Journal of Information Technology Education: Research

An Official Publication of the Informing Science Institute
InformingScience.org

JITEResearch.org

Volume 20, 2021

THE CHALLENGES OF ONLINE TEACHING IN COVID-19 PANDEMIC: A CASE STUDY OF PUBLIC UNIVERSITIES IN KARACHI, PAKISTAN

Huma Akram*	Northeast Normal University, Changchun, China	akram_huma1@outlook.com
Sarfraz Aslam	Shaanxi Normal University, Xian, China	sarfrazaslam@qq.com
Atif Saleem	Zhejiang Normal University, Jinhua, China	ad668@nenu.edu.cn
Khalida Parveen	Southwest University, Chongqing, China	nicepak81@hotmail.com

* Corresponding author

ABSTRACT

Aim/Purpose	This study aims to examine the challenges faculty members face with online teaching practices in public universities in Karachi, Pakistan during the COVID-19 pandemic. Faculty members' pedagogical experiences were examined by following the approach of the technology acceptance model (TAM) framework presented by Davis in 1986 and 1989.
Background	The COVID-19 pandemic has significantly affected educational activities and disrupted the traditional norms of education at colleges and universities in the world, and, as a result, teaching and learning have shifted to online. Accordingly, the outcome of the COVID-19 pandemic has unexpectedly forced educators and educational leaders to analyze pedagogical measures to offer quality education to students and make changes to their curriculum and instruction.
Methodology	This study used a mixed-method research design with closed-ended surveys and interviews. The researchers distributed online questionnaires and conducted phone call interviews, followed by simple random sampling approach to strengthen data collection and analysis. The research data were analyzed through descriptive statistical tests, including mean, standard deviation, and Pearson correlation, and thematic analysis.

Accepting Editor Felix O Quayson | Received: January 15, 2021 | Revised: April 13, May 18, 2021 | Accepted: May 19, 2021.
Cite as: Akram, H., Aslam, S., Saleem, A., & Parveen, K. (2021). The challenges of online teaching in COVID-19 pandemic: A case study of public universities in Karachi, Pakistan. *Journal of Information Technology Education: Research, 20,* 263-282. https://doi.org/10.28945/4784

Contribution	By examining the challenges faculty members face with online teaching practices, this study contributes to the literature knowledge to advance the Practical-Knowledge gap (the lack of empirical studies in the context of practice and theoretical perspective) by knowing faculty members' experiences and attitudes regarding online teaching in public universities in Karachi, Pakistan. The adopted framework of the technology acceptance model provides confirmation of reliability in the context of higher education institutions, which can help explore pedagogical challenges and practices of teachers who teach online in other provinces in Pakistan, cultures, and countries. This study provides suggestions to online teachers in Pakistan to sort out their challenges.
Findings	The findings highlight a favorable attitude of faculty members' usage of virtual platforms for teaching. Likewise, faculty members encountered several challenges that caused restrictions in accomplishing competent teaching and learning. Furthermore, faculty members lacked sound experience in conducting online classes and were not given adequate technical assistance or ICT infrastructure to cope with the technical challenges.
Recommendations for Practitioners	It is recommended by this study that teachers should be given adequate professional development opportunities to develop technical and ICT infrastructure competencies to facilitate them to successfully teach online.
Recommendations for Researchers	Another study should be conducted at the national level to reinforce the understanding and generalization of this study's results. Furthermore, this study assessed public universities faculty members' experiences through self-reported surveys and interviews. However, future researchers should employ other means and methods of examination such as private universities, public universities, primary schools, middle schools, secondary schools, and observations or focus group discussions to broaden the understanding of online teaching practices and challenges in Pakistan.
Impact on Society	By examining faculty members' experiences and challenges of teaching online, this study will help educators and educational leaders to raise the quality of online teaching in Pakistan by knowing the appropriate solutions and recommendations.
Future Research	This study examined the adoption of three ICT indicators through pedagogical practices such as perceived usefulness, perceived ease of use, and attitude to use. For future studies, researchers and practitioners should evaluate other indicators such as students' learning outcomes.
Keywords	higher education, online teaching, pedagogical practices, online teaching challenges, technology acceptance model (TAM)

INTRODUCTION

The affirmation of COVID-19 as a pandemic by the World Health Organization caused an urgent transition of teaching from face-to-face to online in 107 countries that affected about half of the global student population (United Nations Educational, Scientific, and Cultural Organization [UNESCO], 2020). This transition period caused an urgent requirement for teachers to gain understanding and competencies to use digital virtual platforms to teach their students. Meanwhile, technology inclusion in educational institutions has been an international topic for discussion for decades (Daniela et al., 2018; U.S. Department of Education, 2017). Similarly, in Pakistan, the use of ICT is

suggested to achieve maximum results, as it enhances teachers' pedagogical competencies and stimulates learners for active learning (Pakistan Ministry of Education, 2018).

Although traditional technological teaching tools such as PowerPoint or Smartboards are widely used and applicable to online teaching, educational technology experts continue to measure the integration of technological teaching tools in pedagogical practices (Guillén-Gámez et al., 2018; Nikolopoulou & Gialamas 2016). Further, the integration of ICT is essential to construct an effective online educational approach; likewise, the quality of teachers and the e-learning system contribute significantly to the learners' satisfaction and success (Theresiawati et al., 2020). Therefore, it is suggested to apply professional training to integrate technology in teaching (Guillén-Gámez et al., 2020).

This sudden global change in educational practice increased pressure on institutions in teaching to achieve quality learning outcomes for students (Rodriguez-Segura et al., 2020). In China, teachers had to deliver lectures from their homes with no proper technical guidance and online teaching infrastructure (Zhang et al., 2020). In Pakistan's case, teachers did their best to continue to teach students; however, they encountered several challenges in remote teaching and were unable to assign interactive activities among students adequately (Waqar, 2020). This urgency necessitates further review of Pakistan's teachers professional development in online teaching.

Furthermore, online learning is found effective, mostly in developed countries (Basilaia&Kvavadze, 2020). While in developing countries like Pakistan, online teaching and learning have shown significant improvement, several barriers still exist that hinder the effectiveness of ICT integration in education (Salam et al., 2017). Previous studies related to the Pakistani context show that students commonly perform better in digital platforms than the traditional ones (Shehzadi et al., 2020). In contrast, the digital competency of teachers in terms of developing pedagogical lessons is found to be inadequate (Farid et al., 2015), although teachers' contribution cannot be neglected in integrating ICT in the classroom effectively (Oguguo et al., 2020). In addition, the studies cited mainly focused on students as end-users (Alharbi, 2019; Niederhauser et al., 2018). The majority of the teachers are considered to be digitally literate; however, it is essential for them to learn about the professional integration of ICT in the classroom (Al-Samarraie & Saeed, 2018). Some studies highlighted that each teacher experience ICT differently, and they identified a significant difference in gender when it comes to digital instructional development with a tilt towards males over females (Boyte-Eckis et al., 2018).

