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Using Digital Technologies for Testing Online Teaching Skills and Competencies during the COVID-19 Pandemic

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Abstract: This study examines the online teaching abilities and competencies needed to teach online courses in Saudi Arabia's higher education system. As a result, the goal of this study was to examine and expand the technology acceptance model (TAM) to assess online teaching abilities and competences utilizing digital technologies in higher education during the COVID-19 epidemic. Therefore, it aimed to develop a new model to measure and explore critical factors that influence online teaching skills, competencies, and actual use of digital tools in higher education. The participants in the study were 350 lecturers at King Faisal University. The research data were analyzed using structural equation modeling (AMOS-SEM). The findings revealed that: (a) perceived ease of use and perceived usefulness on using digital tools during the COVID-19 pandemic has a direct positive impact on perceived teaching self-efficacy, perceived enjoyment, online teaching skills, and digital tools access; (b) perceived ease of use and perceived usefulness of using digital tools have a direct positive impact on lecturers' attitude toward use and lecturers' behavioral intention to use digital tools during the COVID-19 pandemic; and (c) perceived ease of use. As a consequence of the findings, a validated instrument was designed to assess and investigate crucial elements that impact lecturers' real usage of digital technologies for teaching and learning in Saudi Arabia's higher education.

Keywords: using digital technologies for test online teaching skills and competencies; structural equation modeling (SEM)

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1. Introduction

The coronavirus 2019 (COVID-19) pandemic has become a global threat, according to UNESCO, affecting several areas, including education [1]. On 30 January 2020, the World Health Organization (WHO) designated the COVID-19 virus as a public health concern; then, on 11 March 2020, it was recognized as a worldwide pandemic [2]. COVID-19 has generated serious challenges in the field of education for students, teachers, and educational institutions all across the world [3]. Due to the epidemic, Saudi Arabia's Ministry of Education (MOE) has ordered that all academic activities be totally transformed to online formats [4]. Many higher education courses, particularly those that require physical interaction, are experiencing difficulties. This epidemic has affected over 87 percent of the world's student population in more than 160 nations, according to [1]. As a result, conventional learning is being replaced by digital learning. Furthermore, there is no consensus in the research on how to define traditional (sometimes conventional) learning precisely. According to [5], a model of contextual facilitators for learning activities involving technology for both on-site and distance learning environments in higher education on digital teaching and learning is proposed, as well as a roadmap for future research to understand the complex dynamic factors that lead to successful digital teaching and learning in higher education through learning activities. In this paradigm, the teacher is the active party, transmitting information to students through lectures and printed materials, as well as a sort of interaction between students and both the instructor and the subject. Traditional learning, according to [6], is "delivering learning material face-to-face

with no usage of the Internet for teaching and learning". Traditional learning, according to [7], is "a method of learning that takes place under the supervision of a teacher in a physical learning environment while employing physical learning instruments and direct synchronous communication". Only those courses that do not use any internet technologies are classified as conventional by [8]. Traditional learning, according to these definitions, is a learning process, a teaching style, and a medium for imparting education. Because the instructor and learner are physically and simultaneously present in the same room, they communicate and speak in real time without the need of the Internet or online technologies. Surprisingly, the effectiveness of a model or teaching approach is frequently discussed in educational literature as a comparison to traditional learning or teaching. According to [9], faculty learning approach goals were also positively connected with considering the move to online teaching as a good challenge and as beneficial to their personal competence development. In a large body of literature, traditional learning has been used as an antonym for new modes of learning, such as e-learning, as well as virtual, cyber, hybrid, and online learning and teaching [10]. Others have used the term "traditional learning" to refer to particular teaching methods, such as cooperative learning [11,12], problem-based learning [13,14], project-based learning [15,16], and game-based learning [15–18]. This raises the question of what constitutes a standard education. Allen and Seaman [8] categorize courses depending on how much Internet technology is utilized in their delivery compared to traditional courses. Web-facilitated courses are face-to-face courses that use the Internet to offer less than 30% of the content by distributing learning materials and assignments on an LMS. A hybrid or blended course is one in which the Internet is used for less than 80% of the content and activities. The majority of online courses are given and taught exclusively via the internet. As a result, it might be an opportune time to push for the adoption of a new learning paradigm. It may be helpful to consider web-facilitated or blended learning as the next standard learning approach [19]. Since its debut, a variety of terminology and concepts have been used to characterize online learning. Some of the terminology used to characterize online learning includes e-teaching, virtual learning, cyber learning, Internet learning, distributed learning, web-facilitated learning, web-based learning, remote learning, computer-based learning, resource-based learning, and technology-based learning [20–22].

The phrase "online teaching and learning" will be used throughout this paper. Education in the country has changed dramatically as a result of the increased demand for online teaching adoption. According to [23], institutions that expect their teaching staff to use e-learning systems for teaching and learning should assess their behavioral intention to use e-learning systems for teaching and learning. The technology acceptance model (TAM) is the most commonly utilized model in research of consumer technology adoption [24,25]. The model's major goal is to explain consumers' attitudes toward technology adoption [26,27]. As a result, using the technology acceptance model theory, this study explores teachers' intentions to utilize digital tools during the COVID-19 epidemic.

2. Research Model and Hypotheses

Online teaching skills and competencies must be determined in order to help assess online teaching. Teaching online necessitates a shift in educational thinking. Whereas traditional teaching focuses on the instructor attempting to impart their information to the students, online teaching focuses on the interaction between the teacher and the student as well as the student and knowledge. An online course's efficacy necessitates more from a teacher than just technical competence; it also necessitates a thoughtful and inventive mentality that prioritizes the student-centered learning process.

