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The challenges and opportunities of online learning and teaching at engineering and theoretical colleges during the pandemic

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A R T I C L E   I N F O

Article history:
Received 22 December 2021
Revised 19 February 2022
Accepted 10 March 2022
Available online 23 March 2022

Keywords:
E-learning
COVID-19
Distance learning
Technology
UAE

A B S T R A C T

Education has been one of the major areas disrupted by the COVID-19 pandemic. This study aims to assess the impact of the COVID-19 pandemic on users’ (students and faculty members) learning in higher education, examining how engineering students and faculty perceived the abrupt transition in comparison to other colleges. The current research aims to investigate the outcomes of enforcing eLearning to facilitate teaching and learning processes in higher education after this unprecedented pandemic and identify the most significant challenges and opportunities the users face. This study uses a quantitative approach; it included 1713 respondents, 227 full-time faculty members, and 1486 students at the University of Sharjah. The survey analysis indicated general agreement that the most significant advantage of online learning implementation was its flexibility in place and time, with 77.2% of users providing positive feedback. Moreover, the accessibility and effectiveness of the assessment and communication methods used showed a positive trend in the hypotheses, 80.3% of the users. The sudden implementation of eLearning during the COVID-19 pandemic had discouraging implications for users’ mental health and socialization, where 55.6% of the sample agreed that they had been affected negatively. 75% of the users prefer a flexible model blending face-to-face and e-learning techniques rather than solely depending on either of them. Therefore, A Hybrid-Flexible (HyFlex) is recommended for the university to apply based on the nature of the courses.

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1. Introduction

The spread of the infective disease caused by the COVID-19 has caused an international health pandemic that has had challenging ramifications socially and economically and on education as one of the significant areas disrupted. However, this disruption could be the beginning of a surprising innovation because the institutions, including educational ones, responded to the travel bans and home quarantines by shifting to online interaction. Although major issues arise from the crisis that caused the shift, users worldwide wonder whether COVID-19 could act as a catalyst for the online progress in educational procedures and accelerate the use of the latest technology to the point where the future becomes the present. The coronavirus pandemic has revolutionized global education through the unprecedented introduction of new solutions, tools, and applications. According to UNESCO’s statistics, the closure of universities worldwide to contain the COVID-19 pandemic has affected 91% of the student population. The educational orga-
nizations in the UAE have taken action to ensure that faculty and students are equipped with the technical support and tools needed to go through the crisis, and the decision was made to implement e-learning in all schools and universities until further notice. This raised many doubts [9] whether enough flexibility had been built into the education system and whether students and faculty members were capable of enough adaptability, decision making and problem-solving skills, and above all of dealing with the technological advances. However, as [11] stated, today's generations are digitally driven and do not find it hard to use online platforms. Online learning could become the main form of education and respond to situations students cannot meet on campus. Countering the current challenges may lead to an improved educational environment in the future. The case study in the present research has offered several online courses; however, the ratio of online to traditional courses was comparatively low. However, the outbreak of Coronavirus compelled the university to launch eLearning programs to ensure regular teaching action for 15,952 students, 13,235 undergraduate students, and 1,613 graduate students. Moreover, a further 453 were enrolled on two-year diploma courses, and of course, 636 enrolled faculty members were also involved. These statistics are based on documents retrieved from the statistical specialist at the university and last updated in the academic year 2019/2020. The action was taken to avoid any delay or interruption in the education system; at great speed, millions of teachers were obliged to teach students on-screen who had to stay at home and receive tuition through the internet. Beyond the UAE, after the spread of Coronavirus across the globe, on 13th March 2020, around 60 countries in Africa, Europe, Asia, the Middle East, and North/South America announced or implemented school and university closures [41]. Although online learning has already been incorporated in many universities, the disruption caused by COVID-19 enforced the online learning programs to serve the whole off-campus population without considering users' perceptions or their readiness to make use of them. The enforcement of e-learning was designed to lessen the effects that accompanied the sudden closure of higher educational institutes; faculty members and students had to face and depend entirely on the use of high-tech tools and platforms to guarantee sustained teaching and learning. This research aims to analyze the opportunities and challenges that higher education users (students and faculty members) have faced as a result of the COVID-19 pandemic’s online learning. A case study assessed the perception of the University of Sharjah users on the performance and effectiveness of the e-Learning techniques and methods put into action during the COVID-19 pandemic for learning and teaching. The study analyzes people's views, particularly those of the engineering college (the largest practical college), and compares it with the other theoretical colleges to determine contrasts and parallels. Furthermore, the study addresses future implications and the potential of blended learning as a future solution.

1.1. Overview on eLearning

Technology is an essential element of learning in the 21st century. The increase in the use of technology in education had altered educators’ attitudes from the traditional ones when they were distributors of knowledge to a new and more flexible attitude now that they are considered more as supporters and motivators who urge and encourage students to participate and learn [26]. Moreover, as Shadiev & Sintawati [35] suggested, technology supports intercultural learning on many levels. The role of technology could also be the facilitator of personalized learning that allows students to achieve better learning outcomes [51]. E-Learning is a futuristic mode of education that accommodates the different requirements and expectations of different users; in this way, it allows varied methods of educational technology to operate, redesigns instructional methods, and refines performance and effectiveness to adapt to the priorities of eLearning [12]. Strydom [38] reasons that university structures are rigid and untested in integrating eLearning courses; this is not easy to implement without the support of faculty members and the cooperation of its users. Volery and Lord [43] suggest that the fast growth of technological development has allowed higher education organizations to develop the quality of their students’ learning by introducing eLearning courses, which counter social requirements and allow resources to be used effectively. However, there is not enough eLearning technology yet. This lack could limit the transfer of knowledge from universities to more people worldwide, which runs counter to the concept of globalization. In the COVID-19 crisis, the greatest challenge was whether the current higher education structures could adapt quickly to the process of change and cope with the unexpected implementation of technology.