STATEMENT OF THE PROBLEM

The COVID-19 pandemic was unexpected in the world. It pressured institutions to highlight the importance of ICT integration in education as well as emphasized the importance of making changes to pedagogical practices. Prior studies indicate that teachers are capable of conducting online lessons but are not competent enough to adopt ICT efficiently in their pedagogical practices (Al-Samarraie and Saeed, 2018). In Pakistan, teachers are often unprepared to incorporate digital instructional approaches in their curricula (Adnan & Anwar, 2020). Therefore, it is essential for teachers to gain technological competency in order to adapt to online teaching effectively (Uerz et al., 2018). The individual's acceptance of information systems was considered necessary by Davis (1986, 1989) who presented his framework of Technology Acceptance Model (TAM). The central axis of this model is based on the fact that individuals' attitudes towards system usage depend upon two major beliefs: perceived usefulness and perceived ease of use. This study followed the approach of Davis framework to examine faculty members' attitudes and rate of adoption of ICT in pedagogical practices in public universities in Pakistan. Several studies have followed Davis framework model to examine the rate of adoption of technology in education, but there is no study conducted since the COVID-19 pandemic that examined faculty members adoption of technology and online teaching practices in public universities in Karachi City, Pakistan. This study's researchers decided to make it a research agenda to explore the practices and challenges encountered by faculty members who teach online in public universities in Karachi City, Pakistan. Therefore, this study intends to address the empirical

knowledge gap by contributing to the literature knowledge on faculty members challenges, attitudes, and experiences in online teaching in Pakistan.

RESEARCH QUESTIONS

1. What are faculty members attitudes towards online teaching?
2. What ICT teaching platforms are adopted by faculty members in online teaching?
3. What major challenges are encountered by faculty members in the adoption of online teaching?

REVIEW OF LITERATURE

ONLINE TEACHING

Online teaching is a term that can be illustrated by the following principles: (1) the teacher and learner sit geographically distant from each other; asynchronous learning does not occur at the same place or time, and synchronous learning occurs when groups of student learn at the same time, (2) access to learning materials takes place through technology and shared documents, (3) interaction between the teacher and learner occurs through computer-technology media, (4) teacher provides support to learner through live chats, video chats, discussion board, phone calls, and email (Anderson, 2011a). Generally, online teaching is considered similar to teaching in any other mainstream educational setting (Anderson, 2011b). Online teaching entails several tools, resources, instructional methodologies, responsibilities, institutional framework, and modes of engagement facilitated by monitoring and guidance (Bastes, 2019; Bullen & Janes, 2007). Online teaching emphasizes the flexibility of time, place, space, and interaction (Anderson, 2011b). The online learning environment can make a significant contribution to improve teaching approaches in education (Anderson et al., 2001). The teaching approach involves the selection of strategies for a particular lesson, such as lesson plans or teaching assistance tools, along with the execution of a well-thought out framework (Richey et al., 2011). In online teaching, the teacher becomes the facilitator and actor that helps students to learn (Goodyear & Dimitriadis, 2013).

CHALLENGES IN ONLINE TEACHING

Online classrooms are different from the traditional ones with no in-person face-to-face interaction. Consequently, teachers are challenged to convey their lessons precisely in order to facilitate learners to accomplish desired learning outcomes. However, teachers and learners from developing countries are more likely to face technology challenges or barriers (Eltahir, 2019). Prior literature knowledge identified several obstacles in the adoption of technology in teaching and learning in developing countries; for instance, poor communication between learner and instructor, ineffective assistance, inadequate infrastructure, and inadequate ICT competence were found as the main challenges in adopting technological applications in Saudi Arabia (Aljaber, 2018). Similarly, in higher institutions in Pakistan, inadequate digital self-efficacy and poor internet connectivity were identified as the major challenges that inhibit Information and Communication Technology (ICT) adoption (Kanwal & Rehman, 2017). Another study revealed the challenges that impede the successful integration of ICT in higher education due to the lack of technological experience and skills and classified them into three major groups: (a) learner, (b) teacher, and (c) content development (Kebritchi et al., 2017). The study by Hamutoğlu and Basarmak (2020) explored that the external barriers, such as lack of funding, infrastructure, training, time, vision, and content, positively affect the internal barriers, such as technological pedagogical self-efficacy, guidance, family resistance, and learning-teaching activities beliefs. A study by Al-Samarraie and Saeed (2018) highlights that the intrinsic and extrinsic motivation of teachers plays a major role in the persistent use of flipped teaching and digital self-efficacy. Moreover, poor infrastructure, limited digital competence, and low motivation were identified as the major barriers that affect technology integration (Tosuntaş et al., 2019).

Theoretical Framework

A theory regarding information system usage is the Technology Acceptance Model (TAM). It is one of the most conventionally adopted models to identify the individual's acceptance of information systems. This model is derived from the conception of Ajzen and Fishbein (1980), which was projected by Davis in 1986 and 1989. This study's framework is based on the determined model by Davis. Accordingly, the individual's acceptance of the information system is crucial to obtain the optimal results, which is reflected through the attitudes of individuals towards the system usage. This theory plays a significant role in identifying teachers' attitudes in online pedagogical practices and encountered challenges in the adaptation of online teaching by examining two major beliefs, perceived by teachers, such as perceived usefulness and perceived ease of use. The TAM framework has been used extensively in several studies to explore the applicability of technology in education both quantitatively (Al-Adwan et al., 2020) and qualitatively (Huang et al., 2019). A qualitative study helps researchers to unfold all other aspects of technology integration that cannot be revealed solely by quantitative studies. Vogelsang et al. (2013), using a qualitative method, found that trust in fellows and supervisors had a significant relationship with technology acceptance; however, the variable trust would not have been disclosed without the researchers employing a qualitative approach.

In addition, Safsouf et al. (2020) used the TAM framework to explore the success factors of e-learning and to examine the effectiveness of an online learning management system (LMS) along with learner satisfaction. Scherer et al. (2019) analyzed the acceptance rate of information technology in classrooms of both pre-and in-service teachers and investigated the relationship between technology acceptance and its outcomes. Chan et al. (2018) explored the aspects that cause a behavioral change in adopting online applications among students. Ramirez et al. (2019) used the TAM framework as one of two models to determine the factors that influence the adoption rate of mobile learning among university students.

Perceived Usefulness (PU)

It is ascertained in this globalized world that people from diverse backgrounds and fields use information technology. However, studies on technology applications have been inadequate to the desired level, probably due to the unawareness of its benefits. Research has shown that the adoption rate of advanced technologies would strengthen if users realized its benefit (Cheung et al., 2019). This is due to the reason of Perceived Usefulness (PU) (Davis, 1989), which refers to the perception that the use of the technology will help to enhance the productiveness of work. Al-ShamiSedik et al. (2018) asserted that perceived usefulness is significantly associated with the adoption of technology use. In addition, perceived usefulness is one of the critical factors that affect pre-service teachers' attitudes regarding the applicability of technology in teaching (Baturay et al., 2017). Perceived benefits play an imperative role in successful learning by adopting technological courses (Ray et al., 2019).

Perceived Ease of Use (PEU)

The level of comfort a user feels to use technology is referred to as Perceived Ease of Use (Davis, 1989), which affects the behavioral inclination of ultimate use (Sathye et al., 2018). Any perceived difficulty in using information technology will hinder users towards its usage, and they will not be able to adopt technology successfully. Several studies have identified that Perceived Ease of Use contributes significantly to the adoption of technology (Al-Shami et al., 2018; Papadakis, 2018) and leads to successful teaching. Similarly, for successful online learning, perceived ease of use plays a vital role and is positively correlated with the perceived usefulness and attitudes towards the adoption of E-Learning (Nikolopoulou et al., 2020).

