Effectiveness of Distance Education Systems in the COVID Pandemic: A Case Study from the University of Jeddah

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Abstract

COVID-19 and recently COVID-20 are spreading dramatically worldwide. Vaccines have been made available. Preventive actions are still the most effective in confronting this infectious disease. One of the preventive actions is the social distancing between people aiming to decrease the infection. Social distancing is very useful in many fields characterized by a large number of connections, like education. In this paper, we examine the effectiveness of the distance education delivered at the University of Jeddah, on the BlackBoard (BB), in the age of the COVID pandemic. A survey is conducted with a total of 791 student participants. The questionnaire has three main variables related to distance education, examinations, and other environmental factors. Different master's/undergraduate students are involved. All education levels are also involved as well as different GPAs. Results show that 89% of the participants agree on BB's effectiveness in the pandemic age. Also, 60.6% of the participants express the effectiveness of BB regardless of the pandemic continuity. Cronbach's alpha equals 0.9. Students are willing to use distance technology in the testing and examinations process more than using them in the education process. A positive correlation exists between the three variables at a confidence interval of 95%. ANOVA tests show response differences based on colleges, GPA, educational level, and educational stage. These results are significant as the University may decide to continue on these services after the pandemic ends.

Disciplinary: Management Information System, Education Technology (Distance Education, eLearning).

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1 Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is considered one of the most dangerous crises Today. This virus causes the COVID-19 disease. It has emerged at the end of 2019. According to Johns Hopkins University [23], the worldwide infected cases exceed 102 million at the time of writing this paper, and the global deaths exceed 2.2 million. So, the disease is considered a global threat to public health. The disease initially appears in Wuhan, China [1,3]. In March 2020, the world health organization (WHO) considered COVID-19 as a global pandemic. SARS-CoV-2 is very contagious. It is capable of spreading from human to human quickly. Infection can occur through droplets and contact. [1,2]. The most common symptoms of the infection are fever, cough, and malaise. Worldwide, COVID-19 has a tremendous impact on the life of people. Governments and scholars are attempting to address this worldwide crisis [5]. Due to the pandemic, many countries suspended most activities such as cultural, social, religious, scientific, sporting, and political activities. Alternatively, worldwide countries use remote technology such as videoconferences and telecommunication [2].

Recently, some vaccines have appeared to prevent the disease. However, the effectivenesses of these vaccines are still in debate. A total of 60–70% of the population should be vaccinated to achieve the necessary immunity against the disease. Additionally, there are some logistic challenges associated with vaccine delivery. There is also a debate about the effective duration of the vaccines [12]. Due to the vaccines' challenges, it is necessary to control the infection sources by cutting the disease's transmission route. Till now, the most common sources of COVID transmission include direct contacts [2].

Social distancing is the process of reducing interactions between individuals to slow down the virus's spread [11]. Social distancing could flatten the epidemic curve and reduce total deaths from Covid-19 [4]. However, the impact of social distancing may depend on some parameters, such as the person's age. A recent study conducted by [8] reveals that; infections among people aged 60 and above increase significantly compared to those below 60. According to [10], social distancing schemes should be implemented even if vaccines are developed. The main drawback of social distancing is that it might result in social isolation and limited physical activity [11].

Education is one of the most critical domains affected by the COVID pandemic. The pandemic causes schools and universities to close worldwide. Globally, over 1.2 billion children are out of the classroom [6]. Also, there is a big fear of infection spreading if the education is delivered traditionally. As scientists seek alternatives that ensure a safe return to work [9], new alternatives are required for delivering educational services effectively [4]. Covid-19 pandemic changes regular routines in many countries [14]. Distance education (DE) does not require teachers and students to be in the same place to learn [17]. So, distance education is one of the security measures proposed to protect the community by satisfying social distancing [4]. However, there is a debate about the effectiveness of this type of education [9]. A recent survey from Malaysia reveals an increased

positivity among students using e-learning during the pandemic [19]. However, online education brings some security and privacy challenges [14].

Kingdom of Saudi Arabia (KSA) has decided to deliver education by remote education for all students levels in both schools and universities. This remote education is considered as living and socializing with the pandemic. Distance education could be achieved through many forms, including educational platforms [6]. During the pandemic, The University of Jeddah and other universities in KSA have adopted a successful transition to get all courses online in only 24 hours. The Saudi universities have presented all educational services on the well-known educational platform *BlackBoard* (BB).