1.2. E-Learning during a pandemic

After the sudden shift due to COVID-19, faculty members who had to adapt to technology faced several challenges, such as a lack of eLearning experience and/or too little time to prepare online courses. Their efforts to deploy the new educational delivery system using online techniques and materials affected the performance of the students and instructors. Although users were already familiar with the LMSs (Learning Management Systems) that used to complement face-to-face interaction, the change to online instruction revolutionized learning concepts and gave greater emphasis to the characteristic of an individual’s learning and the central role of the lecturer. Well-designed e-learning practices differ significantly from the emergency courses provided in response to the COVID-19 pandemic. According to Purcell & Charles [29], higher educational institutes working to preserve education during the COVID-19 pandemic should understand the differences when assessing alternatives in distant teaching. In their research, it is suggested that everyone included in the sudden shift to eLearning had to understand that such disasters also create disturbances to the lives of students and faculty members outside their life on campus. Instructors and supervisors are advised to consider that students might not be able to attend courses straightaway and be more flexible over policies and the deadlines for students’ assignments [14]. Likewise, Zhao et al. [52] emphasized the importance of acknowledging students’ social classes and the availability of educational resources among students from lower socioeconomic backgrounds. Their study also addressed the negative impact of the pandemic on college students, such as increased stress, anxiety, and depression due to isolation, emergencies, and uncertainties. Moreover, the threat of COVID-19 has presented some unique challenges for all the parties included in higher education institutions, such as being asked to do unusual things concerning course delivery and learning. These challenges have not been seen before on this scale in their lifetime. Thus, and as suggested by Yin and Mahrous [49], “workplace spirituality” has never been more critical; it’s necessary to build and ensure growth in a business environment by creating strong connections between employees and their organizations, as well as instilling meaning and a higher purpose in the workplace.

Abusaada and Elshater (2020) further imply the need for urban planners and designers to learn from the faced challenges to address social well-being during such times. The authors propose that computer simulations be used to envision open public places that adopt design rules that increase meditation possibilities, guide people toward diverse areas of interest and promote positive environments while respecting social distancing and precautionary measures. Similarly, Abusaada and Elshater [1] encourage opti-
| Researchers | Impact of eLearning on Teaching | Impact of COVID-19 on eLearning | Parameters mentioned |
|-------------|--------------------------------|-------------------------------|---------------------|
| Strang [37] | ×                              | ×                             | Motivation and attitude. |
|             |                                |                               | Information management. |
|             |                                |                               | Understanding fundamental concepts and acquiring knowledge. |
|             |                                |                               | Enjoyment. |
|             |                                |                               | Communication skills. |
|             |                                |                               | Group-work spirit. |
|             |                                |                               | Flexibility. |
|             |                                |                               | Satisfaction |
|             |                                |                               | Social presence. |
|             |                                |                               | Instructor support. |
|             |                                |                               | Interaction. |
| Richardson and Swan [30] | ×                              | ×                             | Effective delivery of information |
|             |                                |                               | Instructor support |
|             |                                |                               | Contingency plan for future incidents |
|             |                                |                               | Interactivity |
| Cao et al. [6] | ¥                              | ¥                             | Mental health |
|             |                                |                               | Stress. |
| Bagriacik Yilmaz [53] | Æ                              | ×                             | Use of technology |
|             |                                |                               | Digital skills |
|             |                                |                               | Flexibility |
| Taylor et al. [40] | ¥                              | ¥                             | Interactivity |
|             |                                |                               | Instructor Support |
|             |                                |                               | Personal Relevance |
|             |                                |                               | Active Learning |
|             |                                |                               | Student interaction and collaboration |
| Onyema and Alsayed [25] | ¥                              | ¥                             | Student support |
|             |                                |                               | Technical issues |
|             |                                |                               | Adaptivity |
|             |                                |                               | Acquiring information |
| Strong [36] | ¥                              | ×                             | Use of technology |
|             |                                |                               | Digital skills |
|             |                                |                               | Flexibility |
|             |                                |                               | Interactivity |
|             |                                |                               | Instructor Support |
|             |                                |                               | Social presence |
| Bilgic & Tuzun [54] | ¥                              | ¥                             | Program structure |
|             |                                |                               | Instructional design |
|             |                                |                               | Assessment and evaluation |
|             |                                |                               | Communication and interaction |
|             |                                |                               | Support |
|             |                                |                               | Technical issues |
|             |                                |                               | Program evaluation |
|             |                                |                               | Accessibility |
| Messaoudi et al. [18] | ¥                              | ¥                             | Adaptability |
|             |                                |                               | Sustainability |
|             |                                |                               | Interoperability |
|             |                                |                               | Reusability |
| Ni [55] | ¥                              | ¥                             | Interaction |
|             |                                |                               | Environment |
|             |                                |                               | Student performance |
|             |                                |                               | Assessments |
| Richardson, Hollis, Pritchard, and Novosel-Lingat [31] | ¥                              | ¥                             | Use of technology |
|             |                                |                               | Technical difficulties |
|             |                                |                               | Blended learning |
| Davis and Wong [9] | ¥                              | ×                             | Perceived usefulness |
|             |                                |                               | Perceived ease of use. |
|             |                                |                               | Focused attention |
|             |                                |                               | Exploratory behavior |
|             |                                |                               | Intention to use |
|             |                                |                               | Usage behavior |
|             |                                |                               | Flexibility |
| Zhang, D et al. [50] | ¥                              | ×                             | Multimedia-integration |
|             |                                |                               | Just-in-time knowledge acquisition |
|             |                                |                               | Interactivity |
|             |                                |                               | Self-directivity |
|             |                                |                               | Flexibility |
|             |                                |                               | Intelligence |
| Veletsianos, G. & Houlden, S [42] | ¥                              | ¥                             | Pedagogical and technical flexibility |
|             |                                |                               | Flexibility for instructors and instructional design |
mistic thinking about the crisis’s difficulties and advocate for
designers to refrain from solutions that increase monotony and
boredom. Due to outdoor public spaces’ role in spreading the virus,
the authors further advise designers to depend not just on stan-
dards, recommendations, and common methodologies to lower
infection rates, but also on inventive solutions that suit users’
physical distancing demands. Purcell & Charles [29] add that after
the pandemic is over, the universities should highlight the
strengths and weaknesses of the current eLearning process to be
better prepared should similar events occur in the future and know
what blends best with traditional methods of learning.

