

Identification of Online Learning Challenges During the COVID-19 Pandemic in Developing Countries: A Case Study of a Metropolis Faculty of Sciences

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Abstract—The unexpected outbreak of the Corona virus (COVID-19) disrupted schools and universities around the world. Traditional classes were canceled, forcing schools and universities to switch to online learning. While developed countries have already adopted e-learning and online learning into their teaching practices, which made the transition relatively easy during the COVID-19 crisis, other developing countries continue to struggle with problems of electricity and information technology infrastructure. The purpose of this paper is to investigate the challenges of online learning faced by students and teachers at the Faculty of Sciences Ain Chock, Hassan II University of Casablanca, Morocco. Thus, two anonymous structured Google Forms questionnaires were sent to participants via email. 498 responses were returned from students and 105 from teachers. We use descriptive statistics to better understand the distribution of study participants. The study reveals that the faculty during the lockdown ensured educational continuity and offered a reliable online learning in terms of digital and educational materials. However, technical problems such as the slow speed of the Internet connection, lack of knowledge about the use of information and communication technologies to teach and learn, low motivation of students, were significant challenges to students' and teachers' use of the digital tools.

Keywords—online learning, e-learning, COVID-19, developing countries

1 Introduction

Online learning is defined as a type of e-learning which is the process of acquiring knowledge using electronic technology. E-learning is generally carried out over the Internet [1]. Students can access their learning materials at any time and from any location [2,3,4,5]. E-learning is part of Information and Communication Technologies (ICT) that provide the opportunity for teachers to improve their teaching and the overall performance of students [6]. The use of ICT in teaching and learning is becoming more common and current [7]. Its incorporation into the teaching and learning environment provides additional opportunities for teachers and students to collaborate more effectively [8].

There are several advantages to online learning over traditional learning techniques. Some of these advantages include the ability for students to employ self and personalized learning as well as to select their own learning environments. This helps to meet the needs of students and outperforms traditional learning [2,4]. E-learning eliminates the geographical barriers and time scale that are often associated with traditional learning [4,9]. In addition, e-learning is cost-effective compared to traditional learning [10]. It offers the possibility of cross-access the global gap in education, can help students living in areas where infrastructure, such as roads or suitable transportation, is lacking, and can reduce travel expenses [2,11]. [3] described e-learning as a cheap mode of education that helps students improve their technology skills [12].

In the time of the COVID-19 pandemic, online learning is no longer a choice; it has become a requirement [13]. The pandemic has caused disturbance in the education sector around the world [14,15]. Due to the physical separation required to prevent the spread of the virus [15], e-learning has become worldwide in a short amount of time [16]. As a consequence, it has grown in popularity and acceptance among students and teachers [17,18]. E-learning has been identified as a necessary intervention to mitigate the impact of the COVID-19 pandemic [19]. The new virus has accelerated the transition from traditional to virtual and online classes. Therefore, the necessity of the transition from traditional to virtual education improved the adaptability and positive attitudes towards e-learning for both students and teachers [18].

For Saudi universities and colleges, the switch to online learning was easy. These universities were implementing online learning for some courses before the pandemic [14,5]. They were equipped with advanced platforms, which allowed them to begin classes online and finish the semester on time [20]. In the same context, Egypt's private higher education institutions were able to continue to deliver online learning and provide high-quality education [21]. [22,4] confirmed that the transformation of education from classrooms to e-learning was carried out successfully. In Jordan, the pandemic gave universities a good opportunity to use many online platforms, allowing staff to develop their knowledge in media use, virtual collaboration and give students the opportunity to access learning materials. Therefore, universities increased their percentage of distance learning courses [23].

However, the effect of the lockdown was more severe in many other developing countries as a result of a lack of preparedness and the absence of infrastructure for online learning [24]. The transition to e-learning in this situation was challenging. For example, Bangladesh suffered from a lack of resources to move to online learning according to [25]. Many universities in Bangladesh have claimed that they are unable to continue academic activities through online classes due to inconsistent Internet availability around the country. They were not well prepared for online learning [20]. Furthermore, in Pacific Island, e-learning is still growing. At the time of COVID-19, many students do not have access to appropriate technology or the Internet, making the transition to online learning difficult [4].

The transition from traditional to online learning for low-income students was challenging due to the technological imbalance. Many students cannot access online learning, which causes psychological stress [26]. Due to the major inequalities between

countries, many students do not have access to online learning because of the lack of the Internet access. There is a gap between developing and developed countries, 95% of students in Switzerland, Norway and Austria have a computer to use for schoolwork, only 34% in Indonesia [27]. In Australia, they move rapidly to online learning [19]. Therefore, this paper aims to present the students' and teachers' learning experience at the Faculty of Sciences, Hassan II University during the COVID-19 pandemic and identify the challenges and difficulties facing developing countries during this special period.

