RESEARCH ARTICLE

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Design, Implementation and Evaluation of an Online Module for Undergraduate Medical Students at the Faculty of Medicine, Suez Canal University

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Abstract

Background: The COVID-19 pandemic has significantly fastened the development of online education in Egypt. This led to a more emphasis on student-centered activities including group collaborative activities, discussions, hands-on learning activities, and reduced reliance on traditional lectures. **Methods:** A mixed methods research design was used that included both qualitative and quantitative data. Post-test-only interventional study was conducted to design implement, and evaluate online modules for undergraduate medical students, at the Faculty of Medicine, Suez Canal University. The study population consisted of 100 students who completed the pre/post-implementation (module evaluation questionnaire). A convenience sample was taken from each year. A convenience sample was taken from teachers at, the Faculty of Medicine, Suez Canal University. **Results:** The online learning experience was perceived positively by the students. They reported that E-learning saved their time and facilitated learning at their own pace, taught them self-dependence, and helped them diversify resources. However, they reported that the interaction with their teachers in the online module is less comparable to face-to-face classes. Also, they haven`t enough experience in dealing with the used online applications. Comparison between fully online learning during COVID and blended learning post-COVID students' perception of the online learning experience showed that there was no statistically significant difference in their overall perception as well as different elements of E-learning which indicates sustainability and anchoring of the online learning within the formal educational system. **Conclusion:** The study highlighted the benefits of online learning during the COVID-19 pandemic and post-COVID, showing significant satisfaction regarding e-learning experience between students and teachers which is most relevant to students' engagement and performance. The lessons learned from the COVID era shaped the road of blended online learning (post-COVID) which has been integrated into the faculty education strategy from the COVID period till now.

Major Findings: The online learning experience was perceived positively by the students both during COVID and Post-Covid.

Keywords: Blended Online Learning, COVID-19, E-Learning, Post-COVID

1. Introduction

After the outbreak of the coronavirus at the end of 2019 and early 2020, universities in general and medical schools more specifically faced a new challenge: The inability to cope with in-person education in halls and laboratories. Therefore, they had to provide affordable educational services to their students, contributing to the e-learning trend[1].

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The coronavirus pandemic has significantly accelerated the development of E-learning globally and locally in Egypt. This led to a paradigm shift from traditional, passive, teacher-centered, and lecture-based activities towards more active student-centered activities including group activities, and discussions, and limited the use of traditional lectures. Consequently, considerations should be given to reform the nature of teaching and learning, and different ways of communication with teachers to cope with the emerging post-digital learning communities[2].

Online learning refers to learning that utilizes internet networks and technology to carry out the learning processes. Hence, learning and collecting tasks can be done using technology without time and space limitations[3].

Online learning classes are becoming progressively popular, and teaching-learning strategies should be carefully planned to provide students with high-quality engaging learning experiences and to compensate for space and time distance. Hence, educational strategies should encourage three-way interactions: student-to-teacher, student-to-student, and student-to-content engagement[4].

Digital transformation after COVID-19 provides medical students with opportunities for technology-enhanced learning and an engaging learning environment that enhances lifelong learning[5]. However, there are many challenges to this mandatory digital transformation including the faculty training on online teaching skills, the development and sharing of online resources, and effective planning and implementation of online assessment[6].

Creating engaging content that captures and holds the attention of the students can motivate and encourage them to stay focused, which can increase their knowledge retention and understanding through using interactive case-based discussion instead of traditional lectures, using forums, enriching the content with multimedia elements such as videos, images and audio clips and chunking the content in digestible ways so students are better able to pace themselves and engage with the content[7].

The Faculty of Medicine-Suez Canal University was established in 1976 to be the first problem-based, community-oriented/based, and student-centered medicine school in the Middle East[8].

2. Methods

2.1 Type of the Study

A mixed methods research design was used which included both qualitative and quantitative data. Quantitative in the form of close-ended likert scale questionnaires and qualitative in the form of self-administrative open-ended questionnaires. Post-test interventional study was conducted at the Faculty of Medicine, Suez Canal University, Egypt. The study's target population included undergraduate medical students, and teachers, at the Faculty of Medicine, Suez Canal University.

