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# Promoting Online Education in Higher Education Institutions in Pakistan: Insights from the Technology Acceptance Model

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### ARTICLE DETAILS

### ABSTRACT

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*PU, PEU, TAM, University students' attitude, Behavioral intention, Actual adoption of online education, Student geographical status, Student degree programs.*

This study, based on the Technology Acceptance Model, explores how perceived usefulness (PU) and perceived ease of use (PEU) affect university students' attitudes, intentions, and actual adoption of online education. It also examines how students' geographic status and educational levels moderate the relationship between PU and PEU and attitudes toward online education. Three hundred and thirty-one students from public and private universities participated in this study. The hypotheses were tested using structural equation modeling and multigroup modeling in AMOS. The results supported the positive effect of PU and PEU on university students' attitudes toward online education, their behavioral intention, and subsequent actual adoption/use of online education. The moderation analysis revealed that PU had a significant effect on attitudes toward online education for university students from rural areas but not for students from urban areas. Additionally, PEU was found to strengthen attitudes toward online education more effectively for students from urban areas than for students from rural areas. The moderation analysis also showed that the link between PU and attitudes toward online education was significant for undergraduate students but not for postgraduate students. Conversely, the relationship between PEU and attitudes toward online education was stronger among undergraduate students than among postgraduate students.



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## Introduction

The World Health Organization (WHO) declared COVID-19 a global pandemic in March 2020. In response to this pandemic, governments all across the world were forced to establish a range of emergency management protocols (Zhang et al., 2020). Various governments have taken actions such as city lockdowns, educational institution closures, and the imposition of tight social distancing measures. The global spread of the Coronavirus hampered educational activities, prompting many schools/universities to close (Onyema et al., 2020). Japan, China, South Korea, Thailand, Pakistan, India, Saudi Arabia, Iran, Italy, Spain, Austria, Germany, Ghana, Ethiopia, the USA, and Australia are just a few of the countries that have closed schools owing to COVID-19. Closures of universities and schools, according to UNESCO (2020), have a variety of detrimental implications for students, including disruption in learning, which deprives youngsters of opportunities for growth and development. As a result, the Chinese government launched a strategic initiative known as "Suspending Classes without Stopping Learning" (Zhang et al., 2020), which was eventually followed by governments around the world to convert to online education while educational institutions were closed. Specifically, online education as a response to the COVID-19 pandemic began in China with their "Schools out, classes in" campaign, which intended to mitigate the academic loss caused by the global pandemic.

Online education has become increasingly viable, cost-effective, and operational around the world as technology has advanced, yet it is still in its infancy in many developing countries for a variety of reasons. One of the major hurdles to online education acceptance is technology (Dijk, 2020). Many students in developing countries, for example, suffer technological difficulties when using e-learning platforms such as Microsoft Team and Google Class (Almaiah & Alyoussef, 2019). Another factor that hinders students' desire to pursue online education is their lack of understanding of internet skills and capacities (Al-Araibi et al., (2019). In many struggling countries, online education was a long way off until the WHO declared COVID-19 a pandemic on March 11, 2020, resulting in the closure of schools, colleges, and universities around the world, including Pakistan. To prevent social interaction, Pakistan's Higher Education Commission (HEC) has announced the closure of universities and a transition to online education. COVID-19, therefore, has accelerated Pakistani universities' to change their mode of education from traditional class room setting to online. This also provided researchers with an opportunity to investigate strategies to strengthen the adoption of online education. Given this knowledge gap, the question of what motivates students to adopt online education becomes critical. This study, therefore, aims at identifying the factors that encourage students to adopt online education.

The present study is related to TAM users' interest in understanding motives for adopting technology and information systems, as we believe it is useful in understanding online education adoption (Davis, 1985). Online education is a technological phenomenon and its adoption is based on various factors proposed by TAM (Davis, 1985). The TAM examines users' attitudes and behavioral intentions to adopt technology, focusing on two key aspects: PEU and PU. PEU assesses whether a user believes that using a specific information system will be easy, while PU measures the user's belief that using a particular information system will improve their performance (Davis, 1989). Based on these TAM assumptions, The study examines if PU and PEU influence university students' attitudes, intentions, and actual adoption of online education.

Moreover, prior educational research has found a significant difference in educational performance between urban and rural students (Olsson et al., 2019; Singer, 2020; van Maarseveen, 2021), as well as a significant difference in the adoption of emerging technology between undergrad and postgrad students (Sultan et al., 2022). In light of these considerations, it's critical to see if students' geographic location and degree program may differentiate the effects of PU and PEU on online learning adoption in Pakistan. The current study, therefore, will also check the moderating effect of students' geographical status (e.g., urban vs. rural areas), and the degree program (e.g.,

undergraduate vs. postgraduate) in which they enrolled on their attitude towards online education.

