Instructors Experience of using Cloud Computing Based Applications in Saudi Arabia

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***Abstract*— With the recent global spread of the COVID-19 (also known as the corona virus) pandemic, several governments have attempted to control its transmission through preventive and precautionary measures. Education is one of the factors that has been impacted by the pandemic. As a result, to limit the spread of the virus, many countries adopted distance education instead of traditional education to ensure the continuity of the educational process. Cloud computing is a technology that offers numerous advantages in the field of education. The Kingdom of Saudi Arabia was one of the countries that had decided and continues to use various cloud platforms for distance education. In this study, we look at how effective cloud computing platforms are in the learning process in Saudi Arabian schools. The primary goal of this research was to investigate the teacher's ability to access different cloud computing services, as well as their ease of use and utility, by evaluating the effectiveness of these platforms as a mode of teaching before and after the pandemic. A total of 559 male and female schoolteachers' data was collected using self-administered questionnaires in Al-Bahah region and was analyzed using the IBM SPSS Statistics software. The analysis of this study expanded our understanding on the possibility of using educational platforms across schools in the kingdom. The findings also revealed that the use of cloud platforms during the pandemic increased by 28% in the region which have now become integral part of education. Furthermore, the findings revealed that teachers frequently encountered difficulties in implementing cloud-based educational processes, particularly in rural and mountainous areas.**

Keywords—cloud computing, education, e-learning, distance education, Saudi Arabia

I. Introduction

The recent global pandemic resulted in dramatic changes at all levels and in various fields. The Kingdom of Saudi Arabia implemented quarantine procedures between 2020 to 2022. The educational sector was one of the first to be affected by this epidemic. Several schools and universities were closed down immediately in many countries around the world, and formal education had to be suspended in order to enforce strict social distancing regulations. Distance education, is defined as the use of technological tools to provide education and applications to students via the Internet while also monitoring their development and academic performance [1]. Distance education emerged as a solution to this quandary with the spread of COVID-19 and was quickly adopted in many countries, including the Kingdom of Saudi Arabia. In response to the pandemic, the Saudi Ministry of Education (MOE) made a quick decision to implement distance learning across the country for all the students and at all academic and university levels. There are two types of distance education identified in this study: synchronous and asynchronous based learning. Students could access asynchronous learning based on their needs, including video lessons and lectures, recorded audio, and email correspondence, as well as video and audio conferencing and duplex connections that allow students and teachers to interact directly with each other [2]. To support the online educational process, many educational platforms, such as Classera, Edmodo, Zoom, and Microsoft Teams, were integrated. Earlier platforms relied on a cloud-based on-demand model [3].

Initially, educational material was provided to school students via asynchronous electronic services, the most notable of which was the Ain educational channel, which displayed all of the lessons created by teachers for the students. Later, at the start of the new academic year, the ministry began to heavily rely on simultaneous e-learning, which allowed teachers to present relevant courses to their students online over the Internet to facilitate interaction between them. This brief shift in educational policy caused significant consternation among ministries, teachers, students, as well as parents. Despite significant efforts to improve distance learning, the lack of nonverbal contact, time management challenges, and communication consistency concerns remained a major problem for both students and instructors. Hence, this study aimed to understand and determine teachers' preferences for cloud-based educational platforms. The study officially included Al-Bahah region teachers of all levels. Self-administered questionnaires were used to collect data, and statistical results were extracted using IBM SPSS Statistics.

The rest of this paper is organized as follows. Section 2 discusses previous studies related to the research topic at hand, Section 3 discusses the retrospective analysis conducted, Section 4 includes the statistical results while Section 5 covers our discussions and findings. Section 6 concludes the paper and makes further recommendations for this research.

II. Review of Literature

In [4], a descriptive analysis was performed demonstrating how pre-service instructor courses tend to allow instructors to use online lessons. These courses also allowed students to interact with teachers and improve their academic abilities by utilizing online networking resources. In that study, three stages of experience were identified: preparation, implementation, and reflection. The study's findings assisted in mitigating the disadvantages of online teaching and provided a method for utilizing parental support.

