Determinants of Teacher's Attitude towards Online Teaching and Learning

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Abstract

Faculty attitude is an important aspect in determining their readiness for online education. This study seeks to understand the attitude of teachers in higher education regarding online teaching and learning. There were 759 participants from different colleges and universities in India (92 professors, 73 associate professors, and 594 assistant professors). This study was completed during the lockdown owing to Covid-19 outbreak. After reviewing relevant literature, data was initially gathered using Google forms based on the "Attitude Scale towards Online Teaching and Learning for Higher Education Teachers". Scale reliability was verified with the Cronbach Alpha and split-half reliability. Interrelationships between the constructs of attitude were examined using PLS-SEM. The study also revealed the existence of parallel and serial mediations between the constructs. It was established that knowledge could lead to responsiveness only in the presence of appreciation and proficiency. Hence, appreciation and proficiency are important constructs for teachers' responsiveness towards online education.

Keywords: attitude, online education, teaching and learning, PLS-SEM, mediation

1. Introduction

Education is described as a systematic development of one's abilities in the light of acquired knowledge. It is a constant process that begins with an individual's birth and plays an essential role in the life of all. There are numerous ways to achieve education, but technology has largely changed the education delivery mechanism. Many studies have shown the significance of technology in various aspects of our life (Jovanova-Mitkovska, 2010; Ghavifekr & Rosdy, 2015). We have observed an increase in internet use in everyday life in recent years (Anderson & Tracey, 2001; Haythornthwaite & Wellman, 2002). This digital revolution has dramatically transformed the education sector around the world. Technology has played a significant role in increasing the efficiency and effectiveness of teaching (Gigurovic, 2010; Wells, de Lange, and Fieger, 2008).

Furthermore, millennial children are digital natives, and technology is intertwined in all aspects of their life. Teachers can benefit from improving their digital abilities in today's digital environment (Kalanda, 2005). Over the last decade, online education has grown in popularity and acceptance to obtain higher education (UNESCO, 2009). However, the teacher community seems to be divided on online teaching. Some find it the best replacement for traditional teaching in resolving access-related issues (Weller, 2007; Garrison, 2011). However, some think that technology can never replace a teacher. Many teachers consider conventional methodologies no longer adequate in today's world (Enayanti et al., 2012) and integration of technology can improve student performance (Draude and Brace, 1999; Salmon, 2011; Costley, 2014). As a result, the teacher cannot overlook technology, and digital literacy has become a prerequisite for a teacher these days.

Blended learning and online education have been a feature of higher education since the early 21st century (Singh & Thurman, 2019). The year 2019 ended with the arrival of COVID-19, which quickly became a global threat (Spina et al., 2020), bringing countries to a halt in the first quarter of the new year. However, to deal with the severity and limitations of the COVID-19 lockdown, schools and other educational institutions have preferred to switch to online or synchronized learning overnight. The rapid shift in all instruction presents an unprecedented opportunity to observe how teachers feel prepared for online teaching (Brooks & Grajek, 2020). Faculty members around the world

have done everything to get students enthusiastic about academic work at home, from recording lectures to exchanging notes with students (asynchronous learning); from online instruction (synchronized learning) to urging students to enrol in online courses (Kumar, Kumar & Ting, 2021). This abrupt transition from a traditional learning approach to a new technology-linked learning approach left teachers no time to develop an appropriate plan for instructional delivery, assessment, technical arrangements, or support (Mohalik & Sahoo, 2020).

It is crucial to assess teachers' e-readiness and perception in this situation. It is essential to consider that teachers' attitudes in higher education play an important role in their preparation for online teaching and learning (Martin et al., 2019; Trivedi, 2018). Optimal ICT integration in the classroom is determined by teachers' thought patterns, beliefs and attitudes towards ICT (Sang, Valcke, Van Braak & Tondeur, 2010). The effectiveness of any online course is explained by the setting, assignments and student attitudes towards ICT (Wasserman & Migdal, 2019). In order to ensure that all students have equal access to quality teaching and learning, different factors that influence the acceptance of university teachers need to be examined (Hung, 2016; Kebritchi et al., 2017). Online teaching performance mainly relies on teachers' attitudes toward online education (Van Den Berg et al., 2006; Wasserman & Migdal, 2019).