Attitude to Use

Attitude is defined as a psychological construct that helps to evaluate the performance of individuals either positively or negatively. Attitudes can reflect weak or strong behaviors towards the adoption of technology (Wu & Chen, 2017). Prior studies have identified that attitude is considered the most significant determinant regarding technology usage (Hussein, 2017). Rusu et al. (2015) found a significant relationship between self-efficacy and positive attitudes of pre-service teachers towards online instruction in their pedagogical practices.

RESEARCH METHODOLOGY

This study employs a mixed-method research design followed by Creswell and Plano Clark (2018), as this approach helps in unfolding the facts comprehensively and gives a true picture. The research design is followed by synchronized triangulation of quantitative and qualitative data using questionnaires and interviews, respectively. The quantitative data helped to identify the association of strength of relevant factors in teaching practices. The qualitative data provided an in-depth understanding of pedagogical practices and challenges.

Participants

The population of the study involved faculty members in public universities in Karachi City, Pakistan. Questionnaires were distributed online by the researchers, followed by a simple random sampling approach to strengthen the data collection and analysis. Out of 98 faculty members, eighty-two (82) faculty members completed the surveys from ten different recruited universities. Their demographic information is shown in Table 1.

Table 1. Demographic information of the faculty members participating in the surveys

Category	**N**	**%**
Gender		
Male	38	46.3
Female	44	53.6
Disciplines		
Social Sciences	24	29.2
Natural Sciences	37	45.1
Arts & Humanities	21	25.6
Professional Ranks		
Professor	6	7.3
Assistant professor	31	37.8
Teaching fellow	45	54.8
Education Level		
Ph.D.	26	31.7
M.Phil	56	68.2

Regarding interviews, 15 faculty members (9 males and 6 females) were selected randomly from diverse academic disciplines to generalize the whole sample (Table 2).

Table 2. Demographic information of the faculty members participating in interviews

Category	N	%
Gender		
Male	9	60
Female	6	40
Disciplines		
Social Sciences	6	40
Natural Sciences	6	40
Arts & Humanities	3	20
Professional Ranks		
Assistant professor	5	33.3
Teaching fellow	10	66.6

Instruments

The closed-ended survey questionnaire was constructed to measure the faculty members attitudes toward technology usage and consists of three dimensions: Perceived Usefulness, Perceived Ease of Use, and Attitude to Use. The questionnaire comprised of 11 items which follow a five-point Likert scale ranging from strongly disagree to agree strongly. Perceived Usefulness and Perceived Ease of Use scales are adapted from Davis (1989), while the Attitude to Use scale is taken from Venkatesh et al. (2003).

The interview protocol was formulated to find out about the practices and challenges faced by members of the faculty. The interview questions were semi-structured constructed to obtain detailed information (Whiting, 2008).

Procedure

The closed-ended surveys were conducted online via a server hosting platform. Approximately 82 out of 98 faculty members completed the surveys from different universities and departments in Karachi City, Pakistan. Among the 82 faculty participants that completed surveys, 15 were requested randomly to participate in online interviews. The duration of the interviews was within 20-35 minutes depending upon participants' convenience, and interviews were audio-recorded with the consent of participants.

Data Analysis

All the obtained quantitative data were examined statistically via SPSS (version 23) with the help of different statistical tests such as Mean, Standard Deviation, and Pearson Correlations. Concurrently, the qualitative data was transcribed by one of the authors and double-checked by the entire research team for validity and reliability. Subsequently, the data was analyzed by adopting the approach of thematic analysis from Miles et al. (2013). The data was refined by repeating initial coding several times and then categorized into their respected categories that finally ended up as central themes (Miles et al., 2013).

Ethical Concerns

The researcher collected the data by following all the ethical guidelines to ascertain the security of the respondents. The faculty members participated in the study voluntarily after ensuring their consent

and private information of all the participants was encrypted and kept private by altering their names with the sequential number, e.g., P#01, P#02, P#03, and P #15. The transcribed data were re-evaluated and coded again by co-researchers (Miles et al., 2013) to enhance the reliability of the interview results.

RESULTS

RESULTS OF THE QUANTITATIVE STUDY

The rate of ICT adoption in pedagogical practices of faculty members was assessed quantitatively via scales presented by Davis (1989) and Venkatesh et al. (2003). The descriptive statistics for various dimensions of the questionnaire are presented in Table 3. The mean ratings for all dimensions of the questionnaire are greater than 3, ranging from 3.51 to 3.90, shows a satisfactory rate of adaption. The highest mean is obtained by the Perceived Ease of Use, i.e., 3.90, which shows the best utilization rate. In contrast, Perceived Usefulness is found as the least utilized one among all practices with a mean of 3.51.

Pearson correlation test was applied to determine the association among different dimensions of the questionnaire (Table 3.). Faculty members' attitude toward technology usage was positively associated with the other two constructs, i.e., Perceived Usefulness ($r=0.66$, $p< 0.01$) and Perceived Ease of Use ($r=0.73$, $p< 0.01$). Both constructs, i.e., PU and PEU, were also found positively correlated with each other, i.e. ($r= 0.81$, $p< 0.01$). While the values of all dimensions were reported above 0.50, showing a large correlation (Cohen et al., 2003).

Table 3. Descriptive Analysis and Pearson Correlations

	AU	**PU**	**PEU**
Attitude towards Usage (AU)	1		
Perceived Usefulness (PU)	0.66**	1	
Perceived Ease of Use (PEU)	0.73**	0.81**	1
Mean	3.79	3.51	3.90
S.D	1.41	1.20	1.15

** Correlation is significant at the 0.01 level (2-tailed).

Furthermore, the results specify that faculty members have used different digital platforms for instruction which includes synchronous online classes (via Whatsapp, Zoom, and Webex recorded videos) and asynchronous platforms for the purpose of data sharing (via PowerPoint, LMS, Screencast, and YouTube videos) as shown in Figure 1.

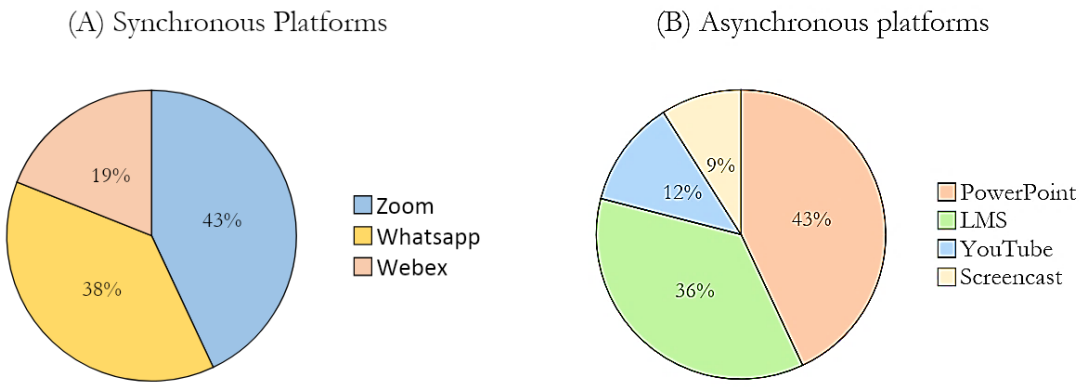

Figure 1. Digital platforms for instructions

RESULTS OF THE QUALITATIVE STUDY

In order to explore the challenges encountered by the faculty members in adopting ICT in their pedagogical practices, this study's researchers conducted semi-structured interviews. Based on the results, the challenges are summarized into seven major themes described in Table 4.