Overall, the conceptual framework proposed in the present study is supported by TAM. Online education is a technological phenomenon and its acceptance and adoption are based on various factors proposed by TAM (Davis, 1985; 1989). Further, Davis (1985) proposed the TAM as the acceptance or adoption of the information system. TAM has proven to be a comprehensive framework for predicting and explaining users' adoption of information technology. TAM serves as a foundation for finding how external factors influence beliefs, attitudes, and intentions to use. In addition, TAM proposes that the actual use of the technology-based phenomenon (Online education) is caused by the user's attitude, behavioral intention, PU, and PEU of the system (Davis, 1989). Venkatesh & Davis (2000) further add that the TAM model provides the essential factors that impact an innovation's acceptance. The TAM undertakes PEU and PU to explain the intentions (behavioral) of individuals to accept the technology. The PEU measures how confident a user is that utilizing a given information system will be painless (Davis, 1989). An employee, for example, may believe that the Warehouse Management System (WMS) is free of effort (not much effort would be required to use the system). Likewise, university students may believe that the upgraded Learning Management System (LMS) will be simple to use. Similarly, the user's belief that utilizing a particular information system will improve his performance is measured by the PU (Alsabawy et al., 2016). For example, the same individual may assume that implementing a WMS will improve warehouse management. Similarly, in educational contexts, the LMS system will improve students' performance by approaching courses quickly (Perceived Usefulness). Both the PEU and the PU lead to a behavioral intention to use the LMS system for learning purposes at the institution, which eventually leads to its actual use.

To conclude, the current study provides new insights into the existing literature by examining the impact of PU and PEU on students' actual adoption of online education indirectly through their attitude and behavioral intention. By applying TAM as a theoretical lens, this research expands on prior studies that revealed the significance of PEU and PU in capturing teachers' intention to use technology, and students' continuing intention to use K-MOOCs (Joo et al., 2018). Furthermore, the study explores the moderating effect of students' geographical status (urban vs. rural), and the degree program (undergraduate vs. postgraduate) between PEU, PU, and students' attitude towards online education. This exploration aims to determine whether the effects of PEU and PU on students' attitudes towards online education differ among one group of students' based on their geographical region and degree programs.

## **Hypotheses Development**

### **Perceived Usefulness and Attitude towards Online Education**

Much of the research in the field of education has studied the adoption of digital learning among students (Hamidi & Chavoshi, 2018; Panigrahi et al., 2018) and teachers using a range of theoretical lenses (Kearney et al., 2018). The TAM, for example, is a prominent model used by many educational academics in the realm of social science. The model states that people's behavioral intention and subsequent actual usage behavior, which in this study is the adoption of online education, can be influenced by their PU and PEU (Davis, 1989). Perception of utility is one of the factors that influence people's behavioral intentions and subsequent actual usage behavior. If users believe that new technology would improve their performance, they will be more inclined to adopt it. It is consistent with Davis' (1989) definition of PU, which states that one's belief that using the system will improve his or her performance. According to Alsabawy et al. (2016), PU is the most important factor in determining the success or failure of e-learning adoption. This notion is supported by prior studies which revealed PU to be one of the most important drivers of strengthening people's attitudes (Chang & Chen, 2020) and it has been shown to have a considerable impact on students' intentions to use online learning (Johari et al., 2015). Based on these findings and the TAM, it is expected that students' attitudes toward online learning will be

strengthened and that students will be more willing to adopt online education in Pakistan if they believe it will help them increase their learning performance. Thus, it is anticipated the following:

**Hypothesis 1:** *PU will have a significant positive impact on university students' attitudes towards online education.*

### **Perceived Usefulness and Behavioural Intentions to Adopt Online Education**

Similarly, another theoretically driven managerially relevant construct based on the TAM is PU, which measures the user's belief that using a specific information system will improve his/her performance (Davis, 1989). PU explains the intentions (behavioral) of individuals to accept the technology (Min et al., 2019). Much of the research in the field of education has studied the effect of PU on downstream behavioral outcomes (Panigrahi et al., 2018). For instance, Johari et al., (2015) discovered that PU has a considerable impact on students' intentions to use online learning. This notion is supported by prior studies which have shown that PU strength through environmental stimulus has shown to have considerable influence on e-learning adoption intentions (Jaiyeoba & Iloanya, 2019). In light of the previous research and the TAM theory, it is anticipated that students in Pakistan will have the desire to adopt if they feel that doing so will improve their academic performance. So, the following is anticipated:

**Hypothesis 2:** *PU will have a significant positive impact on university students' behavioral intentions to adopt online education.*

### **Perceived Ease of Use and Attitude towards Online Education**

Another potential variable that could potentially influence the student's attitude towards online education and subsequent behavioral intention and actual adoption/use, is the PEU. The degree to which users expect the target system to be effort-free is referred to as PEU (Davis, 1989). Although the impact of PUE on students' attitudes about online education, as well as their subsequent behavioral intentions and actual adoption/use, has never been investigated in the emerging setting of Pakistan, there are a few studies that have looked at the impact of PEU in various other life domains. Albort-Morant et al.(2021), for example, investigated the impact of PUE on online banking adoption in Spain and found that the more customers perceive the system to be hassle-free, the more likely they are to adopt. In the context of e-learning, Han & Sa (2021) found that PEU was a significant predictor of Korean students' satisfaction with online education. According to Mailizar et al's (2021) study, PEU, which is impacted by prior e-learning experiences and system quality, contributes to Indonesian students' positive attitudes regarding e-learning. This notion is supported by Doan's (2021) research which revealed that PEU, which is determined by technology self-efficacy, can lead to students' online e-learning intention in Vietnam. Doan (2021) further suggests that students will be more likely to study online if they are confident in their abilities to use technology. In a similar line, Cao et al. (2021) conducted research on Chinese college students' acceptance of intelligent tutoring systems and discovered that PEU is a significant determinant of Chinese students' attitudes toward adopting intelligent tutoring systems. Based on TAM and the previous findings, it is believed that the more Pakistani students consider online platforms to be hassle-free, the more positive their attitude toward online education will be. As a result, it is expected that the PEU will have a considerable positive impact on students' attitudes regarding online learning. As a result, the following is expected:

