Article

Comparison of Academic Results during Conventional and Online Modes of Learning: A Case Study of Two Groups of Saudi University Students

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Abstract: The COVID-19 outbreak disrupted all aspects of people's lives, including pedagogy and instruction at universities, where its impact was felt globally, and the Kingdom of Saudi Arabia is no exception. This paper discusses and compares the academic results during the conventional mode of learning (spring semester of 2019) and during the online mode of learning (spring semester of 2020), which was throughout the pandemic period. Specifically, the study considers two Saudi groups of fifty students who were enrolled in the Department of Health Information Management and Technology at the University of Hafr Al-batin in the eastern region of Saudi Arabia. The students' accumulative marks in six first-year courses in two semesters were analyzed and compared by calculating the passing/failure percentages, descriptive statistics (mean, median, mode, standard deviation, variance, maximum, minimum, and range), and the *p*-value of an inferential *t*-test. Additionally, the students filled out a six-category survey about their experiences and level of satisfaction with online learning compared to the regular learning mode. It was concluded that more students passed with higher grades in the year 2020 in five theoretical courses. Differently, it was deduced that practical courses such as computer applications had similar passing averages in the two years; the course required students to submit continuous assignments and projects in a fixed time period. Additionally, the participants revealed in their filled online survey that they preferred many features of the remote learning mode and the online assessment methodology. They inclined toward online learning for its flexibility and effectiveness, even though they confessed to having less interaction and focus during online sessions. Thus, the results imply to authorities in the Ministry of Higher Education to carefully and gradually embed online teaching for selected subjects with exam validation measures such as time strict limits, question banks, randomizations, and other security features.

Keywords: COVID-19; academic performance; Saudi students; online learning

1. Introduction

The outbreak and wide spread of the COVID-19 pandemic has raised many unresolved issues regarding education worldwide and it has caused countries to migrate to digital media and adopt new teaching strategies. Many universities took the abrupt, rapid measure of switching to online platforms and utilized various electronic technologies to mitigate some of the transformation effects on the educational process. Carmozzino et al. [1] defined online learning as a virtual learning mode using mobile and wireless computing technologies to promote the learning abilities of learners. Bayrak et al. [2] explained that online teaching has rapidly grown globally during the last ten years, but it grew at an incredible pace during 2020, the year of the COVID-19 pandemic. Oyinloye [3] contended that COVID-19 has affected all educational levels in different contexts all over the world. Specifically, many academic institutions gained various merits in their transition, but they also faced many challenges while shifting to the online mode of education, such as a lack

of pedagogical instructors' training in using distance learning applications, shortages of appropriate devices and network infrastructures, and the high cost of implementations. Hashemi and Kew [4] explained some of the barriers that currently face online teaching in Afghanistan: the high cost of electricity, shortages of devices needed for online learning, the high cost of computer networks, and the lack of appropriate training for those working with online applications. One important metric to monitor while transitioning to online teaching is the academic performance of students. The rest of this paper is organized as follows: the literature review details some of the international and Saudi research work that was conducted to examine the effects of COVID-19 on switching to online and other types of learning modes. The methodology includes the research design, study sample, delivery of content and examinations, and data collection procedure. The results section discusses the descriptive and inferential results, then it provides the results of the perception survey of the sample's students.