Table 4. Challenges encountered by faculty members in online teaching

S. No.	Themes	Sub-Themes	Frequency	%
1.	Class management	Difficulty in monitoring students	4	27
		Lack of Student Engagement	3	20
		Poor time management	3	20
		Difficulty Delivering Content	2	13
		Difficulty in practical work	2	13
2..	Lack of guidance	Lack of training	4	27
		Lack of guidance	4	27
		No workshop	3	20
		lack of accountability	2	13
3.	Limited Resources	Electricity failure	3	20
		lack of ICT infrastructure	2	13
		Lack of compatible devices	2	13
		financial constraints	1	7
		Poor internet connectivity	2	13
		Lack of time	2	13
4.	Low Attendance	Students' low-interest	5	33
		Less participation of students	4	27
		Limited work-space	3	20
5.	Lack of Technical skills	Limited Technology competence	5	33
		Limited technical use in pedagogy	3	20
		Limited technological experience	3	20
6.	Communication barriers	Insufficient feedback	4	27
		Improper online discussion	3	20
		Less student-instructor interaction	3	20
7.	Difficulty in Assessments	Students resistance	3	20
		teachers' incompetence	3	20
		Less useful for practical evaluation	3	20

According to the faculty members' responses, class management and lack of guidance are found as the major challenges, while difficulty in conducting assessments is found to be the least one. As

shown in Figure 3, comparison of all the themes demonstrates the value of class management (93%) and the difficulty in obtaining assessments (60%).

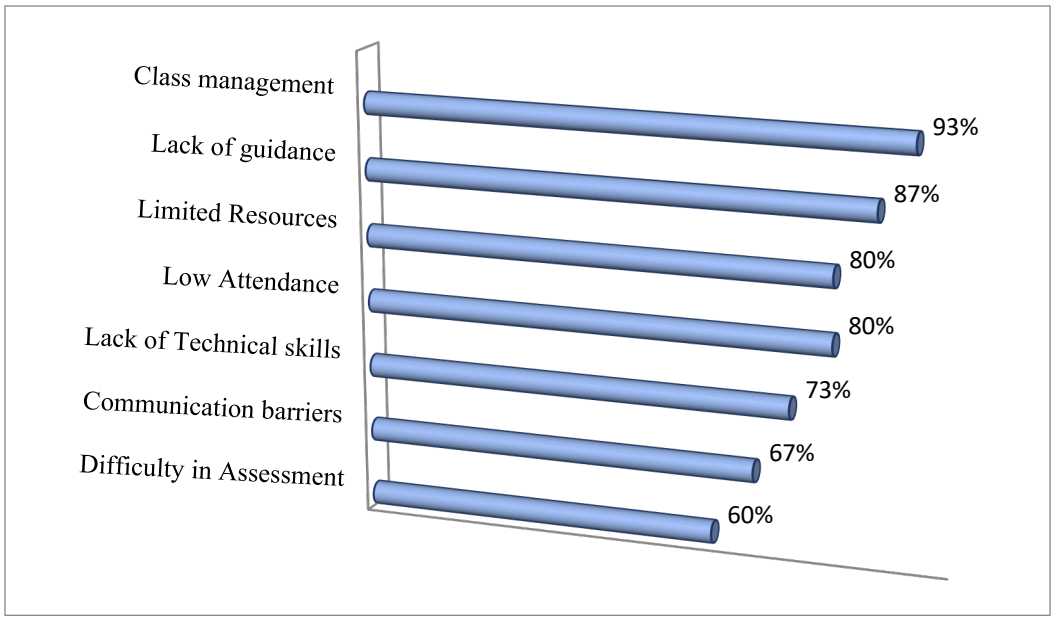

Figure 2. Comparison of challenges encountered by faculty members

The emerged themes are further described below:

Class Management

Class management refers to the fundamental of effective pedagogy in which teachers engage students and establish discipline by cooperating appropriately in the class (Evertson& Weinstein, 2006). Most of the faculty members reported that they faced difficulty in taking attendance of students. Students' engagement was another challenge, as teachers were unable to monitor students properly. According to research participants:

"I feel trouble in making a large number of students engage during the online lecture." —P#1.

"It was a new experience for me to teach online, due to which I was unable to cover lecture in a given time, due to several issues." —P#3.

Lack of Guidance

Professional development is vital to assist teachers in adopting technical skills in an online teaching environment using training and support (Hyndman, 2018); 87% of the faculty members reported that they did not get the opportunity for training from the universities in the period of the pandemic. As a result, teachers' competencies for virtual teaching were not developed.

"Transition from face-to-face to online teaching mode was a sudden decision from the university, but we were not given any training or support to implement successfully." —P#5.

Limited Resources

Resources are characterized as the support or help provided by the institution to teachers in achieving learning objectives efficiently (Hung, 2016). Without having adequate facilities, teachers find it hard to teach effectively. Approximately 80% of the faculty members reported that they were not provided adequate support from their institution, such as scarcity of ICT infrastructure, internet speed, compatible devices, electric supply, and funds.

"We face difficulties regarding electric supply, due to which lectures often get interrupted and make students disconnected. Besides, some students do not have compatible devices to attend online classes." —P#4.

Low Attendance

Regular attendance of students contributes significantly to higher education success (Freeman et al., 2014), and student absenteeism may lead to lower grades (Neri & Meloche, 2007). Participants reported the low attendance rate of students as another obstacle, especially in synchronous sessions. The reasons include challenges related to technology access, limited time, work-space, or home working environmental issues.

"Students often face several technical problems during synchronous sessions, due to which they encounter problems in attending lectures regularly." —P#2.

Lack of Technical Skills

In order to align the education system with 21st Century, teachers are required to learn technology skills and knowledge for teaching and guiding students by providing technological assistance (Care et al., 2018). According to the majority of the faculty members, they had no experience of technological use in pedagogy. Consequently, their technical competence was limited, and they had to face several difficulties in virtual teaching.

"I was not familiar with the technology use in teaching due to which I had to face several difficulties to understand new teaching applications." —P#7.

Communication Barriers

Communication between teacher and student plays a vital role in effective learning outcomes (Zee & Koomen, 2016). Another major inconvenience faculty members face in online instruction is the inability to interact face-to-face with students appropriately. Teachers cannot have tangible check-in with students on their understanding of lessons. Consequently, they find themselves incapable of adjusting their teaching activities and online discussion due to the fact they don't know what their students need.

"We are unable to see each other in online classes due to which I feel difficulty in giving sufficient feedback to each student simultaneously." —P#11.

Difficulty in Assessment

Online assessments help the learner to acquire good final grades and learning objectives (Collings et al., 2018). Online assessments during the pandemic period appeared as another challenge due to unfamiliarity with the new methods. Students were not able to attend real-time problem-solving activities and receive feedback from teachers. However, both formative and summative assessments are carried out in synchronous and asynchronous forms.

"We never conducted assessments online. Thus we did not have the experience to conduct online assessments smoothly." —P#13.