In this paper, we will analyze the effectiveness of distance education as a tool for social distancing. A questionnaire is conducted on a sample of students from the University of Jeddah, Kingdom of Saudi Arabia. The data is collected during COVID-19 and COVID-20 pandemics. Descriptive and inferential statistics are used for questionnaire analysis. Three main variables are studied; the first variable is related to the quality of the delivered education. The second variable is related to the quality of the examinations and testing. The third variable is related to other environmental and health factors that may affect the two other variables. The overall results show the effectiveness of distance education as a tool to achieve social distancing. The majority of the students express the effectiveness of distance education in the age of the pandemic.

Additionally, the students report the effectiveness of the BB in delivering examinations. The other factors also have a significant effect on both education and testing. Studying this problem has great importance due to the pandemic's continuity and the consequent recommendation of social distancing.

2 Previous Work

The authors [7] investigated the attitude among different students toward COVID infection. Their results indicate that the majority of students have good basic knowledge about the disease. A technical report [17] also provides helpful directions for using distance education tools to increase awareness. The readiness of the universities for implementing distance education in the pandemic is crucial. The authors [16] conducted a questionnaire in Sweden to gain insights on teacher and school preparedness. Results show that school preparedness is mainly related to technical aspects.

There is always a debate about the effectiveness of distance education. A study [21] states that, before the pandemic in 2015, students are satisfied with distance learning in only some situations. This result is supported by a second study from Thailand in 2016 [22], revealing that the students' acceptance level of e-learning was slightly higher than neutral. Interestingly, our results support these previous results. The authors [4] determined medical students' acceptance of e-learning during Covid-19 in Jeddah. Their results show that BB and Zoom were the most preferred educational platforms [4]. The students report some challenges about online clinical teaching.

The authors [13] assessed distance education's effectiveness on medical students, in Jordan, during the pandemic. Their results indicate that traditional teaching is still preferred more than

online teaching. Some students believe that clinical access is a significant obstacle when using online learning. There are also some recommendations to convert to a more integrated educational system. The authors [18] revealed the challenges of distance education in Georgia, US, that students were still motivated to learn and complete their assessments and assignments on time. The authors [20] evaluate the efficiency of the distance learning system in Turkey. Their results indicate that the courses taught in distance learning are not as practical as face-to-face education. However, using distance education is still raising some issues such as privacy and security issues. The authors [14] analyze Zoom challenges as a popular tool for online classes.

It is clear from the previous survey that there is still a debate about the effectiveness of distance education, especially before the age of the pandemic. Additionally, some other factors should be taken into consideration, such as environmental and social factors. Training should also be considered. Security and privacy issues are a significant concern. The integrity of the educational platform is essential. The distance educational system should be integrated with the online examination systems. Finally, there are still raising questions about the possibility of delivering distance education in the future regardless of the pandemic continuity. In this paper, we will try to address these issues by conducting a questionnaire on the students of the University of Jeddah. The obtained results are shown and discussed.

3 Methodology

In this paper, we aim to assess distance education's effectiveness in the University of Jeddah delivered during the COVID-19 pandemic. Also, we evaluate the possibility of continuing this type of education in the future. A questionnaire is conducted on the students of all colleges of the University of Jeddah, KSA, with 791 participants. The participants vary in their educational levels, GPA, and specialization. Both master and undergraduate students are involved in the questionnaire. The questionnaire has three variables. The first variable consists of ten questions regarding the quality of the educational services delivered on the educational platform used in the University, which is called the BlackBoard (BB). The second variable concerns the quality of the examinations and the testing processes delivered by BB. This variable consists of seven questions. The third variable concerns other factors (environmental and health factors) that may affect BB's usage. This variable consists of six questions. Finally, two other variables are added to the questionnaire to assess the overall effectiveness of the BB. We conduct a questionnaire using Google forms in Nov. 2020.

3.1 The Questionnaire

The proposed questionnaire consists of general information about the participant, three-question variables, and two overall variables. The general information includes the college, specialization, educational stage (undergrad/postgrad), GPA, and educational level. All this information is labeled as X1-X5, respectively. Other statements of the variables are in the form of the Likert scale. Table 1 shows statements of the first variable.

Table 1: Statements of the first variable

Statement No.	Question
X6	Time of perception using BB is less than traditional education
X7	Solving assignments on BB is more comfortable than traditional education
X8	I have previously received adequate training on BB
X9	Perception on BB is more comfortable than in traditional classrooms
X10	Attendance on BB is preferable to traditional classrooms
X11	Studying on BB needs fewer efforts than traditional education
X12	The quality of BB education is better than traditional classrooms
X13	Interactivity on BB is better than in traditional classrooms
X14	BB avails both theoretical and practical courses with better quality
X15	The University avails technical support and other logistics for using BB

The second variable concerns the delivered examinations and testing services. This variable consists of the statements shown in Table 2.