Therefore, this research develops a model that is unique in extending the technology acceptance model (TAM) to measure online teaching skills and competencies in using digital tools during the COVID-19 pandemic. It does so by exploring critical factors that influence lecturers' actual use of digital tools for teaching and learning in Saudi Arabia's higher education through perceived teaching self-efficacy, perceived enjoyment, online

teaching skills, digital tool access, perceived ease of use, perceived usefulness, attitude toward using digital tools, behavioral intention to use digital tools, and actual use of digital tools for teaching and learning, see Figure 1.

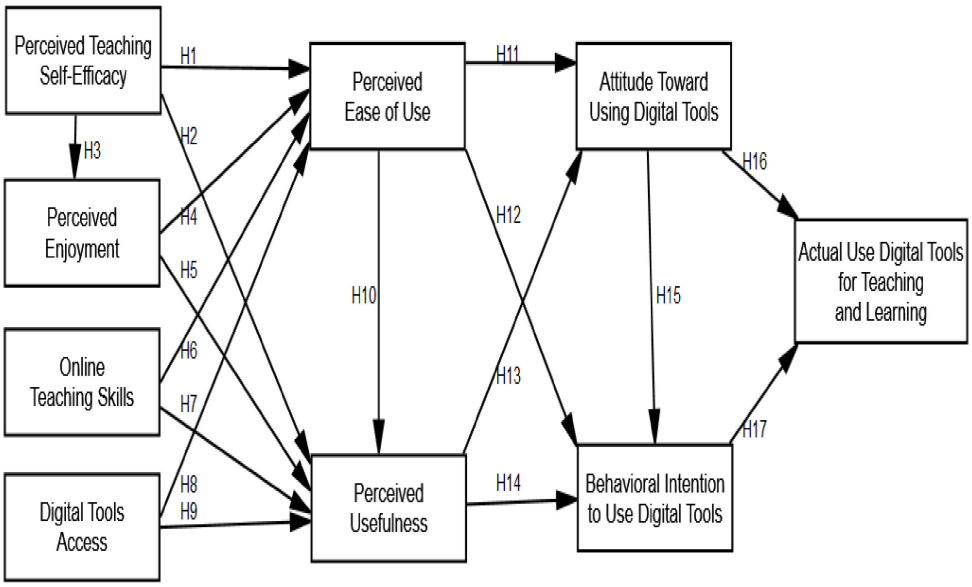


Figure 1. Research model and hypotheses.

2.1. Perceived Teaching Self-Efficacy (PTSE)

The success of online teaching and learning is influenced by teachers' perceived teaching self-efficacy and attitude toward adopting digital technology for teaching and learning [28]. According to [29], self-efficacy beliefs influenced changes in behavior and how people regulate and impact their environment, and the notable conclusion from these studies is that teachers with high self-efficacy beliefs perceived teaching efficacy to have positive correlations with desired outcomes that benefit student learning [29–31]. As a result of these advantages, teachers will be more eager to experiment with new ideas [32] and demonstrate a greater commitment to the teaching profession. According to [33], there is a strong link between instructors' comfort and competency with technology and the degree to which they use it. Additional hurdles, such as bandwidth, access, and technical skill, may also affect high technology acceptance. Teachers' impressions of how classroom technology interacts with teaching can be influenced by their self-efficacy. As a result, the following hypotheses emerged from this study:

Hypothesis 1 (H1). *There is a strong relationship between PTSE & PEU.*

Hypothesis 2 (H2). *There is a strong relationship between PTSE & PU.*

Hypothesis 3 (H3). *There is a strong relationship between PTSE & PE.*

2.2. Perceived Enjoyment (PE)

Perceived enjoyment, according to Davis et al. [24], is similar to intrinsic motivation, which drives the execution of an activity that is unrelated to anything other than the process of executing the activity. Venkatesh [34] also observed that the influence of enjoyment on perceived ease of use was stronger as users gained more direct experience with the system. The degree to which users believe using the system to be enjoyable has an impact on perceived ease of use, according to these studies. Davis et al. [25] observed that perceived usefulness was influenced by ease of use, whereas [34] discovered that perceived usefulness was influenced by ease of use. Perceived usefulness is a statistic that measures how people believe technology may help them be more productive and effective. Teo, Lim, and Lai [35]

investigated the effects of perceived ease of use, perceived utility, and perceived enjoyment on Internet usage, finding that perceived usefulness and perceived enjoyment had an impact on respondents' enjoyment of the Internet. They also observed that the amount of perceived satisfaction had a significant influence on the frequency with which people used the product. As a result, the following hypotheses emerged from this study:

Hypothesis 4 (H4). *There is a strong relationship between PE & PEU.*

Hypothesis 5 (H5). *There is a strong relationship between PE & PU.*

2.3. Online Teaching Skills (OTS)

Online teaching abilities must be identified and prioritized based on the jobs that educators will actually perform [36]. Institutions may provide technical assistance for adopting LMSs and other technologies, which may lessen the workload of online educators. It is, nevertheless, critical to achieve sufficient understanding of how to diagnose and resolve issues [37]. Teachers' skills and competencies can aid in the design and creation of online educator professional development activities. As mature, self-regulated, and self-determined learners, online teachers may utilize these to self-evaluate their abilities and subsequently detect their own learning and training requirements [38]. Competencies may also be used as a process to guarantee that teachers are qualified and ready to teach in online learning environments [39]. The duties, talents, and skills that are necessary to be a competent and successful online teacher should be identified and emphasized by educational institutions, online learning organizations and authorities, and online learning theorists. As a result, online instructors need a framework and rules to help them stay afloat, improve their skills, and offer relevant training programs [40]. Bawane and Spector [36] also provide a general framework for developing and implementing teacher professional development programs. Furthermore, if online instructional staff members are exposed to examples of exceptional online instructors and view them as role models, they may obtain a better understanding of their function as online professors [38]. As a result, the following hypotheses emerged from this study:

Hypothesis 6 (H6). *There is a strong relationship between OTS & PEU.*

Hypothesis 7 (H7). *There is a strong relationship between OTS & PU.*

2.4. Digital Tools Access (DTA)

Technology ushers in fundamental structural changes which can be critical in driving significant productivity improvements. To enhance both teaching and learning, technology enriches classrooms with digital learning aids, including computers and handheld devices. It promotes student involvement and motivation while also expanding course offerings, experiences, and learning resources [41–44]. According to a meta-analysis on the integration of technology into education [45], the most common obstacle to technology integration is the availability of technological resources. Teachers have explained how digital technology may help diversify learning and "increase grades, keep students' interest, and even enhance the confidence of many kids," [46]. However, more recent research has demonstrated that growing technology accessibility does not always imply increased or improved technology usage quality [47,48]. The findings, which are consistent with earlier studies, emphasize the factors that impact instructors' usage of technology [49,50]. As a result, the following hypotheses emerged from this study:

Hypothesis 8 (H8). *There is a strong relationship between DTA & PEU.*

Hypothesis 9 (H9). *There is a strong relationship between DTA & PU.*

2.5. Perceived Ease of Use (PEU)

The extent to which a user feels that using digital tools for teaching and learning will be free of effort is described as perceived ease of use in the context of utilizing digital technologies for teaching and learning [51]. It influences perceived usefulness as well as attitudes toward adopting digital resources for teaching and learning [25,52,53]. Furthermore, a number of studies has confirmed that adopting digital tools for teaching and learning is one of the most important indicators of attitude toward technology adoption [54,55]. We investigated instructors' perceptions of how easy it is to use digital technologies for teaching and learning in higher education in this study. As a result, the following hypotheses emerged from this study:

Hypothesis 10 (H10). *There is a strong relationship between PEU & PU.*

Hypothesis 11 (H11). *There is a strong relationship between PEU & ATUD.*

Hypothesis 12 (H12). *There is a strong relationship between PEU & BIUD.*

2.6. Perceived Usefulness (PU)

Perceived usefulness of utilizing digital tools for teaching and learning is defined by Lin et al. [51] as the degree to which a user feels that using digital tools for teaching and learning may assist them in achieving learning objectives. According to previous research, perceived utility is one of the most important elements influencing consumers' attitudes toward technology [53,55,56]. Furthermore, perceived utility influences behavioral intention both directly and indirectly [57,58]. As a result, the following hypotheses emerged from this study:

Hypothesis 13 (H13). *There is a strong relationship between PU & ATUD.*

Hypothesis 14 (H14). *There is a strong relationship between PU & BIUD.*

2.7. Attitude toward Using Digital Tools for Teaching and Learning (ATUD)

Kaplan [59] defined attitude as a predisposition to react positively or negatively to an occurrence. Much research on the acceptability of digital technologies in education has found that attitude is a strong predictor of behavioral intention to use digital tools in education [60,61]. The link between user attitude and behavioral intention meant that users are more likely to engage in specific actions if they have a good attitude toward them [62]. Furthermore, behavioral intention to utilize digital tools for education is totally mediated by attitudes about technology. As a result, the following hypotheses emerged from this study:

Hypothesis 15 (H15). *There is a strong relationship between ATUD & BIUD.*

Hypothesis 16 (H16). *There is a strong relationship between ATUD & AUDT.*

2.8. Behavioral Intention to Use Digital Tools for Teaching and Learning (BIUD)

The TAM approach produces two outcome variables: behavioral intention to use and actual usage. The behavioral intention to utilize digital tools is described as a behavioral inclination to continue utilizing technology in the future; as a result, it influences technological adoption [63]. Previous research has found that having the desire to utilize digital resources for education has a beneficial impact on actually using them for teaching and learning. Furthermore, previous research has found that perceived utility [64], perceived ease of use [52,64], and attitude toward utilizing digital tools all impact behavioral intention to use digital tools [65,66]. As previously stated, behavioral intention to utilize digital tools

is a dependent variable in this study. As a result, the following hypothesis emerged from this study:

Hypothesis 17 (H17). *There is a strong relationship between BIUD & AUDT.*

2.9. Actual Use of Digital Tools for Teaching and Learning (AUDT)

Distance learning has becoming more popular in higher education institutions across the world [67]. Students and instructors use technology to aid the learning process in distant learning. Teaching with technology does not apply to everyone. Its execution will be determined by the technology resources available and students' educational demands [68]. According to research conducted at Hong Kong University, students' computer skills, attitudes toward technology, learning styles, and instructors' and peers' support are all factors that influence technology use for learning [69]. "The use of electronic technology to deliver, assist, and enhance both learning and teaching, and involves communication between learners and teachers utilizing online information," according to a definition of distance learning using digital technologies [70]. Distance learning may help students shift from a teacher-centered approach, in which they are a passive observer following the teacher's instructions, to a student-centered approach, in which they are active participants in their own education as well as other students'. Individuals may benefit from adopting digital tools in distance learning in coping with a wide range of learning environments and in providing self-paced learning and content [71]. The eight main types of digital educational tools include learning management systems (LMS), Massive online open courses (MOOCs), mind mapping, interactive tools, web conferencing, infographics, research visibility tools, and web-based content management systems. Only one third of nursing students favored distant learning using digital technologies according to a recent survey [72,73]. Furthermore, digital platforms for education and learning were linked to students' greater propensity to finish research work successfully [74]. Lesson study and learning have benefited from digital technology because it has permitted rigorous cooperation, synchronous observations, improved data management, and a deeper grasp of material [75].

3. Research Methodology

With a cross-sectional questionnaire, we used a quantitative method [76]. A quantitative technique may produce trustworthy, valid, objective, and generalizable results, and questionnaires can be sent to a large number of people. Furthermore, a quantitative technique [76], allows for population-wide generalizations. Quantitative research also relies on hypothesis testing, which may be performed with explicit instructions and objectives [77]. During the COVID-19 pandemic, hypotheses were explored to evaluate online teaching skills and competencies utilizing digital technologies.