Discussion

The COVID-19 pandemic has reshaped the educational practices around the world and shifted it towards online teaching-learning mode. This transition is not only guided by examining the educational technology infrastructure, but it also provides practical information about teachers' attitudes towards the adoption of online teaching practices. Findings have revealed that teachers possess a favorable attitude towards the usage of online teaching and correlated positively with the other two dimensions such as Perceived Ease of Use (PEU) and Perceived Usefulness (PU), which echoed similar findings

with Al-Shami et al. (2018) and Al-Adwan (2020). The results also illustrate that PEU is more significant than that of PU, which indicates that faculty members' attitudes to adopt ICT are more likely to be affected by the easiness of the applications. A similar finding was explored by Abdullah and Ward (2016), where PEU showed a stronger impact than PU on technology acceptance behavior. The study further reveals that faculty members in Karachi, Pakistan, should employ several modes of digital platforms for the purpose of instruction. The digital platforms are mainly classified into two modes: synchronous and asynchronous instructional platforms. Accordingly, future studies should be conducted to explore the teaching and learning experiences in both digital instructional platforms because students' satisfaction varies in each mode of digital platform (Bailey et al., 2020).

Classroom management guides the teacher to keep the environment of an educational setting safe and dynamic (Cooper et al., 2018). This study has shown that faculty members faced difficulties in monitoring students and making them engaged; this finding shows consistency with Fryling et al. (2016). Teachers also found themselves incapable of aligning content delivery efficiently, which was also identified as one of the barriers by Almaiah and Alamri (2018).

Inadequate guidance has emerged as the second major challenge, as faculty members did not possess a sound experience of virtual teaching; they did not get any opportunity for training from supervisors and upper authorities. The same challenge was reported by Silva et al. (2020) and Ng et al. (2020); accordingly, the majority of the teachers reported a lack of pedagogical and technical support. Therefore, the study suggests that teachers should be provided technical assistance by offering in-service training programs or workshops on information technology solutions (Huilcapi-Collantes et al., 2020).

Sufficient and updated resources contribute significantly to the online learning of students (Azevedo & Marques 2017), and their proper channelization is crucial for successful accomplishment (Akram & Yang, 2021). In contrast, limited resources have emerged as another major challenge that prevents teachers from teaching efficiently. Other studies have explored the same challenge faced by teachers, such as inadequate funding (Nagashima, 2014); limited ICT infrastructure (Tosuntaş et al., 2019); time constraints (Zee & Koomen, 2016), and internet connectivity (McGuinness & Fulton, 2019). In this regard, universities should be equipped with the required latest technological infrastructure to accelerate the learning of students (Wang et al., 2018).

Another factor that hinders online teaching or learning is the communication gap between teachers and students, due to which faculty members cannot get students' feedback properly and thus cannot collaborate actively. A similar challenge was also identified by Magen-Nagar et al. (2019). Similarly, students' active participation is necessary for efficient learning, whereas low attendance of students is found as another challenge that affects their learning process negatively. Other studies have explored the same issue, such as little interest (Hyndman, 2018), low attendance (Kapasia et al., 2020), and lack of motivation among students (Yang, 2017) due to the communication gap between teachers and students. Interactive communication tools should be used to foster e-learning (Park & Kim, 2020). It is suggested to employ an Activity-Oriented Teaching Strategy (AOTS) to keep students involved in the learning process (Kochumarangolil & GR, 2018). Moreover, to accelerate practical learning, simulated videos should be developed to engage students actively (Sobaih et al., 2020).

Teachers should be digitally competent to meet the demands of new educational challenges (Gallardo-Echenique et al., 2015). However, limited digital competence is found as another challenge that hinders faculty members from teaching efficiently. A similar challenge is identified by other studies (Kanwal & Rehman, 2017). Therefore, it is essential for higher educational institutions to organize training sessions for teachers to develop digital competence among them.

The ongoing evaluation is essential to know about students' progress. At the same time, an ideal online learning environment should help learners both theoretically as well as practically (Weinhandl et al., 2020). This study explains that the online assessments were implemented successfully for theoretical evaluation but not helpful for practical evaluation. Concurrently, the transition of an assessment caused

several difficulties which are similar to other studies such as students' resistance (Khan & Khan, 2018), inadequate skills (Aljaber, 2018), and less useful for practical exams (Liebenberg & Pieterse, 2018). Accordingly, this study suggests that both faculty members and students should be helped with training sessions to get familiar with the online assessment techniques. Furthermore, online assessments should be harmonized with other techniques to accomplish the projected learning objectives (Babo et al., 2020).

This study examined and analyzed the experiences of pedagogical practices and challenges encountered by faculty members in the digital setting; however, some limitations restricted the study. In particular, teachers' experiences were assessed through self-reported surveys and interviews. Other means and methods of examination, such as observations or focus group interviews, should be employed to broaden the understanding. Furthermore, the rate of adoption of ICT in pedagogical practices was examined through these three indicators: Perceived Usefulness (PU), Perceived Ease of Use (PEU), and Attitude to Use (AU). Future studies should evaluate other indicators such as students' learning outcomes. Due to other constraints, the study was undertaken in the public universities in Karachi, Pakistan. Further studies may carry out at the national level coupled with private universities.

CONCLUSION

The results of the study reveal similar and different findings in comparison with prior empirical studies and literature knowledge. By following the technology acceptance approach by Davis, the study explored the rate of adoption of ICT in pedagogical practices and challenges encountered by faculty members. The adopted framework was modified, reliable, and verified in the context of university teachers' in public universities in Karachi, Pakistan, which can help explore pedagogical practices of teachers from different regions and colleges in Pakistan or other developing countries and cultures. This study also provides preliminary value in identifying the influence of the COVID-19 transition phase on teachers' expertise level of application of educational technologies in teaching and reveals that teachers exhibit good attitudes towards the use of ICT in teaching. However, faculty members had to face several challenges in order to adopt new technological platforms. The major one is associated with class management and lack of guidance, which did not allow teachers to teach efficiently. The study also reports the low quality of ICT infrastructure; therefore, universities should be equipped with the latest technological infrastructure to optimize the learning outcomes of students. The findings of this study are significant to be applied for further studies by policymakers, higher institutions, teachers, students, government officials, and national or international researchers. This study also increases concern for further investigation on the influence of virtual teaching and learning in education.

RECOMMENDATIONS

This study enables one to obtain a practical apprehension of online teaching practices and challenges in the time of the COVID-19 pandemic when the education system is suffering from the absence of face-to-face teaching and learning. This study suggests ways and means for faculty members to improve the integration of technology in their pedagogical practices and offer a substitute for face-to-face teaching effectively. In line with the findings, this study indicates low interest and participation of students in synchronized lessons. Therefore, it is recommended for teachers to employ interactive communication-based tools and activities to develop the interest and participation of students to foster their e-learning. Students should be provided with support from family and institutional leaders to ensure an appropriate working environment. Furthermore, the university should launch an IT support unit for faculty members and students to provide technical support, and the higher education commission should plan a policy to facilitate internet access for learning purposes.

In addition, a proper channel should be set responsible for monitoring the performance of teachers in attaining maximum outcomes. For this purpose, management authorities should make the proper

use of a well-developed learning management system (LMS) in evaluating remote teaching and learning. A contingency arrangement should be planned to tackle unexpected events of online education.

REFERENCES

Abdullah, F., & Ward, R. (2016). Developing a General Extended Technology Acceptance Model for E-Learning (GETAMEL) by analysing commonly used external factors. *Computers in Human Behavior*, *56*, 238-256.https://doi.org/10.1016/j.chb.2015.11.036

Adnan, M., & Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' perspectives. *Journal of Pedagogical Sociology and Psychology, 2*(1), 45-51. https://doi.org/10.33902/jpsp.2020261309

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Prentice-Hall.

