International Journal of Learning, Teaching and Educational Research
Vol. 20, No. 8, pp. 176-193, August 2021
https://doi.org/10.26803/ijlter.20.8.11
Received May 29, 2021; Revised Aug 14, 2021; Accepted Aug 24, 2021

E-Learning Implementation Barriers during COVID-19: A Cross-Sectional Survey Design

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Abstract. Most higher education institutions have embraced emergency remote teaching (ERT) as a response to school and university closures due to the Covid-19 pandemic. We used a cross-sectional survey design to examine teachers' views on the implementation of e-learning for ERT due to Covid-19 in Omani higher education. We examined four barrier categories: teacher-related, institutional-related, curriculum-related and student-related. We also assessed the relationship between these barrier levels and measured the differences between e-learning and teachers' gender, academic qualifications, teaching experience and prior experience in e-learning. Through an investigation of 856 university faculty members, we found that student-level barriers had the strongest impact on the implementation of e-learning for ERT during Covid-19. Furthermore, teachers' academic qualifications and prior experience influenced the success of e-learning practices. Based on these results, we presented some implications with respect to student preparedness, curriculum modifications and institutional readiness for the successful implementation of ERT during Covid-19 or any similar future pandemics.

Keywords: Covid-19; e-learning; emergency remote teaching; Oman; higher education

1. Introduction

The Covid-19 outbreak has had a serious impact on educational systems around the world. The majority of higher education institutions cancelled face-to-face classes and embraced emergency remote teaching (ERT) in an attempt to maintain social distancing. With millions of students around the world having been affected by school and university closures during Covid-19 (UNESCO, 2020), many educational institutions implemented some type of ERT (Hodges et al., 2020). To curb the spread of coronavirus, the Omani government announced the suspension of all schools and universities on the 15th of March 2020, and

consequently, most public and private institutions used what resources they had available to shift to ERT.

Technology integration for online and distance learning is a crucial component of providing quality education (UNESCO, 2014). Teachers at the tertiary level must be 'fluent users of technology' if they are to support student learning (US Department of Education, 2016, p. 34). Additionally, Trust (2017) argued that future teachers should be capable of using technology to enhance students' learning.

The shift to ERT has enabled higher education to provide instruction during emergencies; however, the shift has caused serious challenges (Crawford et al., 2020; Hodges et al., 2020). As many teachers were not prepared for the sudden shift to online instruction, they faced issues in preparing online content, adapting face-to-face materials, and learning new instructional pedagogies for online teaching and learning (Crawford et al., 2020; Dhawan, 2020; Rapanta et al., 2020). Gacs et al. (2020) and Karalis (2020) suggested that higher education institutions should provide sufficient support to their faculty during emergencies. Students faced issues with online learning during COVID-19 (Crawford, Butler-henderson, et al., 2020; Gaber et al., 2020; Zuo et al., 2020). Apart from teachers and students preparedness for ERT, institutions were not fully ready to shift to online instruction (Bao, 2020; Crawford et al., 2020).

Since ERT is mostly dependent on teachers' use of and competency in e-learning (Crawford et al., 2020; Demuyakor, 2020; Gacs et al., 2020; Hodges et al., 2020), it is essential that we measure the barriers to technology integration for ERT during Covid-19. Therefore, in this paper, we have sought to investigate the barriers faced by university teachers in using e-learning for ERT during Covid-19 in Omani public and private higher education institutions.

In addition to advancing knowledge in e-learning and online pedagogy, the findings of this paper can inform higher education practitioners in overcoming challenges associated with online instruction during emergencies. Also, it can help institutions to better plan their instruction during similar pandemics in the future. People in charge of professional development can use the results of this study as a basis for needs analysis for teacher professional development and student training provisions.

2. Literature Review

ERT is a temporary shift of instructional delivery to an alternative delivery mode due to crisis circumstances (Hodges et al., 2020, p. 6). Remote teaching is not new, and it has been argued that teachers should, in fact, be prepared to teach and administer online courses (Baran & Alzoubi, 2020; Crawford et al., 2020; Gacs et al., 2020; Hartshorne et al., 2020; Hodges et al., 2020; Karalis, 2020). While responses of higher education providers to Covid-19 differed, the majority of institutions in developed and developing economies chose to migrate to online teaching (Crawford et al., 2020; Hodges et al., 2020).

