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Impact of COVID-19 on the Educational Process in Saudi Arabia: A Technology–Organization–Environment Framework

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Abstract: The lockdown of universities and educational institutions during the COVID-19 pandemic has negatively impacted the educational process. Saudi Arabia became a forerunner during COVID-19 by taking initial precautions of curfews and total restrictions. However, these restrictions had a disruptive effect on various sectors, specifically the educational sector. The Ministry of Education strived to cope with the consequences of these changes swiftly by shifting to online education. This paper aims to study the impact of COVID-19 on the educational process through a comparative study of the responses collected from different cases, and the challenges that are faced throughout the educational process. The study conducted a cross-sectional, self-administered online questionnaire during the outbreak and distance learning, which was designed based on the Technology–Organization–Environment (TOE) framework of students. Most questions used a five-point Likert scale. The responses were randomly collected from 150 undergraduate and postgraduate students who were studying in Saudi Arabian universities, to study the overall performance of education institutions during COVID-19. The collected data were analyzed and compared to the results in the literature. The main factors impacted by this transformation are addressed. These factors are based on research and observations and aim to overcome the encountered limitations and to present their level of impact on distance education. The research framework can be useful for higher educational authorities aiming to overcome the issues highlighted and discussed in this study.

Keywords: COVID-19; pandemic; educational process; higher education; online education

1. Introduction

When COVID-19 spread, authorities and organizations around the world found it difficult to respond quickly to the consequences of the pandemic. Consequently, many emergency changes were implemented worldwide in different domains, including government [1–3], public services [4,5], healthcare [6,7], education [8], transnational labor [9], geopolitical issues [10–12], the global energy market [13], spatial dimensions [14], and the economy [15–17]. These changes imposed serious challenges on the global higher education sector in terms of coping with its high impact on the educational process. In March 2020, at least 100 countries announced national school closures to combat virus transmission. The closures affected roughly half of the global student population [18]. Reviews also cited the negative economic impact of educational institutions' closures on society, which lost (a) a significant number of workers, who were forced to leave work to take care of their children's education; and (b) the privilege of attending classes, especially for students with poor understanding and educational attainment [18]. This issue prompted many universities and educational institutions to conduct significant transformations, review essential elements of their business processes, and adopt technology to continue their operations according to new guidelines and procedures [19]. Given the speed of change necessitated by social distancing, they had to confront challenges that arose with

the emergence of the online delivery of teaching content, specifically the rapid digitization of the curriculum [20].

In Portugal, for example, after identifying the first case of COVID-19 on 7 March 2020, the Presidential Council announced the suspension of all activities, including education. Accordingly, face-to-face teaching was suspended due to the closure of schools and universities, and online teaching and learning was promoted by the continuity of the activities through teacher–student interaction via digital tools, such as Blackboard [21,22]. Another precautionary measure was taken by the United Arab Emirates (UAE) to contain the spread of the virus. The authorities in the UAE applied several safety measures by closing universities and schools, suspending any outside entry to the country, canceling public events and gatherings, and moving to online education [20,23,24]. Higher education institutions in the UAE also worked on engaging students in interactive discussions, whether synchronously through web meeting tools or in asynchronous ways via discussion boards and other tools. As a result of this situation, many universities in the UAE adopted new digital delivery methods [20]. The smart university of Hamdan Bin Mohammed has a rich experience in delivering online content, as it is considered to be the first e-University in the UAE [25]. Heriot Watt University in Dubai is working on “Vision”, a virtual learning delivery tool, and the universities of Sharjah and the UAE have adopted the Blackboard system [20]. Saudi Arabia is another example that faced the same scenario. After the World Health Organization (WHO) pandemic announcement, the Saudi Arabian government applied a lockdown in most sectors. On 9 March 2020, the Ministry of Education (MOE) in Saudi Arabia immediately started to deliver online education in all government and private educational institutions [26,27].

Given this history, this paper aims to study the impact of COVID-19 on higher education by highlighting the educational processes that were followed during COVID-19, and how they could be improved from a student’s perspective. In addition, this research mainly focuses on studying the impact of those rapid changes on student satisfaction in Saudi Arabian universities. It was crucial to identify the factors that play important roles in facilitating and improving the higher education responses to the pandemic. This research would benefit educational institutions located in Saudi Arabia in understanding the current status of learning and education in universities. Furthermore, it is important to understand how to improve the explored status based on the recommendations discussed in this study. The identified factors can also be useful and applicable for other countries, to enhance the performance of their educational system.

The rest of the paper is organized as follows: in the next section, a literature review and related work is presented to give more insights regarding the context of this paper. This is followed by highlighting the methodology used during the study. After that, data analysis and results are discussed side by side. The discussion section highlights major developments and achievements of research objectives. Finally, the paper concludes with a summary of this study and ideas for future research.

2. Literature Review

The lockdown of universities and educational institutions around the world during the COVID-19 pandemic showed a rapid transformation from face-to-face learning to online learning, which comes in two forms of interactions: synchronous and asynchronous [28]. Synchronous education encourages human interaction between an instructor and a student to assist the student’s engagement and interactivity. Asynchronous education relies on technologies that do not require real-time interaction between instructors and participants, such as email, recorded video, discussion forums, etc. Most online education provides an asynchronous learning environment that encloses the flexible practical educational process [28].

In this section, previous work was reviewed to understand the degree of the educational process change in universities and other educational institutions globally, regionally, and locally. It aims to find out how the COVID-19 pandemic has changed the educational

process and to what extent this emergency situation has created a considerable impact on the performance of academic staff and students. The subsequent sections describe the educational situation after COVID-19 in different regions.