2 Literature review

During the closure of universities and schools caused by the COVID-19 pandemic, online learning tools helped to maintain the teaching and learning process [28]. The crisis was a new era for online learning, allowing people to consider the positive aspects of e-learning technologies [3]. In fact, e-learning was a beneficial tool for both students and educators during the lockdown [21]. Universities have noted the importance of e-learning as a key component of their learning system [12]. To continue teaching and learning, many educational applications and platforms were used to assist parents, teachers and school administrators. During school closures, these platforms facilitate student learning and provide social care. Choosing the best e-learning platform can help educators achieving their learning objectives and goals [7].

However, both teachers and students face numerous challenges while using e-learning [29]. Financial and technological challenges are among them. [30] showed that in low-income countries, educational institutions, and students struggle with infrastructure challenges. Only 23.8 % of Indian homes have Internet connectivity in urban areas. The ratio is much lower (14.9 %) in rural areas. [31] classified challenges into subjective ones, such as the lack of prepared lecture notes and seminars or laboratory exercises to be conducted remotely. They also addressed technological ones, such as the insufficient amount of computer equipment, capacity of the Internet connection and also the lack of implemented tools in e-learning platforms to allow controlled tests and exams.

[32] cited a financial challenge of the high cost of Internet access and a technical challenge of slow Internet speed and unstable electricity supply faced during the pandemic. They confirmed that the main barrier to acceptance of the e-learning system has always been a reliable Internet connection. According to their findings, Shaikh Zayed University in Afghanistan currently doesn't have a suitable learning management system to efficiently implement e-learning. Therefore, knowledge about e-learning among all actors is still basic. [25] showed that villages in Bangladesh still suffer from inconstant electricity supply. Most of students do not have Wi-Fi in their homes. Consequently, they were not familiar with the use of online resources. Following developed countries in the transition to online learning in order to finish the semester was difficult. For Bangladeshi students, continuing online learning in the post-pandemic will be challenging. [33] identify and describe the challenges of online learning from the perspective of medical students in the Philippines during the COVID-19 pandemic.

Power interruptions, weak infrastructure, and Internet costs restricting student access to online content were the main challenges.

In Nigeria, [19] found that socioeconomic factors are highly related to compliance with e-learning, with educational attainment serving as the main influence in the time of COVID-19. [3] cited the unequal distribution of ICT infrastructure, the Internet, and digital illiteracy in the use of e-learning tools as the main challenges in time of the crisis. Students and teachers from different universities have never practiced e-learning because the Internet and Wi-Fi are not available to everyone. For [7], the most important challenges of implementing e-learning are the lack of Internet access and the financial allocation for e-learning initiatives. The budget allocation for e-learning is still limited because institutions consider it not a priority. The paper also showed that students from low-income may be unable to access e-learning resources and activities due to the high cost of Internet access.

For The British University in Egypt [21] students and staff were under a lot of emotional pressure during the crisis. The most significant challenges were IT problems, some content was difficult to deliver online, and students had problems using the Internet because they were not always able to connect properly.

During the lockdown, universities in Jordan used a variety of online learning platforms that allow staff to develop competencies in the use of media and virtual collaboration, as well as to provide students with practice in accessing teaching materials, answering questions and performing other academic activities. Jordanian students faced several difficulties, including anxiety, lack of a device to join online classes, lack of a separate space to study at home and Internet connectivity issues. A significant portion of students have not been able to participate in online classes [23].

Libyan students faced numerous challenges when implementing e-learning, such as poor Internet connectivity, lack of knowledge about the use of ICT, degradation of the Internet infrastructure, and the high cost of purchasing and maintaining the necessary electronic equipment. Students confirmed that e-learning is challenging and that the poor quality of Internet services is the main barrier to its implementation [12]. [19] showed that in Nigeria, the state of the infrastructure is deplorable. The lecture rooms are old and unsuitable for productive learning Labs, libraries and ICT units are poorly equipped.

In Iran, [18] showed that at the beginning of lockdown they detected another challenge which is related to the teachers' reticent to adopt e-learning because of their unfamiliarity with it. They also showed that infrastructure problems, Internet speed and the lack of face-to-face interaction can negatively impact the e-learning experience.