The preference for using educational technology (EdTech) rather than traditional schooling was evaluated in [5]. This study included two examinations with a test group of 10,000

students from primary schools in China and Russia. On the one hand, it was concluded that commitment to EdTech exercises has a positive effect on academic achievement in China. In Russia, however, it was concluded that EdTech may be a limited substitute for formal schooling. The report also suggested that, with some constraints and caution, EdTech can be used as a holistic alternative to traditional school curricula.

Similarly, in [6] the perspectives of 362 teachers and students on the effects of a sudden shift from the traditional system of education to distance learning were discussed. The study's findings suggested that online education could have a significant impact on the educational process. The results also showed that traditional training was more effective than online training. [7] discussed the differences in effectiveness between the e-learning model and the traditional classroom method. Questionnaires and interviews were conducted to find the statistics on students and instructors. According to the findings, half of the participating teachers were aware that learning through cloud platforms had facilitated the learning process. Furthermore, 92% of teachers stated that using cloud computing technologies to educate their students is more comfortable than the traditional method.

[8] sought the opinions of medical students at the College of Medicine and Medical Sciences on receiving distance education via the Internet. In total, 60 medical students participated in the study. Participants in the study stated that they frequently encounter technological and behavioral challenges when taking exams. Nonetheless, they reported that they welcome online education. This means that many pre-clinical students would be able to pursue their academic studies via distance learning in the coming years.

In [9], the authors discussed the significance of cloud computing in the e-learning field in Riyadh, Saudi Arabia. They analyzed two questionnaires, one with university information technology (IT) staff and the other with students, as well as secondary data from previous studies. They concluded that cloud computing improves the quality of service provided to users while also strengthening communication among them. They also stated that cloud computing is successful in learning organizations because it improves students' professional skills and experiences and prepares them for everyday situations. The survey also revealed that cloud computing simplifies and improves the field of IT while lowering costs by allowing such organizations to pay only for IT services and resources.

The authors in [10] discussed the concept of emergency remote teaching at Middle East College in Muscat, Oman. In their study, they used a two-stage strategy: (1) an online curriculum transformation lecture via Microsoft Teams, which is then recorded and uploaded to the Moodle platform, and (2) employee development through training courses. Data on four-week student and instructor experiences with synchronous and asynchronous learning were collected. The study's findings revealed that asynchronous lectures are more important than synchronous ones because they allow students who are unable to attend to participate. Furthermore, the results revealed that courses with a final exam are more attended, by more than 30%, than those without a final exam. It was also discovered that classes requiring a presentation task are 45% more likely to be attended than classes requiring a writing task. In general, students' levels are related to their attendance. Another study in Oman [11] looked at the impact of Google Classroom on the learning process at Oman College. They used IBM SPSS Statistics to analyze the data in their study. The main findings of that study revealed that distance learning is convenient and that the Google Classroom framework is simple to use.

A similar study was recently conducted on 1,692 university students to investigate the effects of distance learning during the COVID-19 pandemic in [12]. An online survey was used to collect data for the study. To analyze the data and extract the results, all analyses were carried out using the SmartPLS 3 software. The findings revealed that students were comfortable using computers and learning technologies to study, but that they would also like to return to traditional education. On the psychological front, some studies sought to reveal faculty members' perceptions of their emotional intelligence during the pandemic in some Indian universities [13]. To collect data, an online questionnaire was distributed, and the study sample included 683 faculty members. The study's findings revealed that faculty members' perceptions of their emotional intelligence were higher than average during the outbreak. Researchers from Wuhan, the source of the COVID-19 outbreak, proposed a cloud computing platform called Eduforce for distance learning and continuing education in universities in [14]. After reviewing and comparing with others, this platform was proposed to unify the educational platforms in China.

Nenko et al. conducted a survey focusing on online learning imposed by the Ukrainian government during quarantine in [15]. They distributed an anonymous questionnaire via Google Classroom and Google Forms, and emailed 540 respondents from three major higher-education institutions. The goal of that survey was to investigate students' actions and their need for distance learning, as well as to identify the issues associated with providing data to stockholders in order to improve distance learning and help students understand better. All analyses were conducted using IBM SPSS Statistics and revealed that digital media is often ineffective in higher education.