Karalis (2020) proposed a model that was intended to provide a good response to crises in education. He argued that a needs analysis that includes the needs of students, instructors and available resources, as well as considering the nature of

the courses themselves, is required for the success of any emergency plan. Furthermore, Baran and Alzoubi (2020) proposed a human-centred model for transferring face-to-face courses online during Covid-19. Based on their model, they asserted that human-centred design models can enhance student empathy, engage students in pedagogical problem-solving and help them build a learning community (Baran & Alzoubi, 2020). Despite these efforts, ERT is mainly aimed at ensuring the continuity of education during emergencies, which entails some sacrifices if it is to guarantee a rapid response to a crisis (Gacs et al., 2020; Hodges et al., 2020).

ERT requires technology integration, which poses challenges and difficulties for both teachers and students. Crawford et al. (2020) identified a variety of challenges that can hinder institutions in their migration to online education during ERT, including lack of infrastructure, teacher skillsets and readiness to design, offer and implement online teaching and learning. Apart from these challenges, many educational systems worldwide continue to lack online instruction strategies (Crawford et al., 2020). Moreover, Bao (2020) reported that higher academic institutions lacked the preparedness to shift to online teaching and learning during Covid-19, calling for systematic planning and investments from all sectors to ensure the ability to successfully shift to ERT. Similarly, Chang and Fang (2020) reported that teachers in higher education were not familiar with the teaching tools required for online teaching which posed serious negative impact on the implementation of ERT. Nevertheless, this unpreparedness, interruption and sudden shift, according to McMaster et al. (2020), can provide great learning opportunities for teachers.

Previous research has established a set of common technology integration barriers that have each been labelled, measured and rated differently, and that overlap on certain occasions (Schoepp, 2005). Common challenges include creating content for online spaces, learning new delivery tools, understanding online pedagogy, engaging parents, addressing student mental health issues, and attempting various pedagogical strategies to address both synchronous and asynchronous teaching and learning (Hartshorne et al., 2020, p. 138).

Alqudah et al. (2020) used a survey design to measure the perceptions and experiences of Jordanian academic ophthalmologists in e-learning for an undergraduate course during Covid-19. The study revealed some advantages of e-learning, including convenience, flexibility of time and place for both students and teachers, increased motivation of shy students and overcoming the circumstances of lockdown measures during Covid-19 (Alqudah et al., 2020). Though the majority of their sample viewed their e-learning experience during Covid-19 as positive and successful, Alqudah et al. (2020) did report some disadvantages of e-learning, such as lack of interaction, discomfort of teaching and learning without face-to-face interactions, and lack of practical and clinical training. The study also identified some limitations to e-learning during Covid-19, including poor infrastructure, shortage of e-learning training courses in ophthalmology, students' or teachers' poor e-learning skills and inadequate internet speed (Alqudah et al., 2020).

In another study using a survey design, Mailizar et al. (2020) examined the secondary school teachers' views of e-learning during Covid-19. This study

found that student-related barriers (skills and knowledge, motivation and e-learning infrastructure) had a strong impact on teacher implementation of e-learning (Mailizar et al., 2020). Student-related barriers to e-learning implementation had a strong positive correlation with school-related barriers (i.e. availability of software and hardware, internet connectivity, policies, technical support) and curriculum-related barriers (i.e. content, assessments, e-learning resources, curriculum alignment to online teaching and learning).

Due to the scarcity of research on this topic during Covid-19, for this study we relied on the large and growing body of literature that has investigated the barriers to e-learning implementation prior to Covid-19. Several studies (Assareh & Hosseini, 2011; Naveed et al., 2017; Pelgrum, 2001) have identified various barriers to e-learning implementation. Despite differences in labelling and classifying these barriers, they were similar and overlapping. In general, the barriers can be classified into four main categories: student-related barriers, teacher-related barriers, curriculum-related barriers and institutional-related barriers. The issues related to students included lack of ICT skills, lack of e-learning knowledge, lack of English language proficiency, lack of motivation, lack of technological infrastructure and poor assessment and online learning skills (Assareh & Hosseini, 2011; Naveed et al., 2017; Pelgrum, 2001). Assareh and Hosseini (2011), Naveed et al. (2017) and Pelgrum (2001) also identified barriers related to teachers, including lack of ICT skills, lack of e-learning knowledge, instructor resistance to change, lack of time to develop e-courses, lack of motivation, difficulty in monitoring and assessing student learning and difficulty in integrating technology into teaching. With respect to curriculum, the literature identified a lack of sound instructional design, curriculum ambiguity, poor curriculum quality, unavailability of resources for e-learning and a mismatch between the existing teaching and learning process, current evaluation procedures, and the online curriculum (Assareh & Hosseini, 2011; Naveed et al., 2017; Pelgrum, 2001). Finally, studies have also reported institutional-related barriers, such as inappropriate infrastructure, low internet bandwidth, lack of technical support, lack of financial support, lack of adequate policies and lack of training on e-learning and online pedagogy.