Akram, H., & Yang, Y. (2021). A critical analysis of the weak implementation causes on educational policies in Pakistan. *International Journal of Humanities and Innovation (IJHI), 4*(1), 25-28. https://doi.org/10.33750/ijhi.v4i1.104

Al-Adwan, A. S. (2020). Investigating the drivers and barriers to MOOCs adoption: The perspective of TAM. *Education and Information Technologies, 25,* 5771–5795.https://doi.org/10.1007/s10639-020-10250-z

Al-Adwan, A. S., Albelbisi, N. A., Aladwan, S. H., Al-Horani, O. M., Al-Madadha, A., & Al Khasawneh, M. H. (2020). Investigating the impact of social media use on student' perception academic of performance in higher education: Evidence from Jordan. *Journal of Information Technology Education: Research, 19*, 953–975. https://doi.org/10.28945/4661

Alharbi, H. E. (2019). An Arabic assessment tool to measure technological pedagogical and content knowledge. *Computers & Education, 142,* 103650. https://doi.org/10.1016/j.compedu.2019.103650

Aljaber, A. (2018). E-Learning policy in Saudi Arabia: Challenges and successes. *Research in Comparative and International Education, 13*(1), 176–194. https://doi.org/10.1177/1745499918764147

Almaiah, M. A., & Alamri, M. M. (2018). Proposing a new technical quality requirements framework for mobile learning applications. *Journal of Theoretical and Applied Information Technology, 96,* 19. http://www.jatit.org/volumes/Vol96No20/24Vol96No20.pdf

Al-Samarraie, H., & Saeed, N. (2018). A systematic review of cloud computing tools for collaborative learning: Opportunities and challenges to the blended-learning environment. *Computers & Education, 124*, 77–91. https://doi.org/10.1016/j.compedu.2018.05.016

Al-Shami, S. A., Sedik, S., Rashid, N., & Hussin, H. (2018). An empirical analysis of MOOC adoption from the perspective of institutional theory. *Journal of Advanced Research in Dynamical and Control Systems, 10*(6), 332–343.

Anderson, T. (2011a). Towards a theory of online learning. In T. Anderson (Ed.). *The theory and practice of online learning* (2nd ed., pp. 45–74). Athabasca University Press.

Anderson, T. (2011b). Teaching in an online learning context. In T. Anderson (Ed.). *The theory and practice of online learning.* (2nd ed., pp.343–366). Athabasca University Press.

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2), 1–17 https://doi.org/10.24059/olj.v5i2.1875

Azevedo, J., & Marques, M. M. (2017). MOOC success factors: Proposal of an analysis framework. *Journal of Information Technology Education: Innovations in Practice, 16*, 233-251. https://doi.org/10.28945/3861

Babo, R., Babo, L., Suhonen, J., & Tukiainen, M. (2020). E-assessment with multiple-choice questions: A 5 year study of students' opinions and experience. *Journal of Information Technology Education: Innovations in Practice, 19,* 1–29. https://doi.org/10.28945/4491

Bailey, D., Almusharraf, N., & Hatcher, R. (2020). Finding satisfaction: Intrinsic motivation for synchronous and asynchronous communication in the online language learning context. *Education and Information Technologies*, *26*, 2563-2583. https://doi.org/10.1007/s10639-020-10369-z

Basilaia, G., & Kvavadze, D. (2020). Transition to online education in schools during a SARS-CoV-2 coronavirus (Covid-19) pandemic in Georgia. *Pedagogical Research, 5*(4), 1-9. https://doi.org/10.29333/pr/7937

Bates, A. W. (2019). *Teaching in a digital age*(2nd ed.). Tony Bates Associates. https://pressbooks.bccampus.ca/teachinginadigitalagev2/

Baturay, M. H., Gökçearslan, Ş., & Ke, F. (2017). The relationship among pre-service teachers computer competence, attitude towards computer-assisted education, and intention of technology acceptance. *International Journal of Technology Enhanced Learning, 9*(1), 1–13. https://doi.org/10.1504/ijtel.2017.084084

Boyte-Eckis, L., Minadeo, D. F., Bailey, S. S., & Bailey, W. C. (2018). Age, gender, and race as predictors of opting for a midterm retest: A statistical analysis of online economics students. *The Journal of Business Diversity, 18*(1), 17–28. https://doi.org/10.33423/jbd.v18i1.515

Bullen, M., & Janes, D. P. (2007). *Making the transition to E-learning: strategies and issues*. Information Science Publishing.

Care, E., Kim, H., Vista, A., & Anderson, K. (2018). *Education system alignment for 21st century skills: Focus on assessment*. Brookings Institution.

Chan, M. M., Plata, R. B., Medina, J. A., Alario-Hoyos, C., Rizzardini, R. H., & De la Roca, M. (2018). Analysis of behavioral intention to use cloud-based tools in a MOOC: A technology acceptance model approach. *Journal of Universal Computer Science, 24*(8), 1072–1089.

Cheung, M. L., Chau, K. Y., Lam, M. H. S., Tse, G., Ho, K. Y., Flint, S. W., Broom, D. R., Tso, E. K. H., & Lee, K. Y. (2019). Examining consumers' adoption of wearable healthcare technology: The role of health attributes. *International Journal of Environmental Research and Public Health, 16*, 2257. https://doi.org/10.3390/ijerph16132257

Cohen, J., Cohen, P., West, S., &Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Lawrence Erlbaum Associates.

Collings, D. A., Gerrard, J. A., & Garrill. A. (2018). Shaking up biology—Our experiences teaching cell biology and biochemistry to a first year undergraduate class through the Canterbury (New Zealand) earthquakes. *Journal of Biological Education, 53*(3), 236–49. https://doi.org/10.1080/00219266.2018.1472134

Cooper, J. T., Gage, N. A., Alter, P. J., LaPolla, S., MacSuga-Gage, A. S., & Scott, T. M. (2018). Educators' self-reported training, use, and perceived effectiveness of evidence-based classroom management practices. *Preventing School Failure: Alternative Education for Children and Youth, 62*(1),13–24. https://doi.org/10.1080/1045988X.2017.1298562

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research*(3rded.). Sage.

Daniela, L., Visvizi, A., Gutiérrez-Braojos, C., & Lytras, M. (2018). Sustainable higher education and technology-enhanced learning (TEL). *Sustainability, 10(11),* 3883. https://doi.org/10.3390/su10113883

Davis, F. D. (1986). *A technology acceptance model for empirically testing new end-user information systems: Theory and results* (Doctoral dissertation, Massachusetts Institute of Technology). Sloan School of Management. https://dspace.mit.edu/handle/1721.1/15192

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Eltahir, M. E. (2019). E-learning in developing countries: Is it a panacea? A case study of Sudan. *IEEE Access, 7*, 97784–97792. https://doi.org/10.1109/access.2019.2930411

Evertson, C. M., & Weinstein, C. S. (Eds.). (2006). *Handbook of classroom management: Research, practice and contemporary issues*. Lawrence Erlbaum Associates.