Attitude is a theoretical construct created by psychologists to explain any phenomenon of interest. It is the ability to discern anything based on experience, intellect, affection, and behaviour (Schwarz, 2007). People's perspectives on things and how personally significant they are being referred to as their attitudes (Krosnick & Petty, 1995). It is among the social and psychological constructs with the greatest sway (Fishbein & Ajzen, 1980). Social scientists have utilised this attitude to explain human activities throughout the history of social psychology (Kisanga & Ireson, 2016). Attitude plays a significant role in adopting technology as a useful instrument for a positive transformation (Krishnakumar & Rajesh, 2011). Knowledge, willingness to learn (Papp, 1998), sense of ease (Nair & Das, 2012), beliefs and the external environment can influence a teacher's attitude towards online education. Even customs, value systems, and social conditions have been found to impact a person's mindset (Gardner, Dukes, & Discenza, 1993). Teachers with a positive attitude have shown better familiarity with new technologies (Uzunboylu, 2007). So far, many research studies have reported favourable attitudes of teachers toward e-learning (Suri and Sharma, 2017; Akaslan and Law, 2011). However, very few teachers use technology in the classroom, which is more common in research (Maria Duart, 2011). This study makes an effort to comprehend teachers' perceptions of online learning during the COVID-19-induced forced shift to online education.

2. Theory and Hypotheses Development

This study analyses teachers' attitudes towards online teaching and learning and the interrelationship between their constructs during this COVID-19. Also, the shift to online teaching due to the pandemic has not been studied in depth due to the limited incidence of these global pandemics (Kumar, Kumar & Ting, 2021). Past studies have focused on the impact of MOOCs on student satisfaction, achievement and learning, among other things (Marks et al., 2005). The current study aims to guide academicians in emphasising the relevance of understanding teachers' perceptions of online education. Although these prerequisites are crucial in both offline and online education because content delivery, resource mobilisation, student support, and the success of online education depend on teachers' attitudes, they become even more vital in the online teaching-learning process during this pandemic. The success of online education depends on teachers' acceptance of it as a viable alternative to traditional face-to-face instruction (Smith & Sivo, 2012). Davis (1989) developed the Technology Acceptance Model (TAM), a theoretical model based on four variables: external variables, perceived utility, perceived ease of use, and attitude towards e-learning. Many researchers have extended the TAM model by adding new variables like self-efficacy, user characteristics, and organisation-related factors (Lee, Kozar, & Larsen, 2003; Pan, Gunter, Sivo, & Cornell, 2005). Trends over the past years show the development of many scales for assessing different aspects of the attitude towards online education. Some of them are: "The Computer Attitude Measure" (Kay, 1993), "The Computer Attitudes Scale for Secondary Students" (Jones & Clarke, 1994), and "Attitude Scale towards Using Instructional Technologies for Pre-Service Teachers" (Metin et al., 2012). According to Garland and Noyes (2008), these attitude scales are no longer relevant in the current situation due to time lag and technological developments. Wilkinson, Roberts, and While (2010) supported this by saying that educators require scales that demonstrate predictive validity even while reflecting such developments (Garland & Noyes, 2008). The previous studies suggest that all scales display psychometric qualities. However, they lack utility in different cultural domains, and their items lack diverse themes to measure attitudes about e-learning (Kisanga & Ireson, 2016). After an extensive examination of the literature and discussion with the experts in the field, the theoretical framework given by Martin, Budhrani, and Wang (2019) was found to be the most suitable for understanding faculty readiness for online education. They defined faculty readiness as preparation for

online teaching. They considered knowledge, importance, and ability as the main predictors of readiness. Numerous studies have looked at the relationships between readiness, ability, and attitude (Logan & Johnston, 2009; Rollnick, Mason, & Butler, 1999). Still, no research has been conducted on the relationships between attitude, ability, and readiness for online teaching (Martin, Budhrani, and Wang, 2019). This model examined the relationship between knowledge, importance, ability and readiness for online education. This model was adapted and has been presented in Figure 1.

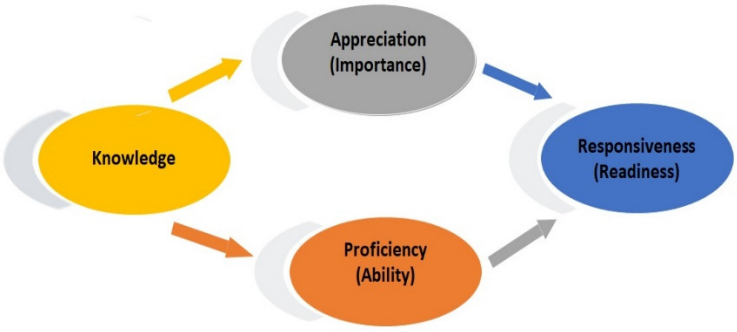

Figure 1. Theoretical Framework for Teachers' Responsiveness or Readiness for Online Education Adapted from the Model Given by Martin, Budhrani, & Wang, (2019)

In the adapted model, knowledge, appreciation, proficiency, and responsiveness are important constructs determining teacher attitudes towards online education. Knowledge, competence, and readiness are foundational constructs of preparedness (Mikovits, 2021). Knowledge is a treasured mental state in which an individual is cognitively connected to reality (Zagzebski, 2017). It encompasses all known and is a fundamental aspect of human thinking (Bloom, Krathwohl & Masia, 1984). It is the awareness of and familiarity with something. Teachers' attitudes toward e-learning change because of the differences in teachers' knowledge of computers (Krishnakumar & Rajesh, 2011). Knowledge of anything leads to a better understanding of that area, and a person tends to develop opinions about that area (National Research Council 2000), which may be reflected in appreciation or criticism.