**Hypothesis 3:** *PEU will have a significant positive impact on university students' attitudes toward online education.*

### **Attitude and Behavioral Intention to Adopt Online Education**

Aside from these anticipated relationships, the current study investigates the relationship between students' attitudes regarding online education and their behavioral intentions, which has never been examined in Pakistani HEIs. The notion that attitude is a key determinant of behavior can be studied from several theoretical perspectives including the theory of reasoned action (TRA), the theory of planned behavior (TPB), and TAM. These theories and models state that attitude captures

the characteristics that drive behavior, and that if an individual has a positive attitude toward a specific behavior, he or she is more likely to do or engage in that behavior (Fishbein & Ajzen, 1975; Ajzen, 1985; Davis, 1989). Many studies examine the link between attitude and behavioral intention in various domains of life, such as sports sciences (Gilal et al, 2019), health promotion (Fishbein, 2008), and hospitality management (Song et al., 2021) were guided by the above-mentioned theories/models. However, in an e-learning context, less research has explored the link between attitude and behavioral intention. Notable exceptions were Cao et al. (2021) and Mailizar et al. (2021) studies, which found a positive relationship between students' attitude and their behavioral intention. Based on the findings of those research and the theoretical underpinnings of TRA, TPB, and TAM, it is possible to infer that the greater a person's formed attitude toward online education, the more likely they are to acquire behavioral intention toward it. As a result, the following is expected:

**Hypothesis 4:** *Attitude has a significant positive impact on university students' behavioral intention to adopt online education.*

### **Behavioral Intention and Actual Adoption/Use of Online Education**

Apart from this expected relationship, the current study aims to look into the link between students' behavioral intentions to adopt online education and their actual adoption/use of online education, which has never been delved into in Pakistani HEIs. Behavioral intention is a cognitive process that determines a person's willingness to engage in a specific behavior (Webb et al., 2022) and is an immediate antecedent of usage behavior (Mailizar et al., 2021; Cao et al., 2021). The link between behavioral intention and actual adoption/use behavior is generally recognized (Mailizar et al., 2021; Cao et al., 2021), as is the recognition that behavioral intention alone is insufficient to accomplish actual adoption and/or use behavior (Webb et al., 2022). Prior research reveals, for example, that people may have strong behavioral intentions but fail to translate them into actual action/usage behavior (Webb et al., 2022). Behavioral intention, according to the literature, accounts for only twenty-eight percent of the variation in behavior. As a result, there is still a strong need to investigate whether a person's behavioral intention leads to the actual adoption of an action. It is therefore important in the present study's settings to finally confirm whether students' behavioral intentions are translated into their actual action/usage behavior. As a result, the following is expected:

**Hypothesis 5:** *Behavioral intention significantly affects university students' actual adoption/use of online education.*

### **Moderating effect of Students' Geographical Status (Urban vs. Rural)**

The geographical status of a student is defined by whether the student lives in an urban or rural setting (James, 2001; Kemer & Atik, 2012). According to previous studies, a student's geographical status has a significant positive impact on their performance (Olsson et al., 2019; Singer, 2020). As such, Olsson et al., (2019) found substantial differences between urban and rural students in Cyprus in terms of oral performance and linguistic attitudes. A recent study by van Maarseveen (2021) supports this viewpoint, stating that kids growing up in urban areas and metropolitan cities continuously achieve better levels of human capital than kids growing up in rural areas. Based on these findings, it's critical to determine whether the impact of PU and PEU on students' attitudes toward online learning is moderated by their geographic location. That is, whether the PU and PEU are important predictors of urban vs. rural students' attitudes toward online education. As a result, the following is to be expected:

**Hypothesis 6:** *The effect of (a) PU and (b) PEU on university students' attitudes toward online education will be moderated by their geographic location.*

### **Moderating effect of Students' Education Level (Undergraduate vs. Postgraduate)**

A student's educational level is determined by whether they are pursuing undergraduate or graduate degrees (Lan, 2005; Jurinovich & Domenici, 2022). Previous research has found that the

educational degree of parents has a strong favorable impact on positive outcomes. For example, Kobul (2022) found that children whose moms have a higher education level are more inclined to utilize the internet for academic purposes than students whose mothers have a lower education level. Sultan et al. (2022) discovered that undergraduate medical students are more open to emerging technology than seniors pursuing higher studies. According to these findings, it's essential to see if the impact of PU and PEU on students' attitudes about online learning is influenced by the degree programs (e.g., educational level) in which they're enrolled. That is if the PU and PEU are significant predictors of undergraduate vs. postgraduate degree program enrollment. As a result, the following is to be expected:

**Hypothesis 7:** The effect of (a) PU and (b) PEU on university students' attitudes toward online education will be moderated by their educational level.