3.1. Participants in the Study

The participants in this study were university lecturers from Saudi Arabia's King Faisal University who taught using an online learning system. Participants completed the online training over the course of a semester. The disciplines of instruction were educational technology, and instruction via an online learning system was introduced in 2021 and is now available at all Saudi Arabian universities. The research was carried out in one of the allocated areas at King Faisal University, which will provide training for 240 instructors in 2021.

3.2. Data Gathering and Analyze

An online questionnaire was used in this study since it was simple to administer and available from a variety of devices [76]. The bulk of those who took part were reached by WhatsApp and email. We used Google Forms to run the online survey, emailing participants a link and keeping the survey open for five weeks. In order to test the online

teaching abilities and competences utilizing digital technologies during the COVID-19 pandemic, structural equation modelling (SEM), AMOS-SEM, and SPSS were used. As a result, AMOS-SEM was used to perform confirmatory factor analysis (CFA) and test the model's reliability, validity, and internal consistency. The hypotheses were proven, and a structural model was created [78]. Therefore, composite reliability and validity can be calculated as follows:

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + (\sum \varepsilon_i)} \quad (1)$$

The standardized factor loading is represented by (λ) with (i) denoting the item index, whereas error variance is represented by (ε). Error variance is defined as the following:

$$\varepsilon_i = 1 - \lambda_i^2 \quad (2)$$

Meanwhile, as given in the following, r-squared represents items variances percentage justified through latent constructs. R-squared is defined as follows:

$$r^2 = \lambda_1^2 = 1 - \varepsilon_i \quad (3)$$

3.3. Instruments Model

As stated in, a survey instrument was used to meet the study goals through an in-depth analysis. There were ten factors with thirty-one indicators. Perceived teaching self-efficacy was adapted to three items as recommended by [30], perceived enjoyment was adapted to three items as recommended by [24,25], perceived ease of use and perceived usefulness were adapted to three items for each factor as recommended by [24], online teaching skills was adapted to three items as recommended by [36], digital tools access was adapted to three items as recommended by [46], attitude toward using digital tools was adapted to three items as recommended by [61], behavioral intention to use digital tools was adapted to three items as recommended by [63]. Finally, actual use of digital tools for teaching and learning was adapted to five items as recommended by [68].

4. Data Analysis and Results

The demographic data is presented in Table 1. Among 345 useable ques-tionnaires, 200 (57.1%) were from male respondents while 150 were from female respondents (42.9%). Additionally, 106 (30.3%) were 28–31 years old, 194 (55.4%) were 32–38 years old, 25 (7.1%) were 39–45 years old, 17 (4.9%) were 46–50 years old, and 8 (2.3%) were more than 51 years old. With regards to academic level, 273 (78.0%) were lecturers and 77 (22.0%) were senior lecturers. Finally, regarding the respondents' faculties, 101 (28.9%) were from the faculty of education, 89 (25.4%) were from the faculty of art, 62 (17.7%) were from the faculty of law, and 98 (28.0%) were from the faculty of management, see Table 1.

Table 1. Demographic Data.

	Factors	Frequency	Percent		Factors	Frequency	Percent
Gender	Male	200	57.1	**Level of study**	Lecturer	273	78.0
	Female	150	42.9		Senior lecturer	77	22.0
	Total	350	100.0		Total	350	100.0
Age	28–31	106	30.3	Faculty	Education	101	28.9
	32–38	194	55.4		Art	89	25.4
	39–45	25	7.1		Law	62	17.7
	46–50	17	4.9		Management	98	28.0
	>51	8	2.3		Total	350	100.0
	Total	350	100.0				
University	KFU	203	58.0				
	KSU	147	42.0				
	Total	350	100.0				

4.1. Structured Equation Modeling

In order to test the online teaching abilities and competencies utilizing digital technologies during the COVID-19 pandemic, structural equation modelling (SEM), AMOS-SEM, and SPSS were used. As a result, SPSS 23 was used to evaluate quantitative data. In this study, descriptive statistics were used to describe the characteristics of the participants, and AMOS-SEM was used to investigate hypotheses and significant predictors in the extended TAM model, which included nine variables for actual use of digital tools for teaching and learning as well as outcome expectancy variables. Additionally, to ensure that the scales were meaningful, all factors were examined by Cronbach's alpha as shown by [78], see Table 2.

Table 2. The Reliability Coefficient for All Variables.

Factors	Code	Pilot Test	Final Test
Perceived Teaching Self-Efficacy	PTSE	0.713	0.896
Perceived Enjoyment	PE	0.754	0.907
Online Teaching Skills	OTS	0.729	0.921
Digital Tools Access	DTA	0.804	0.899
Perceived Usefulness	PU	0.799	0.877
Perceived Ease of Use	PEU	0.792	0.900
Behavioral Intention to Use Digital Tools	BIUD	0.817	0.912
Attitude Toward Using Digital Tools	ATUD	0.722	0.891
Actual Use of Digital Tools for Teaching and Learning	AUDT	0.729	0.918

4.2. Model Fit Mesuerment

The CMN/DF ratio in Table 3 is 2.265, which is lower than the necessary threshold (5.00). The RMR value is below the threshold of 0.33 (0.05), AGFI (0.914) is a valid value, GFI (0.931) is a valid value, CFI (0.959) is a valid value, TLI (0.952) is a valid value, IFI (0.959) is a valid value, RFI (0.934) is a valid value, and NFI (0.943) is a valid value as suggested by [78]. Figure 2 shows all items and factor values. This shows that the measurement model was acceptable and well-suited to the structural model. See Table 3 and Figure 2.

Table 3. Model fit evaluation.