2. Literature Review

Many studies were carried out during the period of the COVID-19 pandemic, where the overall perception of online teaching has been mixed. Many studies have researched the perception of students of the new online learning mode using mainly an online survey. First, outside the Kingdom of Saudi Arabia, Means and Neisler [5] concluded that there was a profound impact of transitioning to online university teaching on students with lower satisfaction levels of online learning. Sadid-Zadeh et al. [6] conducted a survey of dental students at the University of Buffalo and concluded that 99 % of them were happy and satisfied with online web-based lectures during the COVID-19 pandemic. Schlenz et al. [7] presented a favorable result in a study of German school students and reported a positive attitude towards online learning of the students who wished to continue to have some online instruction in their studies. On the other hand, Chen et al. [8] concluded in a study of Harvard University students they felt that learning during the COVID-19 period had worsened and students' engagement had suffered. Tanjea Ane and Tabatshum Nepa [9] designed an online google survey form to collect the opinions of Bangladeshi and Nepal undergraduate students during the COVID-19 period. They argued that online education should be adopted and maintained for higher education studies. Aminuddin Hashemi [10] investigated the effects of COVID-19 on the academic performance of Afghan students and the level of their satisfaction with online teaching. The researcher concluded that COVID-19 has negatively affected the academic performance of Afghan students and that their studied students did not prefer online teaching. Gonzalez and Rubia et al. [11] investigated the academic effects of confinement during the COVD-19 period on two groups of university students and concluded that the confinement enhanced the students learning strategies and their academic performance. Lorenzo-Alvarez et al. [12] found that the academic marks of an online course at an Australian university are similar to those found as a result of face-to-face learning. Elhadary et al. [13] researched the many factors of the COVID-19 pandemic on social science and science students' academic performance and revealed that the students and their teachers had a positive experience with online learning and teaching. Regarding satisfaction with online learning experiences, Dinh and Nguyen [14] revealed that online learning and teaching is less satisfying than face-to-face teaching, while a study by Baber H. [15] indicated a high satisfaction with online teaching. Bokayev et al. [16] studied both parents' and their children satisfaction with distance learning during the COVID-19 pandemic period. The researchers found an overall positive correlation between parents' and children's satisfaction of the online learning experience. Khan et al.'s [17] study concluded that during the COVID-19 outbreak, the students preferred online teaching over face-to-face teaching for reasons such as the ease and freedom of joining teaching sessions.

In response to the pandemic, the Saudi Ministry of Higher Education (MOH) decided to shift to vital online teaching for all public and private universities in the Kingdom. Therefore, many studies have looked at the views of various stakeholders related to online learning. Second, inside the Kingdom of Saudi Arabia, Nasrin Altuwairesh [18] studied the

perceptions of 241 female Saudi students at the University of King Saud of online teaching during the COVID-19 pandemic. She revealed that many of the students conveniently enjoyed their online experience and participated in online discussions. However, the researcher also concluded that many students faced some problems in online education such as motivation, face-to-face interaction, and technical issues. Additionally, Haifa Al-Nofaie [19] examined the perceptions of 25 English major university Saudi students in learning using Blackboard during the COVID-19 period. The researcher aimed at identifying the advantages and challenges of online learning. The author concluded that the students preferred the flexibility of online learning but admitted to its ineffectiveness in learning fundamental language skills. In addition, Safaa M. Hanafy et al. [20] used a five-point scale questionnaire to gauge the perceptions and attitudes of 230 university medical Saudi students and 20 faculty members towards online learning and online exams in comparison to the conventional mode of learning and examination. The respondents preferred online experiences because of immediate examination results and the students professed that they obtained higher mean scores during the online period. Rajab, M.H et al. [21] studied the impact of the COVID-19 pandemic on the transition from traditional to online learning by distributing a questionnaire to faculty members and students in the college of medicine at Al Faisal University. The questionnaire inquired about time management, online experience, technology utilization, assessment, and students' interactions online. The study concluded that the online experience developed the confidence level of students and their overall interactions in the short beginning period of the pandemic. Abdulrahim and Mabrouk [22] distributed a questionnaire to investigate the Saudi university's students and faculty members' perceptions of the effectiveness of the digital Saudi educational transformation and online technological revolution in mitigating the COVID-19 pandemic impact on higher Saudi education.

Therefore, a lot of the studies have focused on views of the impact of COVID-19 on the educational process and academic assessment from the different perspective of students, faculty members, or staff by distributing a questionnaire, while only few studies investigated the effect of the pandemic on the actual academic performance and marks of the students. The significance of this study is that it fills an essential lack of research in not only presenting the views of Saudi students of their new experience using the virtual learning mode as compared to their previous inside campuses method of learning, but the study also examines the actual marks of students in their courses during the two periods. Thus, the study aims to compare the academic achievements of Saudi university students in their first-year courses in the periods before and after the pandemic. The first period is during the conventional university period (2019), and the other period is during the COVID-19 pandemic year (2020). Face-to-face lecture delivery and physical exams were the norm during 2019, while online teaching and exams were used in the year 2020. This research analyzes eight statistical measures of the students' academic achievements in two academic semesters. The second aim of the study is to gauge students' overall acceptance of their first online learning experience as compared to having their classes inside the university campus. The current research is an extension of a previous study by Al-qdah and Ababneh [23] that compared online and paper exam achievements for Saudi students in another Saudi public university but during regular non pandemic periods; both paper and online exams were supervised by the researchers.