Several research studies have identified various determinants to successful e-learning practices. Although gender was not a crucial factor influencing e-learning use, research has reported that female teachers are more confident in utilising e-learning in their teaching (González-gómez et al., 212; Mahdizadeh et al., 2008). In addition to gender, teacher's academic qualification and prior experience in e-learning can affect the use of e-learning (Fryer & Bovee, 2016; Jones, 2003; Sørebø et al., 2009; Wilson, 2012).

These studies highlight the barriers that teachers face when using e-learning in teaching and learning at various levels. These barriers hinder the teaching and learning process in ERT during Covid-19, as ERT is entirely based on either synchronous or asynchronous online teaching and learning (Hodges et al., 2020). Assareh and Hosseini's (2011) four-dimension classification of e-learning barriers (learners, teachers, curriculum and school) were used in this study. Since the context of the current study is higher education (i.e. colleges and universities), we changed the school classification to 'institution'. Learner-

related barriers included insufficient e-learning knowledge and skills, limited accessibility and lack of motivation. Teacher-related barriers included insufficient knowledge and skills in e-learning, attitudes and beliefs towards e-learning, lack of confidence and previous experience. The barriers related to curriculum that can hinder e-learning use included in this study are disparity between curriculum and assessment, f2f curriculum that does not have e-learning components and complex tasks that cannot be delivered through an e-learning system. Finally, we included the following institutional-related barriers in our study: e-learning infrastructure, policies and professional development in e-learning.

Our research is guided by the following research questions:

1. What barriers do teachers face in implementing e-learning for ERT during Covid-19 in Oman?
2. What is the relationship between each level of barrier to e-learning implementation?
3. Are there any significant differences between e-learning implementation barriers and teachers' gender, academic qualifications, teaching experience and prior experience in e-learning?
4. Are there any significant relationships between e-learning implementation barriers and type of institution?

3. Methodology

3.1 Research Design

The study employed a cross-sectional survey research design. Creswell (2018) defined survey research as "a set of procedures in quantitative research in which investigators administer a survey to a sample or to the entire population of people to describe the attitudes, opinions, behaviours, or characteristics of the population" (p.376). Elsewhere, Fraenkel et al. (2012) stated that using a questionnaire in survey research methodology could provide reliable, valid and generalizable quantitative and qualitative results.

3.2 Research Instrument

We developed a questionnaire consisting of three main parts to gather teachers' views on the implementation of e-learning during Covid-19. In Part A, the participants' demographic information, including gender, level of education, teaching experience, institution, specialisation, teacher certification and devices used for e-learning was obtained. The second part comprised 39 Likert-scale items that were grouped into the four main dimensions (teacher-related barriers, institution-related barriers, curriculum-related barriers and student-related barriers). We adapted the items included in the scale from various studies (Flack et al., 2020; Haney, 2002; Mailizar et al., 2020; Naveed et al., 2017) and added some items for the purpose of this research. Participants were asked to mark their responses on a five-level agreement scale ranging from strongly disagree to strongly agree. The third part included two open-ended questions that asked about other barriers that teachers faced in implementing e-learning during COVID-19 and about their suggestions for better online pedagogy during emergencies.

Five academics from different institutions reviewed the questionnaire for clarity and relevance to ensure its content validity. Along with the questionnaire, a content validation form was provided for the reviewers. The questionnaire achieved satisfactory level of content validity (the content validity index for each item ranged between 0.8 to 0.92 across the five reviewers. In addition, we piloted the questionnaire with a group of university teachers from a private university in Oman who had experienced ERT during Covid-19. Twenty-seven teachers (55.9% males, 44.4% females) completed the survey. The majority of the participants had a master's degree (77.8%), while 22.2% had doctoral degrees. The sample included teachers from different specialisations, such as business, education, language and literature, information and communication technology and English language teaching.

To ensure the reliability of the research instrument, we computed Cronbach's alpha reliability coefficient in SPSS, which was found to be 0.88. The reliability coefficient of the four dimensions ranged from 0.42 to 0.85. Teacher-related barriers had a lower coefficient (0.42) compared to other dimensions of the questionnaire (teacher-related barriers = 0.75; curriculum-related barriers = 0.77; student-related barriers = 0.85). Thus, we removed three items from the teacher-related barriers dimension to increase the instrument's reliability. Once these items were removed, the coefficient increased to 0.89.

The questionnaire was distributed to teachers using Google Forms®. Participation in the study was voluntary. Although participants were not asked to fill out an informed consent, their submission of the questionnaire was regarded as their consent. Both researchers stored the data and the data was discarded once the data was analysed.