Similarly, knowledge plays a vital role in acquiring proficiency in any area. Limjuco, Laya, Aleria, and Shalah (2017) reported a positive, significant relationship between knowledge and appreciation and knowledge and manifestation. Milton (2013) mentioned that knowledge is related to the ability to perform and found it to be an important predictor of appreciation.

Along with knowledge, one must have the capacity and willingness to act (Spinello, 2000), which directly influences appreciation, proficiency, and responsiveness. According to Merriam-Webster, appreciation is the feeling of admiration or expression of approval for something. It is a favourable critical estimate which leads to the recognition of the worth of something. Guo (2018) observed the direct effect of ability and proficiency on reading and the indirect effect of metacognitive knowledge on reading via reading ability and language proficiency. It was also reported that proficiency magnifies the impact of metacognitive knowledge on reading. Technical skills are solely related to using technology; they have nothing to do with pedagogy (Varvel, 2007), and it includes technical knowledge (e.g., use of software, synchronous and asynchronous tools of online teaching and learning) and proficiency with current technology, including identifying and fixing operational issues (Darabi et al., 2006; Varvel, 2007). Following hypotheses were developed in light of the review:

H1: K→R: Knowledge has a direct influence on responsiveness.

H2: K→A: Knowledge has a direct influence on appreciation.

H3: K→P: Knowledge has a direct influence on proficiency.

H4: A→R: Appreciation has a direct influence on responsiveness.

H5: P→R: Proficiency has a direct influence on responsiveness.

H6: A→P: Appreciation has a direct influence on proficiency.

H7: K→A→R: Appreciation mediates the relationship between knowledge and responsiveness.

H8: K→A→P→R: Appreciation and proficiency serially mediate the relationship between knowledge and

responsiveness.

H9: K→P→R: Proficiency mediates the relationship between knowledge and responsiveness.

H10: K→A→P: Appreciation mediates the relationship between knowledge and proficiency.

H11: A→P→R: Proficiency mediates the relationship between appreciation and responsiveness.

3. Research Method

In order to assess whether faculty members are prepared to teach online, several universities have developed readiness assessment tools. However, there haven't been many thorough studies to ascertain faculty attitudes in the Indian context. This study aims to determine faculty preparedness to teach online by examining their attitude towards appreciation and their understanding of their ability to teach online. After exhaustive research, the "attitude scale towards online teaching and learning for higher education teachers" (Sangwan, Sangwan, & Punia, 2021) was found suitable for the present study. This scale is based on four factors: Knowledge, Proficiency, Appreciation and Responsiveness. This scale is divided into two parts: Part A contains general information, and Part B contains four different factors. The scale's reliability was verified by calculating the Cronbach Alpha value (0.88) and split-half correlation (0.80). Data collection has been completed by using Google forms. A total of 768 responses were received, and after cleaning the data, 759 responses were included in the study. The demographic details included gender, designation, age and experience. Among the respondents, men (58.23%) outnumber women (41.77%). Regarding designation, assistant professors (78.26%) have shown maximum participation in comparison to associate professors (9.62%) and professors (12.12%). Further details about the sample have been presented in Table 1. Adequacy of sample size was further determined using G*Power analysis by considering medium effect size, 5% error probability, and three predictor variables. The minimum sample size was computed as 114. Thus, a sample size of 759 > 114*2=228 is much greater than the required sample size. Jamovi, R-Studio and Smart PLS software have been used for describing and testing hypotheses.

Table 1. Demographic Detail of the Sample

		Frequencies (f)	Percentage (%)
Gender	Female	317	41.77
	Male	442	58.23
Social media	Yes	714	94.07
User	No	45	5.93
Desktop/Laptop	Yes	702	92.49
Friendly	No	57	7.51
Age	Less than 30 Years	131	17.26
	30-40 Years	359	47.30
	40-50 Years	209	27.54
	More than 50 Years	60	7.91
Experience of teachers	Less than 5 Years	209	27.54
	5-10 Years	220	28.99
	10-20 Years	232	30.57
	More than 20Years	98	12.91
Designation	Assistant Professor	594	78.26
	Associate Professor	73	9.62
	Professor	92	12.12

4. Results

4.1 Demographic Factors Influence

4.1.1 Gender

In the present study, the independent t-test was run to test the gender differences in the four dimensions of attitude towards online education, as shown in Table 2. Both male and female faculty members responded in the same way on knowledge and proficiency dimensions; however, female faculty members have shown significantly better responsiveness and appreciation for online education than their male counterparts.