Table 1. Summary of the challenges faced by some developing countries during the covid-19 pandemic

	Technical	Financial	Human/Domestic	Institutional
[3]	<ul style="list-style-type: none"> – Power interruptions – Weak infrastructure – Unreliable, slow, or no Internet access – Lack of technical skills 		<ul style="list-style-type: none"> – Mental health problems – Lack of physical space suitable for studying – Difficulty adjusting learning styles 	<ul style="list-style-type: none"> – Lack of organization – Poor communication between learners and educators – Poor quality of learning materials
[32]	<ul style="list-style-type: none"> – Slow Internet speed – Unstable electricity supply. 	<ul style="list-style-type: none"> – High cost of Internet access 		
[19]	<ul style="list-style-type: none"> – Power problem – Poor state of infrastructure 	<ul style="list-style-type: none"> – Expensive price of computer hardware and software 		
[16]				<ul style="list-style-type: none"> – Lack of live lectures lab sessions.
[3]	<ul style="list-style-type: none"> – Unequal distribution of ICT infrastructure – Technology obsolescence 	<ul style="list-style-type: none"> – Technology cost 	<ul style="list-style-type: none"> – Digital Illiteracy 	<ul style="list-style-type: none"> – Quality of education
[14]	<ul style="list-style-type: none"> – Lack of basic infrastructure 			<ul style="list-style-type: none"> – Lack of laboratory classes/practical lessons. – Lack of interactions
[7]	<ul style="list-style-type: none"> – Absence of technical support – Internet access 	<ul style="list-style-type: none"> – Limited allocation for e-learning 	<ul style="list-style-type: none"> – Resistance to change 	
[21]	<ul style="list-style-type: none"> – IT infrastructure technical support 			
[23]	<ul style="list-style-type: none"> – Internet connectivity – Lack of technology use in the teaching and learning 	<ul style="list-style-type: none"> – Poor economic conditions 	<ul style="list-style-type: none"> – Lack of a separate space to study at home – Lack of motivation 	
[12]	<ul style="list-style-type: none"> – Internet connectivity and infrastructure 	<ul style="list-style-type: none"> – Cost of purchasing and maintaining the necessary electronic equipment 		<ul style="list-style-type: none"> – Lack of knowledge about the use of information and communication technology
[13]	<ul style="list-style-type: none"> – Lack of technological skills – Lack of technical assistance 		<ul style="list-style-type: none"> – Lack of interactions – Lack of awareness of the learner’s personality traits and attitudes 	
[18]	<ul style="list-style-type: none"> – Internet speed – IT infrastructure 		<ul style="list-style-type: none"> – Teachers’ reticent to use e-learning – Lack of face-to-face interactivity – Time management 	

3 Method

3.1 Transition to online learning at the Faculty of Sciences Ain Chock Hassan II University

Although Morocco is considered a developing country [34], Morocco goes through a rapid digital transition. Several years ago, Moroccan universities have adopted a strategy for digitizing their main activities. Faculty of Sciences Ain Chock, Hassan II University is a public higher education institution located in Casablanca, Morocco. The faculty is part of the digital university initiative, which aims to transform it into a higher education and research institution capable of intelligent knowledge development and distribution. Therefore, the incorporation of ICT into the faculty tasks allow the fulfillment of several educational teaching and research missions.

On 16 March 2020, Morocco's Ministry of National Education, Vocational Training, Higher Education and Scientific Research announced the closure of nurseries, schools, colleges, high schools and universities as in other parts of the world until further notice to prevent the spread of the COVID-19 pandemic [35]. The Moroccan Ministry has decided to move from traditional learning to online learning, allowing students to follow the courses at home. For higher education, each university has integrated online courses on its digital platform. In our side, the faculty started urgently the improvement of the existing online learning system and began immediately the training of the teachers on how to use the platform. The online learning platform was integrated into the digital workspace named in the French abbreviation ENT (Espace Numérique de Travail) [36]. ENT is a centralized hub of the university that provides many e-services such as students' enrollment and electronic resources (e-books) that enable better communication and collaboration. As a result, the digital workspace has become the core part of the learning and teaching experience at the faculty during the COVID-19 pandemic. After training the teachers on how to use the online learning platforms integrated on the ENT, they made the courses available to students and started sharing materials.

3.2 Instruments

To investigate the challenges of online learning faced by students and teachers at the faculty during the COVID-19 pandemic, we choose online-based surveys for this study. This type of surveys is appreciated by surveyors, it allows a quicker preparation and administration. Online surveys make data collection and analysis, simple and rapid, with fewer errors than traditional surveys [23,37]. They also ensure the health security measures imposed by the COVID-19 pandemic. Our investigation has relied on collecting required data by conducting the surveys between 6 October and 20 October; this period corresponds to the beginning of the academic year 2021/2022 using face-to-face learning. Teachers and students are the major actors to comprehend and explain the success or failure of such experiment. We released the surveys at this specific time to evaluate how satisfied the students and teachers were with online learning and if they would prefer to return to online learning. A significant issue to cite of online surveys is the participation rate. Generally, response rates are extremely poor compared to the offline survey method [38]. In our case, we created two anonymous Google forms

questionnaire links. The first link to the survey was intended for teachers (see Figure 1), the second was intended for students (see Figure 2), and the two surveys had a number of common questions using a combination of multiple choice, closed-ended questions and one open-ended questions. Students were asked 27 questions and teachers 37 questions. Number of questions destined to teachers is higher than the number of questions destined to students because the role of the teachers is the most important in the online learning process because it's in his hands to create the course content, encourage and communicate with students.