2.1. Education during COVID-19 in Europe

In Portugal, telework was implemented in terms of teaching and administration. Later on, it was announced that the education process would be conducted remotely for the second semester [21,29]. The second semester extended to 27 June 2020, to ensure the completion of curriculum activities more flexibly. The working scenario was applied as follows: first, teachers started to coordinate with program supervisors and educational councils to adjust teaching and learning strategies considering the distance learning context, with educational resources available to students at different times to work on activities and assignments. Second, teachers provided students with regular feedback on their educational progress by recording all activities in a summary form for evaluation and adding related notes. Third, teachers should also have shared the changes made in the teaching process with students and agreements on the assessment methodologies that were to be adopted. Last, in order to support teachers in this transformation, the Center for Innovation and Teaching and Learning Development developed a number of procedures for posting advice and suggestions throughout the blog and sharing ideas through webinars [21,29]. This training was focused on how to teach online, how to manage online activities, etc. Despite this, there were limitations to investigate, such as the way faculty members use the platforms and develop teaching methods to meet the program's institutional requirements [21]. This means, despite the effectiveness of the platforms in the continuity of the education process, there is no potential to ascertain the methods of faculty members and their development in using the platforms to meet the institutional requirements of the programs.

Similarly, COVID-19 created visible impact over educational institutes located in the United Kingdom (UK). A research study conducted a survey by taking opinions from the final-year medical students in the UK. The purpose was to illustrate the impact of COVID-19 on final examination and placement processes. The research managed to collect responses from 33 medical institutes across the UK. The collected results identified that 38.4% of participants' examinations were cancelled due to the pandemic situation [30]. Moreover, the digital higher education status in Germany was analyzed in research to investigate the impact of COVID-19 on learning processes. The research discussed the positive side, as due to this pandemic situation, the success of the digital education and innovation process widely increased [31]. Another significant issue is outdoor education for university students (or for younger people), which has been presented in different ways related to transitional justice [32,33].

One more study was conducted in Spain to analyze the effect of the COVID-19 quarantine on the learning performance of students in higher education [34]. A field experiment was applied to 458 students from three subjects at Universidad Autónoma de Madrid (Spain). The researcher studied the differences in assessments by splitting the students into two groups. The first group was of the academic years 2017/2018 and 2018/2019 while the second group was of the academic year 2019/2020, which is the group that was disrupted by the pandemic and shifted to online education. The results showed a positive effect of COVID-19 quarantine on the student's performance and the continuity of the activities that did not change after the confinement. It even led to an increase in activity assessments and subjects. Additionally, the results showed that the first group did not study continuously, while the second one did. This means that COVID-19 confinement changed the study strategy to a continuous habit that improves student efficiency in the studies. Based on that, better student assessment scores are expected due to COVID-19 confinement, which would lead to the improvement in their educational performance [34]. The research highlighted that despite the global negative impact of COVID-19, it may have

had a positive effect on students (with additional autonomous activities), which leads to spending more time understanding and mastering all lessons and activities.

2.2. Education during COVID-19 in Middle East

In the Middle East, the situation is different, where many developing countries in the region, such as Egypt, have limited access to formal learning management systems (LMS) for distance learning and academic communication. [35]. This situation forced many institutions to look for alternatives in free communication software, e.g., Zoom, Microsoft Teams, and Google Classroom, or through social media platforms, e.g., WhatsApp, Facebook, and YouTube. A study was conducted to focus on investigating the extent to which faculty members and students rely on informal communication platforms and social media to sustain academic communication in developing countries [35]. The study conducted surveys and in-depth interviews to gather opinions from faculty members and students from nine educational institutes. The results showed that the proper use of such platforms could promote a new era of social e-learning and social media can be used effectively to create a positive learning experience.

Further research was conducted in Jordan to examine distance e-learning amongst medical students during the COVID-19 pandemic [36]. The study highlights possible challenges and limitations in medical education to deliver educational material and clinical training using synchronous live streaming sessions supported by advanced communication technologies. The research showed that advanced technologies and social media platforms represent a new approach to the teaching methods and could provide the ideal solution to preserve the educational process in exceptional and emergency situations such as the COVID-19 pandemic. However, presenting educational materials sessions using synchronous live streaming technologies could represent the biggest challenge for students, as nearly 69% of students in the research stated that this was the main obstacle for them due to the internet quality and coverage [36]. To conclude this section, Table 1 represents the summary of some previous studies that covered the educational process during the COVID-19 situation.

Table 1. Summary of the related literature outside of Saudi Arabia.

Methodology	Theory	Purpose	Country	Year	Ref.
Analysis of the initiatives and responses from the authors' university	Reflective Practice Theory	To provide the Portuguese context of the initiatives and responses to COVID-19 on education.	Portugal	July 2020	[21]
Linear test—computer adaptive test (CAT)	Item Response Theory	To identify the effect of COVID-19 confinement on students' performance.	Spain	October 2020	[34]
Surveys and in-depth interviews among faculty members and students	Mixed-methods sequential explanatory design—theory of practice	To investigate the usage of informal communication platforms and social media to sustain academic communication in the developing countries.	Egypt	August 2020	[35]
Students questionnaire	N/A	To study the challenges and limitations to deliver medical material and clinical training using synchronous live streaming sessions	Jordan	October 2020	[36]

2.3. Education during COVID-19 in Saudi Arabia

To keep the education process uninterrupted in Saudi Arabia, the MOE developed a temporary emergency policy to control and to facilitate remote education for both schools and university education. For public education, the MOE fully supervised the educational

process by employing online education platforms for supporting virtual classrooms and enriched digital materials, such as (Vschool.sa), which is the formal online school education platform in Saudi Arabia [37]. Additionally, all the lessons for all the student's levels were asynchronously available on the Ain channel run on Arabsat and YouTube [37]. On the other side, higher education institutions and universities were given further freedom for managing educational programs. Nevertheless, the MOE established several strategies and procedures for safeguarding student's learning, their future opportunities, and their cumulative average [27]. Currently, all Saudi universities utilize e-learning platforms by one of the most commonly used systems, which is Blackboard. This practice of education made the experience more flexible by utilizing reliable communication tools. Subsequently, universities had overcome several obstacles regarding the communication between instructors and students, and empowered all stakeholders to reach each other [38,39]. A review on some published material related to academic education and the learning process investigated in Saudi Arabia (during the COVID-19 period) is illustrated in Table 2, and further explained in this section.