Table 2: Statements of the second variable

Statement No.	Question
X16	BB preserves privacy during exams
X17	Time management in BB exams is better than in traditional exams
X18	Questions types on BB is better than traditional exams
X19	BB helps in obtaining a better GPA than traditional exams
X20	Testing on BB for me is better than that of traditional exams
X21	Fairness of evaluation on BB is better than that of traditional exams
X22	Transferring from traditional exams to BB exams is flexible during the COVID pandemic

The third variable concerns other factors (environmental and health) that may affect BB usage either in education or exams. Table 3 shows the statements of this variable.

Table 3: Statements of the third variable

Statement No.	Question
X23	I have connectivity problems when using BB
X24	I have technical problems when using BB
X25	I have health problems that prohibit me from sitting on computers and other electronic devices
X26	I do not like sitting a lot on computers and other electronic devices
X27	I need more training to use BB effectively
X28	I cannot perceive my lessons well from BB

Besides the previous three variables, two additional variables reflect the participant's overall opinion about the usage of BB. These two questions are;

X29: Using BB is effective in the age of the COVID pandemic.

X30: Using BB is effective compared to traditional classrooms, regardless of the COVID pandemic.

However, the answers to the two questions are just yes/no.

3.2 Preprocessing

As stated before, the questionnaire is distributed to the students using a Google form link sent to their university accounts. This process ensures many things. First, this process ensures the authentication of the participants. So, only authenticated students can fill the form. Second, the design of the responses is in the form of drop-down lists. So, there is no empty data on the responses obtained. The students must answer all of the questionnaire questions. Also, the first

five questions are supported by drop-down lists in Google form. It is noted that the questions of the third variable (environmental and health factors) are of negative form. So, as a preprocessing step, these values should be encoded in SPSS before being used. The encoding of these values is given as

$$Xnew = 6 - Xold \hspace{6cm} (1).$$

4 Experimental Results

We will analyze the responses obtained from the questionnaire, using SPSS®25. The target is to test the effectiveness of the distance learning delivered by the University of Jeddah during the COVID pandemic. The Likert scale gives students' responses: Strongly Disagree, Disagree, Neutral, Strongly Agree, and Agree. All conducted statistical tests use a confidence interval of 95%. So, the significance level α = 0.05. Statistical analyses presented in this paper include both descriptive and inferential statistics, based on [15].

4.1 Descriptive Statistics

We will describe the responses obtained from the questionnaire. Table 4 shows the distribution of the participants according to their college, with a total number of 791 participants. These participants are collected from all colleges in the University of Jeddah (21 colleges). College of law has the maximum number of participants. Additionally, colleges of business, engineering, and computer sciences also have the majority of the participants added to the college of law.

Table 4: Distribution of students colleges participating in the questionnaire

No.	College	Freq.	Percent. (%)
1	Media & Comm.	10	1.3
2	Business	130	16.4
3	Business – AlKamel Branch	1	.1
4	Business – Kholies Branch	13	1.6
5	Education	22	2.8
6	Arts & Design	10	1.3
7	Computers & IT - AlKamel Branch	2	.3
8	Computers & IT - Kholies Branch	3	.4
9	Applied Studies	1	.1
10	Medicine	14	1.8
11	Sciences	62	7.8
12	Social Sciences	34	4.3
13	Medical Applied Sciences	22	2.8
14	Sciences & Arts - AlKamel Branch	4	.5
15	Sciences & Arts - Kholies Branch	15	1.9
16	Law & Jud. Studies	201	25.4
17	Holly Quran & Islamic Studies	16	2.0
18	Languages & Translation	9	1.1
19	Engineering	113	14.3
20	Sports Sciences	8	1.0
21	Computer Science & Engineering	101	12.8
Total		791	100.0

Table 5 shows the distribution of participants according to the educational stage (undergraduate or postgraduate). It is clear from the Table that most students are bachelor students (88%). The rest are postgraduate students. It was expected because it reflects the percentage of

these students in the population (University) as most students are undergraduates. However, postgraduate students are also involved representing 12% of the participants.

Table 5: Distribution of participants according to study stage

Degree	Freq.	Percentage (%)
Bachelor's	696	88%
Post Grad. (Master's)	95	12%
Total	791	100.0

Table 6 shows the distribution of participants according to their GPA. For simplicity, GPA is divided into categories. The majority of the students have a GPA greater than 4 (62.1%). However, different GPA categories are also represented in the sample. It is also noted that some students have no GPA as they are newcomers to the University considered in the preparation year.