The authors of [16] considered the factors that may prevent the adoption of cloud computing in the educational sector in Kenyan universities. A questionnaire was used to collect data from 69 higher-education institutions for that study. The findings revealed that more than 95% of higher-education institutions use cloud computing, though, as with any other institution, there are privacy and security concerns. The authors of [17] investigated the impact of e-learning service quality on students by analyzing the responses of 300 people using IBM SPSS Statistics and SmartPLS tools. According to the findings of that study, the first criterion is the quality of the e-learning service, followed by the instructor, and finally the course itself. However, the authors did not identify the population in order to determine whether the sample was appropriate. The authors of [18] discussed the benefits of using Google applications at Muhammadiyah Yogyakarta University in Indonesia. They used a five-stage method, which included preparation, analysis, migration to Google Cloud, concluding cloud migration, and finally maintenance. The main conclusion was that Google Cloud has many advantages in supporting online activities.

Kurelovic et al. investigated whether students require cloud applications and services, the scope of their use, and the types of applications and services required in [19]. The study was conducted at the University of Rijeka in Croatia, with a three-part questionnaire published in Google Docs. Students

provided 158 responses in total. The findings revealed that students frequently use cloud communication to share and learn rather than storage or file synchronization. [20] discussed in detail the benefits of using cloud computing in the educational sector in the Kingdom of Saudi Arabia, as well as cloud service models, deployment models, features, advantages, benefits of using e-learning in the cloud, some examples, and challenges that may arise. Following a review of previous studies, five steps were proposed to ensure progress in cloud management. Finally, a hybrid cloud model for higher education institutions was proposed, which aids in the sharing of research processes with a variety of information aspects. Finally, a hybrid cloud model for higher education was proposed, which aids in the sharing of research processes with a variety of information aspects.

TABLE I. DEMOGRAPHIC DATA STATISTICS

Variable	Assessment	Frequency
Gender	Male	131
	Female	305
Age (year)	Below 25	1
	25–30	16
	30–35	47
	35–40	163
	Over 40	209
Educational level	Institute	34
	Bachelor	366
	Master's	36
School location	Village	219
	City	217
Major	Religion	116
	Arabic	65
	Social education	45
	Math	53
	Biology	18
	Chemistry	13
	Physics	7
	Computer	26
	English	36
	Home economics	42
	Sports	9
	Art	8
Graduation (years)	Less than 5	8
	5–10	26
	10–15	82
	15–20	124
	Over 20	196
Experience (years)	Less than 5	18
	5–10	102
	10–15	82
	15–20	83
	Over 20	151
Sector	Public	428
	Private	3
	International	5

III. RETROSPECTIVE ANALYSIS

In this section, we will explore how our analysis stages fit into the entire research process after presenting the analytical approach we employed. The purpose of this study was to determine the impact of COVID-19 on the adoption of cloud computing in schools in the Al-Bahah region through analyzing the information provided by teachers. The investigation of the phenomenon in question served as the foundation for a quantitative and qualitative approach that aimed to appropriately describe and express the phenomenon in both qualitative and quantitative terms. The qualitative term describes and illustrates the phenomenon. To explore the link between variables and express the strength of the relationship in a quantitative description using quantitative measurements, other phenomena were used, such as the descriptive approach [20]. Through the review of literature, descriptive analytical approach was selected as the best way for this study to fulfill its goals while ensuring objectivity and accuracy [21, 22].

A. Study Data

The study population included both male and female teachers from the Al Bahah region in Saudi Arabia which, according to MOE statistics, had nearly 10,000 people preparing for the new academic year [23]. The questionnaire was distributed via social media and educational offices in the region across differnt schools. The collected sample size for our study consisted of 559 male and female teachers.