2.2 Sampling

- Students' sample:

The calculation of the sample size used the following equation:

N=Z2 PQ/D2 where**:**

- "Z" is a constant that equals 1.96
- "P" is the prevalence of students' perception of online modules. It was estimated in a similar study conducted at De Sales University, USA as 67.5%**.**
- "Q" is the completion of the prevalence so that the summation of both equals 1 (P+Q=1),
- "D" is the difference between the prevalence and the results of the study; it equals (Zx1/10P) as only 10% bias is accepted.

So, the equation will be (1.96)2 × 0.675 × 0.325 / (1.96 × 0.0675)2= 50 students.

The study population comprised 100 students who completed the pre/post-implementation (module evaluation questionnaire).

  – 50 students from pre-clinical years (years 1-3) and 50 students from clinical years (years 4-6).
  – Convenience sampling was taken each year.

- Convenience sample was taken from teachers, Faculty of Medicine, Suez Canal University.
- The teacher sample consisted of 34 teachers: 20 pre-clinical and 14 clinical specialties.

2.3 Educational Module Design

The module's design was divided into two interconnected parts: the module plan and the communication architecture. These two parts worked together to develop and manage the learning activities Module design steps presented in Trentin's research were considered[9].

A needs assessment of targeted undergraduate medical students was conducted to explore students' experience with Information and Communication Technology (ICT) before online module implementation to make sure that they had the prerequisite technical knowledge and skills.

An informal interview was held with stakeholders (dean, vice dean of education and students' affairs, academic year, and phase coordinators) and the strategy of introducing online learning to all six years was discussed.

An e-learning committee (recruiting representative members from each department in the faculty) was developed.

The aims and objectives of each module in the six years were identified and a comprehensive module blueprint was developed.

Communication with teachers for module adaptation to fit with the (teaching) in the form of recorded labs, recorded lectures, interactive sessions through Zoom and Microsoft Teams, telegram groups for communication, online Problem-based learning sessions, online multidisciplinary seminars, online case-based discussion sessions and online assignments and quizzes for online assessment.

The MOODLE learning management system was chosen as the platform for implementation due to its ease of accessibility and connectivity. and Microsoft Team for live sessions alongside staff and students training on Moodle by the IT unit.

Module scripts were designed and those scripts were transferred to media-rich content to cover broader learning styles.

Teachers' roles and responsibilities were explained to them in an orientation session. Their main role was to guide and mentor students all over the E-learning experience, providing help, support, and immediate constructive feedback.

The ways of communication between teachers and students, as well as among students, were established. Forums and chatting were used for that.

Educational Strategies used during this study were fully online learning at the beginning of the study (the peak of COVID-19) (academic year 2020-2021) followed by a blended learning approach (academic year 2021-2022) which is the one still implemented up to date.

2.4 Module Implementation

Once the initial draft of the module was developed, it underwent a review process until the final version of the 27 online modules was uploaded onto MOODLE. (list of the created modules annex 1).

The design of the pre-clinical online module includes online lectures both synchronous (through Microsoft team) and asynchronous (recorded) in different disciplines, references for further readings, practical sessions (recorded labs and pre-labs), seminars (discussion forum with teachers), online problem-solving sessions, recorded clinical skills videos (skill lab), online students' presentations, online assignments as MCQs, short answers and Essay Questions.

The design of online modules in clinical years includes recorded lectures, references for further readings, and recorded clinical examination videos (e.g. Vital signs, chest, abdomen, cardiac examination) with an orientation of OSCE (objective structured clinical examination) as a method of assessment, online assessments as quizzes, problem-based exams, and script concordance test.

The IT unit conducted an orientation session to guide students on how to use MOODLE, address common inquiries and navigation issues, and explain the nature of online modules and communication methods with teachers and peers.

Students' log-in usernames and passwords were distributed and any accessibility issues were checked and solved.