Briefly, this study in the eastern region of Saudi Arabia presents its own perspective regarding the current knowledge of blending online learning with face-to-face learning. Furthermore, the research will fill some of the shortages in the studies which currently exist as little work has been done regarding the impacts of e-learning in the eastern region of Saudi Arabia. Additionally, most studies in Saudi Arabia focused only on feedback from students or teachers without reflecting on the academic results of those students. Thus, this paper sheds some light on the students' academic results and the students' perceptions during online learning periods. The real value of this study is that it took place in a university that was only starting to offer some common online university courses but

had to switch to full online conduct of courses for all faculties/colleges in the university. In short, the research is formulated around two main questions:

(1) Is there any statistical differences of the academic results of Saudi students in the two periods of study using two different modes of learning: conventional and online?

(2) Is there a positive or negative perception of online learning and online assessment by Saudi students?

3. Methodology

Traditionally, blended learning allows students to take their theoretical lectures online, but it also requires them to take their major exams physically inside a university campus. The exams are usually supervised by the courses' instructors and some assigned invigilators. This work explored and compared the grades and accumulative marks (100%) for two groups of Saudi students who completed six first-year courses (Biology, Mathematics, Computer, Chemistry, English, and medical terminology) in the program of health information management and technology (HIMT). The courses codes are: Biol115, Chem116, CSE111, Engl101, Math132, and Med112, respectively. The final grades and marks were collected from the submitted course files of each course after final approval by the department council and the department chairman. Unconventionally, this work compares the students' academic achievements who had both their lectures/labs and attempted their exams online from outside the campus (mostly homes) as a result of the COVID-19 pandemic. Thus, the study theorizes that students' grades and academic results during online periods are different from those of regular study periods for all classes (theoretical or practical) and we attempt to explore that notion using descriptive statistics and inferential tests. The study also probes the students' perception of their experience in online learning compared to the traditional on-campus mode of learning using a short survey. Therefore, the study theorizes that students perceive online learning positively in some aspects, while they prefer on-campus learning for other reasons. The research discusses the responses of the students to a survey; specifically, the particular preferences of students regarding the two modes of learning.

3.1. Research Approach

This research focuses on the grades of two Saudi university students' groups in two study periods: online and traditional. In addition, the study measures if students perceive the two learning modes either positively or negatively. Therefore, the study adopted and employed a hybrid method of two research types: a qualitative approach and quantitative approach. Gay, Milla, and Airasian (2009) explained that quantitative research relies on a sample of participants to provide statistics and interpret the data collected. On the other hand, Gay, Milla, and Airasian (2009) elaborated that the qualitative method does not rely on numbers or any statistical data, but rather it is the collection, analysis, and interpretation of comprehensive narrative and visual (i.e., non-numerical) data to gain some insights into a particular phenomenon. The first research question is mainly analyzed using quantitative statistical analysis, while the second question is resolved using the qualitative approach of inference. This study is distinguished as it does not rely only on self-reported data from students' surveys as many studies have done, but rather it incorporates the students' actual marks into the analysis.

3.2. Sample of Students

The selected students in this study were male Saudi nationals around the age of 20 years old in their first semester of study. The students derived from two different groups: group 1 were the students who were admitted into the health information management and technology (HIMT) program in the spring of 2019, while group 2 were the students who joined the HIMT program in the spring semester of 2020. All the participants had no prior experience of online learning nor online exams before joining the university. However, as a result of the COVID-19 pandemic, all the students had possessed or bought

at least one electronic device (personal computer, tablets, mobile phones, laptop, or iPad) with Internet access to join and participate in online learning sessions. The students had similar demographic profiles and a similar educational background of having attended Saudi schools inside the country of Saudi Arabia within the eastern region of the country. According to the department registration records, all the students had attended public or private schools in the eastern region of Saudi Arabia without any international or English-medium schooling. The number of students in each group was around 50 students who were physically fit without any health disabilities or handicaps. All the students were fully financially supported by Saudi educational ministry scholarships, where each student received a monthly remuneration that covered his personal expenses and privately owned car's fuel. Additionally, the students did not have to pay semester tuitions or any fees to the university since public universities are mostly fee-free for all Saudi citizens at the bachelor level. Every student lived in a moderate-income household with a family that arranged an appropriate study room for his online classes and teachers' interactions. Therefore, it is safe to assume that all the subjects were fulltime students and were not fulltime employees during their study. All the students completed one preparatory year in the medical stream before being admitted into the bachelor program of Health Information Management and Technology (HIMT). The entry requirement of the HIMT program is for the students to have passed each preparatory course with a minimum of a "C" grade, even though only the top fifty to sixty applicants to the program are usually accepted, with some of the students not continuing the program. Thus, there were no major disparities between the two groups in terms of prior educational background and level of education that the students had received before joining the department of HIMT.