**Conceptual Framework**

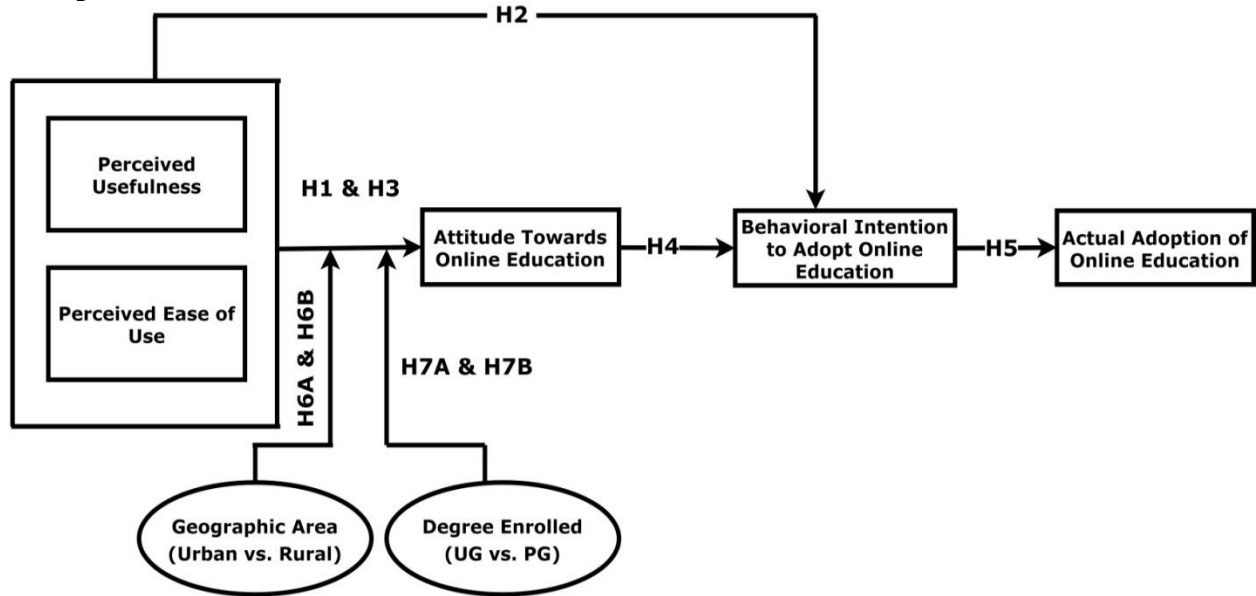


Figure 1

**Research Method**

**Participants and Procedure**

Based on the convenience and purposive sampling approach, originally 500 English-language surveys were distributed to the students from both public and private universities and their sub-campuses in Sindh, Pakistan, using the sample size (i.e., a ratio of 1:20, or 20 responses per scale item) threshold indicated by Hair et al. (1998). Since English is widely spoken language in Pakistan, so this study conducted survey in English, as it has been done in several earlier studies (Khan et al., 2018; Gilal et al., 2020).

**Table 1**  
**Profile of respondents**

Items	n	(%)
<b>Gender</b>		
Male	186	56.2
Female	145	43.8
<b>Degree Enrolled</b>		
Bachelors	204	61.6
Masters	73	22.1
MS/PhD	54	16.3
<b>Geographic Areas of the Students</b>		
Students from Urban Areas	169	51.1
Students from Rural Areas	162	48.9
<b>Education Category</b>		
Undergrad Students (Bachelors Degree)	204	61.6

Undergrad Students (Masters + MS/Ph.D. Degree)	127	38.4
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Note: Sample Size = 331, PKR = Pak Rupees

The number of returned surveys was lower than the number of surveys originally distributed, as in many cross-sectional studies. As a result, N=64 surveys with a substantial number of missing values were removed from the N=395 recovered surveys, leaving a total usable sample of N=331, with a response rate of 62.2 percent. The complete demographics are shown in Table 1.