Table 2. Summary of related work in Saudi Arabia.

Methodology	Theory	Purpose	Country	Year	Ref.
Questionnaire for the academic staff	A Model of Information and Communication Technology	To assess academic staff satisfaction with distance learning and its affect on the administrative work.	King Khalid University	July 2020	[37]
Surveys among students and faculty members	N/A	To analyze the impact of the COVID-19 pandemic on online education at the College of Medicine.	Al Faisal University	July 2020	[40]
Focus group	SWOT Model	To analyze the processes management followed by Health Sciences Colleges for delivering online education.	King Saud Bin Abdulaziz University	September 2020	[26]
Focus group and interviews	N/A	A study on the effectiveness of simultaneous online learning on medical students.	Qassim University	August 2020	[28]
Survey among students and faculty members	Formulated hypothesis method	To examine the effectiveness of the fourth industrial revolution technologies that was the emergence of digital educational transformation, in relieving the impact of COVID-19 on higher education.	Many Universities	June 2020	[41]

In the College of Medicine and Medical Sciences in Qassim University, a group of researchers conducted a quantitative study on the effectiveness of live online streaming learning sessions [28]. The result showed high level of acceptance and approval from medical students. All participants agreed that online sessions save time, and thus their performance has improved due to extra time they have for studies. However, students indicated some challenges, including methodological challenges, content perception, technical and behavioral challenges during the online sessions, and exams. The participating students emphasized the rigorous and regular evaluation of the principles of the online learning model and learning outcomes to monitor its effectiveness [28].

Another study was conducted in Pharmacy College at King Khalid University (KKU), which aimed to evaluate the satisfaction of the academic staff with shifting into virtual education, and additionally, how suspension has effected the academic work [37]. The online questionnaire completed by the entire pharmacy's academic staff reported that the educational environment in KKU was already prepared for the emergency digital transformation. In addition, the Pharmacy College's staff noticed that virtual education is more flexible than the traditional model. However, the successful shift into virtual learning environment required some online training for instructors provided by the Electronic Learning Deanship, providing the virtual classrooms, recording the lectures, and facilitating the online discussion. Furthermore, the results showed that the shift into e-learning encountered issues regarding the lack of face-to-face human interaction. A majority of instructors have faced challenges of directly engaging the students besides evaluating and judging the participants with integrity. In addition to the previous limitations, covering all the content of the syllabus, a lacking attendance in practice sessions were some other issues highlighted in this study [37].

Similar research was sponsored by Al Faisal University in Riyadh [40]. The research studied the impact of conquering the COVID-19 pandemic during the shift from traditional to online education at the College of Medicine (COM). The developed questionnaire was emailed to targeted faculty members and students, which revealed 41% of the responders had a low level or no online education experience (and some students had no experience of online learning). Therefore, the issues highlighted in this study were associated with some relevant tools and academic processes including communication, the assessment of students, the use of technologies, time management, online experience, and technophobia. Nevertheless, in general, there is a largely affirmative influence of online education at the COM, Al Faisal University, where the confidence of the responders in the effectiveness of virtual medical education increased during the first few weeks of COVID-19 [40].

In addition, a study highlighted the processes management that was followed by health science colleges at King Saud Bin Abdulaziz University (KSAU-HS) to respond to the changes by delivering online education during the COVID-19 crisis [26]. The focus groups were constructed to develop emergency planning using the SWOT (strengths, weaknesses, opportunities, and threats); an analysis model that focused on four main areas, (i) faculty abilities development, (ii) curriculum management, (iii) assessment policies, and (iv) technology infrastructure and support. The authors proposed a model established by KSAU-HS as a framework that could be taken as the guidelines for delivering online education in health science colleges [26]. Similarly, another study prepared and distributed a survey among two samples: faculty members and students in some Saudi universities [41]. The questionnaire was designed to examine the formulated hypothesis, to discuss the effectiveness of the fourth industrial revolution technologies (4IR) that was the emergence of digital educational transformation, in relieving the impact of COVID-19 on higher education at Saudi universities [41].

Furthermore, this literature review revealed the changes related to the shift of the educational process to the virtual form in universities and educational institutions globally, regionally, and locally. Some previous studies were focused on studying the impact of COVID-19 on the medical education from different perspectives, such as faculty members, students, and administrative staff. Table 3 shows a summary of the main factors and areas investigated by previous studies in the local universities.

Table 3. Summary of main factors investigated by Saudi universities.

Ref.	[28]	[37]	[40]	[26]	[41]
University	Qassim University	Khalid University	Alfaisal University	King Saud Bin Abdulaziz University	Some Saudi universities
Faculty	College of Medicine	Pharmacy College	College of Medicine	Health Science	All
Objective	To study the effectiveness of synchronized digital learning	To evaluate the satisfaction of academic staff	To study the impact of switching to online education	To highlight process management that was taken by KSAU-HS	To highlight effectiveness of digital educational transformation
Measuring Factors					
Time Management	✓		✓		✓
Assessment		✓	✓	✓	
Communication and Engagement		✓	✓		
Course Material		✓		✓	
Technology Infrastructure		✓	✓	✓	
Focus on					
Faculty Members		✓	✓	✓	✓
Students	✓		✓	✓	✓

In this research, a study was conducted to examine the effectiveness of distance learning education during the COVID-19 pandemic. To fulfill this main objective, the study was designed based on the Technology-Organization-Environment (TOE) Framework. The TOE examined the adoption of new technology based on three substantial perspectives contexts, which are: (i) the technology context, (ii) the organization context, and (iii) the environment context [42,43]. Hence, in this paper, the authors employed TOE to investigate the effectiveness of virtual distance education during this pandemic by identifying three main aspects that may impact the educational process. Therefore, the main research question of this study is: “Is the distance learning impact effectively on the learning curve of higher education during the COVID-19 pandemic?”, which further breaks down into the three following research questions discussed in the next sections:

- How has distance learning in high education impacted students during COVID-19?
- What are the perceptions that students have about the effectiveness of distance learning processes during COVID-19?
- What are the difficulties and challenges which students are facing with distance learning in terms of educational processes and tools?