3.3. Delivery of Lectures and Labs and Examinations

This section presents the teaching content and evaluations techniques, which were unified in two periods: online and conventional. The section also details the features of the Blackboard tool that was utilized for delivering the lectures and conducting the exams. Means and Neisler (2020) recommended several practices for online instructions: shorter activities, live online sessions, continuous assessments, projects in groups, 'breakout groups' during online classes, personal messages to students asking about their performance on the course or ensuring that they can access teaching materials, real-world examples, and setting sharing tasks that would make students discuss their learning progress. Therefore, the choice of an appropriate online software is vital to accomplish the aforementioned tasks. Blackboard is an interactive learning management environment that is used by many academic institutions globally. The system uses a real-time collaboration tool to deliver live lectures. The Blackboard learning system was used for mostly uploading teaching materials during the year 2019, but it was additionally used for conducting teaching and examinations during the COVID-19 pandemic year of 2020. The system has features to upload various learning resources of different file types, assign assignment activities, and conduct online exams. It utilizes the client/server model where the teaching materials are on a web server and are accessed through a browser on the client's side from any computing machine connected to the Internet. The Blackboard online examination tool has options of timing constraints, IP strict access of certain machines, shuffling, randomization, general and specific feedback to students, automatic grading, and other various useful options. The exam tool allows for various types of questions: true/false, MCQ, short answer, matching, and calculated types.

The courses' specification, learning outcomes, and courses evaluation weights did not change from the year 2019 to 2020, which means that the same content and distribution of marks (exams, quizzes, projects, and assignments) were followed by the instructors in each course, even though the mode of teaching and assessment criteria were modified in the year 2020. Course content refers to concepts, information, facts, theories, and principles that students are expected to acquire from a specific course. The same teaching material of textbooks and eBooks, notes, and power point slides were available to students during

both traditional and pandemic periods. Additionally, the first group of students completed their theoretical and practical sessions by physical attendance using the traditional method of face to face teaching and attempted paper exams by physical attendance inside the university campus in the year 2019, while the second group of students had their lectures and labs conducted online by their courses' professors using the Blackboard Collaborate Ultra tool, shown in Figure 1, and that second group of students attempted all their exams online in the year 2020. The students interacted with their instructors mainly electronically during the 2020 pandemic year. The time duration of lectures and lab sessions in the two years were similar as required by the number of credit hours of each course. Each online lecture and online lab session in the year 2020 was recorded as a requirement by the university; thus, the students could watch any previous lecture or lab session at their own convenient time. Additionally, the instructors in the year 2020 had to submit a daily report of their online teaching session experience, while no recording of the physical sessions nor any daily teaching report were submitted in the year 2019. The courses were taught by the same group of instructors in both semesters who allocated four weekly office hours to meet with students during face-to-face teaching periods, but they only communicated with their students using the Blackboard online collaboration tool during the pandemic year of 2020.
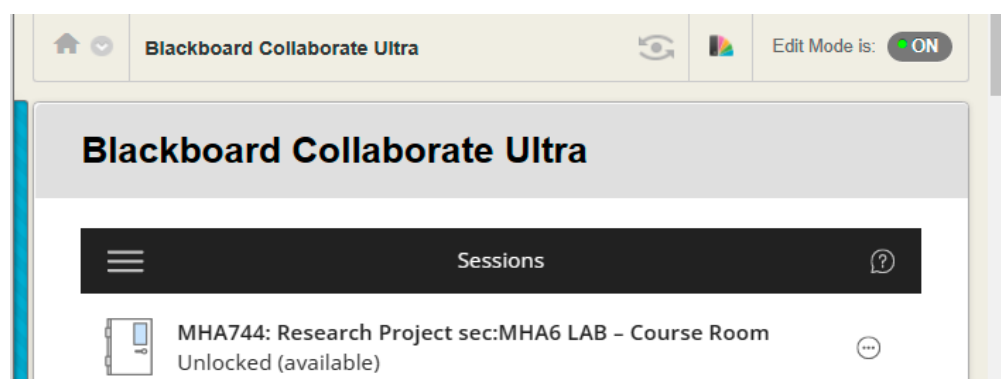

Figure 1. Blackboard Collaborate Ultra tool for online sessions.