3.3 Sample

Following random sampling, we drew the actual study sample from public and private higher education institutions in Oman (teachers from public institutions, N = 726; teachers from private institutions, N = 122). Note that the numbers of teachers from each sector is not equal as there are more public institutions compared to private institutions in the country. The sample included 856 university teachers who experienced ERT during Covid-19 (63.3% males, 36.7% females). As shown in Table 1, the sample included teachers with various educational degrees. Exactly 70 of the participants held bachelor's degrees (8.2%), 535 held master's degrees (62.5%) and 251 held doctoral degrees (29.3%). Although the teachers' teaching experience ranged from one to more than 15 years of experience, half of the sample had more than 15 years of teaching experience. The sample also included teachers from different specialisations, including social sciences, science, computer and information systems, education, business and management, engineering, mathematics and health. Four hundred and seventy-one of the teachers (55%) had completed teacher preparation programmes, whereas 385 teachers (45%) had not taken part in a teacher education programme. The majority of the participants (83.2%) had some experience in e-learning prior to the implementation of ERT during Covid-19. During ERT, the teachers used various devices for online teaching and learning.

Table 1: Demographic information of the research sample

Variable	N	%
Gender		
Male	542	63.3
Female	314	36.7
Academic Qualification		
Bachelor's Degree	70	8.2
Master's Degree	535	62.5
Doctoral Degree	251	29.3
Teaching Experience		
0 to 5 Years	32	3.7
5 to 10 Years	123	14.4
10 to 15 Years	237	27.7
More than 15 Years	464	54.2
Specialisation		
Social Sciences	129	15.1
Science	40	4.7
Computer Science and Information Systems	124	14.5
Education	110	12.9
Business and Management	88	10.3
Engineering	283	33.1
Mathematics	68	7.9
Health	14	1.6
Institution		
Public	726	84.8
Private	122	14.3
Teacher Certification		
Yes	471	55.0
No	385	45.0
Experience in E-Learning Prior to ERT		
Yes	712	83.2
No	144	16.8
Devices Used for E-Learning in ERT		
Mobile/Handheld Device	13	1.5
Computer/Laptop	249	29.1
Both	594	69.4
Total	**856**	**100.0**

4. Findings

We used a set of descriptive statistical tests including means, standard deviations, Spearman's correlation and one-way multivariate analysis of variance (MANOVA) to analyse the quantitative data. On the other hand, we used content analysis to analyse the qualitative data obtained through the open-ended questions. First, we familiarised ourselves with the data by reading the responses. Then, we defined grouping themes under which the initial data was classified. For question 1, we defined six emerging themes: policies and procedures, technological and infrastructure issues, student-related issues, curriculum-related issues, time-related issues and teachers' experience in online

pedagogy. We then read the data, categorised it into six groups, and followed the same procedures to analyse the second open-ended question.

4.1 E-Learning Implementation Barriers

As indicated earlier, the barriers were classified into four main categories: teacher-related barriers, institution-related barriers, curriculum-related barriers and student-related barriers; the results of which are displayed based on this classification. Our descriptive results revealed that teacher-related barriers did not significantly hinder the implementation of e-learning during Covid-19 (see Table 2). Overall, the participants believed that e-learning was useful (M = 1.99, SD = 1.11) and convenient (M = 2.24, SD = 1.07) for ERT during Covid-19. The participants also held that they were confident (M = 2.12, SD = 1.06) as they had sufficient knowledge (M = 2.15, SD = 1.06) and the necessary skills (M = 2.13, SD = 1.03) to use e-learning during the pandemic.

Table 2: Descriptive results of teacher-related barriers

Statement	***N***	***M***	***SD***
1. I have sufficient knowledge to use e-learning for emergency remote teaching during the Covid-19 pandemic.	856	2.15	1.06
2. I have the necessary skills to use e-learning for emergency remote teaching during the Covid-19 pandemic.	856	2.13	1.03
3. I am confident in using e-learning for emergency remote teaching during the Covid-19 pandemic.	856	2.12	1.06
4. E-learning is useful for emergency remote teaching during the Covid-19 pandemic.	856	1.99	1.11
5. The use of e-learning for emergency remote teaching during the Covid-19 pandemic is convenient for me.	856	2.24	1.07

Overall, institution-related barriers did not considerably obstruct the use of e-learning (see Table 3). The participants confirmed that they had enough training (M = 2.22, SD = 1.11) and technical support (M = 2.16, SD = 1.16) from their institutions in implementing e-learning during the pandemic. Moreover, they agreed that the institutions provided them with a clear assessment policy (M = 2.42, SD = 1.13) and online conferencing tools (M = 2.21, SD = 1.11) for synchronous communication with their students. However, the teachers reported that their institutions encountered challenges in monitoring the quality of online teaching (M = 2.94, SD = 1.11).