Farid, S., Ahmad, R., Niaz, I. A., Arif, M., Shamshirband, S., & Khattak, M. D. (2015). Identification and prioritization of critical issues for the promotion of e-learning in Pakistan. *Computers in Human Behavior, 51,* 161-171. https://doi.org/10.1016/j.chb.2015.04.037

Freeman, S., Eddy, S., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings for the*

National Academy of Sciences of the United States of America, 111, 8410–8415. https://doi.org/10.1073/pnas.1319030111

Fryling, M., Yoder, R., & Breimer, E. (2016). Full flip, half flip, and no flip: Evaluation of flipping an introductory programming course. *Information Systems Education Journal, 14*(5), 4–16.

Gallardo-Echenique, E. E., de Oliveira, M. J., Marqués-Molias, L., & Esteve-Mon, F. (2015). Digital competence in the knowledge society. *MERLOT Journal of Online Learning and Teaching, 11(*1), 1–16.

Goodyear, P., & Dimitriadis, Y. (2013). In medias res: Reframing design for learning. *Research in Learning Technology, 21*. https://doi.org/10.3402/rlt.v21i0.19909

Guillén-Gámez, F. D., Mayorga-Fernández, M. J., & Álvarez-García, F. J. (2018). A study on the actual use of digital competence in the practicum of education degree. *Technology, Knowledge and Learning*, *25,* 667–684. https://doi.org/10.1007/s10758-018-9390-z

Guillén-Gámez, F. D., Mayorga-Fernández, M. J., Bravo-Agapito, J., & Escribano-Ortiz, D. (2020). Analysis of teachers' pedagogical digital competence: Identification of factors predicting their acquisition. *Technology, Knowledge and Learning,* 1–18.https://doi.org/10.1007/s10758-019-09432-7

Hamutoglu, N. B., & Basarmak, U. (2020). External and internal barriers in technology integration: A structural regression analysis. *Journal of Information Technology Education: Research, 19,* 17-40. https://doi.org/10.28945/4497

Huilcapi-Collantes, C., Hernández Martín, A., & Hernández-Ramos, J. P. (2020). The effect of a blended learning course of visual literacy for in-service teachers. *Journal of Information Technology Education: Research, 19,* 131-166. https://doi.org/10.28945/4533

Hung, M. L. (2016). Teacher readiness for online learning: Scale development and teacher perceptions. *Computers & Education, 94,* 120–133. https://doi.org/10.1016/j.compedu.2015.11.012

Huang, F., Teo, T., & Zhou, M. (2019). Factors affecting Chinese English as a foreign language teachers' technology acceptance: A qualitative study. *Journal of Educational Computing Research*, *57*(1), 83-105. https://doi.org/10.1177/0735633117746168

Hussein, Z. (2017). Leading to intention: The role of attitude in relation to technology acceptance model in e-learning. *Procedia Computer Science, 105*, 159–164. https://doi.org/10.1016/j.procs.2017.01.196

Hyndman, B. (2018). Ten reasons teachers can struggle to use technology in the classroom. *The Conversation.* http://theconversation.com/ten-reasons-teachers-can-struggle-to-usetechnology-in-the-classroom-101114

Kanwal, F., & Rehman, M. (2017). Factors affecting e-learning adoption in developing countries–Empirical evidence from Pakistan's higher education sector. *IEEE Access, 5,* 10968–10978. https://doi.org/10.1109/access.2017.2714379

Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., Barman, B., Das, P., & Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. *Children and Youth Services Review, 116*, 1–5. https://doi.org/10.1016/j.childyouth.2020.105194

Kebritchi, M., Lipschuetz, A., & Santiague, L. (2017). Issues and challenges for teaching successful online courses in higher education: A literature review. *Journal of Educational Technology Systems, 46*(1), 4–29. https://doi.org/10.1177/0047239516661713

Khan, S., & Khan, R. A. (2018). Online assessments: Exploring perspectives of university students. *Education and Information Technologies,* 1–17.

Kochumarangolil, J. &V G, R. (2018). Activity oriented teaching strategy for software engineering course: An experience report. *Journal of Information Technology Education: Innovations in Practice, 17,* 181–200. https://doi.org/10.28945/4116

Liebenberg, J., & Pieterse, V. (2018). Investigating the feasibility of automatic assessment of programming tasks. *Journal of Information Technology Education: Innovations in Practice, 17,* 201–223. https://doi.org/10.28945/4150

Magen-Nagar, N., Shachar, H., & Argaman, O. (2019). Changing the learning environment: Teachers and students' collaboration in creating digital games. *Journal of Information Technology Education: Innovations in Practice, 18,* 61–85. https://doi.org/10.28945/4405

McGuinness, C., & Fulton, C. (2019). Digital literacy in higher education: A case study of student engagement with e-tutorials using blended learning. *Journal of Information Technology Education: Innovations in Practice, 18,* 1–28. https://doi.org/10.28945/4190

Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative data analysis: a methods sourcebook* (3rd ed.). SAGE.

Nagashima, T. (2014). What makes open education thrive? Examination of factors contributing the success of open education initiatives. *INNOQUAL–International Journal for Innovation and Quality and in Learning, 2*(3), 10–21.

Neri, F., & Meloche, Y. (2007). *The impact of lecture attendance on academic performance in a large first year economics course.*SSRN.https://doi.org/10.2139/ssrn.975573

Niederhauser, D. S., Howard, S. K., Voogt, J., Agyei, D. D., Laferriere, T., Tondeur, J., & Cox, M. J. (2018). Sustainability and scalability in educational technology initiatives: Research-informed practice. *Technology, Knowledge and Learning, 23*(3), 507–523. https://doi.org/10.1007/s10758-018-9382-z

Nikolopoulou, K., & Gialamas, V. (2016). Barriers to ICT use in high schools: Greek teachers' perceptions. *Journal of Computers in Education,3*(1), 59–75. https://doi.org/10.1007/s40692-015-0052-z

Nikolopoulou, K., Gialamas, V., & Lavidas, K. (2020). Acceptance of mobile phone by university students for their studies: An investigation applying UTAUT2 model. *Education and Information Technologies, 25,* 4139–4155. https://doi.org/10.1007/s10639-020-10157-9

Ng, D. T. K., Reynolds, R., Chan, H. M. Y., Li, X. H., & Chu, S. K. W. (2020). Business (teaching) as usual amid the COVID-19 pandemic: A case study of online teaching practice in Hong Kong. *Journal of Information Technology Education: Research, 19,* 775-802. https://doi.org/10.28945/4620

Oguguo, B. C. E., Nannim, F. A., Agah, J. J., Ugwuanyi, C. S., Ene, C. U., & Nzeadibe, A. C. (2020). Effect of learning management system on student's performance in educational measurement and evaluation. *Education and Information Technologies.* https://doi.org/10.1007/s10639-020-10318-w

Pakistan Ministry of Education. (2018). *National education policy 2018.*Islamabad: Government of Pakistan.

Papadakis, S. (2018). Evaluating pre-service teachers' acceptance of mobile devices with regards to their age and gender: A case study in Greece. *International Journal of Mobile Learning and Organisation, 12*(4), 336–352. https://doi.org/10.1504/ijmlo.2018.095130

Park, C., & Kim, D. (2020). Perception of instructor presence and its effects on learning experience in online classes. *Journal of Information Technology Education: Research, 19,* 475-488. https://doi.org/10.28945/4611

Ramirez, I. G., Arias, A. V., & Duque, L. (2019). Approach to m-learning acceptance among university students: An integrated model of TPB and TAM. *The International Review of Research in Open and Distance Learning, 20*(3), 141–158. https://doi.org/10.19173/irrodl.v20i4.4061

Ray, A., Bala, P. K., & Dasgupta, S. A. (2019). Role of authenticity and perceived benefits of online courses on technology based career choice in India: A modified technology adoption model based on career theory. *International Journal of Information Management, 47*, 140–151. https://doi.org/10.1016/j.ijinfomgt.2019.01.015

Richey, R. C., Klein, J. D., & Tracey, M. W. (2011). *The instructional design knowledge base: theory, research, and practice.* Routledge.