The courses evaluation weights in the year 2019 and 2020 were similar: mainly 60% for course work (major exams, quizzes, assignments, and projects) and 40% for finals, but the exam design was different in the two years. The type of questions for all exams in the year 2020 was of the multiple-choice questions (MCQ) type, while the questions in the year 2019 varied slightly from the MCQ type to include other essay questions, even though the instructors preferred to use predominantly the MCQ type of questions for most courses in the first year. The on-campus paper exams were supervised by the department instructors, while the online exams were attempted from outside the university campus using the Blackboard online examination tool without any physical monitoring by the instructors, although some important measures were followed to provide more validity to the results. Specifically, each exam had similar characteristics: questions banks, limited time exam sessions, shuffling and randomization of questions and answers, etc. The instructors reported that the overall exam difficulty was similar in the two modes of assessment. Additionally, the login sessions were recorded by the system, i.e., the instructors knew the exam start and end times of each student's attempt. The online exams were automatically evaluated, and the students could view their marks immediately after each exam session, while the paper exams were manually graded and the papers were handed back to the students during future class sessions. The online exams had some issues of delayed login and network connection problems, even though the system could save the online examination sessions automatically and allowed the students to resume their exams during the availability period.

3.4. Data Collection Procedure

The quantitative data were collected from the submitted course files of each course after approval by both the instructors and the department head. As part of the quality requirements, the department collects data files for each course that includes the course description, sample exams and quizzes, sample assignments, content material, and final marks. The accumulative final courses' marks for the students in the two groups were analyzed: the first group completed its six courses in the first semester of the year 2019, while the other group finished its six courses in the first semester of the year 2020. The data files were analyzed using descriptive statistics by calculating the average, median, mode, standard deviation, variance, maximum, minimum, and range of the values of each course. Additionally, an inferential analysis was carried out using a *t*-test to determine if the means of the two sets of accumulative marks for each course were significantly different from each other. In addition, upon returning to regular study periods in the year 2021, the students in both groups filled in an online 5-point scale (5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1 = strongly disagree) survey about their satisfaction and preferences of on-campus and online academic experiences. The researchers administered the survey inside two computer labs (25 students' capacity) and were able to obtain responses from all of the students; the students were well-known and easily identified in the department. Then, the answers were compiled, checked, and saved for a further analysis.

4. Results and Discussions

The grading scheme followed by the university is that marks of at least 95, 90, 85, 80, 75, 70, 65, and 60 refer to a grade A+, A, B+, B, C+, C, D+, or D, respectively, while any marks below 60 receive an F grade. It should be noted that the general perception among students at the university is that they should manageably pass their foundation first-year courses if they wish to continue with the program, otherwise they would change their major. The analysis of the data is detailed below.

First, for the courses in this study, the passing percentages of the students in all courses were similar in both semesters. The only exception was on the English course, which had only a 46% passing percentage in the year 2019 in comparison to a 98% passing percentage in the year 2020. Additionally, the failure percentages were noticeably lower in the year 2020 in contrast to the year 2019; the exception was on the biology course (Biol115), which had a 0% failure percentage in the year 2019 but, surprisingly, a 13% failure percentage in the year 2020, as shown in Table 1. On the other hand, the percentage of students who passed their courses with lower than a C grade was significantly high (28% to 53%) during the year 2019, while the percentages of students who passed with lower than a C grade for five of the six courses was very low (0% to 7%) in the year 2020. Surprisingly, only the students on the computer course (CSE111) achieved a percentage of 51% of a C or higher grade in the year 2019, compared to 33% in the year of 2020. Thus, it is fair to say that more students passed with higher grades during the online mode than during the on-campus physical learning mode for most of the courses under study.

Table 1. Students' passing and failure percentages in the years 2019 and 2020.