Table 3: Descriptive results of institution-related barriers

Statement	***N***	***M***	***SD***
1. My institution has a policy for emergency remote teaching.	856	2.38	1.14
2. My institution's policies and regulations support the use of e-learning for emergency remote teaching during the Covid-19 pandemic.	856	2.21	1.12
3. My institution has a clear assessment policy for emergency remote teaching during Covid-19.	856	2.42	1.13
4. My institution has online conference tools for synchronous communication with students and teachers.	856	2.21	1.11
5. My institution provided technical support for e-learning use for emergency remote teaching during Covid-19.	856	2.16	1.16

6. My institution provided training on e-learning for emergency remote teaching during the Covid-19 pandemic.	856	2.22	1.11
7. My institution allowed me to design my own learning experiences.	856	2.33	1.07
8. My institution faced difficulty in monitoring the quality of online teaching in emergency remote teaching during the Covid-19 pandemic.	856	2.94	1.11

The curriculum-related barriers appeared to be more critical than the teacher-related and institution-related barriers (see Table 4). The teachers reported that though learning and teaching materials and textbooks were available (M = 2.24, SD = 1.01) and suitable (M = 2.43, SD = 1.05), the nature of the courses made them difficult to teach online (M = 2.95, SD = 1.22). They also stated that the courses included materials that could not be delivered properly online (M = 2.94, SD = 1.11). Furthermore, the participants stated that some courses required face-to-face attendance for practical tasks (M = 2.52, SD = 1.32) or settings that allowed for a community of learning, neither of which were attainable during e-learning (M = 2.94, SD = 1.14).

Table 4: Descriptive results of curriculum-related barriers

Statement	***N***	***M***	***SD***
1. Learning and teaching resources that are available in the e-learning system are in accordance with the curriculum.	856	2.24	1.01
2. The textbooks that I use are suitable for e-learning use.	856	2.43	1.05
3. Student's assessments are in line with e-learning use.	856	2.47	1.04
4. The nature of my course makes it difficult to be taught through e-learning.	856	2.95	1.22
5. My course has practical tasks that require students to attend in person at a specific time.	856	2.52	1.32
6. My course has many materials that cannot be conveyed online.	856	2.98	1.27
7. The e-learning activities address different learning styles of students.	856	2.56	0.99
8. My course requires a community of learning, which was difficult to build in the e-learning system.	856	2.96	1.14

For the student-related barriers, the results (see Table 5) indicated that English language proficiency was a strong barrier (M = 3.00, SD = 1.11) in the use of e-learning for ERT during Covid-19. Lack of training (M = 2.99, SD = 1.19), resistance to participation due to cultural norms (M = 2.96, SD = 1.06), and inadequate internet connection (M = 2.95, SD = 0.94) comprised the second, third and fourth barriers, respectively. The next most significant barriers were availability of devices (i.e. laptops and tablets) (M = 2.89, SD = 1.07), lack of interest in using e-learning (M = 2.80, SD = 1.04), lack of sufficient knowledge (M = 2.68, SD = 1.17) and lack of necessary skills (M = 2.66, SD = 1.13). On the other hand, ability to access the e-learning system (M = 2.55, SD = 1.01), ability to progress (M = 2.49, SD = 0.96), prior experience (M = 2.46, SD = 1.29), raising questions (M = 2.43, SD = 0.99), and completing course assignments (M = 2.30, SD = 1.00) were the least significant barriers, respectively.

Table 5: Descriptive results of student-related barriers

Statement	*N*	*M*	*SD*
1. My students used e-learning prior to Covid-19.	856	2.46	1.29
2. My students have sufficient knowledge in the use of e-learning.	856	2.68	1.17
3. My students have the necessary skills for the use of e-learning.	856	2.66	1.13
4. My students have devices (i.e. laptops and tablets) for the use of e-learning.	856	2.89	1.07
5. My students received training on the use of the e-learning system prior to the Covid-19 pandemic.	856	2.99	1.19
6. My students are interested in using e-learning.	856	2.80	1.04
7. My students have an internet connection.	856	2.95	0.94
8. My students are able to access the e-learning system.	856	2.55	1.01
9. My students' English skills are a barrier to using the e-learning system.	856	3.00	1.11
10. My students are able to do online assignments during Covid-19.	856	2.30	1.00
11. My students are able to raise questions and concerns during the course in the e-learning system.	856	2.43	0.99
12. My students are able to progress in the course during Covid-19.	856	2.49	0.96
13. My students find online assessment challenging.	856	2.58	1.03
14. My students find e-learning hectic because of the number of online courses during Covid-19.	856	2.66	1.00
15. My students are resistant to participate in e-learning activities due to cultural norms.	856	2.96	1.06

