is observed that a strong fit is achieved. Finally, it has been determined that the SRMR value is 0.0458. Therefore, in the multigroup analysis revealed no specific problems with residuals. The structural model path diagram obtained for both groups is shown in Figure 3.

Figure 3

SEM path diagram for both groups



RESULTS

The findings of the MGSEM analysis comparing university students' distance education adaptation during the COVID-19 pandemic and post-February 6, 2023 earthquake periods are summarized in Table 6.

Table 6
Multigroup structural equation results

<i>Hypothesis</i>	Covid-19 pandemic period		After 6 February 2023 Earthquake Period		$\Delta\chi^2$	p value
	Std. Estimate	t-value	Std. Estimate	t-value		
<i>PEOU → PU</i>	0.554	9.727**	0.621	9.249**	$\Delta\chi^2(1) = 0.002$	<i>p=0.965</i>
<i>PEOU → ATU</i>	0.148	2.521**	0.232	3.258**	$\Delta\chi^2(1) = 0.001$	<i>p=0.983</i>
<i>PU → ATU</i>	0.696	10.824**	0.607	5.944**	$\Delta\chi^2(1) = 5.144$	<i>p=0.023</i>
<i>PU → BI</i>	0.074	0.745 ^{AD}	0.020	0.216 ^{AD}	$\Delta\chi^2(1) = 0.167$	<i>p=0.683</i>
<i>ATU → BI</i>	0.913	6.464**	0.983	6.871**	$\Delta\chi^2(1) = 3.599$	<i>p=0.058</i>
<i>BI → AU</i>	0.689	11.854**	0.609	9.185**	$\Delta\chi^2(1) = 0.088$	<i>p=0.767</i>

According to the results in Table 6, tested hypotheses $H_{1a}, H_{1b}, H_{2a}, H_{2b}, H_{3a}, H_{3b}, H_{5a}, H_{5b}, H_{6a}$ and H_{6b} in both groups, have been accepted. Only the hypotheses H_{4a} and H_{4b} ($PU \rightarrow BI$) hypotheses have not been accepted. According to the "Structural Weight model" test results in Table 3, since there is a statistical difference between the two groups, it is necessary to determine which structural equation(s) make the difference. For this purpose, all structural equations between groups were tested.

The results of the first test, which evaluates the relationship between Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), indicate that there is no significant difference between groups ($PEOU \rightarrow PU: \Delta\chi^2/1sd = 0.002; p = 0.965$). Therefore, we can say that the effects of Perceived Ease of Use on Perceived Usefulness are similar over the two groups. According to tests performed similarly: Test 2 ($PEOU \rightarrow ATU: \Delta\chi^2/1sd = 0.001; p = 0.983$), Test 4 ($PU \rightarrow BI: \Delta\chi^2/1sd = 0.167; p = 0.683$), Test 5 ($ATU \rightarrow BI: \Delta\chi^2/1sd = 3.599; p = 0.058$) and Test 6 ($BI \rightarrow AU: \Delta\chi^2/1sd = 0.088; p = 0.767$) are shown in Table 6. According to these 5 hypotheses test results, no significant differences were found between the groups. We determined that the relationship that creates the difference between the two groups (Test 3) is between Perceived Usefulness and Attitude Towards Usage ($PU \rightarrow ATU: \Delta\chi^2/1sd = 5.144; p = 0.023$). Therefore, it was determined that the relationship between Perceived Usefulness and Attitude Towards Use was significantly different between the groups.

DISCUSSION

Significant changes in education and training systems are brought about by today's technological advances. The widespread use of the Internet has allowed distance education and online learning applications to be accepted as alternatives to traditional classroom education. Web-based technologies offer a variety of educational tools that extend educational opportunities beyond the traditional classroom environment. Web-based education eliminates space and time restrictions by providing students with the opportunity to access learning resources anytime and anywhere. The Covid-19 pandemic has affected not only daily life but also especially education processes. As in many countries, Turkey transitioned to distance education for approximately eighteen months. It turned into traditional education in the last education period of 2021. The process of students adapting to new education systems also affects their academic motivation. Following the devastating earthquake centered in Kahramanmaraş on February 6, 2023, numerous Turkish universities transitioned to distance education

for the completion of the 2023/2024 spring semester. According to experts, continuing education process with the distance education system and supporting this system in the future is considered a very possible scenario.

Artificial intelligence and machine learning methods are considered one of the biggest technological developments of recent years, and thus, many innovative technologies such as smart watches, autonomous vehicles, 5G technology, extended reality, smart delivery robots, and advanced software are entering our lives more and more every day. Considering that approximately 3 semesters have passed between the mandatory distance education periods in Turkey (Covid-19 Period and the period after the February 6, 2023 Kahramanmaraş earthquake), it is obvious that many technological developments have entered our lives during this period. It is thinking to be important in terms of distance education program technology to determine whether there is a difference in students' adaptations to the use of distance education between these two periods.

The process of students adapting to education systems also affects their academic motivation. The purpose of this research is to determine differential patterns of university students' attitudes and behaviors towards distance education adoption during the COVID-19 pandemic and post the Kahramanmaraş earthquake of February 6, 2023. For this purpose, we used the Technology Acceptance Model (TAM). We performed a MGSEM analysis to determine whether there was a difference between the two periods.

Firstly, we performed multi-group confirmatory factor analysis and SEM analysis for both periods. Our findings suggest that the model demonstrates a good fit, as evidenced by the goodness-of-fit indices. According to the structural model results obtained for both groups, we determined that five of the six hypotheses tested in each group are accepted. Only the hypotheses H_{4a} and H_{4b} are rejected. Subsequently, a multi-group structural equation model was employed to assess overall structural differences between the two periods.

According to the structural weight model result in Table 3, there is a statistically significant difference between the two groups. Consequently, we determined that there is a structural difference for university students' distance education system adaptations between the Covid-19 and after February 6, 2023 earthquake periods. Therefore, all structural equation coefficients tested to determine which structural equation(s) caused differences between periods. According to the p significance values of the six test results, we determined that the structural equation that causes the difference between the two periods is $PU \rightarrow ATU$. This structural equation coefficient calculated as 0.696 during the Covid-19 period and 0.607 during the after February 6, 2023 earthquake period. In conclusion, for the distance education system, we can say that the structural equation coefficient of 'Perceived usefulness positively influences attitude toward use' was higher during the Covid-19 period and created a difference between after the February 6, 2023 earthquake period.

In today's technology context, the integration of the distance education system into the educational processes holds significant importance. This study, using the TAM, reveals the attitudes and behaviors of university students towards the distance education system during the periods Covid-19 and after the earthquake on February 6, 2023. Obtained analysis results provide an opportunity for an examination of the relationship between factors influencing the distance education system and to identify differences between the two periods. The scope of this research, limited to students from two state universities, restricts the extent to which its results can be generalized to the broader population. Future studies could be conducted with large sample groups, including students from different state and private universities in various cities. The research model can be enhanced and analyzed by adding different variables, and the results can be compared with the findings of other studies.

Ethics Committee Approval

Ethical approval for this study was obtained from the Necmettin Erbakan University Social and Human Sciences Scientific Research Ethics Committee on October 13, 2023 (decision number 2023/411).

Author Contributions

Research Design (CRediT 1) Author 1 (100%)

Data Collection (CRediT 2) Author 1 (100%)

Research - Data Analysis - Validation (CRediT 3-4-6-11) Author 1 (100%)

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There is no conflict of interest.

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