Production Systems and Information Engineering
Volume 12 (1), pp. 1-14
doi: https://doi.org/10.32968/psaie.2024.1.1

IMPLEMENTATION OF E-LEARNING IN SUDANESE UNIVERSITIES: A CASE STUDY OF THE UNIVERSITY OF GEZIRA

GAIS ALHADI BABIKIR
Computer Science, University of Gezira, Sudan
gais.alhadi@hotmail.com

MUKHTAR M. E. MAHMOUD
Faculty of Computer Science and Information Technology, University of Kassala, Kassala, Sudan
mukhtaredris@gmail.com

HUSSEIN A. A. GHANIM
Faculty of Computer Science and Information Technology, University of Kassala, Kassala, Sudan
elrashid2011@gmail.com

Abstract. In light of the circumstances that Sudan is going through (the internal war between the regular army and the Rapid Support Forces), we had to find a way to continue education in universities by applying the e-learning experience. This study aims to conduct an assessment of the readiness of the University of Gezira in order to identify the challenges that may hinder the implementation of the e-learning process in order to address them at an early date. The results of the study revealed that 94% of the faculty members have a computer, and they have the skills to use it, and 71% have a smartphone (or a tablet). Also, about 83% of the staff members are able to prepare their courses electronically, which is very important for the start of e-learning. Furthermore, there is a need to train staff members to use modern technologies that help them in the e-learning process. Moreover, the results showed that the students are distributed in 17 states, and 73.9% of students are from the state of Al Jazirah. The analysis of the results also showed that the best internet service provider that can be used according to geographical distribution is Zain and Sudani.

Keywords: E-learning, Challenges, Higher Education in Sudan, Technology

1. Introduction

The tremendous development that the world is witnessing in the field of technology has greatly affected every aspect of life, especially the educational field, so e-learning has become an indispensable duty to keep pace with the civilizational progression and the development of the educational process. It is worth noting that many educational institutions in the world have resorted to e-learning, especially after the emergence of the Corona pandemic, in order to ensure the completion of the educational process without the need for actual attendance in places of education and study. E-learning can be defined as an educational system that relies

on the use of electronic devices such as computers, tablets, and even smartphones that are connected to the internet. In e-learning, we use appropriate educational media to provide educational programs at anytime and anywhere for students, and it is subject to electronic management to organize the educational processes resulting from it, that is, it is designed in an organized manner with clear learning objectives.

The current studies seek to shed light on e-learning and choose the most appropriate method of education according to the circumstances and natural disasters experienced by the specific geographical area/country. Sudan is one of these countries that suffer from these conditions, especially after the emergence of the Corona pandemic (Covid-19), which greatly affected all sectors, including the education sector, as universities were closed in all states of Sudan, which led to the suspension of education in the country. After that, life continued normally and there were attempts by some universities to continue studying through electronic attribution. Also, in April 2023, an internal war broke out between the regular army in Sudan and the Rapid Support Forces in the Sudanese capital, Khartoum, which spread to the rest of the states, which led to the suspension of education once again in most states in Sudan, especially universities. This study comes to help Sudanese universities to find solutions to continue the educational process through electronic attribution, in a manner commensurate with the conditions of the region.

2. Related Work

In this section, we briefly review some studies related to the subject of e-learning.

In [6], the authors proposed a framework for teachers for a better e-interaction with students. Clearly, the major challenges for e-learning in Romania have been identified. In [7], the author aimed to conduct an assessment of readiness for e-learning in some Sudanese universities. Hence, some policies have been proposed to help boost the cyber readiness of the surveyed universities. Abdullah and Osman [8] designed a questionnaire to assess the influencing factors facing faculty members at the University of Gezira to adopt e-learning in the educational process. Although the results of this study were very good, it did not address the most important aspects related to the educational process, which are the students and the implementation of the courses. Ouadoud et al. [9] provides an overview of free and proprietary e-learning platforms for teaching and learning, and also the types of e-learning devices that can be used for online learning platforms. In [10], the study addressed the importance of online learning in Sudanese universities during the Covid-19 pandemic.

The reader is invited to consult the studies by Shahzad et al. (2021) [11], García-Peñalvo (2021) [12], Maatuk (2022) [13], Coman (2020) [14], and Mseleku (2020) [15] for more details about e-learning in higher education.