Table 6: Distribution of participants according to GPA

GPA	Freq.	Percentage (%)
None	59	7.5
<2	1	.1
>4	491	62.1
>2 & <3	30	3.8
>3 & <4	210	26.5
>4	491	62.1
Total	791	100.0

Table 7 shows the distribution of participants according to their educational level. The education levels range from 1 to 10. Again, it is clear that all educational levels are involved in the study. The majority of the students belong to levels 3 and 5, respectively. The reason is the dataset is collected during fall 2020. The majority of the students are at odd levels this semester.

Table 7: Distribution of participants according to the educational level

Level	Freq.	Percentage (%)
1	142	18.0
2	48	6.1
3	275	34.8
4	23	2.9
5	157	19.8
6	25	3.2
7	66	8.3
8	14	1.8
9	29	3.7
10	12	1.5
Total	791	100.0

Table 8 shows the summary of the responses of the overall variable (X29). This variable measures the general evaluation of BB during the pandemic. It is clear that most participants (89.4%) agree that using BB is very effective in the age of pandemic in the University of Jeddah.

Table 8: Effectiveness of BB in the age of pandemic

Response	Freq.	Percentage (%)
No	84	10.6
Yes	707	89.4
Total	791	100.0

Table 9 shows the summary of the responses of the overall variable (X30). This variable measures the general evaluation of BB at any time (regardless of the COVID pandemic). Many participants (60.6%) agree that using BB is very effective at any time regardless of the COVID pandemic. This result is encouraging as the University plan to deliver more distance education shortly regardless of the pandemic's continuity.

Table 9: overall BB evaluation

Response	Freq.	Percentage (%)
No	312	39.4
Yes	479	60.6
Total	791	100.0

Figure 1 shows the distribution of the averages of the first variable (also called Track1). It is computed by averaging all statements of the variable. The majority of responses of this variable are located between neutral and agree. Hence, many students agree on using BB as a useful tool for education.
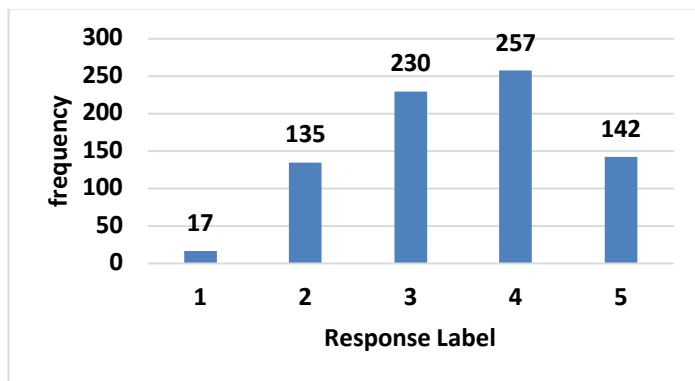

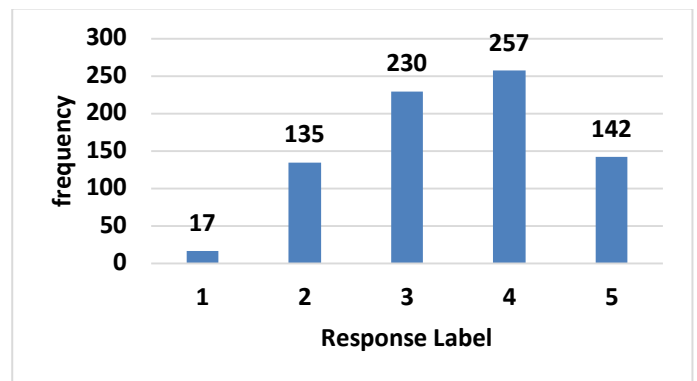**Figure 1**: The average of the first variable (Track1).

Figure 2: the average of the second variable (Track2).

Figure 2 shows the distribution of the averages of the second variable (Track2). The majority of responses of this variable are located between agreeing and strongly agreeing. Hence, most students agree with using BB as an effective tool for examination and testing.