3. The TOE Framework

The study builds on the TOE framework to investigate the major factors that impact the effectiveness of the educational process on students during the COVID-19 pandemic in Saudi Arabian universities. The TOE theoretical framework was first introduced by Tornatzky and Fleischer [44]. TOE framework has been exceedingly used in technology adoption relevant studies. The theory is based on three contexts: the environmental context, the organizational context, and the technological context, which is shown in Figure 1 and further discussed in previous research [44,45]. Therefore, three aspects of the TOE are

introduced to suggest influential factors that could be beneficial for the universities and the higher educational institutions.

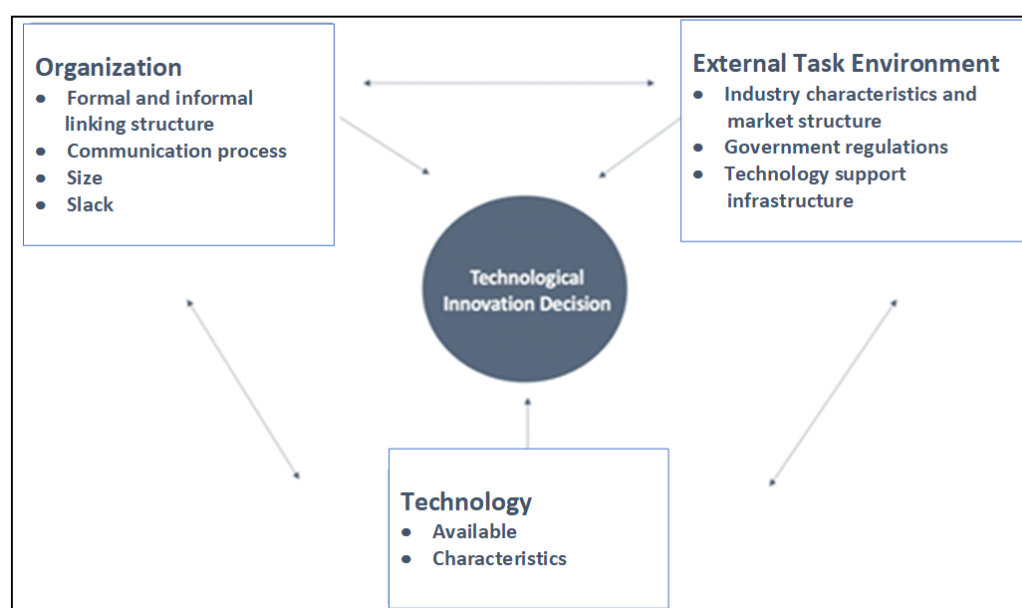


Figure 1. The technology–organization–environment framework [44].

3.1. Environmental Context (EC)

The environmental context consists of some environmental characteristics surrounding an organization. These characteristics include factors from stakeholders, such as supporters, suppliers, customers, the government, society, and competitive pressures, which can influence the organization's structure, decisions, and performance. The stakeholders may either support or prevent technology adoption [45,46]. Government regulations can mandate the allocation of resources for compliance. The Kenyan government, for example, has applied some policy and strategy documents to guide the integration of Information and Communications Technology (ICT) into education through its ministries of Education, Science, Technology, and ICT [43]. This application has created awareness of the place of ICT in education in all its forms, especially in distance education, which represents a large segment of education at the present time [47].

Saudi Arabia's Ministry of Education implemented some regulations to determine the evaluation mechanism in final exams, which was applied to all the educational institutions nationwide [48]. These regulations were circulated for the interest of students in light of the exceptional circumstances of education during COVID-19. The regulations included the mechanisms followed for the continuation of the educational process, the distribution of students' grades, the activation of analyzing the student's score for the past semesters by the admission and registration deanships and information technology in universities, when exams will be conducted, how to calculate the student's GPA, and how to deal with preparatory year programs for the fresh students in universities [48].

3.2. Organizational Context (OC)

The organizational context embraces multiple aspects, such as regulatory background, organizational culture, the quality of human resources, management structure, the degree of centralization, top management support, and the organization's size. From the perspective of new technology adoption, the organization context refers to conditions of an institution, such as employee competence and management support that impact this adoption [49]. Furthermore, the OC explores the extent of the leadership quality at the level of management along with the departments to achieve the institution's goal [43].

In the case of education institutions, the educational culture comprises the vision, plans, standards, and values shared by the top management, staff, and students [43]. The support of top management is demonstrated by providing supportive regulations and decisions. The higher administration has an impact on implementing proper processes and technologies by professors and administrative staff through its influence on participation in decision making, promoting professional developments and reducing feelings of uncertainty [45]. The educational institution's culture plays a mediating role in adopting technologies, which measures their readiness to adopt ICT in the educational process. Therefore, studying the educational institution's responses to the unexpected changes that led to rapid decisions and the adoption of new technologies to support distance education is important to examine its impact on the learning curve from the student's perspective during the pandemic.

3.3. Technological Context (TC)

The technological context points out the technology's boundaries, including external and internal technologies correlated with the institution. Hence, the technology extends to the capabilities of the institution by adapting existing available technologies in the industrial market. Further, the TC refers to the internal variables regarding technologies' performances that were taken into account in the pre-implementation phase. This perspective aimed to gain the benefits of external and internal technologies that may assist in increasing the efficiency of the institution's processes and outcomes besides speeding up the response to the market changes [49,50]. For applied TOE in the higher learning institution of Kenya, the cost and technology competence were the main factors investigated from the technology perspective. The technical competence of institutions is a fundamental infrastructure enabling the adoption of information technology (IT) as the basic form in such institutions' resources are built. The technology competence in the case of Kenya reflects the performance of technical infrastructure and resources in addition to the internet availability and bandwidth [43]. The TC includes the following main factors: compatibility, complexity (usability and learning curve), expectancy, performance, and reliability [51].