3. E-learning in higher education

In this study, we will focus on two types of e-learning that we can see in higher education in Sudan, namely synchronous and asynchronous e-learning [2] [3] [4].

3.1 Synchronous e-learning

This type relies on the internet to access information and connect learners to the e-learning system. Where the preparation of virtual classes, management of educational content (lectures, exercises, seminars, reports, references, etc.), and assessment tools, are carried out online. Among the advantages of this type are

obtaining a direct explanation of the educational content, asking questions directly to the instructor through text, video, or audio chat, as well as obtaining quick feedback (see Figure 1).

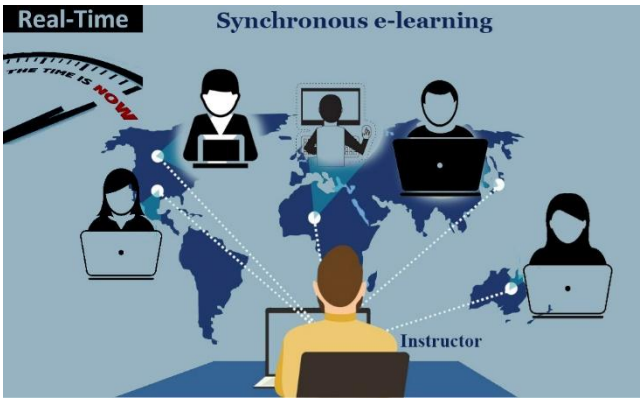

Figure 1. Illustration of synchronous e-learning

3.2 Asynchronous e-learning

In this type, the educational process takes place indirectly at times and locations different from each other without the need to make a real-time connection, where the student can obtain the contents of the course (lectures, exercises, seminars, reports, references, etc.) at the time and place that suits him, as well as the possibility of repeating the learning by referring to the course content at any time. For these reasons, students without good network connectivity and flexible schedules often prefer asynchronous e-learning, as it allows them to benefit from self-learning. In fact, students can wait until they have a good network connection and can set their own timeframes for learning, and they are not required to learn in specific time slots with other students (see Figure 2).

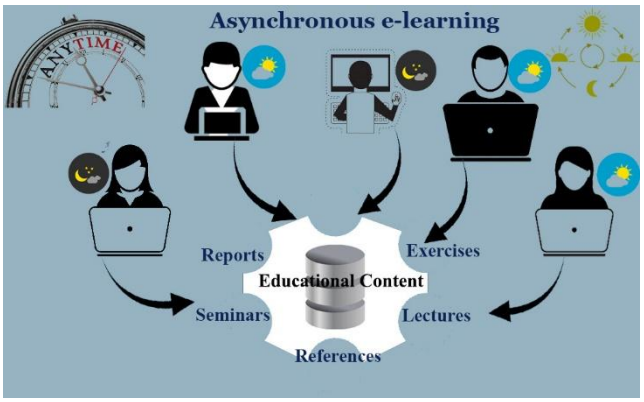

Figure 2. Illustration of asynchronous e-learning

4. Materials and Methods

The sample of the study was students (a sample of 3960) and faculty members (a sample of 260) at the University of Gezira (Sudan). The data collection method used in this study was a survey designed to obtain input from faculty members and students who are able to judge various issues related to readiness for e-learning.

Then, the SPSS (Statistical Package for the Social Sciences), we used for the analysis of collected data.
It should be noted that one of the obstacles to e-learning in Sudan is the weak electronic infrastructure in most universities, and this problem can be solved by improving the electronic infrastructure in universities, at least by establishing a fully equipped office to assist faculty members in preparing course content electronically. Moreover, an e-learning committee should be established in each University/Faculty to deal with problems that can occur.
In the remainder of this section, we will present our proposed model for e-learning in Sudan. Which is based on three main objects faculty members (instructors), students, and courses, as shown in Figure 3.