Objectives of each module were announced on the learning management system (MOODLE).

2.5 Data Collection Tools

2.5.1 Quantitative Test

E-learning experience questionnaire (Annex 2) to assess students' perception regarding the designed modules after implementation. It consisted of 32 items with a 5-point Likert scale (Disagree, Strongly Disagree, Neutral, Agree, and Strongly Agree

Scales: Good E-Teaching scale, good E-resources scale, appropriate workload scale, Appropriate Assessment, Interaction scale, and the blended learning scale evaluate the quality of blended learning and its relation to face-to-face activities[10].

Items Development: The Original items of the E-learning experience questionnaire were developed and discussed with subject matter experts in online learning. The items focused on distance, online, and blended learning[11].

Validity and Reliability: Confirmatory factor analyses were conducted using LISREL 8.54 to identify the properties of the e-learning scales. Multivariate normality is a fundamental assumption of standard confirmatory factor analysis. Univariate and multivariate normality statistics were computed using PRELIS 2.54, revealing statistically significant levels of univariate and multivariate skewness and kurtosis in the data.

The internal consistency of the e-learning scales was assessed using Cronbach's alpha coefficient. The resulting estimates ranged from 0.71 to 0.83[12].

Post-Test using the same e-learning experience questionnaire from the same undergraduate students included in the sample (the pre-clinical years' students) the subsequent academic year to evaluate the sustainability of E-learning experience post-COVID (blended online learning).

2.5.2 Qualitative Test

An open-ended questionnaire (Annex 3) was administered online through Google Forms (semi-structured interview) to assess the perception of teachers towards the e-learning experience regarding the advantages, disadvantages, challenges, and recommendations. The questionnaire consisted of 8 items.

Face and content validation were performed for the questionnaire by Medical Education experts from the MED, FOM-SCU.

2.6 Data Analysis

Once the completed questionnaires were collected, they were entered into an Excel spreadsheet. Data analysis was conducted using SPSS version 21. The appropriate statistical methods were chosen based on the type of data.

A. Quantitative Data

1. Descriptive analysis was used to present the data in the form of mean, percentage, and standard deviation. Tables and graphs were utilized where needed.
2. The t-test was utilized to compare the average perception of pre-clinical and clinical years, as well as the average perception of fully online and blended learning among students. A normality test was conducted before applying the t-test.
3. Although prior research was performed on the E-learning experience questionnaire's validity and reliability, the tool's internal validity and correlation among different study variables were done. P-value was set at <0.05 for significant results. Internal consistency using Cronbach's alpha of the questionnaire and its scales was also performed.

B. Qualitative Data

The process of thematic analysis involves five steps: 1. Familiarization with the data, 2. Generation of initial codes, 3. Searching for themes, 4. Reviewing themes, and 5. Defining themes. This process is then followed by writing up the findings[13].

3. Results

3.1 Evaluation of Students' Perception of the E-learning Experience

The 32 items were grouped into 8 constructs: quality of teaching, students' interaction and engagement, clarity of goals and standards, quality of online resources, appropriate assessment, appropriate workload, and student management,

3.1.1 Evaluating the Quality of Teaching in the Implemented Module

Table 1 shows students' responses to the 7 items related to the quality of teaching. Most students (68%) agreed that they were satisfied with the feedback in the E-learning. In most of the items, students agreed that the teaching in the online learning context was supportive and engaging, and the teachers' online responses motivated them.

3.1.2 Evaluating Student Interaction and Engagement

Table 2 shows students' responses to the items reflecting students' interaction and engagement. Near half of the students in items 16 and 21 (44% and 42% respectively) agreed that they got benefits from their colleagues' online contributions to forums, synchronous discussions, and problem-solving sessions

3.1.3 Evaluating the Clarity of Goals and Standards

Table 3 shows students' responses to the items representing the clarity of goals and standards. Responses were not satisfactory generally regarding clear goals and standards for a module.