### Measures

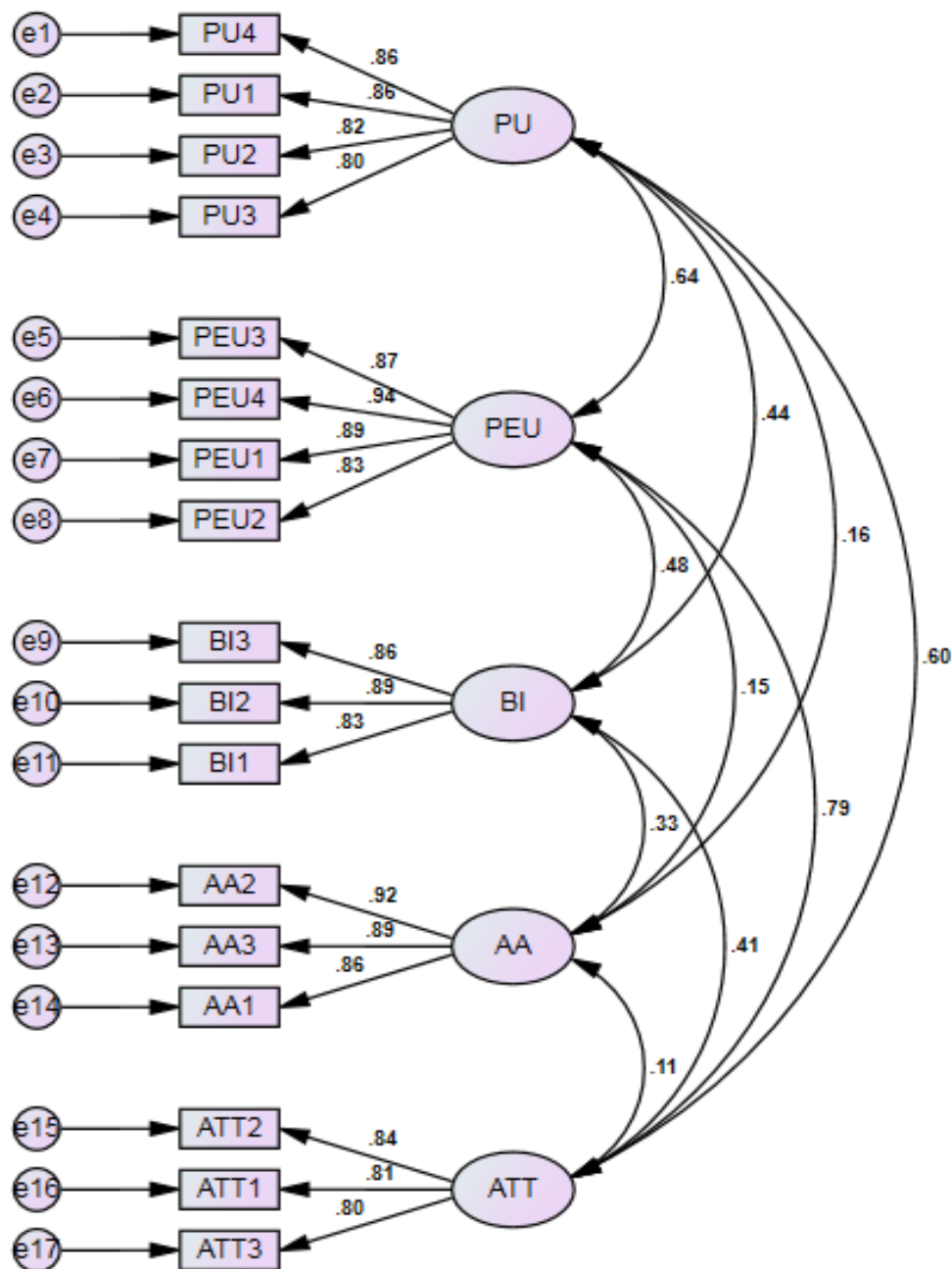
All of the survey's items were assessed on a 5-point Likert scale, with 1 denoting strong disagreement and 5 denoting strong agreement, with the exception of demographic characteristics (age, gender, geographic region, and degree programs in which the students were enrolled), which had a distinctive scale for each item. Table 2 shows the reliabilities of the scale scores, which are all greater than 0.80. To measure PU, this research adopted the four-item scale implemented used by Mailizar et al.(2021). To measure PEU, a four-item scale was adopted by Mailizar et al., (2021). To measure students' attitudes toward online classes/education, we adopted the four-item scale implemented by Unger & Meiran (2020). Likewise, to measure students' behavioral intention to adopt online education, a three-item scale was adopted, sourced from Mailizar et al. (2020). Students' actual adoption/use of online education was measured using a three-item scale borrowed from Pal & Patra (2021).

### Results

*Confirmatory Factor Analysis (CFA)* was used to determine whether the original scale items accurately reflected the theorized latent variables. The results shows that all the items revealed good loadings on their respective constructs along with model fit indices,  $\chi^2/df=1.519$ , [RMR]=0.071, [GFI]=0.943, [CFI]=0.987, [TLI]=0.983, [IFI]=0.987, [RMSEA]=0.040. These CFA results indicate that the five-factor model with 17 items should be favored (see Figure 2).

**Figure 2**

#### **Confirmatory Factor Analysis Model**



“**Note:**PU = Perceived Usefulness, PEU = Perceived Ease of Use, AA = Actual Adoption of Online Education, BI = Behavioral Intention to Adopt Online Education, ATT = Attitude Towards Online Education”

**Table 2**  
Summary of measurement reliability and validity

Factors	Items	Standardized Regression Weights (CFA)	CR	AVE (Alpha)
Perceived Usefulness (PU)	PU4	.859	0.902	.698(.902)
	PU1	.859		
	PU2	.823		
	PU3	.800		
Perceived Ease of Use (PEU)	PEU3	.872	0.935	.782(.934)
	PEU4	.937		
	PEU1	.892		
	PEU2	.833		
Actual Adoption of Online	AA2	.924	0.920	.794(.920)
	AA1	.866		



Education (AA)	AA3	.889		
	AA1	.859		
Behavioral Intention to Adopt Online Education (BI)	BI3	.861		
	BI2	.886	0.894	.737(.893)
	BI1	.827		
Attitude Towards Online Education (ATT)	ATT2	.841		
	ATT1	.814	0.859	.671(.858)
	ATT3	.801		

**Note:** CR = Composite Reliability, AVE = Average Variance Extracted

*Convergent and Discriminant Validity.* The convergent validity was assessed by looking at indicator loadings (IL), composite reliability (CR), and average variance extracted (AVE). The loadings of all indicators reached the threshold value of 0.70, according to our findings (see Table 2). All the values for CR were higher than 0.70 and all of the AVE values were substantially above 0.50 the required threshold, confirming convergent validity. As demonstrated in Table 3, discriminant validity was also confirmed since all of the AVE measures' square roots were greater than the latent variable correlations in the proposed model (Fornell & Larcker, 1981).