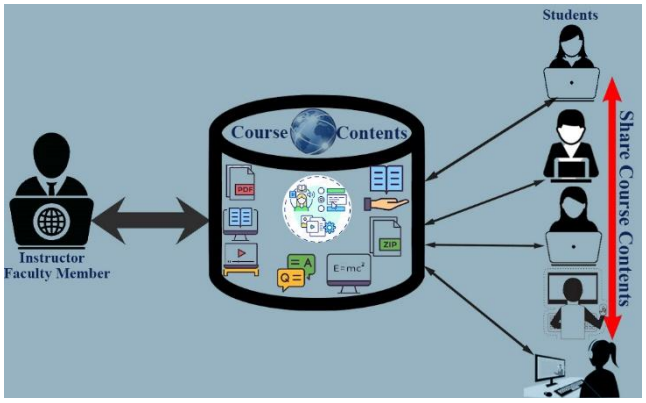

Figure. 3. Illustration of the proposed e-learning model

4.1 Faculty members (Instructors)

One of the challenges facing e-learning in Sudan is that most university faculty members prefer the traditional method (i.e., actual attendance in classrooms) in implementing courses. In fact, this is due to the lack of familiarity with modern technologies, the difficulty of preparing the content of an electronic course, in addition to the presence of some faculty members who are not convinced of the idea of e-learning. Therefore, there is a need to hold specialized training courses to develop the skills of university faculty members in using modern technologies to prepare course contents and upload them to the e-learning platform.

4.2 Courses Contents

4.2.1. Learning Management Systems

In Figure 4 we suggest some of the best Learning Management Systems (LMS) [5] software systems that can be used to manage the contents of courses. Clearly, under the free licensing platforms, we recommend Moodle (which is an open-source learning platform). Also, for the licensed platforms, we recommend Blackboard Learn. It should be noted that the course contents (i.e., lectures, exercises, seminars, reports, references, etc.) can be in PowerPoint, PDF, Video, Audio, …, etc.

Figure 4. Best LMS platforms for e-learning model

4.2.2. Course Group

We recommend supporting the e-learning process with the Telegram application | WhatsApp. This is to answer students' inquiries about the course, and a faculty member can answer them when he is available online.

4.2.3. Virtual Class

For virtual classes, we recommend using: Zoom and Google Meet.

4.3 Students

4.3.1. Registration

Students can register for the Semester | academic year through the university's electronic registration system.

4.3.2. Access to Course Contents

Students can access the course contents when they have internet, otherwise, they can share the course contents with each other’s. Furthermore, we recommend that all the contents of the courses be provided in one office in the University/Faculty where the students study or the nearest place where the students are, so that they can obtain it easily. In addition, students who do not have a smartphone or computer can contact the University/Faculty e-learning committee to help them, possibly by obtaining a smartphone | computer or providing a place to study.

5. Results

Given the importance of e-learning, its success depends not only on the availability of technology but also on the support of faculty and students to make the educational process a success. In the following subsections, we will present the results of the analysis of the data we collected from faculty members and students.

5.1 Faculty members

In this subsection, we provide the results of faculty members in Table 1, Figures. 5, 6, 7, 8, 9, 10, 11, 12, and 13. As we can see in Table 1, most of our results come from the staff members most involved in the educational process (i.e., Lecturers by 56.9% and Assistant Professors by 29.6%).

Table 1. Job Description

staff members	Frequency	Percent %
Professor	6	2.3
Associate Professor	29	11.2
Assistant Professor	77	29.6
Lecturer	148	56.9
Total	260	100%

One of the challenges facing e-learning is owning a computer and knowing how to use it to prepare lectures electronically. As we can see in Figures. 5, 6, and 7, most of the staff members have a computer (or a smartphone) with acceptable skills, which is very important to start e-learning.

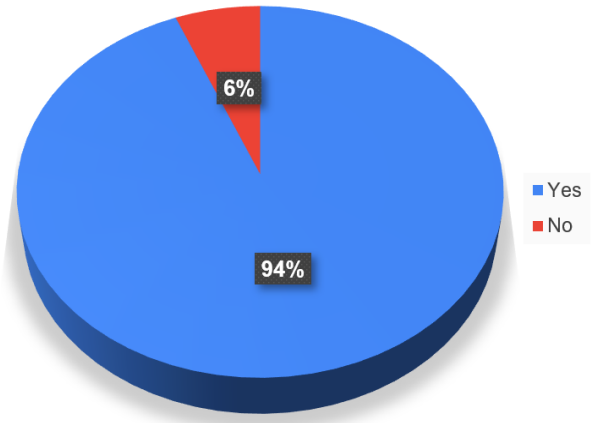

Figure 5. Do you have a computer (desktop or laptop)?