2. Literature review
A wide-ranging literature review covering eLearning and the
perceptions of its users was conducted Table 1. The review indicated
that not many studies had hitherto covered the impact of the
COVID-19 pandemic and the major challenge that it posed to
educational structures since the systems had not anticipated nor
been entirely ready for the sudden switch to online learning.
According to Taylor et al. [40], the learning transfer systems will
improve and build up over a certain period, given that the precau-
tions were first taken halfway through the academic semester. The
vast, disrupting shift needed to suddenly transform all the ongoing
courses into online courses in a matter of days required an elabo-
rate plan and learning materials such as recorded instructional
videos or electronically communicating groups. Moreover, other
studies highlighted the psychological effect on university students
in terms of fear, worry, or anxiety, whether because of the impact
of COVID-19 on their education or their chances of future employ-
ment [44]. Anxiety disorders were exaggerated by social distancing
during the quarantine period [20]. Universities and faculty mem-
bers should not be perceived merely as carriers in delivering
knowledge: they should also regulate what they teach and conduct
it. Technology promotes the role of instructors from being simply
information transmitters to dynamically functioning as co-
creators of knowledge among their students. Onyema and Alsayed
[25], having discerned the negative impact of COVID-19 on educa-
tion, recommended that all educational organizations, teachers,
and students need to adopt technology and develop their digital
skills in line with the developing universal trends and conditions
in their field. Given the lack of literature covering the sudden
transformation in response to a crisis such as the COVID-19 pan-
demic, it was necessary to identify the challenges accompanying
this change, assess them and identify the parameters associated
with online learning.

2.1. Literature related to online learning
Several studies have analyzed the effects of online learning on
teaching and shown how this sort of teaching emerges from the
need for education at a distance. There are wide-ranging eLearning
tools that facilitate online education, especially during epidemics
such as the COVID-19 pandemic; these technologies and online
platforms can reduce the gaps in education and reach everyone
across the globe. Previous research has produced both positive
and negative insights into online learning associated with students
and teachers. One of the most valued aspects of e-learning based
on past studies is its flexibility, whether in terms of time or loca-
tion; this gives students more options to interact with lecturers
or their peers. According to Wheatley & Greer [46], the primary
benefit of the eLearning process is that it saves time, lets instruc-
tors handle larger numbers of students without the worry of tim-
ing conflicts, and ultimately reduces the overhead costs of
faculty. Romeu Fontanillas et al. [33] analyzed the students’ per-
ception of E-assessment, and the results revealed a high level
of satisfaction with the e-assessment activities of the course and an
improvement of the learning process. A study by Alhefnawi [2],
investigated the effectiveness of online handouts (blackboard doc-
uments) and active lectures in improving students’ performance,
specifically engineering undergraduates. While both presenting
techniques had beneficial impacts, students preferred active lec-
tures, which resulted in higher ideal responses. Another aspect
revealed by Bisciglia & Monk Turner [5] is that eLearning obviates
traveling time and expense, especially in fields where information
frequently changes. Other researchers have added that, even in
eLearning-based education, presence in a community can affect
learners’ contentment and, thus, the motivation for eLearning
[37]. Richardson et al. [31] found that social presence was a major
forecaster of student fulfillment with LMS-based courses. Other
studies, however, suggest that eLearning courses had drawbacks
in terms of the lack of clear and specific face-to-face interaction
between students and teachers or with other students; as a result,
students might lose track of the learning process [48,50], while
more technical difficulties might cause distress to users. Moreover,
considerable time is needed to adapt to new technology and the
interruptions to communication that occur in the process; thus,
it is always necessary to provide enough training to faculty mem-
bers and students in using the technology to improve their satis-
faction with online courses [15]. Other disadvantages mentioned
in the literature include the inexperience of eLearning among
teachers [50], the lack of tutorial support (Li, 2009), and planning
student courses without considering what is appropriate. These
issues could offset the convenience offered by eLearning. Users
might encounter problems of understanding course information
that is technical, quantitative, or scientifically oriented, leading to
a failure to deliver course outcomes efficiently. Students also
regarded technical problems as critical obstacles to eLearning.
For instance, Ibrahim et al. [16] conducted a similar study on
online education, focused on architectural design and fundamental
design courses. According to the findings of the survey, 94.4% and
48.8% of students experienced technical challenges in design
classes and basic design courses, respectively. The encountered
difficulties included low internet speed and troubles with their com-
puter devices. These findings align with a relevant study conducted
by Noori [24] regarding the pandemic’s impact on higher education
in Afghanistan. Noori’s qualitative analysis revealed that nearly all
students faced Internet and technical concerns including finan-
cial problems to attain improved Internet bundles and inadequate
full-time power supply. Moreover, lack of immediate feedback
plays a significant role in students’ negative perceptions of the
online learning process [36]. The conditions of eLearning and
working or learning from home could be very challenging to many
instructors and students, particularly those who have difficulties
in such areas as the accessibility, obtainability, and use of technology
in learning besides affecting positive teacher-student relationships,
which is one of the process goals of education [10].