Model Fit	NFI	RFI	IFI	TLI	CFI	GFI	AGFI	RMR
Default model	0.943	0.934	0.959	0.952	0.959	0.931	0.914	0.033
Saturated model	1.000		1.000		1.000	1.000		0.000
Independence model	0.000	0.000	0.000	0.000	0.000	0.157	0.101	0.331

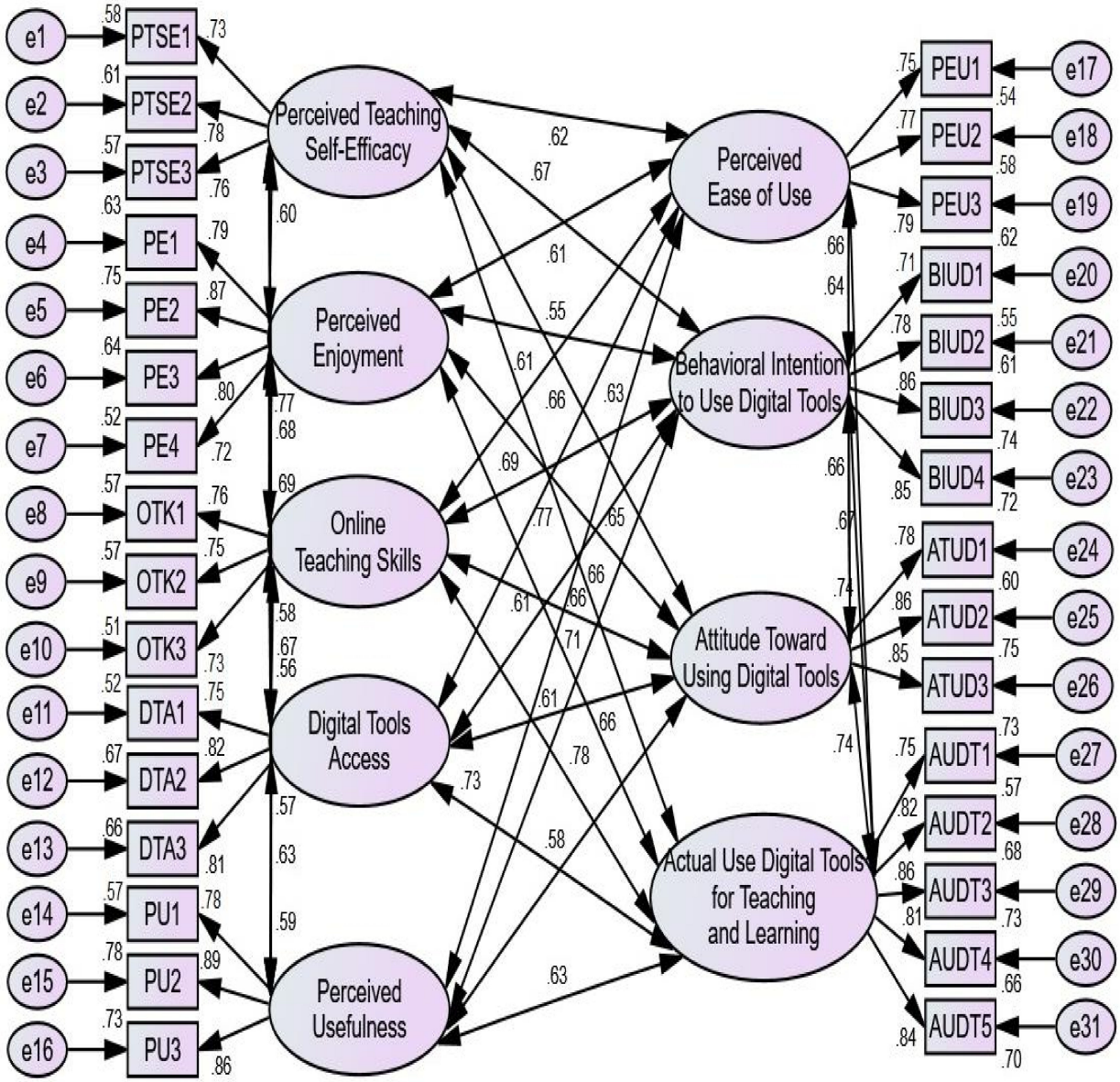


Figure 2. Measurement model.

4.3. Reliability, Validity, and Measurement Model

The SEM-AMOS measurement model for each idea has its own set of characteristics, such as reliability and validity. The structural model was used to investigate the intensity of the link direction using confirmatory factor analysis (CFA) and model fit. The survey's psychometric qualities are evaluated in order to determine its reliability, validity, and collinearity. The variables' reliability was investigated using item loadings, Cronbach's alpha (CA), and composite reliability (CR), with acceptance values of (>0.7). Table 3 shows that all of the constructs' Cronbach's alpha (CA) values varied from 0.877 to 0921, the CR values ranged from (0.889 to 0.928), and the loadings of the indicators' items ranged from (0.711–0.885), showing strong internal consistency [78]. Loadings of indicators, average variance extracted (AVE) values, and the square roots of AVE values were used to assess convergent and discriminant validity (0.591–0.672). Table 4 shows the results.

Table 4. Reliability, validity, and measurement model.