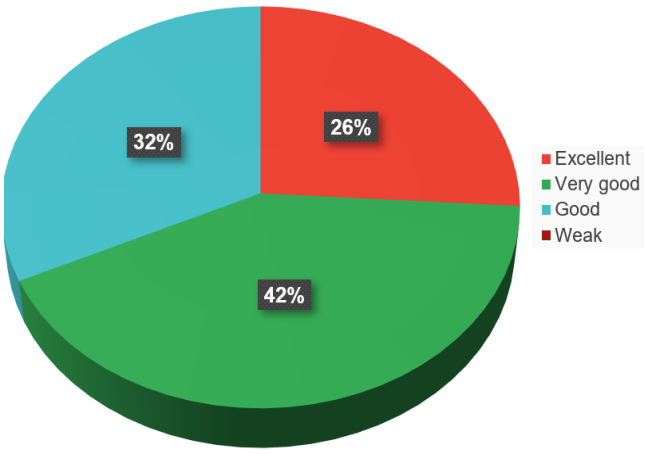

Figure 6. What are your computer skills?

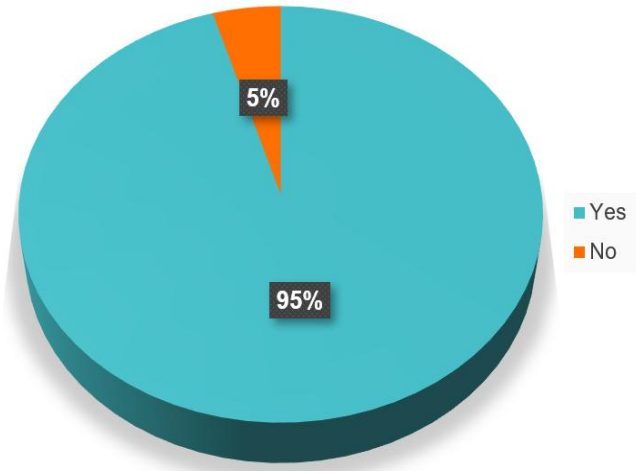

Figure 7. Do you own a smartphone (or tablet)?

Also, as we can see in Figure 8 about 71% of staff members have previously benefited from the Internet experience in the educational process as learners, which is also good for moving forward towards the e-learning experience.

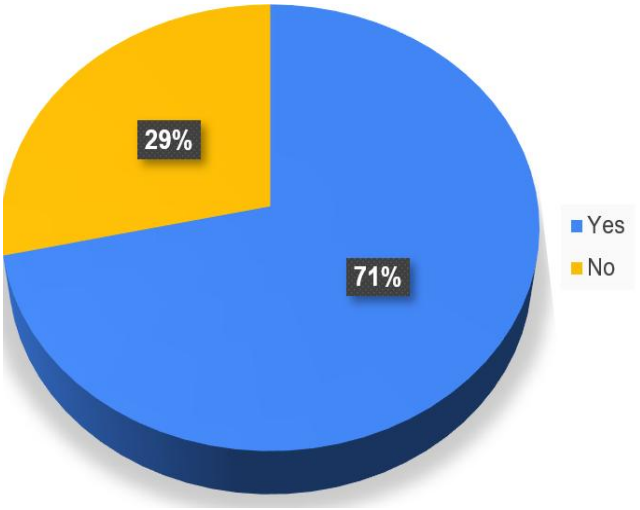

Figure 8. Have you ever benefited from the Internet experience as a learner?

Moreover, the analysis of the results showed that about 44% of staff members use Zain as an internet service provider, whereas 42% use Sudani, and 14% use MTN (see Figure 9).

In Figure 10, we present the quality of internet service in the staff area. Also, we can see in Table 2 Zain has good quality compared to Sudani and MTN.

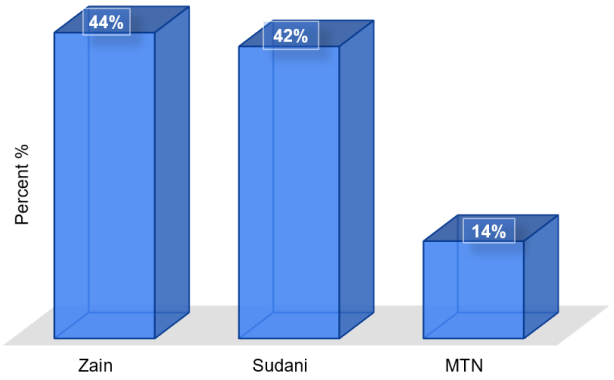

Figure 9. What internet service provider do you use in your area?