Instructors and students perceive the online process differently;
thus, this paper approaches its methodology based on the assump-
tion that different users have different attitudes to online learning.
Although previous writers assumed that lecturers were concerned
about interaction aspects, they welcomed the idea of replacing tra-
tional courses with online teaching [17]. Shin, et al., [34] suggest
that peer motivations may influence achievement by identifying
processes, while instructor rationales emphasize students’ atten-
tion to content. The positives and negatives in the literature
regarding the perceptions of the eLearning process among students
and faculty members raised a research question, knowing that it
had never been implemented on such a scale before, what were
the perceptions of the sudden implementation of distance learning
following COVID-19 in the case of the University of Sharjah? The studies in the above review were analyzed to identify the specific parameters surrounding the COVID-19 pandemic and the impact of online learning on teaching and learning.

3. Research questions

The analysis of the literature review covered the sudden introduction of distance learning in the case study due to the COVID 19 pandemic and the way that the users perceived it, which in turn led to the following questions:

- What has been the impact of the pandemic on the users’ performance in the University in terms of learning, teaching, and assessment?
- What are the similarities and differences of the pandemic impact on the University’s various colleges?
- What is the perception of users about the future expectations of eLearning?

4. Research objective

The research aims to assess the impact of enforcing eLearning in consequence of the COVID 19 pandemic on facilitating the education process and examine the future implications of the eLearning process on the educational system to know whether or not new learning or teaching models can be introduced to the educational structures.

5. Research methodology

This study uses a quantitative research methodology which is defined as a form of educational study in which the scholar chooses what to assess; asks precise, well-constructed questions; gathers quantitative data from participants, evaluates the information using statistics; and evaluates in an unbiased, detached manner [7]. Several steps were taken to evaluate the impact of COVID-19 in the present study. In the literature review, different scholars mentioned several parameters that affect the perception of users of online learning in higher educational institutes. These parameters were used to create a survey that would allow students and faculty members to report their online experience at this time. An assessment of the methods used in previous papers concluded that surveys were the most viable way to collect data from the respondents [48]; Li, 2009; [18]. In this study, the surveys took the form of a questionnaire, and the data thus gathered were statistically analyzed to test the research hypotheses. To provide an indicative overview and assess the users’ perspectives, the engineering college was selected as the study’s baseline case. Since this college is the largest at the university with numerous departments, the study seeks to examine it against other colleges to address the research questions. In the following sub-sections, the survey study design and the methodological processes used in this study are discussed.

5.1. Survey research design

According to Prickett and Rapley [28] and Author (2018), three prominent aspects should be considered in creating a survey: the survey’s design, its procedure, and the design of the sample. The survey was created using an online template through Google forms and disseminated to the sample of respondents. This study used a single survey to assess the perceptions of users, designed by selecting a list of parameters from previous studies based on the frequency with which they occurred in the studies. The parameters were correlated with the questions to be used; the purpose was to suggest a model for benchmarking eLearning in higher education institutes and the relationship between learning strategies in online education and academic performance [22]. The gathered parameters were used to create a set of questions about the perceptions of faculty members, graduate students, and undergraduate students on three main aspects of the online learning experience: Performance, Effectiveness, and Future Prospects. Then the survey and the non-parametric hypothesis testing were used to assess the impact of COVID-19 on teaching and learning. A pilot study sent to a limited number of faculty members and students was conducted to test the survey questions’ reliability, transparency, and rationality and get responses to the design and deal with any queries before distributing the survey to the entire university.

5.2. Design of the sample

The target sample of the survey included faculty members, graduate students, and undergraduate students. This university represents the higher educational institutes in the UAE; it has over 15,000 students and over 600 faculty members. The cut-off date of the survey was 14th July 2020, and the number of responses from all the colleges in the university totaled 1719. The least representative sample size was estimated using the modified sample size equation (1) [47]. This was based on the sample size formula of William Cochran [8], where $n$ is the sample size, $N$ is the population size, $e$ is the margin of error. In the present research, the total number of students and faculty members, $N = 16,588$, and the margin of error was chosen to be 3%; thus, the minimum required sample size was $1,042$; in the event, an even larger sample volunteered to respond. Fig. 1 represents the total number of respondents to the questionnaire, showing that the minimum sample size for each category was achieved successfully.

$$n = \frac{N}{1 + N * (e)^2}$$  (1)

5.3. Methodological procedure

Fig. 2 illustrates the systematic methodological approach followed in this study; the identification of parameters was then related to the sudden implementation of eLearning to analyze the perceptions of their experience among the users and assess whether teaching and learning were affected.