Table 1. Students' responses to the 7 items related to the quality of teaching

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	I received excessive feedback online from my teacher.	3.88	2%	0%	30%	44%	24%
2	Teachers' online feedback motivated us to understand more deeply.	3.28	0%	22%	38%	30%	10%
3	Teachers' guide students' online discussions	3.34	4%	10%	42%	36%	8%
4	Teachers' online interaction with me motivates me to maximize my learning.	3.7	0%	10%	32%	36%	22%
5	Teachers' online interaction encouraged me to learn better than I could do alone.	3.14	6%	10%	34%	44%	6%
6	I didn't get sufficient online effective feedback from my teachers.	3.36	4%	12%	38%	36%	10%
7	Teachers helped me to engage in online discussions with my peers	3.78	26%	54%	10%	4%	6%

Table 2. Students' responses to the items related to interaction and engagement

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Reading other students' online participation in forums' discussion boards clarified some of the unclear ideas	3.12	2%	24%	36%	36%	2%
2	I interacted with my colleagues' online submissions on discussion boards	3.48	2%	2%	52%	34%	10%
3	My colleagues' online contributions aided me to understand my thoughts from a different point of view	3.44	4%	4%	42%	44%	6%
4	My colleagues' online contributions motivated me to search for new and informative resources.	3.34	4%	10%	44%	32%	10%

Table 3. Students' responses to items related to the clarity of goals and standards

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	The information necessary to comprehend the purpose and content of the module was consolidated in a single online location.	3.22	4%	20%	32%	38%	6%
2	The instructions for participating in online discussion boards were clear.	3.7	2%	4%	30%	50%	14%

3.1.4 Evaluating the Quality of Online Resources

Table 4 shows students' responses to items reflecting the appropriate assessment. Responses were not strongly positive concerning online assessment support (item 10). In item 1, they rated online quizzes positively as 18% disagreed that memory is all needed for quizzes

3.1.5 Evaluating Appropriate Workload

Table 5 shows students' responses to the items representing the appropriate workload for online activities. Responses were positive, the workload was appropriate (item 11) and they had enough time to understand online activities (item 14).

3.1.6 Evaluating Students' Management

Table 6 shows students' responses to the items reflecting students' management. Students agreed (52%) that teachers used the online learning environment when necessary and agreed (48%) that the teachers regularly inform students about related module study resources, further readings, and online assignments

3.2 Overall Students' Perception of the Online Learning Experience

Figure 1 shows that (55%) of students were satisfied with the overall quality of online learning modules while 20% were not satisfied.

3.3 Students' Perception of the Advantages of Online Learning

Figure 2 shows that (70%) of students reported the advantage of saving time on online learning, 23% reported that it taught them self-dependency and 11% reported that it helped them in having variation in resources

3.4 Students' Perception of the Disadvantages of Online Learning

Figure 3 shows that (20%) of students reported the disadvantage of losing communication with professors and colleagues, 12% reported that they haven't good internet access and 4% reported that they haven`t enough knowledge in dealing with applications.

3.5 Comparison between Pre-clinical and Clinical Years Students' Perception of E-Learning Experience

Table 7 compares students' perceptions of the online learning experience in pre-clinical years and clinical years. There was no statistically significant difference in their overall perceptions or different constructs of online learning.

Table 4. Students' responses to items related to the quality of online resources

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	online teaching materials of this module are effective at explaining concepts	3.82	0%	6%	26%	48%	20%
2	The online activities are planned to enhance the student's potential	3.34	4%	12%	44%	26%	14%
3	The online teaching materials are created to engage and motivate students.	3.48	2%	10%	40%	34%	14%

Table 5. Students' responses to items related to appropriate assessment

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Good memory is all that I need to solve online quizzes.	3.38	4%	14%	32%	40%	10%
2	Online assignments helped me to learn better	2.88	6%	38%	24%	26%	6%

Table 6. Students' responses to items related to students' management

N	Item	Mean	Likert scale (%)				
			Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	Teachers used online platforms to keep us updated on the results.	3.32	4%	18%	26%	46%	6%
2	Teachers utilized the online platforms to inform us about related module resources.	3.64	0%	8%	44%	24%	24%