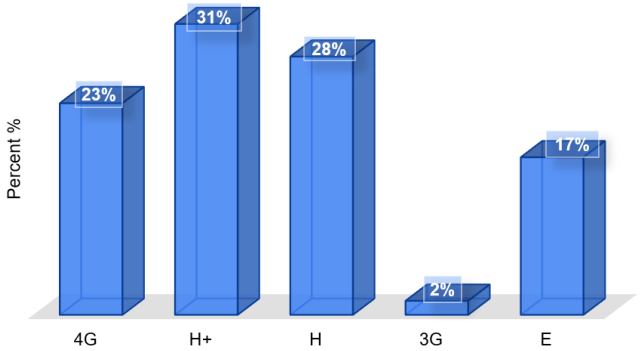

Figure 10. What is the quality of Internet service in your area?

Table 2. Crosstabulation: internet service provider vs. quality of internet service

Internet Service Provider	4G	H+	H	3G	E	Total
Zain	31	39	27	3	15	115
Sudani	27	26	34	0	22	109
MTN	1	16	11	1	7	36
Total	59	81	72	4	44	260

From Figure 11, we can see that 83% of the staff members are able to prepare their courses electronically. However, Figure 12 shows that about 54% of the staff did not use either Google Meet, Zoom, or Microsoft Teams. So, as we mentioned before, there is a need to train staff members to use modern technologies that help them in the e-learning process.

Finally, from Figure 13 we can see that about 65% of the staff members preferred WhatsApp to communicate with students, while 24% preferred Telegram. Therefore, we recommend using Telegram as it has good functionalities to increase the student's engagement.

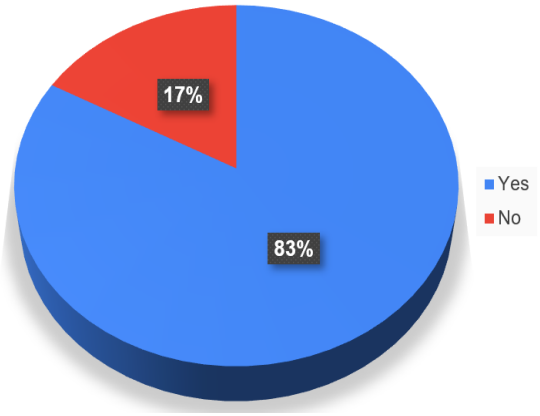

Figure 11. Can you prepare the course electronically (PPT presentation, video recording, audio recording, ... etc.)

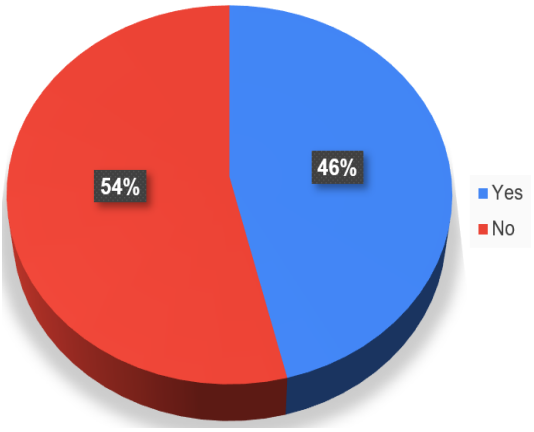

Figure 12. Have you used any of the following programs before (Google Meet, Zoom, Microsoft Teams)?

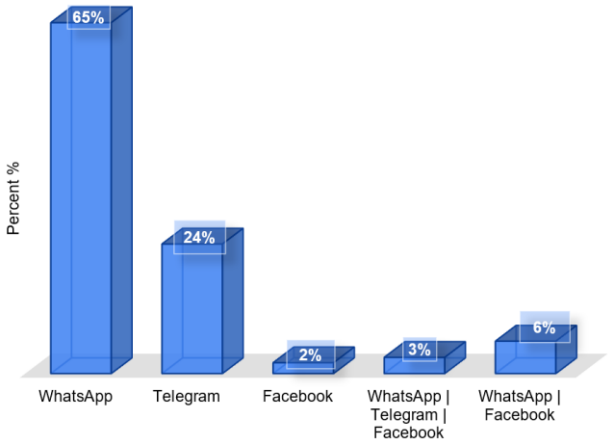

Figure 13. What is your preferred way to communicate with students via social media as an academic advisor or a course instructor?