5.4. Selecting the parameters

At this stage, a wide-ranging review was conducted of the literature that assessed the influence of online learning on education, and several parameters were chosen based on their frequency of occurrence in the literature (see Table 2). This review helped to identify different scholars’ choices of the most effective parameters, which were then visually represented in a pie chart in Fig. 3. The parameters comprised motivation, attitudes, knowledge acquisition, accessibility, and adaptability, in addition to instructors’ support, assessment, and evaluation, technical issues, and difficulties, interactivity, and flexibility. These parameters were used to evaluate the perception of performance among the users. In the second section, the effectiveness of the techniques used was evaluated as Sullivan [39] suggests the effectiveness of the eLearning should meet the criteria of online education and provide learners with the understanding and knowledge that they would have gained from traditional class education. This could be ascertained through properly evaluating the methods and components of
online learning education. The third section aimed to evaluate the future implications of distance learning and to judge whether a blended model could be an efficient solution in future years.

5.5. Assessing the impact of the COVID-19 pandemic and the sudden implementation of online learning on teaching and learning by validating the perceptions of the parameters

Not much literature has been found on the recent impact of COVID-19 on teaching and learning; hence it seemed helpful to assess the impact of the sudden implementation of online learning on the above parameters. The questionnaire created for this purpose asked the students and faculty members how they had perceived this impact. To facilitate data collection and avoid lengthy surveys and bias in the answers, the survey was presented in three sections, and all the questions could be answered using a 4-point Likert scale, where 1 signified strongly agree, and 4 signified strongly disagree. The respondents were given 25 questions that would reveal their perception of the online learning experience during the COVID-19 pandemic and their personal experiences. A 4-point Likert-scale questionnaire is an example of an even-point scale that eliminates the mid-point. It was chosen mainly because a scale without a “neutral” point seems to help eliminate the social desirability bias without changing the direction of people's opinions. This is sometimes called a “forced choice” approach since it removes the neutral option [3]. A study conducted by Armstrong and Robert [4] suggests that the middle option becomes the only option when a respondent is undecided; therefore, it is debatable whether it is a neutral option. The research concludes that negligible variances were found between using and eliminating “undecided” as the middle option in a 5-point Likert scale. Another study [32] provides evidence that a social desirability bias resulting from respondents’ desire to satisfy the interviewer or not to seem to answer in a socially unacceptable way may be reduced by eliminating the mid-point, such as the “neutral” category, from Likert scales. Thus, the respondents were requested to evaluate their perception of every parameter listed according to a 4-point Likert scale. The linguistic term was then transformed to its corresponding numerical value in which “Strongly Agree”, “Agree”, “Disagree” and “Strongly Agree” correspond to 1, 2, 3, and 4, respectively.

Each set of answers was statistically analyzed, and the hypotheses on the consequences of this survey were tested to establish whether the difference between responses was statistically significant or not. The first step in the hypothesis testing was to use Pearson’s chi-square test (see Equation (2)), which is a method used in statistics that calculates the difference between observed and expected data values. The test establishes a statistically significant variation between the anticipated frequencies and the noted frequencies in the categories of a cross-tabulation table which is an arrangement where data is categorized according to two distinct variables. The chi-square test was carried out in SPSS to obtain the p-value, as shown in the sample in Table 3.

\[ X^2 = \sum \frac{(o - e)^2}{e} \]  

where: \( X^2 \) is the Chi Square obtained, \( \sum \) is the sum of, \( o \) is the observed value and \( e \) is the expected value [23].

The P-value separates the significant answers from the insignificant ones to eliminate the null hypothesis; in other words, there is no significant difference between distinct populations, and any practical difference observed is due to sampling or investigational error. If the normality hypothesis is violated, the non-parametric test is used. According to Montgomery and Runger [19], the main goal of this test is to examine whether the samples have matching population medians. With the p-value calculated, the current hypothesis was formulated as shown in Equation 3, and the test was applied at the 5% significance level (\( \alpha \)).

\[ H_0: \mu = 3n = 1.2\ldots24 \]
\[ H_1: \mu < 3n = 1.2\ldots24 \]
\[ \alpha = 0.05. \]

Decision rule: Reject \( H_0 \) if \( P \text{ value} < 0.05 \) (3)

Where \( \mu \) represents the median of the responses received for the \( i \)th parameter; \( i = 1,2, \ldots 24 \), and the terms \( H_0 \) and \( H_1 \) are the null and alternate hypothesis, respectively. The alternative hypothesis means that the median of responses is affirmative, suggesting more “strongly agree” and “agree” answers than answers in disagreement. Rejection of \( H_0 \) means that the \( i \)th response is significant, while acceptance of \( H_0 \) leads to rejecting the response to the question. The hypothesis for each question was tested to show the differences between students and faculty members and then tested to show the differences between different colleges.

6. Results and discussion

The survey shown in Table 8 was distributed to all 14 colleges in the University in June 2020. Responses were received from 229 full-time faculty members and 1486 students (194 postgraduates and 1296 undergraduates). The characteristics of the participants are summarized in Table 4. The survey asked participants to pro-
vide authentic responses about their experiences with this learning approach. Therefore, the results of the study are based on 1719 responses, which represent more than 10% of all the students and faculty enrolled in the University of Sharjah.