Figure 3 shows the distribution of the averages of the third variable (Track3). The majority of responses of this variable skewed towards the strongly agree. Hence, the students have less difficulty dealing with BB, such as public health and environmental difficulties. It is important to note that this variable is previously preprocessed, as explained in the previous section.
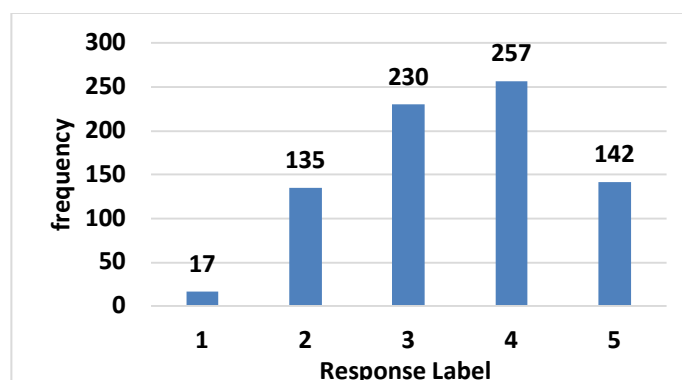

Figure 3: the average of the third variable (Track3).

Next, the responses of each variable are furtherly analyzed. There are three variables in the questionnaire. The first variable concerns the effectiveness of BB in both the education and teaching process. The second variable concerns the effectiveness of BB in the examinations, testing, and evaluation processes. The third variable concerns other factors affecting the usage of BB. The results of variable1 are shown in Table 10.

The last column contains the maximum scale of each statement. For example, in the first row, the maximum frequency is 207, which indicates a scale of 3 (neutral). So, the adjacent value in the last column is 3. The last row of the Table represents the totals of the frequencies of each scale. The bottom right value (3) is computed based on the average of the last column. That is, after computing the average, a mapping function is used according to Table 11. Concluding from Table 10, the responses of the participants are neutral for this variable which equals 3. So, students are neutral about using BB in distance education and teaching. That is, they do not fully agree on this type of education. The probable explanation is; using BB, and other distance education is not entirely the best alternative to traditional education. That is, in traditional education, the instructor and students are interactive. This interaction is slightly missed when using BB. Also, body language and emotions are missed when using distance education.

Table 10: Results of variable 1

Statement	Strongly disagree	disagree	neutral	agree	Strongly agree	average	SD	Result
X6	117	135	207	171	161	3.16	1.331	3
X7	59	55	131	203	343	3.91	1.242	5
X8	87	96	193	244	171	3.40	1.256	4
X9	284	109	176	90	132	2.59	1.480	1
X10	230	90	131	96	244	3.04	1.623	5
X11	83	121	169	196	222	3.45	1.321	5
X12	216	159	197	104	115	2.68	1.380	1
X13	224	146	160	126	135	2.75	1.449	1
X14	84	82	281	228	116	3.27	1.155	3
X15	18	19	164	293	297	4.05	.939	5
Totals	1402	1012	1809	1751	1936	3.23	1.3176	3

Table 11 shows the mapping of the average values and the adjacent scale used. This Table is necessary to convert the continuous averages into discrete averages.

Table 11: Mapping values

Average	Scale
1 - 1.79	1
1.80 - 2.59	2
2.60 - 3.39	3
3.40 - 4.19	4
4.20 - 5	5

Table 12 shows the analysis of the second variable. It is clear from the Table that the students agree on using BB in exams and evaluation. The average evaluation of this variable is four which means Agree. The explanation is; using BB helps students organize their time in exams and also ensures fair evaluation. Also, the evaluation results could be delivered immediately.

Table 12: Results of variable 2

Statement	Strongly disagree	disagree	neutral	agree	Strongly agree	average	SD	Result
X16	112	74	112	187	306	3.63	1.430	5
X17	140	149	234	137	131	2.96	1.316	3
X18	78	99	256	188	170	3.35	1.225	3
X19	65	36	125	162	403	4.01	1.261	5
X20	133	93	225	141	199	3.23	1.388	3
X21	70	77	178	270	196	3.56	1.212	4
X22	47	31	129	288	296	3.95	1.108	5
Totals	645	559	1259	1373	1701	3.527143	1.27	4

Table 13 shows the analysis of the third variable (Track 3). It is clear from the Table that the students also agree with other factors affecting BB's usage in their educational process. So, the students have no difficulties in dealing with BB. Such difficulties may include environmental, health, or training difficulties. Again, the overall average of this variable is four which means agree.