5.2 Result of Students

This section displays student results by student location, state, and city Moreover, there are other challenges facing e-learning among students, which we will address in the following questions: Have you ever benefited from the Internet experience as a learner? Do you have (or can you provide) a computer or smartphone? What internet service provider do you use in your area? What is the quality of Internet service in your area? What is the best way to contact you?

According to the data we have collected 99% of the students are from inside Sudan and 1% are from outside Sudan (see Fig. 14). As we can see in Table 3, the students are distributed in 17 states and a number of cities presented in Table 4, it is clearly that 73.9% of students are from the state of Al Jazirah and 50.9% from the city of Wad Madani. This must be taken into account in the implementation of the e-learning experience.

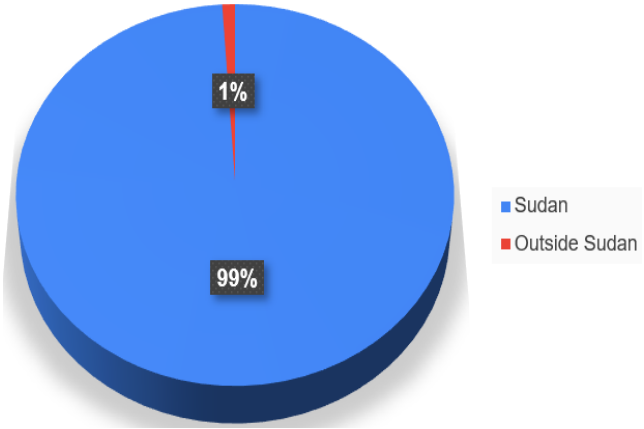

Figure 14. Students' location

Table 3. Students' states

Students' states	Frequency	Percent %
Al Jazirah	2927	73.9
Khartoum	540	13.6
Al Qadarif	80	2.0
North Kurdufan	31	0.8
West Kordofan	13	0.3
Sennar	117	3.0
White Nile	53	1.3
Red Sea	15	0.4
Gharb Darfur	6	0.2
South Darfur	32	0.8
East Darfur	10	0.3
North Darfur	11	0.3
Northern	18	0.5
River Nile	24	.6
Blue Nile	9	0.2
Kassala	29	0.7
Central Darfur	7	0.2
Outside Sudan	38	1.0
Total	3960	100%

Table 4. Students' cities

Students' cities	Frequency	Percent %
Khartoum	416	10.5
Sennar	124	3.1
Nyala	31	.8
Wad Madani	2015	50.9
Outside Sudan	38	1.0
Omdurman	74	1.9
Khartoum Bahri	51	1.3
Al Qadarif	55	1.4
Kassala	35	.9
Alfa	16	.4
El Obeid	31	.8
El Fula	13	.3
Ad Douiem	13	.3
Rabak	21	.5
Kosti	19	.5
Port Sudan	6	.2
Suakin	9	.2
Al Junaynah	6	.2
El Daein	8	.2
Rufaa	181	4.6
Tamboul	24	.6
Hantoob	12	.3
Al Hasaheisa	321	8.1
Al Manaqil	185	4.7
South of Al-Jazirah	60	1.5
Al Kamlin	105	2.7
Al Qurashi	12	.3
Abu Asher	10	.3
Al Fashir	10	.3
Al Shmalea	18	.5
Al Damar	7	.2
Atbara	9	.2
Shandi	9	.2
Er Roseires	9	.2
Zalingei	7	.2
Total	3960	100 %

From Figure 15 we can see that 50% of the students benefited from the Internet experience as a learner and 50% did not. Furthermore, in Figure 16 we can see that 73% of the students can own a computer or smartphone. Which is also a positive point to move forward with the e-learning experience.

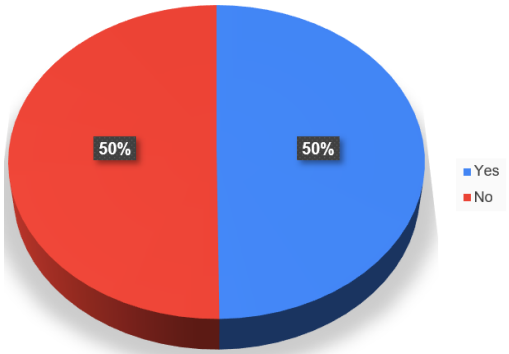

Figure 15. Have you ever benefited from the Internet experience as a learner?