No				Estimate	CR	CA	AVE
1	PTES1	<—	Perceived Teaching Self-Efficacy	0.730	0.889	0.896	0.591
2	PTES2	<—		0.779			
3	PTES3	<—		0.758			
4	PE1	<—	Perceived Enjoyment	0.792	0.924	0.907	0.611
5	PE2	<—		0.865			
6	PE3	<—		0.802			
7	PE4	<—		0.720			
8	OTK1	<—	Online Teaching Skills	0.758	0.928	0.921	0.632
9	OTK2	<—		0.754			
10	OTK3	<—		0.731			
11	DTA1	<—	Digital Tools Access	0.753	0.902	0.899	0.672
12	DTA2	<—		0.820			
13	DTA3	<—		0.813			
14	PU1	<—	Perceived Usefulness	0.783	0.891	0.877	0.642
15	PU2	<—		0.885			
16	PU3	<—		0.855			
17	PEU1	<—	Perceived Ease of Use	0.754	0.908	0.900	0.598
18	PEU2	<—		0.772			
19	PEU3	<—		0.786			
20	BIUD1	<—	Behavioral Intention to Use Digital Tools	0.711	0.923	0.912	0.672
21	BIUD2	<—		0.778			
22	BIUD3	<—		0.860			
23	BIUD4	<—		0.850			
24	ATUD1	<—	Attitude Toward Using Digital Tools	0.776	0.907	0.891	0.643
25	ATUD2	<—		0.864			
26	ATUD3	<—		0.852			
27	AUDT1	<—	Actual Use of Digital Tools for Teaching and Learning	0.752	0.905	0.918	0.668
28	AUDT2	<—		0.824			
29	AUDT3	<—		0.857			
30	AUDT4	<—		0.814			
31	AUDT5	<—		0.838			

4.4. Measurement Discriminant and Convergent Validity

Table 5 displays the Fornell–Larcker criteria for determining discriminant validity, where the square roots of AVE for all items were larger than their correlations with other components [79]. The AVEs' square roots are on the diagonal. Table 5 further reveals that at the 0.80 threshold, when applying the heterotrait-monotrait criteria, which imposes a stricter examination, all constructs are clearly different [80].

Table 5. Discriminant and convergent validity.

Factors	PTSE	PE	OTS	DTA	PU	PEU	BIUD	ATUD	AUDT
Perceived Teaching Self-Efficacy	0.855								
Perceived Enjoyment	0.270	0.888							
Online Teaching Skills	0.369	0.289	0.837						
Digital Tools Access	0.291	0.344	0.313	0.871					
Perceived Usefulness	0.297	0.329	0.343	0.325	0.816				
Perceived Ease of Use	0.351	0.342	0.430	0.361	0.445	0.863			
Behavioral Intention to Use Digital Tools	0.282	0.333	0.303	0.381	0.303	0.347	0.822		
Attitude Toward Using Digital Tools	0.282	0.330	0.328	0.348	0.335	0.377	0.326	0.883	
Actual Use of Digital Tools for Teaching and Learning	0.308	0.367	0.340	0.339	0.355	0.394	0.357	0.358	0.903

4.5. Evaluation of the Structural Model

This study's structural model included nine components with two degrees of linkages. As a consequence, the model hypotheses depicted in Figure 3 is evaluated using the AMOS approach, which uses bootstrap resampling to examine each hypothesis path's significance levels. Table 5 illustrates the hypothesis testing findings, with a two-tail test used to establish the statistical significance of each hypothesis (0.000). Furthermore, the path coefficient value estimate (β), which measures the association between variables based on their degree of significance (*p* value), is significant when $p = 0.05$, see Figure 3.

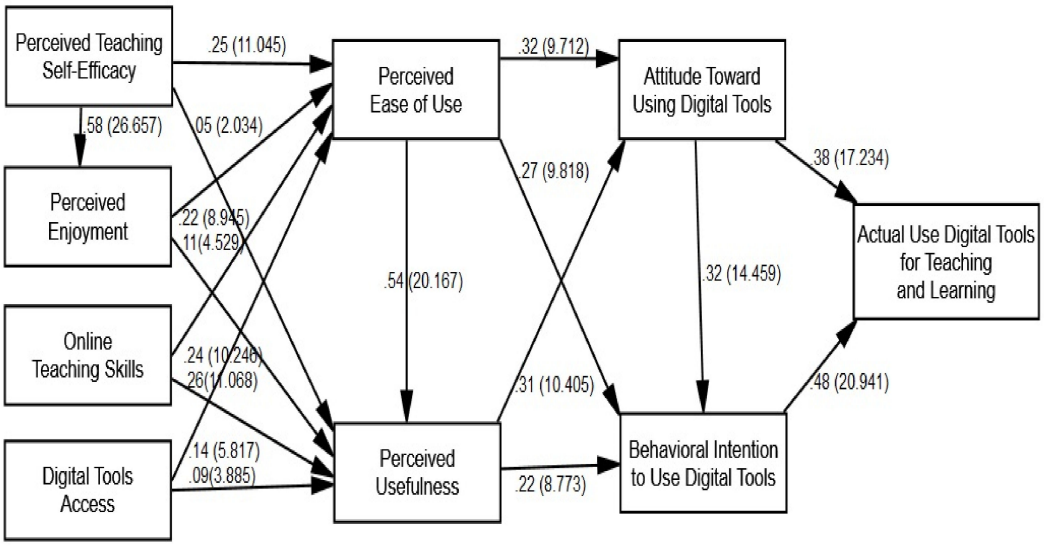


Figure 3. Path and T-values results.

4.6. Hypotheses Testing Results

Based on the results shown in Figure 3 and Table 6, the relationship between perceived teaching self-efficacy and perceived ease of use (β = 0.253; C.R = 11.045, $p < 0.000$), the relationship between perceived teaching self-efficacy and perceived usefulness (β = 0.054; C.R = 2.034, $p < 0.000$), and the relationship between perceived teaching self-efficacy and perceived enjoyment (β = 0.585; C.R = 26.657, $p < 0.000$) were accepted. Similarly, the relationship between perceived enjoyment and perceived ease of use (β = 0.216; C.R = 8.945,