Table 13: Results of variable3

Statement	Strongly disagree	disagree	neutral	agree	Strongly agree	average	SD	Result
X23	141	190	145	183	132	2.97	1.361	2
X24	100	180	163	201	147	3.15	1.308	4
X25	178	151	119	175	168	3.01	1.471	1
X26	40	70	99	213	369	4.01	1.184	5
X27	24	74	103	251	339	4.02	1.099	5
X28	152	103	165	149	222	3.24	1.469	5
Totals	635	768	794	1172	1377	3.40	1.32	4

4.2 Testing Validity and Reliability

Before publishing the questionnaire, all statements are revised by three experts to test clearness, correctness, and unambiguity. Additionally, a test sample of 40 students responded to the questionnaire reporting their comments. All comments are fixed before publishing the questionnaire. Also, SPSS is used to test the questionnaire's reliability, Cronbach's Alpha is computed to test reliability. SPSS results show that Cronbach's Alpha equals 0.895, which is very good (> 0.6). Additionally, we use the option "if item deleted" to show the effect of removing or adding each statement.

Table 14 shows the details of reliability testing. The Table shows the statements, mean, variance, and correlation. The last column of Table 14 shows the Cronbach's Alpha values if a statement is deleted from the questionnaire. All values in this column are closer to one. Also, there is no significant difference between the overall Cronbach's Alpha and these values. Concluding that, all items of the questionnaire are essential.

Additionally, as noted from the last column, both X6 and X11 can enhance Cronbach's Alpha (larger values). Validity could be computed as the square root of the reliability. In this questionnaire, the validity = $\sqrt{0.895}$ = 0.946, which is also very large.

Table 14: Item-Total Statistics

Statement.	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
X6	81.21	310.175	-.441	.911
X7	80.46	269.464	.498	.891
X8	80.97	268.298	.521	.890
X9	81.78	255.340	.714	.885
X10	81.33	251.420	.724	.884
X11	80.92	314.211	-.526	.913
X12	81.69	256.494	.744	.884
X13	81.62	255.606	.725	.885
X15	81.10	271.868	.475	.891
X16	80.32	276.247	.454	.892
X17	80.74	261.663	.596	.888
X18	81.41	273.973	.358	.894
X19	81.02	272.223	.435	.892
X20	80.36	267.103	.548	.890
X21	81.14	259.241	.674	.886
X22	80.81	263.313	.674	.887
X23	80.41	270.866	.526	.890
X25	81.40	265.458	.541	.890
X26	81.22	266.057	.551	.889
X27	81.36	256.827	.685	.886
X28	80.36	271.779	.464	.891
X29	80.35	276.263	.378	.893
X30	81.13	255.266	.722	.885
X31	80.58	282.925	.385	.894
X32	81.16	268.685	.675	.888

4.3 Correlation

In this subsection, we will show the different correlations between different variables. This test examines the possible correlations between the three variables and the possible correlations between them and one of the overall variables (X30). The research hypotheses (alternative hypotheses) are

H_{11}: there is a correlation between the first and the second variable at a confidence level of 0.95.

H_{12}: there is a correlation between the first and the third variable at a confidence level of 0.95.

H_{13}: there is a correlation between the second and the third variable at a confidence level of 0.95.

H_{14}: there is a correlation between the first and the overall variable at a confidence level of 0.95.

H_{15}: there is a correlation between the second and the overall variable at a confidence level of 0.95.

H_{16}: there is a correlation between the third and the overall variable at a confidence level of 0.95.

Table 15 shows the correlations obtained from SPSS. For the three variables, the average of each variable is firstly computed to apply correlations.

It is clear from the Table that the correlation coefficient between variable1 and variable2 is 0.616, which indicates a positive correlation between the two variables. That is, there is a positive correlation between using BB in education and also in the examination. The *p*-value equals zero, which is less than 0.05, thus H_{11} is accepted. So, there is evidence that the first and second variables are correlated. The correlation coefficient between the first and third variables is 0.529. The significance is also less than 0.05. The same case occurs between the second and the third variable. In all cases, the correlation between the three variables is positive, and the p-value is less than

0.05. So, in all cases, we can conclude a correlation between every variable pair (variable1, variable2, variable3). However, the largest correlation coefficient occurs between the first and the second variable. So, in these experiments, The research hypotheses H_{11}, H_{12}, and H_{13} are accepted.

Table 15 also shows the correlations between the overall variable X30 and the other three variables. It is clear from the Table that there are also positive correlations between X30 and the other three variables. The correlation values are 0.591, 0.552, and 0.546 respectively. In all cases, the *p*-value <0.05, the research hypotheses H_{14}, H_{15}, H_{16} are accepted.