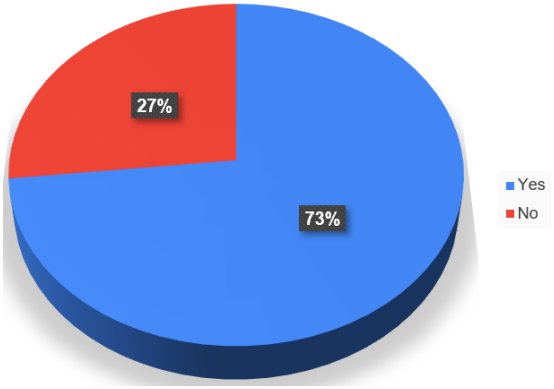

Figure 16. Do you have (or can you provide) a computer or smartphone?

In Figure 17, we can see that about 48% of students use Zain as an internet service provider, whereas 31% use Sudani, and 21% use MTN. The quality of Internet service has been presented in Figure 18. From the crosstabulation in Table 5, we recommend using Zain, which has good quality compared to Sudani and MTN. Finally, from Figure 19 we can see that about 76% of the students prefer to communicate via WhatsApp.

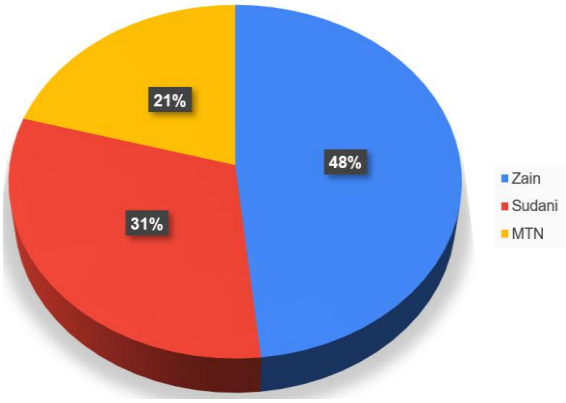

Figure 17. What internet service provider do you use in your area?

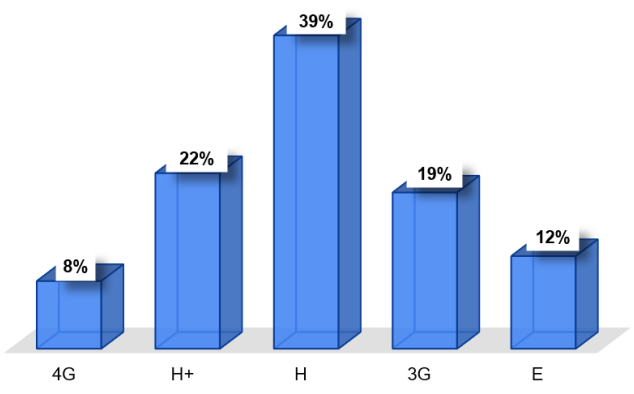

Figure 18. What is the quality of Internet service in your area?

Table 5. Crosstabulation: internet service provider vs. quality of internet service

Internet Service Provider	4G	H+	H	3G	E	Total
Zain	183	427	718	379	207	1914
Sudani	95	269	462	238	165	1229
MTN	53	169	360	151	84	817
Total	331	865	1540	768	456	3960

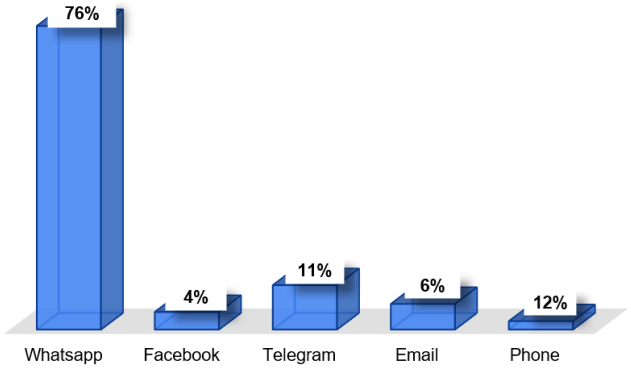

Figure 19. What is the best way to contact you?