Table 2. Descriptive Statistics and t-test of Gender on Teacher's Attitude Scale Dimensions

	Gender				t-test	P	Effect size
	Male		Female				
	M	SD	M	SD			
Knowledge	18.6	2.98	18.2	2.89	1.726	0.085	0.1270
Proficiency	24.4	4.97	24.7	4.90	-0.657	0.511	0.0484
Responsiveness	17.2	4.06	17.9	3.92	-2.312	0.021	0.1702
Appreciation	31.7	3.83	32.3	3.68	-2.327	0.020	0.1712

4.1.2 Desktop/laptop Friendliness

The study further analysed the influence of desktop/laptop friendliness on the four dimensions of the teacher attitude scale using an independent t-test. The study revealed significant difference in all the four dimensions i.e., knowledge ($t=4.47$, $p<0.001$), proficiency ($t=3.29$, $p=0.001$), appreciation ($t=2.087$, $p=0.038$) and responsiveness ($t=4.25$, $p<0.001$). It was observed that desktop or laptop friendly teachers have shown better knowledge, proficiency, responsiveness and appreciation for online education.

Table 3. Descriptive Statistics and t-test of Desktop/laptop Friendliness on Teacher's Attitude Scale Dimensions

	Desktop/laptop friendly				t-test	P	Effect size
	Yes		No				
	M	SD	M	SD			
Knowledge	18.6	2.90	16.8	2.99	4.47*	<0.001	0.61
Proficiency	24.7	4.89	22.5	5.10	3.29*	0.001	0.453
Responsiveness	17.6	3.99	16.5	4.15	2.08*	0.038	0.28
Appreciation	32.1	3.68	29.9	3.99	4.25*	<0.001	0.58

4.1.3 Social Media Usage

It has been observed that social media usage also influences the teachers' attitude scale dimension of appreciation ($t=2.32$, $p=0.02$). However, no significant difference was observed in knowledge, proficiency, and responsiveness dimensions.

Table 4. Descriptive Statistics and t-test of Social Media Usage on Teacher's Attitude Scale Dimensions

	Social Media User				t-test	P	Effect size
	Yes		No				
	M	SD	M	SD			
Knowledge	18.4	2.91	18.7	3.42	0.67	0.5	0.10
Proficiency	24.5	4.91	24.2	5.43	0.43	0.66	0.06
Responsiveness	17.5	3.96	17.0	4.72	0.88	0.37	1.36
Appreciation	32	3.76	31	4.01	2.32	0.02	0.35

4.1.4 Designation Differences

Table 5. Descriptive Statistics and F Test of Designation on Teacher's Attitude Scale Dimensions

	Designation Mean (SD)			F-test	Post hoc analysis
	Asst. Professor (1)	Associate Professor (2)	Professor (3)		
Knowledge	18.4 (2.92)	18.4 (2.81)	18.8 (3.19)	0.631	
Proficiency	24.3 (4.94)	25.3 (5.16)	25.3 (4.16)	2.55	
Responsiveness	17.3 (4.02)	17.9 (3.79)	18.4 (4.02)	2.99*	3>1
Appreciation	31.8 (3.19)	31.9 (3.01)	33.0 (3.35)	4.48*	3>1

The ANOVA test results revealed that designation makes a significant difference between assistant professors and professors in the dimensions of responsiveness (F=2.99) and appreciation (F=4.48). Senior teachers (Professors) have shown more responsiveness and appreciation for online education. However, no difference was observed in the knowledge and proficiency of teachers on the basis of their designations.

4.2 PLS-SEM

PLS-SEM is a structural equation modelling based on a partial least square approach. This covariance-based structure analysis is suitable for studies having many latent variables (Vijayabanu and Arunkumar, 2018) and formative constructs (Hair et al., 2019). PLS-SEM model evaluation includes both the measurement model and the structural model. First, the measurement model is assessed for all the required criteria, and then the structural model is evaluated for path coefficients, predictive relevance, and explanation power (Hair et al., 2019). Four latent variables and twenty-seven observable variables were considered for the study. These latent variables include knowledge, appreciation, proficiency and responsiveness. Table 6 indicates constructs and indicators' details and distribution.