Hence, based on the literature review, the paper focused on two main factors: performance and complexity of the internal and external technologies that were employed in distance education during the COVID-19 pandemic to examine their impact on the learning curve from the student perspective.

4. Research Framework and Methodology

It is worth recalling that the main objective of this paper is to examine the effectiveness of distance learning on higher education during the COVID-19 pandemic. This section discusses the research framework and major research methodological steps taken in this study to answer the research questions. This study used a cross-sectional, self-administered online questionnaire directed to the fresh, undergraduate, and postgraduate students who were studying in Saudi Arabian Universities during the first semester of the 2020–2021 academic year during the COVID-19 outbreak. Most of the data collected were qualified for a quantitative analysis except two open-ended questions. The questionnaire was prepared based on the enhanced TOE framework that was modified with the help of the literature review and initial investigation, as shown in Figure 2. The questionnaire was prepared using each factor presented in the figure and further associated with multiple attributes categorized under each factor.

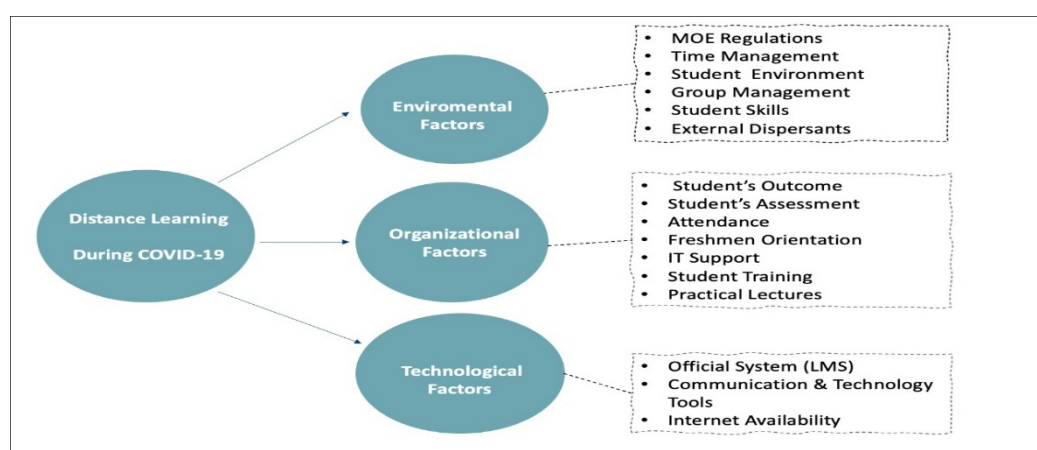


Figure 2. The conceptual research framework. (Adapted from [44]).

Due to the COVID-19 precautionary measures, the survey was shared over the WhatsApp social media platform and directed to the university students. For their ease and to understand the research context, the purpose of the study also provided using an online link. Overall, the online survey was designed using the Google Forms online survey platform. All responses were anonymous and confidential. In this survey, the total number of participants contacted was 580, where we communicated the survey link using different universities' WhatsApp groups. The received and correct responses (i.e., error free and answered completely) were 150, which provided feedback on 27 compulsory questions. In addition, there were 5 optional questions were asked from the participants, in which, 2 linear-scale questions received 116 and 115 responses, 1 check box question received 138 responses, and 2 open-ended questions received 84 and 59 responses, respectively. All of the received responses were used for data analysis, for which the Google Forms spreadsheet tool and Microsoft Excel were used, which is discussed in the Results and Discussion Section.

5. Data Collection

The structured questionnaire was designed based on the TOE theory of students during the outbreak and distance learning. The questionnaire was prepared in Arabic, consisted of three sections, with demographic information included in the introduction section. Most questions used a five-point Likert scale ranging from “strongly agree” to “strongly disagree”. Section 2 consisted of (8) Likert scale questions to assess the sudden shift towards distance education, students' communication with colleagues and professors, their ability to focus and comprehend during the distance lectures, group work in projects, barriers of practical applications, and time management in the distance education.

Section 3 consisted of (10) Likert scale questions to assess the advantage of recorded lectures and their impact on increasing the understanding of educational content, as well as students' assessment in distance education and the challenges compared to the traditional way. In addition, the official system (LMS) effectiveness and the technical support provided to students was assessed, as well as the alternative solutions for practical lectures provided by the university and their applications. The difficulties faced by freshmen students with LMS were also assessed. The fourth section consisted of (7) questions to assess the technical tools used in distance education in terms of reliability, usability, and effectiveness, the availability of the necessary tools for the distance education process, such as a computer, printer, headset, and the quality of internet connection to attend lectures, submitting assignments, and exams. The survey consisted of one checklist question to determine which technical tools/apps were used in addition to the official LMS system. At the end of the survey, two open-ended questions were provided to assess students' experience

in distance education compared to traditional education and the challenges they faced throughout the process.

To assess the understandability and readability of the asked questions, the questionnaires were reviewed with the help of two professors and one student, who were representative of the study population. This process helped to determine the clarity of the language and the structure of the questionnaire. The questionnaire then was modified based on the feedback received in the pilot test.

6. Result and Analysis

As a result of the distributed questionnaire, one hundred and fifty student's responses were received. Some questions required a cross-analysis, and some provide direct answers by the respondents. The rest of the section will present the result of each questionnaire section.

6.1. The Demographical View

The presented data in Table 4 show that the majority of the participants were (82.7%) females, (71.3%) between 20–30 years old, (70.7%) and studying in the bachelor programs. A total of 34% were freshmen students at the university and 71.3% already used technical tools in education, such as the Blackboard system, before the COVID-19 pandemic.

Table 4. The result of the demographics section in the questionnaire. (N = 150).