**Table 3**  
The discriminant validity index

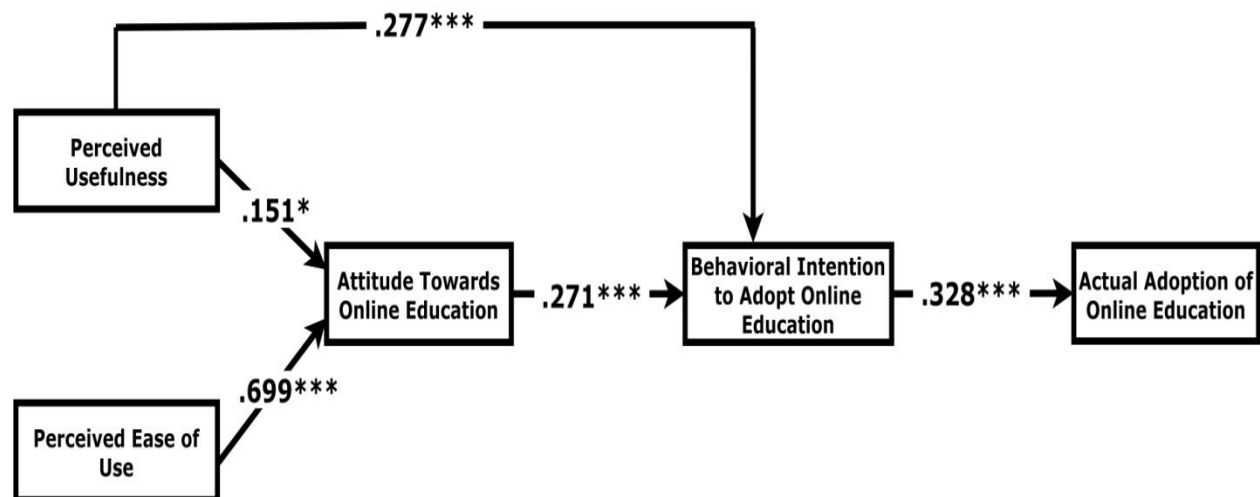
Variables	M	SD	PU	PEU	BI	AA	ATT
PU	4.14	1.14	<b>0.836</b>				
PEU	3.71	1.43	0.637***	<b>0.884</b>			
BI	3.63	1.50	0.443***	0.480***	<b>0.858</b>		
AA	3.14	1.47	0.156*	0.150*	0.328***	<b>0.891</b>	
ATT	3.83	1.38	0.598***	0.789***	0.412***	0.110†	<b>0.819</b>

**Note:** Square roots of AVE is shown on the diagonal of the matrix, while the inter-construct correlations are shown off the diagonal., † = p < 0.100, \* = p < 0.050, \*\*\* = p < 0.001. **M** = mean, **SD** = standard deviation, **PU** = Perceived Usefulness, **PEU** = Perceived Ease of Use, **AA** = Actual Adoption of Online Education, **BI** = Behavioral Intention to Adopt Online Education, **ATT** = Attitude Towards Online Education”

**Structural Equation Modeling (SEM)**

The hypothesized relationships among variables were tested using an SEM with the maximum likelihood approach in AMOS 24.0. The data and the model were well-fitting in all SEM analysis values:  $\chi^2/df=1.366$ , [RMR]=0.083, [GFI]=0.949, [CFI]=0.990, [TLI]=0.988, [IFI]=0.990. The relationships among the suggested variables were investigated using standardized estimates (See Figure 3).

**Figure 3**  
Estimated Structural Equation Modeling Results



Hypothesis 1 stated that PU is positively related to students’ attitudes toward online

education. The results, as shown in Table 4, provide support for the positive relationship between PU and attitudes toward online education ( $H_1: \beta=0.151^*$ ). Hypothesis 2 posits that PU relates positively to students' behavioral intention to adopt online education. The data supported this view ( $H_2: \beta=0.277^{***}$ ). As shown in Figure 3, PEU had the strongest significant influence on students' attitudes toward online education ( $H_3: \beta=0.699^{***}$ ), supporting H3. Similarly, H4 was supported ( $H_4: \beta=0.271^{***}$ ), suggesting that students' attitudes towards online education significantly drive their behavioral intention to adopt online education. Finally, Hypothesis 5 predicts that students' behavioral intention to adopt online education relates positively to their actual adoption/use of online education was supported ( $H_4: \beta=0.328^{***}$ ).