6.1. Statistical analysis

The data were descriptively analyzed using the Statistical Package for the Social Sciences (SPSS for Windows, Version 24.0). Chi-square tests were applied as suitable for testing the presence of statistical significances between numerous measures in this study sample (see Fig. 4). Following the test, the data results were compared against the second hypothesis test, where the results with median ≤ 2 were positive and the results with median ≥ 3 were negative. The three sections of the survey were analyzed independently; the medians of the answers were analyzed using the Mann-Whitney U test to compare students and faculty groups, while the medians of the answers were compared between different colleges using the Kruskal–Wallis one-way analysis of variance. A P-Value < 0.05 was considered statistically significant.
6.1.1. The performance of the engineering college in comparison to other colleges

Generally, in comparing the perceptions of users from different colleges as in Table 5, the results clearly show that the experience of the online learning implemented during the COVID-19 pandemic had different effects on different users. Given that the engineering college comprises the largest number of enrolled students, it is selected as a base case for comparison. The results revealed some similarities between the engineering college and other practical colleges that taught subjects such as medicine and fine arts. These colleges demonstrated low improvements in performance and productivity and a lack of motivation.

However, disparities are noticed with theoretical colleges such as those teaching Sharia, business, arts, sciences, humanities, and law. Several enhancements in performance have been observed, including better experiences among learners and teachers, more productivity, and improved motivation on both sides. Nevertheless, there was general agreement that the biggest advantage of online learning was its flexibility in terms of place and time, with a total of 77.2% positive feedback, supporting the theory of Veletsianos and Houlden [42], who argue that there is a need for educational organizations to have a structure that offers users more flexibility, as seems to have been achieved in the case study. Moreover, as [11] suggested, this generation is digitally driven and has no problem using the new technologies. This matches the findings of the current study that the ease of use of technology was clearly and constructively perceived. Communication, interactivity, and knowledge acquisition were among the aspects in which differences were also identified. The engineering college and medicine and fine arts had tendencies of negative perceptions of the effect of online learning on interactivity and motivation. The experience was described as one with negative social and mental health ramifications; the answers from the different colleges and positions showed the total negative perceptions as 55.6%, and some users claimed to have been highly stressed during the eLearning period. These results match the findings of Cao et al. [6], who maintained that 24.9% of college students were afflicted with anxiety experienced because of the COVID-19 outbreak. On the other hand, the theoretical colleges

| Parameters chosen                        | Authors          |
|------------------------------------------|------------------|
| Flexibility                              | [9,12,25,50]     |
| Interactivity                            | [30,36,53,55]    |
| Motivation and attitude                  | [36]             |
| Knowledge acquisition                    | [9,40,50]        |
| Productivity                             | [6,12,53–55]     |
| Enjoyment                                | [50]             |
| Ease of use                              | [9,18,36,54]     |
| Instructor Support                       | [30,36,40,54]    |
| Use of technology                        | [25,31,50]       |
| Adaptability                             | [6,18,40,54]     |
| Technical issues                         | [25,40,42,54]    |
| Communication/Social presence            | [9,18,30,36]     |
| Self-directivity                         | [50,40]          |
| Assessment and evaluation                | [54,55]          |
| Effective delivery of information        | [6,9,18,50,54]   |
| Usefulness                               | [9,18,50]        |
| Mental health                            | [6]              |

Table 2
Parameters identified from the literature.

Table 3
Chi-square test sample for a question result extracted from SPSS.

| Value               | df | Asymptotic Significance (2-sided) |
|---------------------|----|----------------------------------|
| Pearson Chi-Square  | 11.309a | 3 | 0.010 |
| Likelihood Ratio    | 11.863 | 3 | 0.008 |
| Linear-by-Linear Association | 0.001 | 1 | 0.970 |

N of Valid Cases 1719

a. 0 cells (0.0%) have an expected count<5. The minimum expected count is 31.91.
Table 4
Participants in the survey, according to their colleges.

| Colleges                                      | Faculty | Students | Total | Percent (%) |
|-----------------------------------------------|---------|----------|-------|-------------|
| Engineering                                   | 41      | 497      | 538   | 31.3        |
| Medical colleges                              | 28      | 136      | 164   | 9.5         |
| Science and health sciences                    | 53      | 183      | 236   | 13.75       |
| Business and Arts, Humanities and Social Sciences | 61      | 409      | 470   | 27.3        |
| Law and Sharia                                | 41      | 200      | 241   | 14.0        |
| Fine Arts                                     | 5       | 65       | 70    | 4.1         |
| Total                                         | 229     | 1490     | 1719  | 100.0       |

Fig. 4. Spearman Correlation charts between the samples of faculty members and students.
identified as positively engaging. Swan et al. (2000); Picciano [27]; in their papers supported this finding because it was suggested that interactivity and communication were improved through online learning. Surprisingly, however, faculty members seemed to give positive feedback on their improved involvement in socializing, which defies the social presence parameter mentioned by Richardson and Swan [30]. Students had more positive perceptions of interactivity with instructors than faculty members had with students. This opposes the theory of Inman et al., [17], Wheatley & Greer [46] that faculty members are more comfortable with distance learning since they can interact with a greater number of students at once and save time and effort. Overall, and as expected, the engineering college had multiple parallels with other practical colleges and apparent differences with the theoretical colleges, whose responses appear to be more positive on all aspects of performance from the faculty members and students.