Items	Number	Percentage
Gender		
Female	124	82.7%
Male	26	17.3%
Age		
Less than 20 years old	33	22%
20–30	107	71.3%
31–40	8	5.3%
Over 40 years old	2	1.3%
Educational level		
BSC	106	70.7%
Masters	43	28.7%
PhD	1	0.7%
Are you a freshman at the university?		
Yes	51	34%
No	99	66%
Have you ever used technical tools in education, such as the Blackboard system before the corona pandemic?		
Yes	107	71.3%
No	43	28.7%

6.2. The Environmental View

The environmental factors are evaluated based on the responses collected through university students using a five-point Likert scale, as presented in Table 5. The transformation from traditional to distance education was not carried out very smoothly from the perspective of freshmen, where only 31.4% of them agreed or strongly agreed about that. The possible reasons could be that a freshman has no idea about the university education

as that was the first experiment and of course, psychological factors may play critical roles in a freshman's opinion. For the student who had a good experience with the educational tools and system, the results show that 43.7% of them agreed or strongly agreed with the idea that it was a smooth shift.

Table 5. Survey results of the environmental factors.

Items			1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
The sudden shift towards distance education was smooth	Without Cross-Analysis		16 (10.7%)	25 (16.7%)	45 (31.3%)	35 (23.3%)	27 (18%)
	Are you a freshman?	Yes	7 (13.7%)	10 (19.6%)	18 (35.3%)	8 (15.7%)	8 (15.7%)
		No	9 (9.3%)	15 (15.5%)	27 (27.8%)	27 (27.8%)	19 (19.6%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	9 (8.6%)	18 (17%)	32 (30.4%)	27 (25.7%)	19 (18%)
		No	7 (16.3%)	7 (16.3%)	13 (30.2%)	8 (18.6%)	8 (18.6%)
Communication with colleagues and professors was easy during distance education, during the Corona pandemic	Without cross-analysis		13 (8.7%)	35 (23.3%)	36 (24.7%)	34 (23.3%)	30 (20%)
	Are you a freshman?	Yes	3 (5.9%)	11 (21.7%)	16 (31.4%)	11 (21.7%)	10 (19.6%)
		No	10 (10.3%)	24 (24.7%)	20 (20.6%)	23 (23.7%)	20 (20.6%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	10 (9.5%)	26 (24.8%)	24 (22.8%)	24 (22.8%)	21 (20%)
		No	3 (7%)	9 (21%)	12 (28%)	10 (23.3%)	9 (21%)
Compared to university attendance, the ability to focus and comprehend was greater during the distance lectures			49 (32.7%)	29 (19.3%)	33 (22%)	15 (10%)	24 (16%)
I have a greater opportunity to use the time between lectures to complete the required assignments			30 (20%)	13 (8.7%)	23 (15%)	23 (15.3%)	61 (40.7%)
Presenting presentations from a distance has negatively affected the development of my presentation and speaking skills			48 (32%)	26 (17.3%)	42 (28%)	13 (8.7%)	21 (14%)
Geographical spacing has negatively affected the performance and communication of the members in the group projects	Without cross-analysis		36 (24%)	20 (13.3%)	29 (20.7%)	25 (16.7%)	38 (25.3%)
	Are you a freshman?	Yes	15 (29.4%)	8 (15.6%)	6 (11.8%)	8 (15.7%)	14 (27.5%)
		No	21 (21.6%)	12 (12.4%)	23 (23.7%)	17 (17.5%)	24 (24.7%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	27 (25.7%)	14 (13.3%)	23 (21.9%)	18 (17.1%)	23 (21.9%)
		No	9 (20.9%)	6 (14%)	6 (14%)	7 (16%)	15 (34.9%)
Distance education form an obstacle to practical training, in subjects that include practical hours	Without cross-analysis		14 (9.3%)	12 (8%)	33 (23.3%)	28 (18.7%)	61 (40.7%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	12 (11.4%)	8 (7.6%)	27 (25.7%)	21 (20%)	37 (35.2%)
		No	2 (4.7%)	4 (9.3%)	6 (13.9%)	7 (16.2%)	24 (55.8%)
Distance education has contributed to making use of the time wasted in commuting between home and university			16 (10.7%)	6 (4%)	20 (13.3%)	13 (8.7%)	95 (63.3%)

About the communication process with colleagues and professors, 41.3% of freshmen and 42.8% of the students who used educational tools before agreed and strongly agreed that it was easy. This is due to the availability and diversity of social media applications that have contributed to overcome the difficulties that may face them in this period specially. More than half of the students (52%) disagreed or strongly disagreed that the ability to focus and comprehend was greater during the distance lectures compared with in-campus studies while 56% agreed and strongly agreed that they had a greater opportunity to use the time between lectures to complete the required assignments. At the same time, only 22.7% of the students agreed or strongly agreed that giving presentations from a distance created a negative impact on preparing presentations and speaking skills.

Another question was asked to take their opinion on geographical distance and its impact on group work. A total of 43.2% of the freshmen agreed or strongly agreed that it negatively affected group work, whereas only 39% of the students who had experiences with the educational tools before the COVID-19 pandemic agreed or strongly agreed on its negative impact. Besides, 55.2% of the students who used educational tools before agreed or strongly agreed that distance education formed an obstacle for practical training, especially in the subjects that include practical hours. The majority of the students (72%) agreed or strongly agreed that distance education contributed to saving time traveling from home to university.

6.3. The Organizational View

By focusing on the TOE theory organizational factors, university students assessed the factors by using a five-point Likert scale, as shown in Table 6. The majority of the students (79.3%) agreed or strongly agreed that the possibility of returning to the recorded lectures helped them to increase their understanding and realization of the scientific content, whereas more than half (56.6%) agreed or strongly agreed that remote tests characterized and depended on perception and understanding of the scientific content more than memorization and narration.

Meanwhile, 46% agreed or strongly agreed that for online examination, there is no unified mechanism in terms of the duration and method of the exam. The majority of the students (71.6%) agreed or strongly agreed that the challenges they faced while taking the exam remotely were the exam submission via the Blackboard system, in addition to the possibility of losing the network connection, while only 24% agreed or strongly agreed that they could easily reach technical support or educational affairs when they needed help.