Table 6. Constructs and Indicators

Constructs	Indicators
Knowledge	K_1- Technology updation
	K_2- Knowledge of internet tools
	K_3-Command over G Suite
	K_4- Skillful in preparing e-content
	K_5-Knowledge of OERs
Proficiency	P_1- Online teaching challenges
	P_2-Comfort in preparing video lectures
	P_3-Difficulty in online teaching
	P_4-Difficulty in online learning
	P_5-Use of different LMS for teaching
	P_6- Time concern
	P_7-Confusion regarding usage of different tools
	P_8-Lack of resources
Appreciation	A_1-Creativity and opportunities in online teaching
	A_3-Appreciation for online teaching
	A_4- Students learn at their own pace
	A_5-Possibility of easy collaboration on online platforms
	A_6-Importance of digital competence
	A_7- Great opportunity for sharing material
	A_8-Keenness to attend online teaching-related training
	A_10-Better future for digitally literate teachers
Responsiveness	R_1- Good platform
	R_2- Online teaching is more interesting
	R_3-Flexible
	R_4-Comfortability
	R_5-Active participation of students
	R_6- Students' progress can be tracked easily

4.2.1 Assessment of Formative Model

The first step of PLS-SEM includes the assessment of the measurement model. The theory and statements indicate that items have been asked in terms of causes, indicating that the model has formative constructs. This was further verified by the value of AVE (<0.50) for each construct. The formative measurement model was checked for collinearity issues, and the VIF value for all the indicators was found below the threshold value of 3. Therefore, we can conclude that the model is free from collinearity issues (Chuah et al., 2020). Furthermore, each indicator's relevance and significance were assessed via complete bootstrapping (5000 subsamples). The outer weights (refer to Table 7) for all the indicators were significant except for A_2, A_5, A_6, A_7, A_9, A_10, K_2, A_3, P_2, P_7, R_2 and R_8. However, when indicator loadings were checked, only A_2, A_10 and R_8 were found to have loadings

<0.50 and others were retained because of their importance for constructs. Hence, these three indicators were deleted, and finally, 27 indicators were kept in the model.

Table 7. Result of Measurement Model

Indicators	VIF	Outer Weight	T-statistics	p-value	95% confidence interval	Outer Loading
A_1	1.371	0.548	9.195	0	[0.435, 0.667]	0.822
A_3	1.435	0.198	3.553	0	[0.088, 0.309]	0.598
A_4	1.253	0.246	4.879	0	[0.15, 0.346]	0.554
A_5	1.381	0.056	1.029	0.303	[-0.05, 0.162]	0.519
A_6	1.923	-0.052	0.956	0.339	[-0.159, 0.056]	0.511
A_7	1.802	0.009	0.158	0.875	[-0.109,0.123]	0.593
A_8	1.238	0.273	4.961	0	[0.171, 0.386]	0.572
A_10	1.445	0.14	2.598	0.009	[0.037, 0.247]	0.562
K_1	1.409	0.275	2.45	0.014	[0.065, 0.502]	0.579
K_2	1.732	0.108	0.942	0.346	[-0.111, 0.333]	0.652
K_3	1.377	0.171	1.822	0.068	[-0.011, 0.358]	0.625
K_4	1.617	0.374	3.454	0.001	[0.158, 0.58]	0.793
K_5	1.352	0.461	5.31	0	[0.292, 0.633]	0.797
P_1	1.169	-0.133	2.362	0.018	[-0.253, -0.029]	0.247
P_2	1.595	0.092	1.36	0.174	[-0.043, 0.225]	0.594
P_3	1.723	0.254	3.758	0	[0.12, 0.386]	0.736
P_4	1.43	0.506	6.897	0	[0.367, 0.654]	0.822
P_5	1.536	0.165	2.266	0.024	[0.025, 0.31]	0.643
P_6	1.22	0.26	4.22	0	[0.131, 0.378]	0.59
P_7	1.255	0.115	1.83	0.067	[-0.009, 0.233]	0.481
P_8	1.203	0.131	1.99	0.047	[0.005, 0.255]	0.462
R_1	1.371	0.553	9.67	0	[0.443, 0.663]	0.859
R_2	1.643	0.092	1.805	0.071	[-0.006, 0.197]	0.626
R_3	1.329	0.31	5.74	0	[0.207, 0.421]	0.686
R_4	1.602	0.176	3.572	0	[0.083, 0.274]	0.629
R_5	1.554	0.115	2.182	0.029	[0.014, 0.224]	0.591
R_6	1.343	0.149	2.533	0.011	[0.037, 0.266]	0.503