4.2 Relationship between E-Learning Implementation Barriers

We conducted an analysis of Spearman's correlation coefficient in order to pinpoint the relationship between each category of barriers to e-learning implementation. As Table 6 demonstrates, significant positive correlations existed among all levels, but the correlations were of different strengths. The results revealed that the strongest correlation was between teacher-related barriers and institution-related barriers (r_s = .605, p = .000, N = 856). Meanwhile, the association between teacher-level barriers and student-related barriers was moderate, but still statistically significant (r_s = .553, p = .000, N = 856). We found a moderate positive correlation between student-related barriers and institution-related barriers (r_s = .548, p = .000, N = 856) and between curriculum-related barriers and institutional-related barriers (r_s = .444, p = .000, N = 856). Moreover, there was only a weak positive correlation between student-related barriers and curriculum-related barriers (r_s = .364, p = .000, N = 856), and the lowest positive correlation among all the categories was between curriculum-related barriers and teacher-related barriers (r_s = .271, p = .000, N = 856).

Table 6: The relationship between each category of barriers to e-learning implementation

	Teacher-Level Barriers	Institution-Level Barriers	Curriculum-Level Barriers	Student-Level Barriers
Teacher-Level Barriers	1.000	.605**	.271**	.553**
Institution-Level Barriers		1.000	.444**	.548**
Curriculum-Level Barriers			1.000	.364**
Student-Level Barriers				1.000

** Correlation interpretation scale: .00–.19 = very weak, .20–.39 = weak, .40–.59 = moderate, .60–.79 = strong, .80–1.0 = very strong.*

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

4.3 Differences in E-Learning Implementation Barriers in the Context of Teachers' Gender, Academic Qualifications, Teaching Experience and Prior Experience in E-Learning

We administered MANOVA to investigate any possible significant differences in e-learning implementation barriers in the context of the teachers' gender, academic qualifications, teaching experience, and prior experience in e-learning (see Table 7). There was a statistically significant difference between e-learning implementation barriers and academic qualifications: F (8, 1700) = 4.51, $p < .05$; Wilk's $\Lambda = 0.959$, partial $\eta 2 = .021$. The MANOVA also revealed significant differences in e-learning implementation barriers due to teaching experience: F (12, 2246) = 2.07, $p < .05$; Wilk's $\Lambda = 0.971$, partial $\eta 2 = .010$. There were also significant differences with prior experience in e-learning: F (4, 851) = 12.66, $p < .05$; Wilk's $\Lambda = 0.944$, partial $\eta 2 = .056$. Furthermore, the results did not indicate any significant difference in e-learning implementation barriers resulting from gender: F (4, 851) = 1.99, $p < .05$; Wilk's $\Lambda = 0.991$, partial $\eta 2 = .009$. Although the difference between these variable (gender, academic qualification, teaching experience, prior experience in e-learning) are minor, the results indicate that they influenced teacher implementation of e-learning during COVID-19.

Table 7: Results of the MANOVA

Effect		Value	F	Sig.	Partial Eta Squared
Gender	Wilks' Lambda	.991	1.992b	.094	.009
Academic Qualification	Wilks' Lambda	.959	4.509b	.000	.021
Teaching Experience	Wilks' Lambda	.971	2.073	.016	.010
Prior Experience in E-Learning	Wilks' Lambda	.944	12.662b	.000	.056

4.4 The Relationship between E-Learning Implementation Barriers and Type of Institution

We conducted a Spearman's correlation coefficient to investigate any possible relationship between e-learning implementation barriers and type of institution. The results revealed a very weak, but still statistically significant, positive association between curriculum-level barriers and the type of institution (r_s = .071, p = .05, N = 848). This can be due to the different curriculum development and evaluation frameworks and guidelines implemented at different institutions. Also. Private higher education tend to have flexible curriculum guidelines where adapting and enhancing curriculum is accessible. However, curriculum change is more rigid and centralised in public higher education. Table 8 shows the relationship between e-learning implementation barriers and type of institution. The results of this test should be interpreted cautiously as the number of teachers in the sample were more from public institutions.

Table 8: The relationship between e-learning implementation barriers and type of institution

	Teacher-Level Barriers	Institution-Level Barriers	Curriculum-Level Barriers	Student-Level Barriers
Institution	.000	-.067	.071*	.019
** Correlation is significant at the 0.05 level (2-tailed).*				

4.5 Results of the Open-Ended Questions

There was a good response rate for the open-ended questions in the questionnaire (the number of responses for question 1 = 590, and the number of responses for question 2 = 582). The first open-ended question encouraged participants to voice any issues they faced during ERT, while the second question allowed participants to provide suggestions to improve e-learning implementation practices for ERT during Covid-19.