Table 15: Correlations (N = 791)

		X30	Variable1	Variable2	Variable3
X30	Pearson Correlation	1	.591**	.552**	.546**
	Sig. (2-tailed)		.000	.000	.000
Variable1	Pearson Correlation	.591**	1	.616**	.529**
	Sig. (2-tailed)	.000		.000	.000
Variable2	Pearson Correlation	.552**	.616**	1	.527**
	Sig. (2-tailed)	.000	.000		.000
Variable3	Pearson Correlation	.546**	.529**	.527**	1
	Sig. (2-tailed)	.000	.000	.000	

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

4.4 ANOVA

Finally, the possible effect of general information is tested on each of the three variables. Here, ANOVA tests are conducted. We begin our experiments by testing the possible effect of college on each of the three variables. So, we state the research hypotheses:

H_{17}: There is a significant difference between colleges on responding to variable1

H_{18}: There is a significant difference between colleges on responding to variable2

H_{19}: There is a significant difference between colleges on responding to variable3

Table 16 shows the results of one-way ANOVA used to test the previous hypothesis. It is noted that the *f* value of variable1 is 2.130, the *p*-value is 0.003<0.05. So, H_{17} is accepted. This is also the case for the second and third variables. In all variables, the *p*-value <0.05. So, H_{17}, H_{18}, and H_{19} are accepted. There is a significant difference between different colleges in the University in evaluating the three variables. The conclusion is that different colleges and specializations affect students' evaluations of the three variables. Also, there is a factor related to the nature of the course (theoretical/ practical).

Table 16: ANOVA of colleges/Variables

		Sum of Squares	df	Mean Square	F	Sig.
Variable1	Between Groups	19.445	20	.972	2.130	.003
	Within Groups	351.485	770	.456		
	Total	370.930	790			
Variable2	Between Groups	53.838	20	2.692	3.533	.000
	Within Groups	586.701	770	.762		
	Total	640.539	790			
Variable3	Between Groups	78.889	20	3.944	4.175	.000
	Within Groups	727.434	770	.945		
	Total	806.323	790			

The next is to test the effect of the education level on each of the three variables. Here, we use the research hypotheses:

H_{110}: There is a significant difference for different education levels when responding to variable1

H_{111}: There is a significant difference for different education levels when responding to variable2

H_{112}: There is a significant difference for different education levels when responding to variable3

Table 17 shows these tests. Only H_{110} could not be accepted as the p-value>0.05. So, the student levels do not affect the distance education process (variable 1). However, the situation is different regarding the second and third variables where p<0.05. Here, H_{111} and H_{112} are accepted. Interpreting that, based on the educational level, the students evaluate the effectiveness of the examinations and other factors differently. So, newcomer students may have not the necessary examination experience to deal with BB. Additionally, the other factors of the third variable vary between students' levels. So, additional training may be required for newcomers.

Table 17: ANOVA of education levels/Variables.

		Sum of Squares	df	Mean Square	F	Sig.
Variable1	Between Groups	5.175	9	.575	1.228	.274
	Within Groups	365.755	781	.468		
	Total	370.930	790			
Variable2	Between Groups	17.612	9	1.957	2.453	.009
	Within Groups	622.927	781	.798		
	Total	640.539	790			
Variable3	Between Groups	27.070	9	3.008	3.014	.002
	Within Groups	779.253	781	.998		
	Total	806.323	790			

The next test is the educational stage's effect (undergrad/postgrad) on each of the three variables. We use the research hypotheses,

H_{113}: There is a significant difference for different education stages when responding to variable1

H_{114}: There is a significant difference for different education stages when responding to variable2

H_{115}: There is a significant difference for different education stages when responding to variable3

Table 18: ANOVA of post-undergrad/Variables.

		Sum of Squares	df	Mean Square	F	Sig.
Variable1	Between Groups	3.456	1	3.456	7.421	.007
	Within Groups	367.474	789	.466		
	Total	370.930	790			
Variable2	Between Groups	.553	1	.553	.682	.409
	Within Groups	639.986	789	.811		
	Total	640.539	790			
Variable3	Between Groups	2.359	1	2.359	2.315	.129
	Within Groups	803.964	789	1.019		
	Total	806.323	790			

Table 18 shows the results obtained. Again, from the previous hypotheses, only H_{113} could be accepted. Interpreting that, the evaluation of the distance education services is different between undergraduate and postgraduate students. The previous may be a reflection of the differences in age,

experience, and liabilities. However, the responses of the two other variables were almost the same for both undergraduate and postgraduate students.

The final ANOVA test evaluates the effect of students' GPA on each of the three variables. Here, we use the research hypotheses:

H_{116}: There is a significant difference for student GPA when responding to variable1

H_{117}: There is a significant difference for student GPA when responding to variable2

H_{118}: There is a significant difference for student GPA when responding to variable3

Table 19 shows the results obtained for the previous hypotheses. H_{116} and H_{117} could be accepted as p-value <0.05. Meaning that the students with different GPAs evaluate both the distance education and the examination differently. So, GPA can differentiate student academic performance. So, it has some effect on responding to distance education and examinations. However, H_{118} is not accepted. Meaning that the GPA has no impact on other environmental and health factors.