Nearly half of the freshmen (47.1%) agreed or strongly agreed that they received help in installing and setting up the software that required to use in distance learning, while (41.9%) of the students who used educational tools before the COVID-19 pandemic agreed or strongly agreed with that. Nearly half of the students (47%) also agreed or strongly agreed that they were trained in the applications and systems they needed to use in the courses. Moreover, about half (48.6%) of the students who used educational tools before the COVID-19 pandemic agreed or strongly agreed with that, while only 31.4% of the students agreed or strongly agreed that the university provided an alternative solution to apply the subjects that include practical hours. The number of freshmen students (24.1%) agreed or strongly agreed that they encountered problems and difficulties in dealing with the systems approved by the university and only (25.2%) of them agreed or strongly agreed that they received the necessary training to deal with the university's systems.

Table 6. Survey results of the organizational factors.

Items		1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
The possibility of returning to the recorded lectures helped to increase the understanding and realizing of the scientific content		4 (2.7%)	5 (3.3%)	22 (14.7%)	35 (23.3%)	84 (56%)
Remote tests were characterized by their dependence on perception and understanding of the scientific content more than memorization and narration		19 (12.7%)	17 (11.3%)	29 (19.3%)	20 (13.3%)	65 (43.3%)
When the course exam is remote, there is no unified mechanism in terms of the duration and method of the exam		13 (8.7%)	18 (12%)	48 (32%)	31 (20.7%)	38 (25.3%)
One of the challenges I faced while taking the exam remotely was the submission of the exam via the blackboard system and the possibility of losing the network connection		7 (4.7%)	14 (9.5%)	21 (14.2%)	34 (23%)	72 (48.6%)
I can easily reach technical support or educational affairs when I need help		25 (16.7%)	24 (16%)	65 (43.3%)	21 (14%)	15 (10%)
I received help in installing and setting up the software that required to use	Without cross-analysis	31 (20.7%)	11 (7.3%)	44 (30.7%)	20 (13.3%)	42 (28%)
	Are you a freshman?	Yes	11 (21.6%)	2 (3.9%)	14 (27.5%)	8 (15.7%)
		No	20 (20.6%)	9 (9.3%)	30 (30.1%)	12 (12.4%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	18 (17.1%)	10 (9.5%)	33 (31.4%)	14 (13.3%)
		No	13 (30.2%)	1 (2.3%)	11 (25.6%)	6 (14%)
I have been trained in the applications and systems I need to use in the course materials	Without cross-analysis	19 (12.7%)	12 (8%)	44 (30.7%)	36 (24%)	37 (24.7%)
	Are you a freshman?	Yes	9 (17.6%)	4 (7.8%)	14 (27.5%)	12 (23.5%)
		No	10 (10.3%)	8 (8.2%)	30 (30.9%)	24 (24.7%)
	Have you ever used educational tools before COVID-19 pandemic?	Yes	12 (11.4%)	10 (9.5%)	29 (27.6%)	24 (23%)
		No	7 (16.3%)	2 (4.7%)	15 (34.9%)	12 (27.9%)
The university provided an alternative solution to apply the subjects that include practical hours		16 (10.7%)	18 (12%)	69 (46%)	25 (16.7%)	22 (14.7%)
As a freshman at the university, I encountered problems and difficulties in dealing with the systems approved by the university		28 (24.1%)	18 (15.5%)	42 (36.2%)	14 (12.1%)	14 (12.1%)
As a freshman at the university, I received the necessary training to deal with the university's systems		22 (19.1%)	22 (19.1%)	42 (36.5%)	13 (11.3%)	16 (13.9%)

6.4. The Technological View

Like other factors, the technological factors were also evaluated using a five-point Likert scale, as shown in Table 7. Most of the students were satisfied with the LMS tools used in distance education, as more than 67% agreed or strongly agreed. To support that reason, another question was asked regarding the interaction in the virtual classroom during the lectures, where more than 65% agreed or strongly agreed that the instant chat available in the virtual classroom positively increased the classroom interactions.

Table 7. Survey results of the technological factors.

Items	1 Strongly Disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly Agree
I am satisfied with the use of technical tools such as: the blackboard system in a distance education environment	18 (12%)	11 (7.3%)	19 (12.7%)	49 (32.7%)	53 (35.3%)
In the virtual classroom, instant chat increased interaction and possibility to ask questions during lectures	14 (9.3%)	20 (13.3%)	17 (11.3%)	38 (25.3%)	61 (40.7%)
Technical tools such as: the blackboard system covers all my needs as a student during the distance education process	22 (14.7%)	18 (12%)	24 (16%)	38 (25.3%)	48 (32%)
Other technical tools were adopted in addition to the university approved system	11 (7.3%)	15 (10%)	46 (30.7%)	44 (29.3%)	34 (22.7%)
I have the tools I need for the distance education process, such as: a computer, a printer, a headset	6 (4%)	12 (8%)	25 (16.7%)	33 (22%)	74 (49.3%)
I have a good internet connection that helps me: attend lectures, deliver assignments, give presentations and take exams	5 (3.3%)	29 (19.3%)	28 (18.7%)	42 (28%)	46 (30.7%)

More than half of the students (57%) agreed or strongly agreed that technical tools such as the Blackboard system covered all their educational needs during distance education, while 52% agreed or strongly agreed that there were other technical tools used during the pandemic in addition to the official LMS system. In addition, more than 71% stated that they used WhatsApp, and 43% used Telegram in distance education communication during the COVID-19 pandemic. Other tools were used for the verbal communication and classroom presentations, where around 49% of students claimed that they used Zoom, 30% used Google Meet, and 25% used MS Teams and Skype.

Technical equipment availability was not an issue for most students, as about 71% claimed that they had all the distance education tools, such as a computer device, printer, and a headset for the virtual classroom. The same applies for the internet connection, where around 59% of students stated that they had a good internet connection, enabling them to attend the virtual classroom, deliver their assignments and projects, and to appear in the exams.