As part of data collection, following a review of previous studies, we developed a questionnaire and distributed it to professors of evaluation and measurement to assess the impact of COVID-19 on the use of cloud computing platforms. The IBM SPSS questionnaire tool was used to collect data (Google Forms) [24]. Statements were graded on a five-point Likert scale ranging from 1 (never, extremely low) to 5 (extremely high) (always, extremely high). The questionnaire was divided into two sections: one containing teacher's demographic information and the other containing questions about cloud platforms. Table 1 provides an overview of the demographic variables of the respondents after preprocessing, which included removing random responses with contradictory answers to questions (e.g., "I need training on using the platforms, but I did not encounter any problems with it"). Table 2 lists the questions that were asked to male and female teachers working at different schools in the region.

TABLE II. TEACHERS QUESTIONNAIRE SURVEY

#	Question
1	The educational platforms that you used before the COVID-19 pandemic
2	I used cloud computing platforms prior to the COVID-19 pandemic in the educational process
3	I used cloud computing platforms prior to the COVID-19 pandemic in the process of communicating with my students
4	I will use cloud computing platforms in the educational process with my students in the future, even with traditional education
5	I will use cloud computing platforms to communicate with my students in the future, even with traditional education
6	I need training on the use of cloud computing platforms
7	I am facing problems while using cloud computing platforms
8	The educational platforms that I use for education during the COVID-19 pandemic
9	What is the most prominent problem that you face during education through cloud computing platforms?

IV. Survey Statistics

This survey was divided into three sections similar to [25, 26]. The first axis examined the use of cloud computing platforms in education prior to the COVID-19 pandemic, the second axis examined the use of cloud computing platforms in education during the COVID-19 pandemic, and the third and final axis examined the challenges that teachers face when using cloud computing platforms in education.

A. First Axis

Table 3 displays the first axis statistical results showing Never (N), Rarely (R), Sometimes (S), Often (O), and Always (A) along with mean (μ) and standard deviations (σ) [27]. As can be seen, the use of cloud platforms by teachers for educational reasons obtained a mean of 3.34, which is equivalent according to the five Likert scales. Additionally, it can be seen that the platforms used to communicate with students had a mean of 2.97, which is equivalent to "sometimes" as per the Likert scale.

TABLE III. First Axis Statistics

Question	N	R	S	O	A	μ	σ
	#	#	#	#	#		
	%	%	%	%	%		
I used cloud computing platforms prior to the COVID-19 pandemic in the educational process	33	62	151	100	89	3.3	1.1
	7.6%	14.3 %	34. 7%	23 %	20. 5%		
I used cloud computing platforms prior to the COVID-19 pandemic in the process of communicating with my students	81	84	115	75	80	2.9	1.3
	18.6 %	19.3 %	26. 4%	17. 2%	18. 4%		
Mean for the first axis						3.155 Sometimes	

B. Second Axis

The usage of computer platforms after returning to traditional schooling (post pandemic) were the subject of two questions from the second axis that are shown in Table 4. The results demonstrated that the asymptotic averages for both questions were 3.82 and 3.76, respectively, which are equivalent to "Often" as per the Likert scale.

TABLE IV. Second Axis Statistics

Question	N	R	S	O	A	μ	σ
	#	#	#	#	#		
	%	%	%	%	%		
I need training on the use of cloud computing platforms	31	65	165	91	83	3.2	1.1
	7.1 %	14. 9%	37. 9%	20. 9%	19. 1%		
I am facing problems while using cloud computing platforms	24	66	193	104	48	3.1	1.0
	5.5 %	15. 2%	44. 4%	23. 9%	11 %		
Mean for the third axis						3.248 Sometimes	

C. Third Axis

The third axis values for the difficulties in using cloud platforms are displayed in Table 5. The mean values in this table, which correlate to the Likert scale, shows that there is "sometimes" some difficulty using such platforms as per the Likert scale.