6.1.2. The effectiveness of eLearning during the COVID-19 online pandemic

As indicated in Table 6, in the second section of the survey, users were asked to evaluate how effectively the eLearning techniques and assessment methods were used during the pandemic. The students and faculty members were new to these tools. Remarkably there was a common agreement among colleges and between positions that all the users quickly adapted to the online learning experience, with a total of 80.3% positive responses, which contradicts the contention of Schramm, Wagner, & Werner (2000), that users need a long time to adapt to the new technology and face many communication interruptions in the process. The easy accessibility of the learning and teaching tools and the ability to communicate more quickly through the new online social platforms made the experience much more convenient. Nevertheless, technical difficulties appear to have been a significant issue that 79.7% of users faced. However, the university’s technical support and that of the instructors’ support managed to overcome these challenges and fill the gaps discussed by previous writers, such as Galusha (1997), who stressed that eLearning’s major drawbacks are the lack of instructors’ support. Regarding the assessment of students, their grades during the pandemic show a major effect, of which 71.6% agreed. However, this does not gainsay the fact that the outcome of the courses was successfully achieved, and the assessment methods used on students by the University of Sharjah provided them with fair, convenient, and timely feedback. This opposes the challenge of a lack of feedback mentioned by Strong [36]. While there were some negative perceptions of users to performance, most users agreed about all the responses on the effectiveness of the eLearning methods used so far during the pandemic with a median of 2, signifying “agree”.

6.1.3. Future implications

As indicated in Table 7, in the third section, the participants were asked what they thought about teaching after the COVID-19 pandemic is over. Students and faculty members favored the implementation of eLearning tools in such contexts as online meetings on social platforms and communication methods with 70.8% positive feedback. However, medical colleges had negative feedback about incorporating eLearning assessment tools for learning/teaching in the near future; respondents preferred traditional exams and quizzes. The participants were also asked if traditional learning could be blended with the online learning techniques introduced during the pandemic; 75% of the respondents strongly approved this scenario, and, when asked about the preferred tool, they mainly chose social platforms, virtual class meetings, and interactive chat groups between faculty members and students. Some students suggested that online learning could
Table 6
Results of the second section of the survey.

| Colleges          | Fast Adaptability to e-Learning techniques | Easier Accessibility to learning/teaching tools | Easier meetings and discussions due to improved communication | Technical issues and difficulties were noted | Technical support was needed | The assessment Method were fair and convenient | Faculty feedback on assessments was timely and helpful | Outcomes of the courses were achieved successfully | Grades were affected |
|-------------------|--------------------------------------------|-------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|-----------------------------|-----------------------------------------------|--------------------------------------------------|------------------------------------------------------|----------------------|
| Engineering       | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Medical colleges  | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Sciences          | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Business and AHS  | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Law and sharia    | 1                                          | 1                                               | 1                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Fine Arts         | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
|                  | P value                                    | <0.001                                          | 0.03                                                          | 0.10                                        | <0.001                      | <0.001                                        | <0.001                                           | <0.001                                              | <0.001               |
| Student           | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| Faculty           | 2                                          | 2                                               | 2                                                             | 2                                           | 2                           | 2                                             | 2                                                | 2                                                   | 2                    |
| P value           | <0.001                                     | 0.05                                            | 0.04                                                          | 0.99                                        | <0.001                      | 0.55                                          | 0.15                                             | 0.84                                                | 0.001               |

Table 7
Results of the third section of the survey.

| Colleges          | Do you think e-Learning techniques should form part of learning and teaching? | Do you think e-Learning techniques should be implemented in assessments? | Do you agree on combining traditional classroom learning and online learning? |
|-------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Engineering       | 2                                                                          | 2                                                                      | 2                                                                          |
| Medical colleges  | 2                                                                          | 3                                                                      | 2                                                                          |
| Sciences          | 2                                                                          | 2                                                                      | 2                                                                          |
| Business and AHS  | 2                                                                          | 2                                                                      | 2                                                                          |
| Law and sharia    | 2                                                                          | 2                                                                      | 2                                                                          |
| P-value           | <0.001                                                                     | <0.001                                                                 | 0.002                                                                     |
| Student           | 2                                                                          | 2                                                                      | 2                                                                          |
| Faculty           | 2                                                                          | 2                                                                      | 2                                                                          |

Table 8
Questionnaire questions with the P-values and chi-square tests results.

| Questionnaire (Score 1–4) | Perception of challenges in performance | Faculty (227) | Students (1484) | Chi-square | P-value |
|---------------------------|----------------------------------------|---------------|-----------------|------------|---------|
| 1                         | Better effect on teaching/learning experience | ▲             | ▲               | 0.34       | 0.88    |
| 2                         | Improved productivity                  | ▲             | ▲               | 0.84       | 0.38    |
| 3                         | More motivation to learn/teach         | ▲             | ▲               | 4.79       | 0.03*   |
| 4                         | Better flexibility in terms of time    | ▲             | ▲               | 4.34       | 0.04*   |
| 5                         | Better flexibility in terms of place   | ▲             | ▲               | 11.49      | 0.001** |
| 6                         | Ease of use of online tools            | ▲             | ▲               | 11.34      | 0.001** |
| 7                         | Better understanding and easier acquisition of knowledge by students           | ▲             | ▲               | 1.05       | 0.31    |
| 8                         | Improved interactivity between lecturer and students                             | ▲             | ▲               | 10.66      | 0.001** |
| 9                         | Easier Communication and Group Discussions                                      | ▲             | ▲               | 0.67       | 0.83    |
| 10                        | Less stress and better mental health                                           | ▲             | ▲               | 0.87       | 0.35    |
| 11                        | Better socialization                  | ▲             | ▲               | 10.59      | 0.001** |
| 12                        | Fast Adaptability to e-Learning techniques                                      | ▲             | ▲               | 31.97      | 0.0001**|
| **EFFECTIVENESS OF E-LEARNING** |                                      |               |                 |            |         |
| 13                        | Easier meetings and discussions due to the communication                         | ▲             | ▲               | 11.34      | 0.001** |
| 14                        | Adequate support provided through the online techniques                          | ▲             | ▲               | 12.84      | 0.001** |
| 15                        | Easier Accessibility to learning/teaching tools                                   | ▲             | ▲               | 20.56      | 0.001** |
| 16                        | Technical issues and difficulties were faced                                     | ▲             | ▲               | 9.78       | 0.002** |
| 17                        | The needed technical support was provided                                       | ▲             | ▲               | 16.03      | 0.001** |
| 18                        | The assessment methods used were convenient and fair.                            | ▲             | ▲               | 0.45       | 0.55    |
| 19                        | Faculty feedback on assessments was timely and helpful                            | ▲             | ▲               | 27.12      | 0.001** |
| 20                        | Outcomes of the courses were achieved successfully                               | ▲             | ▲               | 9.21       | 0.003** |
| 21                        | Grades were affected.                                                            | ▲             | ▲               | 0.01       | 0.937   |
| **FUTURE IMPLICATIONS**   |                                      |               |                 |            |         |
| 22                        | Do you think e-Learning techniques should be partially implemented after the pandemic in learning/teaching aspects? | ▲             | ▲               | 29.5       | 0.0001**|
| 23                        | Do you think e-Learning techniques should be partially implemented after the pandemic in assessments aspects? | ▲             | ▲               | 9.89       | 0.001** |
| 24                        | Do you agree on combining traditional learning with online learning techniques in the future? | ▲             | ▲               | 30.6       | 0.0001**|
be used in emergency cases such as pandemics, natural disasters, and conditions that prohibited students from attending classes, but few students indicated that quizzes, exams, and projects should all be online-based and formative.