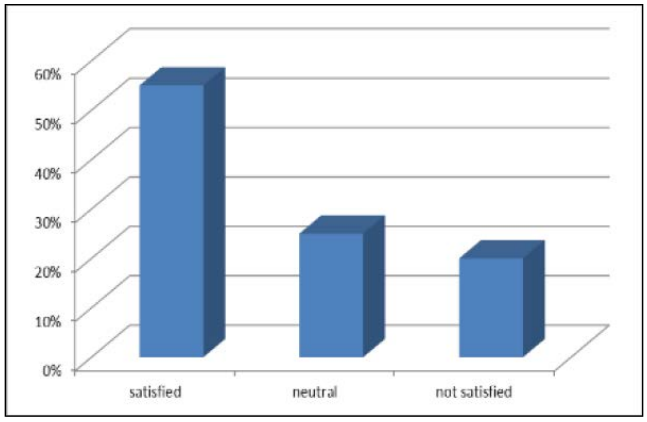


Figure 1. Frequency distribution of students' overall perceptions of the online learning experience.

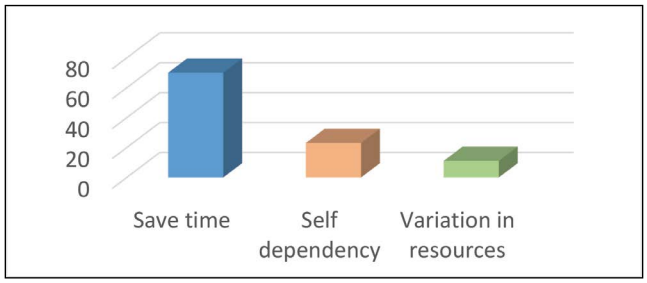


Figure 2. Students' perception of the advantages of online learning.

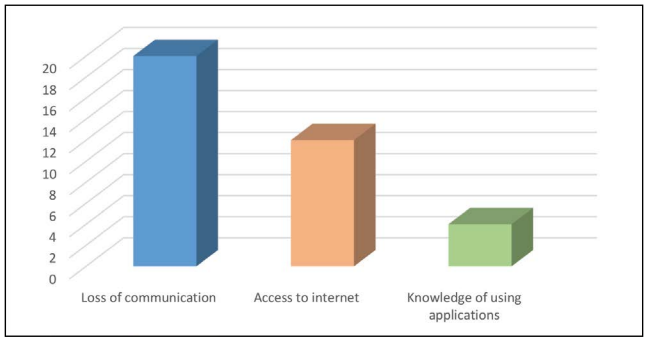


Figure 3. Students' Perception of disadvantages of online learning.

3.6 Comparison between Fully Online Learning and Blended Online Learning Students' Perception of the E-learning Experience

Table 8 shows a comparison between fully online learning and blended online learning students' perception of the E-learning experience. There was no statistically significant difference in their overall perceptions or different constructs of E-learning.

Table 7. Comparison between pre-clinical and clinical years students' perception of online learning experience

Item	Pre-clinical years	Clinical year	T Test Pvalue≤0.05
	Means ±SD		
Overall satisfaction	3.88±0.91	2.99±1.21	0.098
Quality of teaching	3.13±0.3	2.27±0.8	0.077
Students' Interaction	3.13±0.2	2.12±0.3	0.05
Clarity of goals and standards	3.13±0.2	2.12±0.3	0.05
Quality of online resources	3.11±0.2	2.4±0.5	0.127
Student assessment	3.23±0.1	3.01±0.4	0.275
Student workload	3.56±0.2	3.18±0.3	0.513
Student management	3.22±0.1	3.11±0.2	0.139

Table 8. Comparison between fully online learning and blended online learning students' perception of E-learning experience