**Table 4**  
**SEM Results**

<i>H</i>	Paths	Standardized Beta	t-value	p-value
H1	PU→ATT	.151*	2.521	0.012
H2	PU→BI	.277***	3.727	0.001
H3	PEU→ATT	.699***	10.406	0.001
H4	ATT→BI	.271***	3.609	0.001
H5	BI→AA	.328***	5.553	0.001

**Note:** \* =  $p < 0.050$ , \*\*\* =  $p < 0.001$ .

### Moderation effects of students' geographic location and degree programs

The multigroup modeling finding in relation to H6a–H6b indicates that the relationships between PU and attitude toward online education are only significant for students from rural areas ( $H6a: \beta=0.322^{***}$ ), but not for students from urban areas ( $H6a: \beta=-0.130^{NS}$ ). In contrast, the results show that PEU is a stronger predictor of strengthening attitudes toward online education for students from urban regions ( $H6b: \beta=0.743^{***}$ ) than for students from rural areas ( $H6b: \beta=0.563^{***}$ ). See Table 5 for results.

**Table 5**  
**Results of multi-group modeling for two sub-samples (Urban vs. Rural Students)**

<i>H</i>	Paths	Beta (t-value) Students from Urban Areas	Beta (t-value) Students from Rural Areas	Difference in Betas	P-Value for Difference
H6a	PU→ATT	-.130 (-1.408) <sup>NS</sup>	.322 (3.846) <sup>***</sup>	-.452	0.006
H6b	PEU→ATT	.743 (6.838) <sup>***</sup>	.563 (6.493) <sup>***</sup>	.180	0.268

**Note:** \* =  $p < 0.050$ , \*\*\* =  $p < 0.001$ , NS = Nonsignificant, M = mean, SD = standard deviation, PU = Perceived Usefulness, PEU = Perceived Ease of Use, ATT = Attitude Towards Online Education”

The results of multigroup modeling results in relation to H7a–H7b indicate that the relationships between PU and attitude toward online education are only significant for students enrolled in undergrad degree programs ( $H6a: \beta=0.172^{**}$ ), but not for students enrolled in postgraduate (Masters or MS/Ph.D.) programs ( $H6a: \beta=0.119^{NS}$ ). In contrast, the results shown in Table 6 indicate that the positive relationship between PEU and attitudes toward online education is stronger for undergrad students ( $H6b: \beta=0.817^{***}$ ) than for postgraduate students ( $H6b: \beta=0.399^{***}$ ). See Table 7 for results.

**Table 7**  
**Results of multi-group modeling for two sub-samples (Undergrad vs. Postgrad Students)**

<i>H</i>	Paths	Beta (t-value) Undergrad Students	Beta (t-value) Postgrad Students	Difference in Betas	P-Value for Difference
H7a	PU→ATT	.172 (3.157) <sup>**</sup>	.119 (0.985) <sup>NS</sup>	.053	0.656
H7b	PEU→ATT	.817 (12.647) <sup>***</sup>	.399 (3.145) <sup>**</sup>	.418	0.019

**Note:** \* =  $p < 0.050$ , \*\*\* =  $p < 0.001$ , NS = Nonsignificant, M = mean, SD = standard deviation, PU = Perceived Usefulness, PEU = Perceived Ease of Use, ATT = Attitude Towards Online Education”

## Discussion

As expected, the results reveal that PU has a considerable positive effect on students' attitudes toward online learning. This suggests that when higher educational institutions emphasize the importance of the PU of online education, students are more likely to develop a positive attitude toward adopting it. These results support the notion of TAM (Davis, 1989) theory, which states that people typically develop a favorable attitude toward new technology when they recognize its perceived importance and/or value.

The findings also suggest that students' perceptions of PU have a significant positive impact on their behavioral intentions to undertake online education. This demonstrates that during the COVID-19 pandemic, universities and other higher educational institutions can directly improve students' behavioral intention to adopt online education by emphasizing and/or strengthening the perceived PU of online education among students through various awareness seminars and training. These findings support previous research (Goh et al., 2020; Mailizar et al., 2021) that found perceived PU to be a major predictor of faculty members' behavioral intention to adopt e-learning management systems.

Similarly, our findings support hypothesis 3 by demonstrating the PEU's potential role in explaining and changing students' attitudes toward online education. This research showed that being able to use the online system effectively is linked to a more positive attitude toward online learning. The path-by-path analysis also reveals that students' PU, had the greatest effect on their attitudes toward online education and learning. This is an interesting result that indicates that PEU is an important source for forming students' attitudes. Thus, the actual adoption/use of online education among Pakistani students is likely to be strengthened more when HEIs focus on improving the PEU. Although these findings support previous research that found that PEU has the greatest impact on teachers' intention to use virtual learning environments, teachers' intention to use dynamic geometry software (Pittalis, 2021), and teachers' acceptance of mobile technology (Islamoglu et al., 2021), they contradict Mailizar et al.(2021) who revealed that PEU has a negligible impact on teachers' behavioral intention to use e-learning, the adoption of blockchain technology (Sciarelli et al., 2021) and student's acceptance of online educational classes.

In terms of hypothesis 4, the current research reveals that a student's attitude about online education can considerably improve their behavioral intention to adopt online learning. This is due to the fact that once a person has a positive attitude toward something, he or she is more likely to form behavioral intentions to adopt a certain behavior. These results are also consistent with earlier research that has shown a strong positive influence on attitudes in initiating behavioral intention in a variety of life domains (Bashir & Madhavaiah, 2015).