Rodriguez-Segura, L., Zamora-Antuñano, M.A., Rodríguez-Reséndiz, J., Paredes-García, W.J., Altamirano-Corro, J.A., & Cruz-Pérez, M.Á. (2020). Teaching challenges in COVID-19 scenery: Teams platform-based student satisfaction approach. *Sustainability, 12*, 7514. https://doi.org/10.3390/su12187514

Rusu, A. S., Copaci, I. A., & Soos, A. (2015). The impact of service-learning on improving students' teacher training: Testing the efficiency of a tutoring program in increasing future teachers' civic attitudes, skills and self-efficacy. *Procedia – Social and Behavioral Sciences*, 203, 75–83. https://doi.org/10.1016/j.sbspro.2015.08.262

Safsouf, Y., Mansouri, K., & Poirier, F. (2020). An analysis to understand the online learners' success in public higher education in Morocco. *Journal of Information Technology Education: Research,19,* 87-112. https://doi.org/10.28945/4518

Salam, S., Jianqiu, Z., Pathan, Z. H., & Lei, W. (2017). Strategic barriers in the effective integration of ICT in the public schools of Pakistan. In *Proceedings of the 2017International Conference on Computer Science and Artificial Intelligence,* 169-172. https://doi.org/10.1145/3168390.3168422

Sathye, S., Prasad, B., Sharma, D., Sharma, P., & Sathye, M. (2018). Factors influencing the intention to use of mobile value-added services by women-owned microenterprises in Fiji. *The Electronic Journal of Information Systems in Developing Countries, 84*(2), e12016. https://doi.org/10.1002/isd2.12016

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education, 128,* 13–35. https://doi.org/10.1016/j.compedu.2018.09.009

Shehzadi, S., Nisar, Q. A., Hussain, M. S., Basheer, M. F., Hameed, W. U. & Chaudhry, N. I. (2020). The role of digital learning toward students' satisfaction and university brand image at educational institutes of Pakistan: a post-effect of COVID-19. *Asian Education and Development Studies,10*(2). https://doi.org/10.1108/aeds-04-2020-0063

Silva, J. B., Nardi Silva, I, & Bilessimo, S. (2020). Technological structure for technology integration in the classroom, inspired by the maker culture. *Journal of Information Technology Education: Research, 19,* 167-204. https://doi.org/10.28945/4532

Sobaih, A. E. E., Hasanein, A. M., & Abu Elnasr, A. E. (2020). Responses to COVID-19 in higher education: Social media usage for sustaining formal academic communication in developing countries. *Sustainability, 12,* 6520. https://doi.org/10.3390/su12166520

Theresiawati, T., Seta, H. B., Hidayanto, A. N., & Abidin. Z. (2020). Variables affecting e-learning services quality in Indonesian higher education: Students' perspectives. *Journal of Information Technology Education: Research, 19,* 259-286. https://doi.org/10.28945/4489

Tosuntaş, Ş. B., Çubukçu, Z., & İnci, T. (2019). A holistic view to barriers to technology integration in education. *Turkish Online Journal of Qualitative Inquiry, 10(4),* 439–461. https://doi.org/10.17569/tojqi.613969

Uerz, D., Volman, M., & Kral, M. (2018). Teacher educators' competences in fostering student teachers' proficiency in teaching and learning with technology: An overview of relevant research literature. *Teaching and Teacher Education*, *70*, 12-23. https://doi.org/10.1016/j.tate.2017.11.005

U.S. Department of Education, Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 national education technology plan update.* https://tech.ed.gov/files/2017/01/NETP17.pdf

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2020). *COVID-19 educational disruption and response.* https://en.unesco.org/themes/education-emergencies/coronavirus-school-closures

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Vogelsang, K., Steinhuser, M., & Hoppe, U. (2013). *A qualitative approach to examine technology acceptance.* In *Proceedings of the International Conference on Information Systems*, Milano, Italy

Wang, Y., Liu, X., & Zhang, Z. (2018). An overview of eLearning in China: History, challenges and opportunities. *Research in Comparative and International Education, 13*(1), 195–210. https://doi.org/10.1177/1745499918763421

Waqar, K. (2020). *Going online: Lessons from the classroom*. Dawn.https://www.dawn.com/news/1563247

Weinhandl, R., Lavicza, Z., & Houghton, T. (2020). Designing online learning environments for flipped approaches in professional mathematics teacher development. *Journal of Information Technology Education: Research, 19,* 315-337. https://doi.org/10.28945/4573

Whiting, L. S. (2008) Semi-structured interviews: guidance for novice researchers. *Nursing Standard, 22*(23),35-40. https://doi.org/10.7748/ns2008.02.22.23.35.c6420

Wu, B., & Chen, X. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model. *Computers in Human Behavior, 67*, 221–232. https://doi.org/10.1016/j.chb.2016.10.028

Yang, C. C. R. (2017). An investigation of the use of the 'flipped classroom' pedagogy in secondary English language classrooms. *Journal of Information Technology Education: Innovations in Practice, 16,* 1–20. https://doi.org/10.28945/3635

Zee, M., & Koomen, H. M. Y. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: a synthesis of 40 years of research. *Review of Educational Research, 86,* 981–1015. https://doi.org/10.3102/0034654315626801

Zhang, W. N., Wang, Y. X., Yang, L. L., & Wang, C. Y. (2020). Suspending classes without stopping learning: China's education emergency management policy in the COVID-19 outbreak. *Journal of Risk and Financial Management, 13*(55), 2–6. https://doi.org/10.3390/jrfm13030055

AUTHORS

Huma Akram is a Ph.D. candidate from the School of Education at Northeast Normal University in Changchun, China. Her research interests include Comparative Education, Educational Management, Educational technology, and Pedagogy. She published her work in multiple areas and has collaborated actively with researchers in several other disciplines and fields in Education. She is also a reviewer in different international refereed journals.

Dr. Sarfraz Aslam is a Research Fellow in the School of Education at Shaanxi Normal University in Xian, China. He is also serving as Secretary to the International Council of Associations for Science Education (ICASE). His academic research interest areas include Teacher Education, Distance Education, MOOCs, STEM Education, Science Education, Educational Technology, and other related fields. He published several journal articles in international refereed journals and conference proceedings. He is a reviewer in some international refereed journals.

Dr. Atif Saleem is a Postdoctoral Researcher at the College of Teacher Education at Zhejiang Normal University in China. He received his Ph.D. in Comparative Education from the Faculty of Education at Northeast Normal University in Changchun, China. He is a multidisciplinary scholar.

Khalida Parveen is a Ph.D. scholar at Southwest University in Chongqing, China. She received her Master's degree in Education from Government College University in Faisalabad, Pakistan. She has an outstanding academic carrier. Her research interests are educational leadership & management, school improvement process, low-performing schools, STEM education, information & communication technology (ICT). She is an enthusiastic reader and writer.