4.2.2 Assessment of Structural Model

Table 8. Assessment of Structural Model

Sr. No.	Hypothesised path	β-value	T-statistics	p-value	95% confidence interval	VIF	Effect size (f^2)	p-value (f^2)	R^2	Q^2
1.	H6=Appreciation -> Proficiency	0.40	9.582	0	[0.302, 0.469]	1.15	0.19	0	0.269*	0.09
2.	H3=Knowledge -> Proficiency	0.214	3.853	0	[0.094, 0.315]	1.157	0.054	0.071		
3.	H2=Knowledge -> Appreciation	0.368	10.18	0	[0.285, 0.427]	1	0.157	0	0.135*	0.051
4.	H1=Knowledge -> Responsiveness	0.038	1.109	0.267	[-0.03, 0.105]	1.219	0.002	0.645	0.496*	0.210
5.	H5=Proficiency -> Responsiveness	0.31	7.159	0	[0.219, 0.388]	1.368	0.14	0.001		
6.	H4=Appreciation -> Responsiveness	0.482	11.989	0	[0.403, 0.561]	1.376	0.336	0		

Before evaluating the structural model, collinearity (VIF) must be examined. All the VIF values were found lower than 3 (shown in Table 8), which are ideal, as suggested by Hair and Risher et al. (2019). Hence, no collinearity issue existed. The next step evaluated path coefficients to verify the constructs' hypothesised relationship. The significance of coefficients was evaluated using bootstrapping of 5000 subsamples. The complete results, including t-value, p-value, and bias-corrected intervals, are presented in Table 8. The results indicate that all the structural model relationships are significant except for hypothesis H1. This means knowledge does not have a direct effect on responsiveness. Otherwise, all other constructs have a direct impact on responsiveness. Further, the R^2 value, which is shown in Table 8, indicates that appreciation and knowledge jointly explained 26.9% of the variance (substantial explanatory power) in proficiency, knowledge alone explained 13.15% variance (moderate explanatory power) in appreciation. Knowledge, proficiency, and appreciation jointly expressed 49.6% variance (substantial explanatory power) in responsiveness. According to Cohen (1998), the R2 values of 0.02, 0.13, and 0.26 represent weak, moderate, and substantial effect in psychology. The values of f2 of 0.02, 0.15, and 0.35 signify small, medium, and strong effects of an external latent variable, respectively, and no influence is considered if the value of f2 is less than 0.02 (Hair Jr. et al., 2014). The calculated effect size presented in Table 8 shows that the effect size is large for knowledge, appreciation, and proficiency on responsiveness, but the other two models have small effect sizes. After studying in sample explanation power of the model, the value of Q^2 predict was evaluated to find the prediction relevance of the model, and MAE/RMSE values were compared with LM and checked whether PLS-SEM < LM for most of the values. PLS predict was run for 10 folds and 10 repetitions. The results of Q^2 predict are presented in Table 9. It shows that all the values of Q^2 predict except one are greater than zero. The predicted errors were checked for symmetrical distribution, but the prediction errors followed non-symmetric distribution in the present case, so MAE values should be considered for prediction (Shmueli et al., 2019). The majority of MAE values in the PLS-SEM model are less than LM; hence the model has predictive relevance.