TABLE V. Third Axis Statistics

Question	N	R	S	O	A	μ	σ
	#	#	#	#	#		
	%	%	%	%	%		
I will use cloud computing platforms in the educational process with my students in the future, even with traditional education	10	18	126	163	118	3.82 99	0.9
	2.3 %	4.1 %	29 %	37.5 %	27.1 %		
I will use cloud computing platforms to communicate with my students in the future, even with traditional education	15	22	134	145	119	3.76 09	1.0
	3.4 %	5.1 %	30.8 %	33.3 %	27.4 %		
Mean for the second axis						3.79 Often	

V. Discussions

The utilization of educational platforms before and after the epidemic in the Saudi Arabian schools were compared using statistical analysis. We discovered that before the COVID-19 epidemic, WhatsApp and Google platforms saw the highest utilization rates (i.e., 27% and 1%, respectively), while Edmodo and Moodle saw the lowest usage rates (i.e., 1%). The use of the Microsoft platform, however, climbed to 28% during the COVID-19 pandemic, which is thought to be the highest proportion of educational use during the pandemic, as opposed to the Google platform and WhatsApp, which scored 24% and 20%, respectively. Classera, Edmodo, and Moodle, the other educational systems, saw the lowest utilization before and throughout the pandemic.

The questionnaire also contained an open-ended question to the teachers as shown in Table 6. The responses we received addressed general issues that raised in online teaching, particularly with cloud computing applications [28]. These problems included concerns regarding the Internet connection, which is not sufficient in many villages in the Al-Bahah region. They also included technical difficulties and a lack of knowledge about how to use cloud computing applications, as well as an urgent need for training courses that would enable teachers to use these applications to support the remote educational process. The need to train primary-school students and their parents on how to use cloud computing applications to help them with their tests and assignments was also one of the issues as detected in similar study [29]. Another main problem identified was the insufficient number of devices either for the teachers or for the students. Student punctuality were also identified as a major issue because some students are unaware of the value of education and some parents are negligent. Other reasons included high cheating rates, difficulty leading the class, and difficulty teaching the students.

TABLE VI. OPEN-ENDED QUESTIONNAIRE STATISTICS

What was the most difficult issue you encountered while teaching online using cloud computing platforms?	Count	Percentage
Internet connection problems	249	53.5%
Technical problems	91	16.51%
Insufficient devices	10	1.81%
Requiring more training on the use of online learning platforms	93	16.91%
Student punctuality	24	4.36%
Other reasons	53	9.61%
None	30	5.45%
Total answers	550	100%

The main problem, as shown in the above results table, was the Internet connection, which was perceived to be nearly equal to the total of the other problems, at a rate of 53.5%. The imperative need to train students, teachers, and parents on cloud computing applications was the second largest challenge, accounting for 16.91% of the total. This was followed by technical issues (16.51%), which were caused by a lack of knowledge about these applications as well as some Internet or device-related issues. Other factors, some of which have already been mentioned, accounted for 9.61% of the total. In total, 5.45% of teachers reported no problems with online learning, 4.36% reported some problems due to low student punctuality and parents' lack of concern, and 1.81% complained about a lack of facilities. Figure 6 depicts the consequences of the open question.

VI. CONCLUSIONS AND FUTURE WORK

The recent COVID-19 had a huge impact on the field of education resulting in distant learning becoming the primary mode of instruction and has become an integral part of education even post-pandemic. In order to begin this study, we first reviewed the prior research on how cloud computing platforms were used both before and during the recent epidemic. We discovered that distant learning has been greatly facilitated by cloud computing platforms. The effectiveness of cloud computing platforms among instructors in the Al Bahah region before and during the COVID-19 outbreak was officially investigated. The findings demonstrated that instructors had been used cloud computing services prior to the epidemic, with WhatsApp and Google having the highest rate of 27% utilization. The Microsoft platform, however, gained 28% more ground following the outbreak. Internet connectivity is the most frequent problem teachers encountered, with a rate of 53.5%, according to the third axis on the difficulties of utilizing cloud computing platforms. This is followed by technical issues and the requirement for training, which have rates of about 16.51% and 16.91%, respectively.

As part of future research, more attention is needed to fully understand cloud computing systems and users in remote regions of Saudi Arabia. Future directions could also consider learning and looking at further samples of teachers from different geographic locations. Additional research on the side of students and parents would also be necessary to have a complete picture on the experience of using cloud computing-based services before and after the COVID-19 epidemic. We also recommend conducting research on utilizing social media platforms and their advanced analytics as part of blended learning and students' performance evaluations.

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