6. Conclusion

In recent years, in the direction of digital transformation, university teaching methods have evolved, as most universities use e-learning platforms to support educational activities. This study was conducted to assess the challenges facing the e-learning system in Sudanese universities in general and the University of Gezira in particular. And this is in light of the circumstances that Sudan is going through (the war crisis between the Sudanese army and the Rapid Support Forces). Hence, in order to push higher education forward, it was necessary to find a way to apply the e-learning experience, and in order to ensure a higher success rate, some assessments must be made at the level of students and faculty members. Therefore, we used the questionnaire to collect data from 3960 students and 260 faculty members at the University of Gezira.

The study concluded that the most suitable e-learning experience according to the conditions in Sudan is asynchronous e-learning, which can be achieved if some challenges are addressed, which are as follows: Improving the e-learning infrastructure; Training faculty members to use modern technologies that help them in the e-learning process; Creating a course group on Telegram to answer students' questions about the course. On the other hand, the results revealed that the best internet service provider that can be used according to geographical distribution is Zain and Sudani.

References

[1] Allen, Michael W. Michael Allen's guide to e-learning: Building interactive, fun, and

effective learning programs for any company. John Wiley & Sons, 2016.

[2] Khaldi, Amina, Rokia Bouzidi, and Fahima Nader. "Gamification of e-learning in higher education: a systematic literature review." Smart Learning Environments 10, no. 1 (2023): 10. https://doi.org/10.1186/s40561-023-00227-z

[3] Mahoney, Jamie, and Carol A. Hall. "Exploring online learning through synchronous and asynchronous instructional methods." In Exploring online learning through synchronous and asynchronous instructional methods, pp. 52-76. IGI Global, 2020. https://doi.org/10.4018/978-1-7998-1622-5.ch003

[4] Amiti, Flora. "Synchronous and asynchronous E-learning", European Journal of Open Education and E-Learning Studies 5, no. 2 (2020). http://dx.doi.org/10.46827/ejoe.v5i2.3313

[5] Bradley, Vaughn Malcolm. "Learning Management System (LMS) use with online instruction." International Journal of Technology in Education 4, no. 1 (2021): 68-92. https://doi.org/10.46328/ijte.36

[6] Sovic, Dear Anja. "5 th World Conference on Learning, Teaching and Educational Leadership 29-30 October 2014, Prague-Czech Republic." (2014).

[7] Nisperos, Lea Sorilla. "Assessing the e-learning readiness of selected Sudanese Universities." Asian Journal of Management Sciences & Education 3, no. 4 (2014): 45-59.

[8] Osman, Yassin. "Implementation of e-learning in the University of Gezira barriers and opportunities." (2017). https://doi.org/10.22496/esr2016090470

[9] Ouadoud, Mohammed, Nouha Rida, and Tarik Chafiq. "Overview of E-learning Platforms for Teaching and Learning." Int. J. Recent Contributions Eng. Sci. IT 9, no. 1 (2021): 50-70. https://doi.org/10.3991/ijes.v9i1.21111

[10] Viju, G. K. "Online and distance learning In Sudanese Universities: A necessity in the light of the covid-19 pandemic." International Journal of Engineering Applied Sciences and Technology 5, no. 10 (2021): 11-19.

[11] Shahzad, Arfan, Rohail Hassan, Adejare Yusuff Aremu, Arsalan Hussain, and Rab Nawaz Lodhi. "Effects of COVID-19 in E-learning on higher education institution students: the group comparison between male and female." Quality & quantity 55 (2021): 805-826. https://doi.org/10.1007/s11135-020-01028-z

[12] García-Peñalvo, Francisco Jose. "Avoiding the dark side of digital transformation in teaching. An institutional reference framework for eLearning in higher education." Sustainability 13, no. 4 (2021): 2023. https://doi.org/10.3390/su13042023

[13] Maatuk, Abdelsalam M., Ebitisam K. Elberkawi, Shadi Aljawarneh, Hasan Rashaideh, and Hadeel Alharbi. "The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors." Journal of computing in higher education 34, no. 1 (2022): 21-38. https://doi.org/10.1007/s12528-021-09274-2

[14] Coman, Claudiu, Laurențiu Gabriel Țîru, Luiza Meseșan-Schmitz, Carmen Stanciu, and Maria Cristina Bularca. "Online teaching and learning in higher education during the coronavirus pandemic: Students' perspective." Sustainability 12, no. 24 (2020): 10367. https://doi.org/10.3390/su122410367

[15] Mseleku, Zethembe. "A literature review of E-learning and E-teaching in the era of Covid-19 pandemic." (2020): 588-597.