The two surveys were sent in an email invitation to 1500 students from which 498 responses were returned and to 235 teachers from which 106 responses were returned. Therefore, 33.2% and 45% of the students and teachers contacted, respectively, participated in the study. The target sample size was reached satisfactorily. We use descriptive statistics to better understand the distribution of the study participants. We have used the free version of the Social Science Statistical Package (SPSS Version 22.0) for data analysis.

To ensure the validity of the study, the primary author drafted the survey instrument, and the authors revised proposing critical reviews, the vice dean for teaching and learning, who is also the faculty's e-learning administrator provided the face validity.

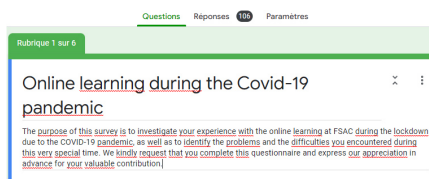


Fig. 1. Survey sent to teachers

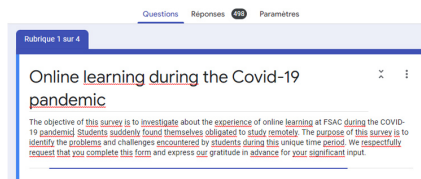


Fig. 2. Survey sent to students

4 Results

4.1 Characteristics of the participants

In the first section of the two questionnaires, participants were asked about their demographic profile, including gender and geographic area. Table 2 shows the profile of the students who participated in this study: for the gender, female students were more than male students with a percentage of (59,7%) and (40,3%) respectively. Most of the students (91,1%) lived in urban areas and only 8,9% lived in rural areas, where they usually have poor infrastructure and face many challenges in obtaining education services.

Table 3 shows the profile of the teachers who participated in this study. For gender, male teachers were more than female teachers with a percentage of (61,3%) and (38,7%), respectively. Almost two-thirds of teachers aged over 50 years (Table 2). We asked teachers about their age to better understand the relationship between age and the adoption of online learning. For the question "How do you rate the state of your digital knowledge?" 61,97% of teachers aged 50 years or more reported that they have basic technological knowledge, consequently they took more than two weeks to adjust to the

new way of teaching. Figure 3 shows that the participant teachers in this study come from various departments of the faculty.

Figure 4 shows the field of study and the semester in which the students were enrolled during the lockdown. We note that the participants are spread across several disciplines or fields of study, which makes the sample of the study diverse and relatively good. We asked participants about their experience of online learning before COVID-19, 75,5% of the teachers affirmed that they had never had the opportunity to teach online before the lockdown, and 48,1% of them affirmed that they were not prepared for such a new way of teaching. On the other side, 90,1% of students discovered online learning for the first time during the lockdown.

Table 2. Demographic characteristics of students

	Number of Students (Out of 474)	Percentage (%)
Gender		
Female	283	59,7
Male	191	40,3
Geographic area		
Rural	42	8,9
Urban	432	91,1

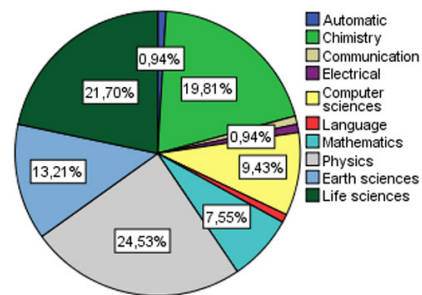


Fig. 3. Specialties of teachers

Table 3. Demographic characteristics of teachers

	Number of teachers (Out of 106)	Percentage (%)
Gender		
Female	41	38,7
Male	65	61,3
Age		
30–40	13	12,3
40–50	22	20,8
>50	71	67

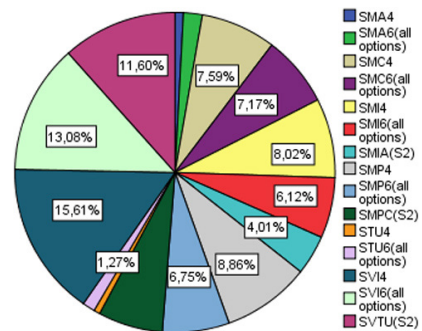


Fig. 4. Field/semester of students during the lockdown

4.2 Challenges of online learning

To know the devices used by students and professors for attending the online classes, we asked “What technological devices did you have used to learn or to teach during the lockdown?” 95,3% of teachers used the personal computer to teach, 20,8% used the

desktop computer and only 17% used the smartphone. In the other side 63,5% of students used the personal computer, 5,9% used the desktop computer and 64,3% used the smartphone (Table 4). We notice that a large percentage of students used smartphones to study.