Additionally, results from hypothesis 5 reveal that students' behavioral intention, which is supported by PU and PEU through a mediating mechanism of attitude, has a substantial and positive role in driving their actual adoption/use of online education in Pakistan. This viewpoint is consistent with the predictions of TRA, TPB, and TAM, which suggest that once an individual develops a positive behavioral intention toward a particular activity, he or she is more likely to adopt and/or perform the activity (Fishbein & Ajzen, 1975; Ajzen, 1985; Davis, 1989).

Furthermore, multi-group modeling results show that the association between PU and attitude toward online education is significant only for students from rural areas, not for students from metropolitan/urban areas. In contrast, the results show that PEU is a stronger predictor of strengthening attitudes toward online education for students from urban regions than for students from rural areas. This can be explained by the fact that students in urban areas are already aware of the importance of online learning as a result of their strong interest in online games and shopping

(Bishnoi & Sharma, 2009), whereas many people in rural areas are not exposed to regular computer use and thus have less exposure to online games and shopping (Schlebusch, 2018).

Finally, our findings establish that the association between PU and attitudes about online education is only significant for students enrolled in undergraduate programs, but not postgraduate ones. Undergraduate students, on the other hand, have a higher positive relationship with PEU and attitudes toward online education than postgraduate students. This is due to the fact that postgraduate students are usually more mature and have a better understanding of how to use technology to its full potential. Students enrolled in undergrad programs in Pakistan, on the other hand, have less exposure to online education and hence require more knowledge and expertise to adopt it.

### **Implications For Theory and Practice**

The results of the present study have both theoretical and practical relevance. More precisely, this study links PU and PEU to the actual adoption/use of online education among Pakistanis under the theoretical tenets of the TAM. TAM focuses on two main aspects to explain human intentions (behavior) to accept technology: PEU and PU. The PEU assesses a user's belief that using a specific information system will be painless, whereas the PU measures the user's belief that using a particular information system would increase his/her performance (Davis, 1989). Based on these TAM assumptions, the current study indicates that PU and PEU adequately strengthen students' attitudes toward online education, behavioral intention, and subsequent actual adoption/use of online learning. Therefore, the current research contributed to the theoretical notion of TAM by stating that by increasing PU and PEU efforts, Pakistani students' actual adoption/use of online education can be increased.

In a similar vein, this research has a wide range of practical implications for HEIs around the world in general, as well as Pakistan's higher education commission and other policymakers including rectors, vice-chancellors, deans, and directors in particular. This research has established the importance of PU and PEU as important tools in strengthening the adoption of online education among students in an emerging market. Particularly, his research explains how PU and PEU impact students' attitudes, intentions, and actual adoption of online education. The findings suggest that higher education institutions (HEIs) should prioritize PEU and PU to increase online education adoption in Pakistan. Specifically, the study highlights PEU as a key factor, followed by PU. Policymakers aiming to boost online education adoption are advised to provide additional training outside regular classes to familiarize students with platforms like Microsoft Teams, Zoom, or Google Meets/Classroom.

Moreover, the results regarding students' geographic differences show a significant effect on attitudes toward online education for students belonging to rural areas but not for students from urban areas. PEU is a stronger predictor of strengthening attitudes toward online education for students from urban regions than for students from rural areas. These insights will be valuable to rectors, vice-chancellors, deans, directors, and other practitioners seeking to increase the use of online education in their universities and HEIs.

Finally, our findings show that the relationship between PU and attitudes about online education is only significant for undergraduate students, not postgraduate students. For undergraduate students, however, the association between PEU and attitudes toward online education is more relevant than for postgraduate students. These findings could aid HEIs in segmenting their total market based on urban and rural undergraduate and postgraduate students, and designing separate pieces of training on how to use online learning platforms like Microsoft Teams, Zoom, or a combination of Google Meets/Classroom.

### Conclusion, Limitations and Agenda for Further Research

Regardless of the importance of this study, there are a few limitations to be addressed in further research. First, the findings of this research are based on data collected from students at public and private institutions in Sindh, Pakistan, in the country's southeastern region. Despite the fact that Sindh is Pakistan's third-largest province by total area, population, and number of HEIs, the generalizability of these findings is questionable due to differences in the education system across the country. For higher generalizability, this research can be replicated in other provinces using data from Punjab, KPK, and Balochistan.

Second, the study finds that students' geographic locations (urban vs. rural) and degree levels (undergraduate vs. postgraduate) moderate the relationship between PU, PEU, and online education adoption. Future studies should investigate the influence of additional variables such as fear of COVID-19 and pandemic severity on attitudes and intentions. Gender, known to moderate outcomes in education, is also expected to impact this study's findings. Third, this study's findings imply that the relationship between PU and online education attitudes is only significant for undergraduate students, not graduate students. However, among undergraduate students, the link between PEU and attitudes toward online education is higher than among postgraduate students. Qualitative scholarship is needed to further understand the fundamental distinctions between undergrad and postgrad students' perceptions of online learning adoption.

Finally, in the link between PU/PEU and the adoption/use of online education, the current study looked at the mediation of students' attitudes and behavioral intentions. In the study model, new mediating variables such as student autonomy, competence, and relatedness satisfaction could be incorporated for future research (Gilal et al., 2019).

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