	Biol115		Chem116		CSE111		Engl101		Math132		Med112	
Year	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Pass	100%	87%	84%	95%	93%	90%	46%	98%	95%	100%	94%	100%
(<C)	33%	4%	53%	7%	51%	33%	38%	3%	35%	1%	28%	0%
Fail	0%	13%	16%	5%	7%	10%	44%	2%	5%	0%	6%	0%

Second, eight descriptive statistical metrics were calculated for the students' overall marks in each course: mean, median, mode, standard deviation, variance, minimum, maximum, and range. Table 2 shows those numerical values in the year 2019 and in the

year 2020. The table shows that the overall mean, median, and mode values were higher in the year 2020 (group 2) than the values in the year 2019 (group 1), while the standard deviation, variance, minimum, maximum, and range values varied between the two years. The mean of the marks ranged between 70 to 90 for all courses in the two years, while the median value shows a distribution shift of about 15 points to the left from the year 2019 to the year 2020. Additionally, the mode of marks shows that more students achieved a B grade in the year 2020 compared to more students achieving a high C grade in the year 2019. Therefore, more students obtained higher marks in the year 2020 than the students in the year 2019 on five of the six courses, evident by the higher marks' averages for five of the six courses under study; the computer applications course was the exception, with almost the same average in the year 2019 and 2020 and a lower mode value (60) in the year 2020. The other five courses had a combined average of around 68 in the year 2019 and a combined average of around 85 in the year 2020. The standard deviation was 5 to 11 and the range of values was 27 to 75, which shows that the marks were fairly distributed on the marks scale, with slightly more dispersion in the year 2019. The minimum and maximum values show that there were some students who achieved a very low "D" grade, while other good students obtained an "A" grade in both semesters.

Table 2. Descriptive statistics of students' marks in the years 2019 and 2020.

	Biol115		Chem116		CSE111		Engl101		Math132		Med112	
Year	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Mean	72	82	65	83	68	68	60	87	72	88	72	86
Median	72	83	65	84	68	70	60	87	73	89	72	86
Mode	75	90	65	88	75	60	60	86	68	87	69	90
STD	6	11	9	8	6	13	9	8	11	6	11	5
Variance	34	124	87	59	41	166	79	66	110	37	117	21
Minimum	60	40	13	52	48	24	40	37	38	68	16	70
Maximum	87	94	100	96	85	95	90	97	90	99	91	98
Range	27	54	87	44	37	71	50	60	52	31	75	28

Third, a *t*-test was administered to determine if there was a significant difference between the two groups' mean of marks in each course. Table 3 shows the calculated numerical *p*-values of the *t*-test for the two independent students' marks with two unequal variances. In short, the table shows a low *p*-value in five courses, which led only to rejecting the null hypothesis and accepting the alternative hypothesis (there is a significant difference between the two means of students' marks for each course). The exception to this conclusion was only in the results of the computer applications course; the two-tail *p*-value was significant (0.72). Thus, inferentially, we can affirm that the marks during online and on-campus periods varied without any correlation between the two sets.

Table 3. *p*-values of the *t*-test for the two groups of students' marks.

Course	*p*-Value (1-Tail)	*p*-Value (2-Tail)
Biol115	1.48484×10^{-12}	2.96968×10^{-12}
Chem116	6.29857×10^{-32}	-1.25971×10^{-31}
CSE111	0.36361188	0.727223759
Engl101	9.12066×10^{-51}	1.82413×10^{-50}
Math132	1.79073×10^{-27}	3.58145×10^{-27}
Med112	5.18171×10^{-25}	2.5396×10^{-22}

Fourth, a questionnaire that included six main categories with a number of questions within each category was distributed. The participants were asked to rate their satisfaction using a five-point scale for both online and on-campus modes. The summed responses were converted into percentages, as shown in Table 4. The table presents the overall students' percentages of preferences and their satisfaction for each mode of learning. It was deduced that most students were satisfied and favored online learning and exams for a number of reasons: less average daily hours spent studying (2.2), the convenience and flexibility (81%) of the online structure where students can take classes from any place without having to be physically present, and the conduct of exams (87%). Apparently, the students liked the structure of exams (multiple-choice questions with little essay-type questions and online assignments) and preferred to attempt their exams remotely. On the other hand, some students favored on-campus learning because they had more student–instructor interactions, such as discussions, questions/answers, or presentations (73%). Additionally, the students professed to have focused more (69%) during physical on-campus classes. Orally, most students indicated that their instructors did not utilize interactive tools, presentation tasks, or collaborative projects to engage them more during online sessions. Overall, a higher percentage of students (68%) believed that physical attendance learning is more effective than the e-learning mode (42%). Specifically, good students were more skeptical of the online mode of learning and favored the face-to-face interaction with their instructors. Surprisingly, good students also preferred paper exams as that distinguished them from their peers.