Table 4. Devices used by teachers and students

	Teachers (%)	Students (%)
Personal computer	95,3	63,5
Desktop computer	20,8	5,9
Smartphone	17	64,3
Tablet	10,4	2,1

To get a clear idea about the state of Internet connection of students, we asked the following questions “Which type of connection Internet you used to study during the lockdown?” and “How do you find the cost of this Internet connection?”. Table 5 shows a cross tabulation between the two questions. 55% of the students reported having Wi-Fi or optical fiber during the lockdown and 62% of the students find that the cost of this connection is affordable (not high or not high at all). This linked with the fact that 91,1% of the students are from urban areas where the income is higher than the income in rural areas [39]. 62,45% of students followed their courses during the lockdown in a corner in the house without a desk and only 20,68% of students had a separate room with a desk. We notice that although the majority of students come from urban area, they may come from low or middle-income families.

Table 5. Type of internet connection versus its price

		How Do You Judge the Cost of this Internet Connection?				Total
		Not at all High	Not High	High	Very High	
During the lockdown period, you had an Internet connection:	ADSL	24	38	21	5	88
	(3G/4G)	35	33	23	34	125
	Wifi/OF	62	105	80	14	261
	Total	121	176	124	53	474

To find out how fast the faculty Internet connection was during lockdown, we asked teachers, “Did you teach online from the faculty or from your home?”. Figure 5 shows that the majority of teachers taught from home using the personal computer and the Internet connection, only 20,75% of teachers taught from the faculty and reported that the Internet was slow.

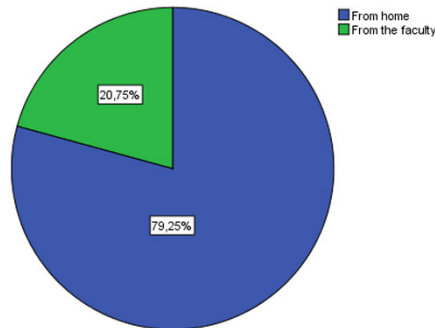


Fig. 5. Where teachers teach online

To find the most used platforms during the lockdown, we asked teachers which platform or platforms they used to teach, Table 6 represents the responses collected, and Google meets was the most used platform for teaching. In the second place, we have the university platform, which includes the BigBlueButton and Blackboard Collaborate platforms. Students and teachers have access to this platform using the digital workspace accounts. 93,2% of students reported that they have accessed to the digital workspace to take a course or to download materials. Therefore, the pandemic was a good opportunity to encourage students and teachers to use different platforms and to use the digital workspace in a short period of time.

Table 6. Platforms used by teachers

Platform	Teachers (%)
Google meets	82,2
ENT/university platform	77,4
Zoom	41,5
Social media (WhatsApp, Skype, Facebook...)	17,9
Classroom	12,3
Microsoft Teams	12,3

To identify the difficulties encountered, we asked students the question “What difficulties have you encountered while following online courses?”. From Table 7, 62,6% reported the problem of interruption and slowness of the Internet connection, this problem can also lead to the second problem which is sound problems. We notice that although the students have an Internet connection but it is not sufficient to learn remotely. An important percentage of the students encountered pedagogical problems like the difficulty in understanding/following the course remotely, low interactivity or communication with teachers.

Table 7. Difficulties encountered by students

Difficulty	Students (%)
Interruption / slowness of the Internet connection	62,6
Sound problems	53,4
Difficulty in understanding / following the course remotely	43,7
Low interactivity and communication with teachers	41,8
Difficulty in using virtual classes (Teams, Zoom, ...)	31,9
Technical difficulty in accessing the digital workspace (ENT)	28,1
Lack of information and communication on the available digital educational resources	24,7
Difficulty in understanding how the digital workspace (ENT) works	13,9
Difficulty in downloading courses materials	12,9

To confirm technical difficulties encountered by students in Table 6, we asked teachers “Have you encountered sound problems and interruption of Internet connection during a video conference (live) on the university platform?”. 57,5% of teachers reported that this occurs from time to time, which corresponds to the students’ responses.

We posed an open question to teachers, asking them to add any technical problems that we did not mention and the majority of teachers insisted on the technical problem of interruption of connection for students which always disrupts the online course.

“Not all students have access to a good connection”

“Online education requires a broadband connection and adequate equipment”

“During the course, we could not see the students, we had to turn off the cameras for a better connection, it was frustrating for us as teachers”

Teachers also raised additional points like:

“Mathematical demonstrations require adequate material”

“For a hybrid course, the lecture theatre was not well equipped with the necessary equipment”

“I feel exhausted after each online session, it took a lot of effort and more energy compared to a face-to-face course”

“The implication of the students requires their disposal of the appropriate material. Additionally, the installation of optical fiber in our homes must be encouraged”

“For the evaluations we have no control to identify the presence of the real candidate”

To determine whether there are other factors that negatively influence online learning, we asked “What difficulties do you often encounter with your students during online learning courses?”. The majority of teachers found that the participation in online courses was weak, followed by the other common problems of online learning which are lack of dynamism and punctuality (Table 8). The first three difficulties may have been caused by lack of motivation, and as a result, only 34.9% of teachers reported

they experienced the lack of motivation as difficult. 48.1% of students affirmed that the courses were not interactive, which explains that a lack of interaction was a major issue during the online courses.