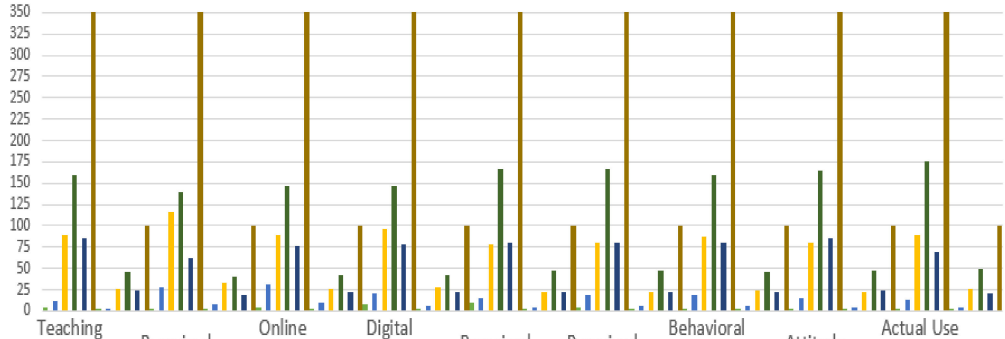
$p < 0.000$) and the relationship between perceived enjoyment and perceived usefulness (β = 0.109; C.R = 4.529, $p < 0.000$) were accepted. Additionally, the relationship between online teaching skills and perceived ease of use (β = 0.235; C.R = 10.246, $p < 0.000$) and the relationship between online teaching skills and perceived usefulness (β = 0.255; C.R = 11.068, $p < 0.000$) were accepted. Moreover, the relationship between digital tools access and perceived ease of use (β = 0.143; C.R = 5.817, $p < 0.000$) and the relationship between digital tools access and perceived usefulness (β = 0.093; C.R = 3.885, $p < 0.000$) were accepted. Furthermore, the relationship between perceived ease of use and perceived usefulness (β = 0.540; C.R = 20.167, $p < 0.000$), the relationship between perceived ease of use and attitude toward using digital tools (β = 0.324; C.R = 9.712, $p < 0.000$), and the relationship between perceived ease of use and behavioral intention to use digital tools (β = 0.273; C.R = 9.818, $p < 0.000$) were accepted. Additionally, the relationship between perceived usefulness and attitude toward using digital tools (β = 0.306; C.R = 10.405, $p < 0.000$) was accepted) and the relationship between perceived usefulness and behavioral intention to use digital tools (β = 0.216; C.R = 8.773, $p < 0.000$) were accepted. Also, the relationship between attitude toward using digital tools and behavioral intention to use digital tools (β = 0.322; C.R = 14.459, $p < 0.000$) and the relationship between attitude toward using digital tools and actual use of digital tools for teaching and learning (β = 0.382; C.R = 17.234, $p < 0.000$) were accepted. Finally, the relationship between behavioral intention to use digital tools and actual use of digital tools for teaching and learning (β = 0.482; C.R = 20.941, $p < 0.000$) was accepted.

Table 6. Hypothesis testing.

No	Relationships			Estimate (β)	S.E.	C.R.	*p*	Results
H1	PEU	<—	PTSE	0.253	0.023	11.045	0.000	Accepted
H2	PU	<—	PTSE	0.054	0.023	2.034	0.002	Accepted
H3	PE	<—	PTSE	0.585	0.022	26.657	0.000	Accepted
H4	PEU	<—	PE	0.216	0.024	8.945	0.000	Accepted
H5	PU	<—	PE	0.109	0.024	4.529	0.000	Accepted
H6	PEU	<—	OTS	0.235	0.023	10.246	0.000	Accepted
H7	PU	<—	OTS	0.255	0.023	11.068	0.000	Accepted
H8	PEU	<—	DTA	0.143	0.025	5.817	0.000	Accepted
H9	PU	<—	DTA	0.093	0.024	3.885	0.000	Accepted
H10	PU	<—	PEU	0.540	0.027	20.167	0.000	Accepted
H11	AT	<—	PEU	0.324	0.033	9.712	0.000	Accepted
H12	BIU	<—	PEU	0.273	0.028	9.818	0.000	Accepted
H13	AT	<—	PU	0.306	0.029	10.405	0.000	Accepted
H14	BIU	<—	PU	0.216	0.025	8.773	0.000	Accepted
H15	BIU	<—	AT	0.322	0.022	14.459	0.000	Accepted
H16	AUD	<—	AT	0.382	0.022	17.234	0.000	Accepted
H17	AUD	<—	BIU	0.482	0.023	20.941	0.000	Accepted

5. Factors Described and Analyzed

The standard deviation (SD) and mean are two statistics that describe how measurements in a population deviate from the average (mean) or expected value. The majority of the data points are close to the mean when the standard deviation is low. The data is more distributed if the standard deviation is high. As a consequence, as shown in Figure 4, all values were accepted and the majority was agree and strongly agree, meaning that the critical factors that influence online teaching skills and competencies by using digital tools during the COVID-19 pandemic through exploring critical factors that influence lecturers' actual use of digital tools for teaching and learning in Saudi Arabia's higher education were perceived teaching self-efficacy, perceived enjoyment, online teaching skills, digital tools access, perceived ease of use, perceived usefulness, attitude toward using digital tools, behavioral intention to use digital tools, and actual use of digital tools for teaching and learning; see Figure 4.



Strongly Disagree	4	1.1	3	.9	5	1.4	8	2.3	9	2.6	4	1.1	3	.9	3	.9	2	.6
Disagree	11	3.1	28	8.0	32	9.1	21	6.0	16	4.6	19	5.4	19	5.4	16	4.6	14	4.0
Neutral	90	25.7	116	33.1	90	25.7	96	27.4	78	22.3	80	22.9	88	25.1	81	23.1	89	25.4
Agree	159	45.4	140	40.0	147	42.0	147	42.0	166	47.4	166	47.4	160	45.7	164	46.9	175	50.0
Strongly Agree	86	24.6	63	18.0	76	21.7	78	22.3	81	23.1	81	23.1	80	22.9	86	24.6	70	20.0
Total	350	100.0	350	100.0	350	100.0	350	100.0	350	100.0	350	100.0	350	100.0	350	100.0	350	100.0

Figure 4. Factors described and analyzed.