In contrast, the engineering college, fine arts, and medicine rejected the idea of blending and preferred to keep all their classes traditional since they are difficult to replace at home. This is expected as students are often enrolled in a scientific laboratory and studio classes that are better equipped and prepared for students’ activities. Suppose this university plans to implement such a model. In that case, all colleges must be considered to ensure that all students have technology-mediated contact with both instructors and other students, improving the learning community (Lea and Nicoll, 2002).

7. Blended learning as a future solution

However, with 75% of the respondents agreeing that combining online and face-to-face techniques would be beneficial, a hybrid model could be the solution to the next phase. Russell et al. (2018) define hybrid learning as a model for delivering instruction that combines face-to-face classroom teaching with eLearning that would be better described as a new term, not a new idea. According to Welker & Berardino, [45], Blended Learning is any combined use of online learning tools that supplements but are not a substitute for face-to-face learning. Their study found that implementing a hybrid model produced more work, according to faculty members, and lacked some traditional classroom dynamics. Students reported flexibility, accessibility, and objectivity as advantages but complained of uncertainty, reduced social communication, and additional work as drawbacks. Another study by Hannay and Newvine [13] examines why students chose online education and their perception of the quality and struggle of their courses compared to courses taught in the traditional ways. They suggest that eLearning alone is not enough. The study assimilated some of the finest features of distance learning into traditional courses to build a “hybrid” educational environment. The findings indicated that students favor online education, largely because it allows them to manage their commitments more conveniently. The case study university, for its part, has already started to incorporate online learning, having accepted a plan for a blended model that starts in the Fall Semester of 2020/2021. It aims to improve interactivity, connections between students and instructors, and active learning that will allow better engagement with the content of courses and considerable feedback on assessments. The government must ensure the accessibility of consistent communication tools, high-quality digital academic involvement, and endorse technology-enabled learning for students to bridge the differences initiated in the education system due to the change process before and after the COVID-19 pandemic [21]. The university also plans to provide all its theoretical courses online and practical courses blended according to the lab/studio set up and the course requirements, thus providing a more flexible and resilient approach. However, the use of technology to aid on-campus courses helps the move from traditional educational structure to a blend-based model to be efficient (Lau, Yang and Dasgupta (2020); Open University (2020); Ross (2020); Sanger (2020), this approach still needs to be tested, and further research is required to analyze the blended-learning model.

8. Conclusion

In this research, the impact of online learning on teaching and learning during the COVID-19 pandemic was analyzed. Different parameters were extracted from a comprehensive literature review. These parameters were classified according to their relevance and used to create a survey of the perceptions of students and faculty members of different colleges, with the engineering college set as the base case, about their performance during the pandemic, the effectiveness of the eLearning techniques, and the future implications of this sudden introduction of complete online learning. The study finds reveal that the implementation of e-learning had both positive and negative impacts on the users. The primary benefit that has been determined is flexibility in place and time, with 77.2% of users providing positive feedback. On the contrary, the survey results showed that the sudden eLearning adoption had discouraging repercussions on user’s mental health and socialization, with 55.6% of the users agreeing that they had been affected negatively. Also, 71.6% of the users reported a decline in their academic performance and grades. As for the comparison between theoretical colleges and practical colleges, theoretical colleges appear to have a more positive perception of the extent of productivity, motivation, knowledge acquisition, and interactivity between users. All in all, the users advocated the idea of adopting online learning techniques in the future in conjunction with traditional classroom learning; 75% of the users preferred a blended model of face-to-face and e-learning techniques combined, rather than solely depending on either online learning or traditional learning.

This study was limited by the lack of previous writers analyzing the impact of the COVID-19 pandemic and by the location of the study. As far as future work can be suggested, the scope of the research could be extended by designing an educational model that combines the best of traditional and online learning and could serve as an educational scheme that could be generally implemented in cases of emergency or events such as a pandemic or a natural disaster of some kind.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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