Table 8. Difficulties encountered by teachers

Difficulty	Teachers (%)
Lack of participation	72,6
Lack of dynamism	57,5
Lack of punctuality	49,1
Lack of motivation	34,9

To find out if the preparation of an online course is similar to a face-to-face course, we ask “In your opinion, preparing a course for online courses”. According to Table 9, the majority of teachers reported that preparing an online course requires additional effort in comparison to face-to-face course. 58,5% of teachers reported that the preparation takes more time, 57,5% reported that the preparation requires specific devices and 48,1% reported that the preparation requires computer skills.

Table 9. Problems while preparing online courses

Problem	Teachers (%)
Requires additional effort	81,1
Takes more time	58,5
Requires specific devices	57,5
Requires computer skills	48,1

4.3 Perspectives of online learning at the faculty

In order to figure out which type of courses online learning is more suitable, we asked teachers and students “In your opinion, for which form (s) of education is online learning more suitable?”. From Table 10, the majority of teachers and students reported that online learning is more appropriate for lectures courses because they are theoretical, given to large groups of students, and generally there is little interaction between teachers and students. Only 28,3% of teachers reported that online learning is appropriate for tutorial courses, despite the fact that the goal of a tutorial class is to facilitate interaction between students and their teachers. This interaction is not always present in online learning.

Table 10. Forms of education suitable for online learning

	Teachers (%)	Students (%)
Lectures courses	87,7	69,2
Tutorials courses	28,3	39,2
Practical courses	11,3	17,1
Assignments	14,2	28,7

In response to the question, “Do you think the subjects you studied/taught during the lockdown can be taught after the pandemic?”. 45,3% of teachers find that their fields require face-to-face mode and 45,3% are for the hybrid teaching. On the other hand, 40,7% of students reported that their studies require face-to-face mode, 36,9% are for hybrid learning.

This is possibly due to the fact that our faculty is a scientific institution where several courses require practical work and hands-on activities, thus the participants prefer the face-to-face mode.

To have a clear idea of teachers’ expectations for online learning in the future, “Do you think that improving network infrastructure and increasing connection speed can solve some of the problems you encountered while studying online?” as well as “Do you believe that implementing new digital resources such as interactive whiteboards and smart tablets can improve the quality of your online education?”. Figures 6 and 7 show that most teachers believe that if the faculty established a suitable infrastructure and increased the Internet connection speed, the technical problems encountered by the teachers during the lockdown will be resolved.

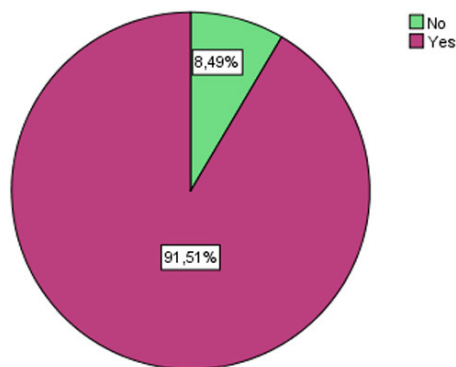


Fig. 6. Improving network infrastructure and speed connection can solve encountered problems

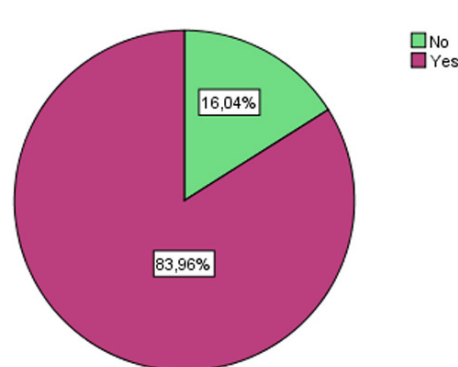


Fig. 7. Implementing new digital resources can improve the quality of the online education

To find out which teaching mode is preferred by the students, we asked the following question: “What teaching mode do you prefer after COVID-19?”. 44,9% of the students prefer the face-to-face mode, 35,4% prefer the hybrid mode, and only 19,6% prefer the online mode. Finally, to find out if participants’ skills in terms of using new technology have improved, we ask both students and teachers “Was online learning during the lockdown a good opportunity to improve your knowledge in terms of using new information and communication technologies (ICT) to study and learn?”. Teachers and students reported that teaching and learning online during the lockdown had improved their ability to use technology with a percentage of 73% and 83,96%, respectively (see Figures 8 & 9).