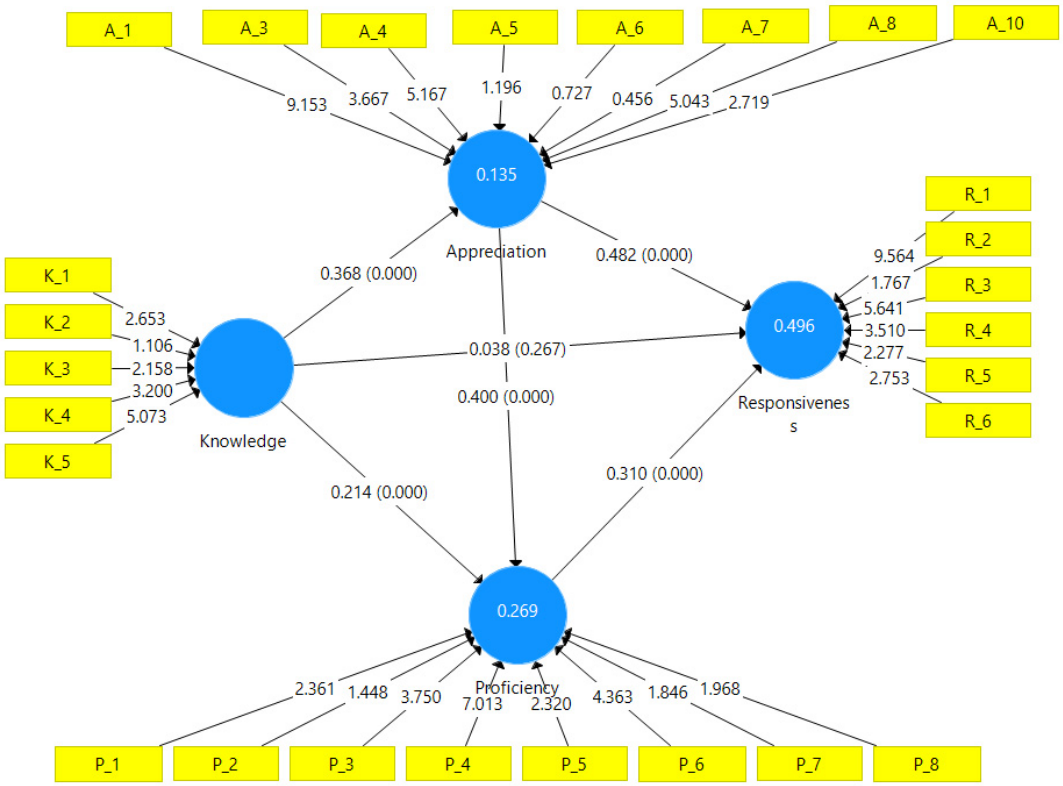

Figure 2. Structural Model

Mediation results are presented in Table 10, which indicates both serial and parallel mediation in the model. Path 1 (H7), 2 (H8) and 3 (H9) indicate full mediation (meaning only indirect effects are significant), while Path 4 (H10) and 5 (H11) indicate partial mediation (both direct as well as indirect effects are significant with VAF> 0.20). In other words, the relationship between knowledge and responsiveness is fully mediated by appreciation (Path 1) and

proficiency (Path 3). The relationship between knowledge and appreciation is serially fully mediated by appreciation and proficiency (Path 2). This indicates that knowledge leads to responsiveness only in the presence of appreciation and proficiency. The relationship between knowledge and proficiency is partially mediated by appreciation (Path 4), and proficiency partially mediates the relationship between appreciation and responsiveness (Path 5). Path 1 and 3 show parallel mediation, and when the mediating effects of appreciation and proficiency were compared, it was found that appreciation acted as a stronger mediator than proficiency.

Table 9. Results of PLS Predict

	PLS-MAE	LM-MAE	PLS-MAE-LM-MAE	Q^2_predict
A_7	0.437	0.443	-0.006	0.066
A_4	0.582	0.583	-0.001	0.031
A_6	0.497	0.497	0	0.042
A_1	0.513	0.513	0	0.067
A_3	0.473	0.476	-0.003	0.043
A_5	0.405	0.404	0.001	0.028
A_10	0.655	0.655	0	0.03
A_8	0.538	0.546	-0.008	0.074
P_4	0.891	0.894	-0.003	0.012
P_3	0.781	0.776	0.005	0.075
P_2	0.792	0.768	0.024	0.088
P_5	0.711	0.673	0.038	0.12
P_7	0.793	0.78	0.013	0.064
P_1	0.851	0.845	0.006	0
P_6	0.86	0.857	0.003	0.005
P_8	0.845	0.828	0.017	0.076
R_6	0.681	0.684	-0.003	0.018
R_5	0.843	0.847	-0.004	0.041
R_4	0.806	0.807	-0.001	0.041
R_1	0.726	0.728	-0.002	0.073
R_2	0.797	0.793	0.004	0.038
R_3	0.79	0.792	-0.002	0.044

Table 10. Mediation Result

Path	Relationships	Direct effect	Indirect effect	VAF	Result
H7 (Path 1)	Knowledge -> Appreciation -> Responsiveness	0.038	0.178*		Full Mediation
H8 (Path 2)	Knowledge -> Appreciation -> Proficiency -> Responsiveness	0.038	0.29*		Full Mediation
H9 (Path 3)	Knowledge -> Proficiency -> Responsiveness	0.038	0.066*		Full mediation
H10 (Path 4)	Knowledge -> Appreciation -> Proficiency	0.214*	0.147*	0.407	Partial mediation
H11 (Path 5)	Appreciation -> Proficiency -> Responsiveness	0.482*	0.124*	0.204	Partial mediation

5. Conclusions and Discussion

There has been considerable discussion over how to provide education to students during this pandemic. To assure uninterrupted learning, schools/colleges/institutes/universities have made a courageous step toward online/e-synchronous learning. However, variables such as disparity in terms of resource availability, teachers' ability to teach online, attitude, network-enabled gadgets, workspace, and internet connection continue to create a divide between face-to-face and virtual learning. Thus, this study used PLS-SEM to examine the relationship between constructs of attitude towards online education during the COVID-19 epidemic.

This study presents a conceptual framework for understanding the relationship between the constructs of teachers' attitudes towards online teaching and learning. It has explored the impact of gender differences, designation differences, social media usage, and laptop and desktop friendliness. The study results also reported gender differences in two dimensions: responsiveness and appreciation. This means both male and female faculty had a similar level of knowledge and proficiency. However, female faculty members exhibited better appreciation (Brigg, 2005) and responsiveness to online education. Various studies have examined gender differences in online learning and have reported favourable attitudes and more involvement of female teachers towards online education (Brigg, 2005; Chase, 2002; Seaman, 2009). Lateef and Alaba (2013) identified gender as an important factor, while other studies did not find the effect of gender on online behaviour (Graff, 2003; Meelissen and Drent, 2008; Adebowale et al., 2010). The results are in agreement with the studies conducted by Campbell and Varnhagen (2002) and Peluchette & Rust (2005). As a result, gender variations in technology-assisted instruction demand additional examination.