Item	Pre	Post	Pvalue≤0.05
	Means ±SD		
Overall satisfaction	2.55±0.18	3.42±1.09	0.062
Quality of teaching	2.99±0.43	3.28±0.22	0.172
Students' Interaction	3.10±0.32	3.33±0.19	0.198
Clarity of goals and standards	3.33±0.11	2.98±0.32	0.134
Quality of online resources	3.0±0.18	2.99±0.42	0.887
Student assessment	3.43±0.29	3.11±0.31	0.435
Student workload	3.11±0.32	3.67±0.22	0.107
Student management	3.09±0.24	3.66±0.11	0.089

3.7 Perception of Teachers Toward E-learning Experience

This phase included 34 teachers:20 pre-clinical science (P1-20) and 14 clinical (C1-14). Thematic analysis of the semi-structured interview questions, the following themes emerged:

3.7.1 Advantages of Online Learning

This theme described the answers to the questions in the semi-structured interview asking the teachers about the advantages of online learning to teachers, students, and curriculum, the following subthemes emerged:

- Time-saving

The majority of the teachers agreed that online assessment is time-saving by saying **"Automated grading and other tools can save teachers time on administrative tasks, allowing them to focus more on teaching and student support"** (P12)**.**

- Flexibility

Most teachers agreed that the online environment allowed them to create and deliver content at their own pace and schedule, allowing for greater work-life balance. **"Online teaching is more flexible to students and teachers"** (C3).

"the easy access to the online module materials anytime, anywhere for teachers and students makes it more flexible" (P7).

- Personalized learning

The majority of teachers agreed that E-learning can offer a personalized learning experience for their students, based on their individual needs, learning styles, and preferences **"Online learning helps students to get rid of their learning experience based on their pace, preferred learning style and need**" (P12).

- Immediate feedback to the students

Most teachers also reported that "Online teaching gives me the ability to provide better, immediate feedback to my online students on their performance in the online module."

3.7.2 Disadvantages of Online Learning

Online learning offers flexibility and convenience, but it also comes with challenges. Staying motivated can be tough without the structure of a traditional classroom, and distractions like social media or household chores can easily derail study time. Technical issues like unreliable internet connections or software glitches can create frustrating obstacles. Plus, the lack of face-to-face interaction can make it harder to build relationships with instructors and classmates, potentially leading to feelings of isolation, after asking the instructors about the disadvantages of online learning the following subthemes emerged.

- Increase Workload

Most of the Teachers in clinical years agreed that the workload in online lectures and seminars is higher than in face-to-face classes to keep their students engaged and motivated to participate online "**Workload is higher in online sessions, especially in the moderation of the discussion and choosing interesting clinical cases"** (C6).

- Lack of face-to-face interaction

Few of the teachers reported that online learning can limit opportunities for social interaction and personal connections between students and teachers **"It is more difficult to motivate my students in the online environment than in the traditional setting"** (P11).

"The rate of my interactions with students in the online module is lower than in a traditional face-to-face class" (P10).

- Students' sense of isolation

Most clinical-year teachers also reported that Online learning can make it harder for students to develop a sense of belonging and community within their academic environment. "**Students may feel isolated from their colleagues and teachers behind their screens."** (C3).

"**Not meeting students face-to-face in an online setting for every class prevents from knowing them as well as on-site students**" (P5).

- The validity of the online information

Most clinical and preclinical year teachers agreed that the validity of the online unofficial resources (not sent by the teacher) **"Students may lack the needed experience to judge the quality and validity of the online resources"** (C2).

3.7.3 Challenges for Online Learning

- Planning engaging online sessions

Online teaching is frustrating to some teachers as saying **"Online teaching requires extra planning time for the module**" (P6).

- Technical difficulties

Most clinical and preclinical teachers reported that students and teachers may encounter technical issues with

their devices, internet connections, or software, which can disrupt the learning process **"Technical difficulties make online teaching frustrating** "(C8).

3.7.4 Recommendation for Further Application

Teachers said **"There is a need to increase online sessions, proper training of the students, provide technical support, and perform training sessions for staff doctors to learn how to deal with online learning problems "**(P9).