Finally, to find out the acceptance of e-learning among teachers, we asked them: “How do you judge the quality of online courses compared to face-to-face courses?” and “Do you believe that in the future, online learning will be able to replace face-to-face learning? (post-pandemic)”. 71,7% of teachers agreed that the quality of online courses is inferior to face-to-face courses, 71% of them aged over 50 years. 55,7% of

teachers believe that online courses will never replace face-to-face courses, 67,8% of them over 50 years old.

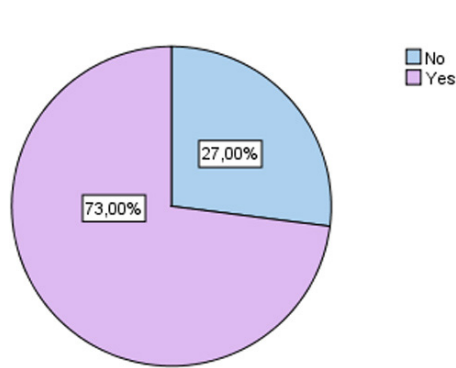


Fig. 8. Online learning was a good opportunity to improve students' skills in ICT use

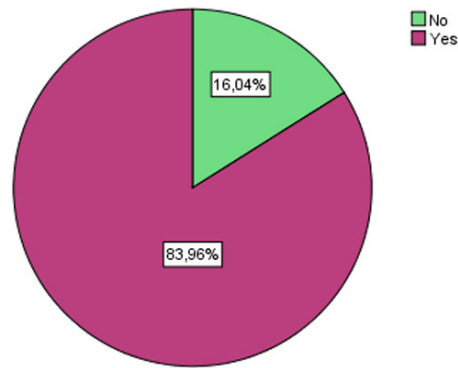


Fig. 9. Online learning was a good opportunity to improve teachers' skills in ICT use

5 Discussion and recommendations

This study examines the state of online learning in the Faculty of Sciences Ain Chock during the lockdown pandemic. The surveyed came from different fields and disciplines of science. They had all participated in the new mode of study as a result of the pandemic. We have lunched a quantitative study by sending surveys using emails and analyzing the various responses presented in the previous section. This research can be considered an addition to the existing literature devoted to identifying the main factors and challenges facing universities to move to online learning during the lockdown in some developing countries.

5.1 Technical challenges

Internet connection and devices. According to the responses, students were not very satisfied with the online learning basically due to technical challenges. Since the faculty is located in the country's economic capital and the majority of the students live in urban area. In our study we didn't face the problem of the interruption of power and electricity like in [33,32]. Furthermore, to ensure the satisfaction of the students, quality of e-learning must be provided [40]. To properly implement online learning and ensure its quality [3], technical factors must be considered. [41] affirmed that it is impossible to adopt online learning if students and teachers do not have access to computers and fast Internet connection. According to our finding, the students surveyed do not all have access to the necessary tools, such as a fast Internet connection and a personal computer to take advantage of online learning [42].

An important percentage of students used smartphones to learn; however, mobile devices provide a number of technological restrictions due to lower capabilities compared to desktop computers [42]. Despite, the fact that the majority of our students claim to have an Internet connection but it was insufficient to learn remotely. The slow

Internet connection produces connection failures and interruptions during videoconference classes for students. These students come from low or middle-income families, have limited learning space at home and access to quality Internet service [13,43,12], and those restrictions affect their families. [33] and [7] found that students in developing countries always encountered the problem of limited devices and the Internet. [32] have also reached similar results by reporting that a bad Internet connection is still a barrier to the acceptance of e-learning. This is one of the main reasons why the surveyed students were not satisfied with online learning and prefer face-to-face learning. To encourage students to take benefit of online learning, the Moroccan ministry of education should launch a new edition of the program Injaz, which allows the university students to purchase a computer and a mobile Internet service at affordable prices. According to [44] online classes will be successful only if Internet access is made available to all by making it equitable and affordable.

The findings reveal that teachers were also not satisfied with online learning; teachers used their personal computers and the private Internet connection to teach. Teachers who taught during the lockdown from the faculty report that the Internet connection is slow. Consequently, in May 2021, faculty acquired a supplementary Internet access in order to increase the speed to encourage teachers to adopt online learning for the post pandemic. Other projects aimed the improvement connectivity are scheduled, in particular the extension of the Wi-Fi network to cover the most important areas of the faculty. At the beginning of online learning, teachers struggled with large classes during the live sessions because the platform limits the number of accesses. In September 2020, the university added Blackboard Collaborate (BBC) to ENT. Therefore, the classroom section reached 500 simultaneous users, making the platform faster. In this situation, blended learning is recommended to reduce the presence of students in universities and promote the hands-on skills and experiences of students [45].