A number of challenges were encountered by the students through open-ended questions centered on two main areas, whether in terms of technological limitation or regarding the education process. Internet availability and instability were significant obstacles that students worried about, especially during online examinations. Another issue was the increase in the number of homework assignments that were caused by non-uniform established assessment methods. For examinations, there were some obstacles, such as less time, the difficulty of questions, and dealing with tools. Some students faced obstacles in communication with the professors due to a lack of defined office hours.

Many answers were in favor of distance education on the condition that future enhancements to the education process would be implemented. Suggestions were mostly focused on the quality of the teaching methods in the virtual classrooms, where some claimed that the issue is with creating an interactive environment to compensate for face-to-face communication, facial expressions, and body language that was easily filled in the traditional education. There were opinions that focused on the assignments, where some claimed that it was challenging to complete the assignments that were designed for traditional education. Other opinions were related to the psychological side of the student, as isolation and learning from home had an effect on their learning experience in general.

7. Discussion

The results of this study showed that the sudden shift towards distance education was smooth, and the existing educational tools were ready for the sudden shift towards online education. The respondents found that communication with colleagues and professors was easy, and they did not face any difficulties in communication with each other. This was due to the availability and diversity of social media applications that contributed to overcome the difficulties that one may have faced, especially in this period. Meanwhile, the ability to focus and comprehend was less than the traditional face-to-face education, which probably depends on the student's environment, social status, and family circumstances.

On the other hand, distance learning provides the students with a greater opportunity to use the time between lectures to complete the required assignments. As for the course projects, presentations continued even in distance education and did not adversely affect the presentation and delivery skills, while geographical distance negatively affected the performance and communication between members in project groups. In subjects that include practical hours, there were obstacles in the practical training application, and thus the benefits of practical training were not achieved successfully. Finally, distance education has the advantage of saving time wasted in traveling between home and university. It provides the student more time to review subjects and work on the projects and assignments required, which helps to improve the student's academic performance; the research in [34] also found similar results. The same advantage was also identified in previous research that online education saved time in different ways, which could be further utilized for different purposes such as extra reading and exam preparation [28].

In this research, most of the participants showed their experience of using online tools before this pandemic situation. Actually, the prior experience provided an extra advantage to them while using online tool during lectures. Previously, we found that during a survey in a university, it took some time for students and faculty members to understand the online tools [40]. The strategy of recording lecturers assists in raising the understanding and realization of the scientific content, since the students can access a lecture more than once. Thus, it is easy to take notes and repeat a particular lesson in the case of a complex concept or a hard lesson. This feature makes distance education more flexible and efficient than traditional education [28]. Besides, the online examination focused on evaluating the realization and understanding of the student by asking analytical and discussion questions instead of memorization and narration of the information. The nature of these questions solidifies the information in the student's mind with the minimum exhaustion of the student required to memorize the information which is quickly forgotten by the end of the exam.

Despite the established regulation and planning regarding the examination process by universities and the efforts made by the administrative and academic staff, there are still some obstacles encountered by students. One of the issues is there is no unified mechanism in terms of the duration and way of the exams that resulted in confusing the student. Therefore, the online exam process needs more clarification and standard procedures to be followed by higher educational institutions. On the other hand, proper guidelines will also be helpful for the students to understand the process and improve their performance in the exam. Based on the findings in this study, network problems, time allocation, the way of examination, and assessment procedures are some of the common factors that require equal importance in standardizing the overall mechanism of online examination.

Furthermore, the submission of the exam via the Blackboard system and the possibility of losing the network connection were significant challenges for most of the students. The results of this study indicated that the universities provided sufficient training for students for using the Blackboard system to join the virtual classroom, submit the assignment, and other useful features. However, the majority of the fresh students did not receive adequate training in the approved system, probably due to difficulties in contacting technical support, where some of the students faced a few issues in reaching technical support. Online education is still inappropriate to deliver practical sessions, as was reported by [36,37],

where they suggested employing a hybrid model with a small group of the students present in a face-to-face session while other students attend the simulation-based online session.

The variety of options, capabilities, and the capability of customization that is offered by LMS provides universities with a powerful mechanism to represent a comprehensive educational content. Most of the educational resources and activities in LMS can be provided via a unified platform that is used by students as well as professors and laboratory technicians. However, this study found that other mediums are used in an influential way, as there is a huge percentage who stated that they have used many social media platforms during the distance educational experience. This study shows that many social media platforms have been used to support communications from students with their academic instructors and among students themselves. Social media platforms support the idea of speeding up the response, alongside ease and mobility being some extra features. It provides the space for practitioners to use it in official forums, including distance education, which is the same idea discussed in previous research [35]. Considering the integration between the official LMS and social media platforms could be proposed as one of the future enhancements of the distance educational experience as this may encourage the convergence between students and professors as well as their fellow colleagues.

8. Conclusions

This study aimed to evaluate the effectiveness of distance education during the COVID-19 pandemic in higher education in Saudi Arabia. In addition, this study reported the main considerable difficulties and challenges encountered by students during the pandemic. The authors examined students' opinions by conducting an online survey based on the modified TOE framework. The results of the survey indicate the shift into online education was positive, with a learning curve to consider for future enhancement to the overall distance education experience. Meanwhile, group projects, student outcomes, freshmen orientation, and practical lectures have been strongly impacted by the university's lockdown. Furthermore, according to the study, universities need to establish a unified mechanism for the examination process, including regulations regarding convenient questions with exam duration and methods. This study introduced the main factors and their impact on the educational process for the decision makers of universities to overcome the encountered limitations and adopt new solutions in order to enhance the overall experience. The identified factors and obstacles discussed in this study can be beneficial for the educational institutes in Saudi Arabia, to overcome problems highlighted in this study. The results of this study can also be useful to improve different processes, such as how to conduct online lectures, a list of preferable online assessments, and most importantly, preparing the standard guidelines for the exams. The main research limitation was the time constraints; due to this, a limited number of participants were contacted in this study. Future research could focus on measuring the faculty members' satisfaction with online teaching tools and students' academic performance in the distance learning environment.

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