The results revealed that teachers faced various issues with ERT during Covid-19. First, the teachers reported facing issues related to technological infrastructure, including poor internet connectivity and lack of hardware and software for online teaching and learning. Consequently, these issues contributed to the failure of many of the online classes conducted during Covid-19.

Our results also indicated some student-related issues. According to the teachers, many students encountered challenges due to poor network coverage, and students were not motivated to attend their online classes. Teachers attributed this issue to a lack of proper training on the use of live streaming platforms, course management systems and online learning skills and strategies. Moreover, the teachers reported issues with monitoring student attendance during the online classes. Some respondents reported that these difficulties were related to the students' joining and leaving classes frequently during the same online class due to internet connection issues.

In addition, the results revealed that skills and knowledge of online teaching and learning were insufficient for some of the teachers. Accordingly, their inexperience in online pedagogy was reported in two contexts. First, the participants who faced these challenges were not competent in using the required applications for online teaching and learning, such as course management systems and video conferencing software. Second, they demonstrated insufficient knowledge of online pedagogy. In other words, they lacked knowledge of the teaching methods required to administer online instruction.

Furthermore, the participants reported issues with the curriculum. A common issue was that the existing face-to-face courses were not suitable for online teaching; the courses contained materials that were challenging for teachers to cover through online classes. Finally, the course assessments for the face-to-face classes were not suitable for online classes.

Our analysis showed that there were issues in relation to institutions' policies and guidelines. The participants reported that their institutions lacked online teaching and learning policies and guidelines. They also stated that their institutions were unable to monitor and assess the quality of e-learning during this period due to a lack of specific quality assurance measures for ERT. Meanwhile, only a few respondents mentioned issues with time; those who reported time as an issue stated that they found online teaching to be time-consuming.

The teachers who participated in our study provided a variety of recommendations to enhance online teaching and learning through ERT during Covid-19. The majority of the respondents emphasised the need for proper student training, which would benefit the quality of both teaching and learning in the online context. They recommended student training in various areas, including video streaming software, learning management systems and screen and voice recording software.

The teachers also recommended enhancements to the technological infrastructure. Their recommendations can be divided into two main parts. Some of the recommendations focused on enhancing internet connectivity at both the national and institutional levels. In addition, the participants recommended providing and upgrading software, hardware and network facilities at the institutional level. Some teachers also recommended establishing video recording studios to aid in recording professional videos for online classes.

Furthermore, the teachers recommended some amendments to teaching and learning policies and institutional guidelines. Some of the teachers recommended establishing new policies that are specific to ERT, including changes to attendance policies, quality assurance and quality enhancement policies, and student support services.

Finally, the participants recommended a redesign of courses and assessments. Teachers who taught practical courses asserted the need to change assessment patterns to suit online instruction, and some of the teachers recommended

including short quizzes prior to and after classes to ensure student readiness and to monitor and assess their understanding of the content.

5. Discussions

5.1 Students preparedness for Emergency Remote Teaching

The current study reveals that students were not prepared for ERT, and they demonstrated insufficient online learning skills, strategies and knowledge. Similar observations have been reported in previous research. Alqudah et al. (2020) identified poor e-learning skills, unpreparedness and inadequate internet accessibility for students as the main obstacles hindering the continuity of learning in the ERT period in Jordan. Research has also confirmed that student issues such as readiness, motivation, accessibility and equity negatively impacted e-learning practices during Covid-19 (Adnan & Anwar, 2020; Bao, 2020; Hartshorne et al., 2020; Landrum, 2020; Mailizar et al., 2020). Prior Covid-19 research has confirmed similar findings (Assareh & Hosseini, 2011; Naveed et al., 2017; Pelgrum, 2001). Therefore, this suggests that students themselves might pose a serious challenge to e-learning implementation in an ERT context. Another possible explanation of this issue that should be considered, however, is that institutions may not have had sufficient time to prepare their students for the sudden shift to ERT.