Technical support. As a result of the crisis, university teachers were forced to provide online courses without adequate assistance or required training, teachers did their best to teach online despite the fact that the majority have not had the opportunity to teach online before. Thus, the quality of the courses was impacted [8]. For teachers, it is crucial to feel at ease when using a computer and surfing the web [44]. Similarly, [13] and [18] find that teachers need technical assistance to choose and use the applications for teaching. For asynchronous courses, teachers also need help in recording and creating video materials [13]. Teachers aged above 50 reported that they have basic technological knowledge; consequently, they needed more technical support and they took more than two weeks to adjust to the new way of teaching. [46] showed that age had no effect on future use or satisfaction with e-learning and should not be seen as an obstacle to the use of e-learning. In the other side,[8] confirmed that the adoption and integration of ICT is determined by teacher characteristics such as age, gender, educational experience, ICT skills, and attitude toward it. [23] confirmed that the covid-19 pandemic allowed staff to develop competencies in the use of media and virtual collaboration. Similarly, the majority of the surveyed teachers reported that online learning during the lockdown was a good opportunity to improve their knowledge in terms of using ICT. However, the faculty must ensure more technical assistance by providing training to the teachers in the use of ICT tools and online learning platforms, as well as assisting them in creating and publishing the online courses. Lack of technical support is one of the most difficult challenges for organizations to implement e-learning [47].

5.2 Pedagogical challenges

Students' engagement. In addition to technical challenges, many pedagogical challenges were raised like low interaction and poor communication with teachers. In addition, students were less engaged in online courses. Similarly, [14] found that face-to-face courses are more interactive than online courses. In the educational system, communication is crucial. Without face-to-face interaction between learners and educators, it is difficult to carry out teaching and learning activities [13,18,48]. [3] reported that online learning offers so much time and flexibility that students cannot find the time to do it. Furthermore, online learning requires a high level of motivation, organization, and self-efficacy in time management, the latest had a significant positive impact on self-efficacy in an online learning environment and learning engagement [18,49]. [23] confirmed that students suffer from a lack of motivation to attend online courses in synchronous time. In this way, the faculty must encourage teachers for using videoconferencing tools; hence, teachers can respond immediately to student inquiries or concerns during live meetings [50]. Teachers can also communicate with students by providing constructive feedback that supports how they are doing well to improve the engagement and interactions of students [33,50,18,44]. Faculty should encourage teachers to use interactive resources to gamify education [42] and online learning should be properly blended with face-to-face learning because student-professor interaction is so important [51]. Thus, the decision makers must acquire supplementary interactive whiteboards to make online courses more creative and collaborative.

Online courses preparation. Preparing an online course is also a difficult challenge, the surveyed teachers reported that preparing an online course requires specific devices, computer skills, additional effort and takes more time. Similarly, to [33] students suffered from the low quality of teaching materials. In the same way, [3] finds that sometimes online content is purely theoretical. It does not allow students to practice and study effectively. Poor course content is also a big problem. [7] reported that selecting the appropriate pedagogical model has an impact or consequence on online learning. [45] confirmed that preparing an online course led to considerable additional work for teachers. Many teachers in developing countries are unfamiliar with converting their knowledge into virtual content. To figure out how an idea can be taught through virtual education, the e-learning technique requires several hours of thinking [45]. Teachers must rethink their courses' pedagogies and adopt new pedagogies dedicated to online courses, such as constructivist student-centered teaching in order to improve students' participation and engagement [52]. [50] discovered a significant relationship between course structure and student satisfaction. In the same way, [53] confirmed that creating an online course requires many skills more than delivering content with a traditional course. Teachers should design the course to be taught online; a poorly designed course can lead to students' disengagement [3]. Effective online instructions encourage learners to provide feedback and ask questions thus teachers need pedagogy support in order to usefully conduct online courses [13].

Our study reveals that the faculty during the lockdown ensured educational continuity and provided a reliable online education in terms of digital and educational materials. However, technical problems such as the slow speed of the Internet connection, the lack of knowledge on the use of ICTs to teach and learn, and the low motivation of students were a significant barrier to the use of digital tools by students and teachers.

6 Conclusion

The COVID-19 crisis has had a significant impact on all aspects of society, including education. Closing all educational institutions was among the first actions taken. The suspension of face-to-face learning has posed a real challenge for all countries, and online learning as an e-learning strategy enabled universities to use a variety of online platforms. As a result, online learning and the use of ICT as a complementary educational mode became the only option when university closures were inevitable. This paper investigated the learning and teaching experiences of students and teachers at the Faculty of Sciences Ain Chock during the COVID-19 pandemic and compared them with those of other developing countries summarized in Table 1. Students faced connectivity problems, lack of dedicated study space, lack of personal device for attending online classes, and so on. Despite the difficulties that COVID-19 has caused in educational systems, there have been some benefits. In a short period of time, faulty technical infrastructures were improved. Before the lockdown, most of the surveyed students and teachers had never taken an online course. Furthermore, all of them have been forced to improve their technical knowledge of online learning. For the future of the Moroccan university education system, the Moroccan government, policymakers and universities should invest in rebuilding and revitalizing the education system by promoting online learning and improving the use of ICT technologies.

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