Table 19: ANOVA of GPA/Variables

		Sum of Squares	Df	Mean Square	F	Sig.
Variable1	Between Groups	10.757	4	2.689	5.869	.000
	Within Groups	360.173	786	.458		
	Total	370.930	790			
Variable2	Between Groups	26.562	4	6.641	8.501	.000
	Within Groups	613.976	786	.781		
	Total	640.539	790			
Variable3	Between Groups	5.610	4	1.403	1.377	.240
	Within Groups	800.713	786	1.019		
	Total	806.323	790			

5 Discussion

This paper assesses distance education's effectiveness in the University of Jeddah, delivered during the COVID-19 pandemic. Also, we aim to evaluate the possibility of continuing to deliver this type of education in the future after the pandemic ends. We conduct a questionnaire on a sample of students from the University of Jeddah. There are 791 participants from all colleges in the University, varied in their educational levels, GPA, and educational stage. The questionnaire contains three critical variables. The first variable is related to the quality of the educational services delivered on the educational platform BlackBoard (BB). The second variable concerns the quality of the online examinations. The third variable concerns other factors (environmental and health factors) that may affect BB's usage. All conducted statistical tests use a confidence interval of 95%. The questionnaire reliability computed using Cronbach's Alpha equals 0.895, which is very good. The validity equals 0.946, which is also very large.

The descriptive statistics show that most participants (89.4%) agree that using BB is very effective in the age of pandemic in the University of Jeddah. However, many participants (60.6%) agree that using BB is very effective at any time regardless of the COVID pandemic compared to traditional education. This result is encouraging as the University may plan to deliver more distance education courses shortly regardless of the pandemic's continuity. When assessing the

three variables' averages, the results show that many students agree on using BB as a useful tool for education. The majority of them agree on using BB as an effective tool for examination and testing. Also, the students have fewer difficulties in dealing with BB. Although students agree on BB's effectiveness in the pandemic, they are neutral on continuing this type of education in the future after the end of the pandemic. The reasons may be related to missing body language and interactions in distance education. For examination and testing, BB helps students organize their time in exams and also ensures fair evaluation. Also, the evaluation results could be delivered immediately. So, students agree on using BB as an effective tool for testing. The students have no difficulties in dealing with BB.

The conducted correlation tests show that the three variables have positive correlations. There is a relationship between student responses to the three variables (distance education, testing, and environmental factors). Moreover, in pairs, the three variables are positively correlated with the overall variable regarding BB usefulness. So, if the students are satisfied with BB's services, they will desire to use BB in the future.

The ANOVA tests show a significant difference between different university colleges in evaluating the three variables. The different nature of the online courses studied for different colleges may be the reason for this difference. Regarding the academic level, only the second and the third variables are affected. That is, newcomers may have not the necessary examination experience to deal with BB. In this case, additional training may be required for those students.

Regarding the academic stage, only the first variable is affected. It may reflect differences in age, experience, and liabilities between undergraduate and postgraduate students. Regarding GPA, the students with different GPAs evaluate both distance education and the examination differently. However, GPA has no impact on other environmental and health factors.

From all results obtained, using distance educational platforms is very useful at the pandemic age in educational and examination services. However, students are neutral with using distance education as an alternative to distance education outside the pandemic age. The students recommend using the educational platform as a useful tool for examination and testing all the time. Other health and environmental factors should also be considered when dealing with distance educational platforms. Using the educational platform is very useful in the University of Jeddah regardless of the continuity of the COVID pandemic, especially in the online examination and testing processes.

6 Conclusion

Social distancing is very effective in confronting the pandemic of COVID-19. Distance education achieves social distancing. However, there is always a debate on the effectiveness of this type of education. This paper investigates the effectiveness of distance education in the age of the COVID pandemic at the University of Jeddah. A questionnaire is conducted on 791 students having different varieties. Three variables are tested related to distance education, remote-examination, and other health and environmental factors. Results show that 89% of the participants agree on the

effectiveness of this type of education at the pandemic age. Also, participants 60.6% express the effectiveness of this type of education regardless of the pandemic continuity. The reliability of the questionnaire is 0.9. A positive correlation exists between the three variables tested and between these variables and the overall students' satisfaction. The ANOVA tests reveal different effects of students' college on the responses of the three variables.

7 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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9 References

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