5.1. Discussion and Implications

This study aims to measure the role of lecturers' attitudes toward using digital tools, behavioral intentions to use digital tools, and actual usage of digital technologies for online teaching and learning as an external variable to the TAM and assess the impact of perceived teaching self-efficacy, perceived enjoyment, online teaching skills, and digital tools access as an external variable to the TAM. In this research, all of the hypotheses were found to be acceptable. This is in line with prior studies, which found that attitude toward technology usage was a strong predictor of desire to utilize technology, particularly under obligatory settings [24,25,81]. Therefore, this research differs from others in that it was performed during the COVID-19 epidemic and looked into lecturers who used digital technology to improve their online teaching skills. As a result, lecturers' attitudes about utilizing digital tools, behavioral intentions to use digital tools, and actual usage of digital technologies for online teaching and learning must all be examined. We intended to improve our understanding of the characteristics that influence lecturers' usage of online teaching, especially for professors who have prior experience with utilizing technology to build online teaching abilities. Therefore, to achieve the research goal, the TAM model [25] was used together with an external component of instructor experience in using technology for the development of online teaching skills. The hypothesis of a directed relationship between TAM scales and external influences was investigated. Thus, the COVID-19 pandemic was a significant driving force for this study. Furthermore, lecturers' attempts to move from traditional teaching techniques to a more tech-oriented approach cause problems [82]. A number of lecturers discussed the nature of the instructional application as well as external and internal issues. As a result, a new category known as developing difficulties has emerged, which is tied to the limitations that teachers face while using Google Classroom. Furthermore, because this style of teaching demands quick and stable connectivity to permit interaction between the student and the educator, the efficiency of remote learning is significantly hampered by unreliable internet access [83]. According to a recent systematic analysis, the new educational standard has had an impact on the United Nations' Sustainable Development Goals, with an increased risk of sustainability in tertiary education [84]. When they required it, however, students received insufficient social assistance and security protection from other students and their professors [85]. Furthermore, universities face challenges in maintaining course content consistency and relevance, communicating clearly with the academic community, and acquiring and recruiting students [86]. The concept

of supporting evidence-based practices to promote scholarly teaching practices is also a challenge [87]. As a result, higher education institutions must guarantee that education is inclusive, egalitarian, and of high quality in order to bridge the digital gap and promote sustainable activities [88]. This involves utilizing digital tools to provide learners with focused and timely feedback as well as analyzing data on learner performance to influence future teaching tactics. Because of their student status during COVID-19 pandemic, the lecturers in this study may not have considered their use of technology to be required, but they use digital technologies to test online teaching skills and competencies during the COVID-19 pandemic. Despite the fact that lecturers were expected to take courses on various aspects of technology usage and were encouraged to use technology for their learning and assignments, their interactions with technology as lecturers, attitude toward using digital tools, behavioral intention to use digital tools, and actual use of digital tools for teaching and learning were examined in three ways.

(1) First, lecturers have more time to experiment with technology throughout training, and they have more self-efficacy in instructing.
(2) Second, lecturers utilize technology primarily to improve their online teaching abilities and prepare for their future profession as a university professor.
(3) Third, lecturers have additional assistance for using technology as part of their instruction as well as access to digital tools.

The results of this study show that perceived teaching self-efficacy, perceived enjoyment, online teaching skills, and digital tool access have a significant impact on the TAM factors' core constructs; perceived ease of use, perceived usefulness, lecturers' attitude toward using digital tools, and lecturers' behavioral intention to use digital tools, in turn, affect actual use of digital tools for teaching and learning (see Figure 3 and Table 6). As a consequence, this research shows that adopting digital tools during the COVID-19 epidemic improved online teaching abilities and competences. Furthermore, our research has resulted in the creation of a validated instrument to assess lecturers' attitudes about utilizing digital tools, behavioral intentions to use digital tools, and actual usage of digital tools in higher education teaching and learning.

Finally, the scientific contributions as follows:

- Regarding the independent factor hypotheses on the actual use of digital tools for teaching and learning by lecturers at universities; perceived teaching self-efficacy, perceived enjoyment, online teaching skills, and digital tools access were found to affect perceived usefulness and perceived ease of use digital tools for teaching.
- Regarding the mediator factor hypotheses on the on the actual use of digital tools for teaching and learning by lecturers at universities; perceived usefulness, and perceived ease of use digital tools for teaching were found to affect lecturers' attitude toward using digital tools and lecturers' behavioral intention to use digital tools for teaching.
- Regarding the mediator factor hypotheses on the on the actual use of digital tools for teaching and learning by lecturers at universities; lecturers' attitudes toward using digital tools were found to affect lecturers' behavioral intention to use digital tools for teaching.
- Regarding the dependent factors hypotheses on the actual use of digital tools for teaching and learning by lecturers at universities; lecturers' behavioral intention to use digital tools was found to affects actual use of digital tools for teaching and learning.

5.2. Conclusions and Future Work

In conclusion, this study discovered three main challenges that impacted the use of digital technologies for online teaching skills and competencies during the COVID-19 pandemic: (a) lecturers voiced their unbiased concerns about digital tools access (Internet and technology); (b) lecturers discussed the challenges of equity and the concern they had for social interaction and peer connection during the pandemic; nonetheless, they viewed this attempt as a challenge, and they were eager to promote perceived teaching

self-efficacy; (c) the lecturers were concerned that students' motivation and engagement would be lower in the online learning environment. This research has some limitations as well. Because this study only considered one public university in Saudi Arabia, the sample size was very small. As a consequence, future studies might include more public and private higher education institutions, as well as student and lecturers' perspectives on the usage of digital tools in the classroom. Qualitative data, such as interviews, must be incorporated in order to properly analyze and explain findings. Future research on the use of digital technology to improve online teaching abilities should concentrate on lecturers' interactions and engagement as well as how pedagogy and course designs impact their willingness to employ digital technologies in the classroom.

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