5.2 Curriculum and E-Learning Implementation during COVID-19

The positive correlation between curriculum-related and institutional-related barriers signifies that the existing curriculum is not suited for ERT. A possible reason for this might be that most of the courses offered during ERT were not subject to sound instructional design due to the emergency situation. This is supported by Hodges et al.'s (2020) argument that online course design during ERT is often rushed with minimum resources, and little attention is paid to typical planning and preparation. This finding also confirms the work of Crawford et al. (2020) and Bao (2020), both of whom claimed that shifting courses to online delivery during Covid-19 lacked systematic course design and evaluation. Furthermore, recent research has pointed out the need for systematic planning when shifting to online instruction. Karalis (2020), for example, emphasised that piloting – piloting the new course, assessment and teaching materials – is an essential and integral part of shaping proper responses to emergencies in education. Meanwhile, along the same line of thought, Gacs et al. (2020) stressed the importance of a quick needs analysis to understand teacher and student needs in relation to technology, workload, accessibility, equity, readiness, motivation and prior knowledge.

5.3 Institutional Readiness for Emergency Remote Teaching

The positive correlation between teacher-related barriers and institution-related barriers can explain the unpreparedness for the shift to ERT during Covid-19. Our results confirm the lack of digital education policies and procedures at most higher education institutions in Oman. Additionally, the dearth of quality assurance measures and polices concerned with emergency teaching and learning negatively affected ERT practices. This finding relates not only to Omani higher education, but can be generalised to educational systems worldwide (see Crawford et al., 2020). Findings from the current research indicate the need for teacher professional development, especially since

inadequate ICT skills in teachers has been reported as a crucial hindrance of e-learning implementation (Alqudah et al., 2020; Assareh & Hosseini, 2011; Bao, 2020; Chang & Fang, 2020; Crawford et al., 2020; Naveed et al., 2017; Pelgrum, 2001; Sharpe et al., 2003).

5.4 Other Influential Barriers

Academic qualifications and teaching experience played a significant role in e-learning implementation for ERT during Covid-19. Although teachers' academic qualifications and teaching experience have a positive effect on their implementation of e-learning, teachers advocated for training provisions specifically related to the ERT context. Previous research confirms the finding that prior experience and academic qualifications of teachers positively correlate to the successful implementation of e-learning (Cidral et al., 2018; Hartshorne et al., 2020; Mahdizadeh et al., 2008; Mailizar et al., 2020; Naveed et al., 2017; Reeves & Pedulla, 2011).

Meanwhile, the type of institution did not lead to any significant differences in e-learning implementation for ERT. In other words, the experience of public and private educational providers was the same, which indicates that neither sector was fully prepared for the sudden shift to ERT.

5.5 Requirements for Successful Emergency Remote Teaching

The evidence from this study suggests that higher education institutions should pay attention to student training provisions. Higher education providers should consider providing and/or enhancing students' internet access to maximise their ability to participate in online learning. Although our findings relate to e-learning implementation for ERT during Covid-19, they are applicable to normal teaching settings and face-to-face teaching that depends, to some extent, on e-learning solutions. The current study also highlights the need for a national policy for digital delivery of higher education and a national policy for ERT. Although the shift to online instruction was accomplished rapidly, it is important that institutions follow a systematic plan for the shift to online instruction that considers the needs of both teachers and students. Additionally, it is necessary that periodic and quick evaluation of courses that are shifted online during ERT be implemented. While it might be argued that this may not be possible or feasible during exceptional circumstances, institutions should ensure that they review and pilot parts of their courses concurrently to online instruction. Student, teacher and parent feedback should also be considered when evaluating online instruction during ERT. Finally, this work demonstrates the importance of enhancing institutional technological infrastructure.

5.6 Limitations and Future Research

A number of limitations need to be considered. First, the study only included English-speaking teachers. The questionnaire was not translated into Arabic, which is spoken by many university teachers in Oman. Second, the study sample only included teachers. Including students in the study sample would have affected the conclusions we were able to draw, especially with regard to student-related barriers to e-learning implementation.

However, the findings of this study do bring up a call to teachers, institutions and policy makers to further investigate issues related to e-learning in ERT

contexts. Future research should explore student training provisions in online learning during ERT and could also investigate the professional development of higher-education teachers in ERT contexts. Design-based research can be useful for designing and piloting teacher- and student-training programmes, and would be useful to assess institutions' readiness for online instruction and course design during COVID-19 and other unexpected emergencies in the future.

6. Conclusion

Using a cross-sectional survey design, we examined teachers' views on the implementation of e-learning in ERT during COVID-19. Student-related barriers had a strong impact on teachers' use of e-learning with teachers' academic qualifications and prior experience having a less significant impact on teachers' use of e-learning in ERT during COVID-19. The study recommends training programmes for both students and teachers to prepare them for handling learning and teaching in ERT contexts. In addition, the study recommends higher education institutions to adapt their curriculum to suite ERT. As teachers were not prepared for the sudden shift to ERT during COVID-19, higher education providers need to implement professional development provisions and amend their teaching and learning policies to suite the ERT context.

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