Table 4. Percentages of satisfaction of the two groups of students.

Category	Subcategories of Questions	Group 1		Group 2	
		Physical	Online	Physical	Online
Studying hours	Average daily studying hours including assignments.	4.3	2.2	4.4	2.1
Convenience and flexibility of learning	Organization and management of taking lessons; space allocation and setup; technology utilization; saving time of movement.	24%	77%	27%	83%
Interest, focus, and motivation during learning session	Attend complete sessions; able to recall lesson material; ask related questions; fully engaged during sessions.	72%	28%	68%	34%
Interaction and communication during learning session	Instructor and classmate communication; opportunities to involve participants in the lesson; encouragement to bring out ideas on some issues; activities that motivate the sharing of opinions; guiding students; constructive feedback from teachers; effective monitoring of learning.	72%	29%	75%	23%
Effective learning of theoretical and practical content	Clear learning objectives; various clear resources and materials; teacher lesson delivery; organization of lessons; varied teaching style; examples and illustrations; adherence to course specifications.	67%	41%	70%	45%
Conduct of exams and assignments	Appropriate type of exam questions; enough number of quizzes and assignments; prompt grading of exams and assignments; continuous assessment.	16%	88%	20%	85%

5. Limitations

There were few limitations to this study. The sample of the participants derived from a single department with students who were enrolled in their first year of study in two semesters, and the sample was not extended to a longer period nor to a larger sample. Spe-

cially, all the participants in this study were of the male gender as government universities in Saudi Arabia have separate campuses for males and females. Thus, the results are only a reflection of a limited period, and a small one-gender sample and cannot necessarily be generalized to other departments, faculties, nor any other university. Additionally, the collected data only focused on the students' marks and perceptions of their learning experiences and did not consider other academic performance indicators such as the nature of course content, emotional and mental readiness, possible home distractions during online sessions, and other correlation factors that might have linked the students' academic performance to the sudden transition to online learning. Future research should select a larger sample over extended study periods and should consider other metrics in the evaluation of students' academic performance. Furthermore, the study does not consider the level of concentration, participation, technology issues and network connections, and the number of study hours during online teaching periods and how that might have influenced the students' examination results.

6. Conclusions

This study investigated the COVID-19 impact of transitioning to online learning on the academic performance of Saudi students and their perception of switching to a web-based mode of learning in comparison to a physical on-campus learning mode. It is concluded that online learning can be a suitable alternative medium to decimate knowledge and evaluate students. Numerically, the students in this study achieved promising marks in the courses they completed fully online. The descriptive statistical measures and the inferential tests showed strong evidence of obtaining higher grades during the 2020 online period compared to the results of a previous regular term, especially on theoretical courses. On the other hand, the study also showed a significant correlation between the marks of practical courses during online and conventional modes. Additionally, there is some clear acceptance and positive satisfaction by students to some important aspects of e-learning, such as flexibility, convenience, study hours, and online exams experience. The students' responses to a distributed survey indicated a willingness to continue in this virtual mode but with paying special attention to issues such as keeping motivation high and interaction active during online sessions. Additionally, this study implies that online teaching can be a successful mode with sufficient training and appropriate computer infrastructure (platforms and accessibility of networks). Ultimately, we cannot claim that online learning has helped the students obtain higher marks or otherwise, but the students' academic performance evaluation could be more valid with strict online exam measures, a continuous assessment, and oral interviews. Therefore, the results of this research adds important knowledge and insight of students' academic performance and their preferences of online learning mode as compared to the existing physical mode of learning. Specifically, the study can help the educational planners and practitioners make informed decisions and policies to achieve their targets of advancing university education by integrating long term e-learning technology tools in the Saudi educational process, which is a key element of the 2030 Saudi vision for sustainable development goals in education. Finally, this research should encourage other researchers in the eastern region of Saudi Arabia to explore various factors specific to the region that might affect disparities in students' marks and the challenges faced in the transition to some form of the e-learning mode and in utilizing technology in learning in general.

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