The designation seems to make a difference in the appreciation and responsiveness between professors and assistant professors, and professors have shown better appreciation and responsiveness. Furthermore, desktop/laptop handling ability has demonstrated significant differences in all four dimensions of attitude, with laptop users demonstrating greater knowledge, appreciation, proficiency, and responsiveness to online education. Hence, teachers must be encouraged to use computers in their everyday jobs. Social media users have a better appreciation of online education but do not differ in the other three dimensions.

The final structural model given in Figure 2 represents different interrelationships between the constructs of teachers' attitude toward online teaching and learning. The assessment model results indicate that knowledge directly influences appreciation and proficiency and indirectly affects responsiveness. Appreciation and proficiency have shown a direct influence on responsiveness. This result found support from Chocarro, Cortiñas, and Marcos-Matás (2021), who empirically tested the TAM model and confirmed that perceived usefulness has a substantial impact on the intention to use technology. The results show that appreciation and proficiency, along with knowledge, play a vital role in developing responsiveness towards online education. In-sample explanatory power (R2 values) indicates that knowledge, proficiency, and appreciation have a large descriptive ability for responsiveness and have a large effect size.

Further appreciation and proficiency fully mediate the relationship between knowledge and responsiveness. This means knowledge leads to responsiveness only in the presence of appreciation and proficiency. The results are congruent to a study by Guo (2018), wherein he reported the relationship between metacognitive knowledge, reading ability, and language proficiency. It can be concluded that knowledge leads to appreciation and proficiency, leading to responsiveness.

However, the relationship of knowledge with proficiency is partially mediated by appreciation, which means knowledge, directly and indirectly, affects proficiency. A person who has knowledge about online education will become more proficient if he appreciates online teaching and learning. Similarly, appreciation has both direct and indirect influence on responsiveness, and this effect is magnified in the presence of proficiency. Furthermore, parallel mediation results indicate that appreciation is more significant than proficiency in the relationship between knowledge and responsiveness. The findings suggest that attitude towards online education is assessed by four constructs: knowledge, appreciation, proficiency, and responsiveness. It is important to emphasize appreciation and competence to create a positive attitude towards online education. Sangeeta and Tandon (2020) posited that attitude is a significant construct affecting the behaviour intention of the teachers in adopting any technology. Moreover, a positive attitude toward technology and previous exposure to training in this area result in better self-efficacy (Doligan and Owen, 2021) and teacher satisfaction. The appreciation and proficiency effects have been crucial in assuring teachers' responsiveness towards online education, followed by the teacher's knowledge. Appreciation and proficiency substantially affect total responsiveness, as it fully mediates the association between knowledge and responsiveness. It has been established earlier in the literature (Kin, Omar and KhalipMusa, 2022) that teachers' digital competency is positively related to their attitude to change. This suggests that merely improving knowledge without working on developing appreciation does not serve the purpose. Hence, training programmes should be focused on developing an appreciation for technology along with knowledge and proficiency development.

6. Educational Implications

Because of the widespread closures due to the pandemic, universities and colleges worldwide have moved to technology-assisted remote pedagogy instruction to supplement their courses. In the present climate, online learning

has the potential to be a tremendous asset. In order to ensure the success of higher education systems, academic officials should be required to adopt the new technology to its utmost potential. When it comes to global crises, they should realise that simply uploading content does not contribute to the overall learning of the students in COVID-19 (Kumar, Kumar, & Ting, 2021).

This study aims to help decision-makers in the field of education create and carry out efficient educational responses to the COVID-19 pandemic. The paper illustrates why it is critical to emphasise appreciation and proficiency to achieve a positive attitude toward online education. The study results indicate that policymakers and administrators should improve knowledge and efficiency by providing adequate training. Institutions should consider training their faculties in online teaching and evaluation to avoid complications and reduce inequalities. We posit that it can help in improving the attitude of teachers toward online education. In order to address the problems that teachers are experiencing in this online transition scenario, colleges and universities should try to understand teachers' attitudes and organise professional development programmes for their faculty members to develop a positive attitude towards online education. Although universities are forced to modernise technology access and usage, the next course of action depends on understanding proficiency, knowledge level, and appreciation for technology. Additionally, universities and colleges should make additional efforts so that teachers and students do not suffer in this pandemic.

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