4. Discussion

This study aimed at planning and implementing online modules for undergraduate medical students at the Faculty of Medicine, Suez Canal University. The evaluation of these online modules will guide the recommending guidelines to improve student's learning experiences and enhance their learning outcomes. In this study, we explored students' perceptions of the challenges they faced during their new learning experience, as well as their recommendations for future perspectives. Moreover, staff perception about the advantages of online learning, problems encountered, and recommendations for further application were explored.

In our study, the module's design was divided into two interrelated parts: module plan and communication architecture. These two parts worked together to develop and manage the learning activities[14].

The learner-content interaction was reported as the strongest predictor of student satisfaction within the online module[15].

The E-learning experience questionnaire was selected, 55% of students were satisfied with the quality of the online learning experience while 20% were not satisfied and 25% had neutral opinions.

A similar study was conducted also during the COVID-19 pandemic at Chitwan Medical College, Bharatpur, Nepal, 53.5% of students were satisfied with the online modules being conducted. Only 16.8% were dissatisfied. The remaining 29.7% (n = 129) have neutral responses[16].

Another similar study was conducted at Tribhuvan University, Institute of Medicine. Maharajgunj Nursing Campus, Nepal, during the COVID-19 outbreak 49% of students were enjoying online learning[17].

On the other hand, a study was conducted at the Medical and Health Sciences Colleges, University of Sharjah, United Arab Emirates. The study reported that more than two-thirds of the students were dissatisfied with online learning.Personality, self-efficacy, and expectations related to the planning and delivery of online learning and teaching. Additionally, the abrupt shift to online learning due to COVID-19, coupled with insufficient preparation time and the stressful conditions of the outbreak, may have contributed to decreased student satisfaction[18].

In our study, (70%) of students reported that E-learning saved their time and learning at their own pace, 23% reported that it teaches them self-dependence and 11% reported that it helped them in having variation in resources, all these advantages guide the design of the blended online courses afterward to preserve these acquisitions a comparable study involving Polish medical students revealed that the primary advantages of online learning included the ability to study from home (69%), constant access to online resources (69%), learning at their own pace (64%), and a flexible learning environment (54%)[19].

Our study revealed that 20% of students reported difficulties in communication with professors, colleagues, and patients, while 12% lacked good internet access and 4% struggled with using applications. These problems were prominent at the start of the experience of online learning at the time of COVID as there was no communication and technology infrastructure at the time but afterward, a communication plan was established to guide the blended online learning transition a similar study of polish medical students found that the majority of respondents cited a lack of patient interactions (70%) and technical issues (54%) as the main disadvantages of E-learning[20].

Concerning the quality of teaching, nearly half of the students stated that teachers' responses were motivating and guiding all through the online discussions, teachers' commitment had a prominent role in students' engagement and satisfaction

A similar study found that students had a positive view of online module coordinators who encouraged and mentored them in their use of online resources[21].

Another similar study also found that a teacher's enthusiasm for online learning, as shown directly to their students, has a motivating effect on them[22].

Regarding teachers' feedback, our students' responses were positive as 68% agreed that they were satisfied with the given feedback.

Regarding the quality of online materials, students' responses were positive, as they were satisfied with the relevance of online resources for topic explanation and agreed that the online resources supported face-to-face activities. The variety of resources has favored these results including online lectures, recorded powerPoint presentations, and formative assessments in the form of online quizzes. Responses were not strongly positive concerning online quiz support. They rated formative online quizzes positively as 50% agree and 18% disagree that memory is all that is needed for quizzes.

A similar study revealed that environmental factors like assessment diversity and interaction with others significantly impact e-learning perception. Incorporating various evaluation methods in an online learning experience can lead students to believe in a strong bond with their teachers and the effective assessment of their learning[23].

An open-ended questionnaire was given online through google forms to identify perceptions of teachers in the online learning environment regarding the advantages, disadvantages, challenges, and recommendations.

This phase included 34 instructors: 20 in basic science and 14 in clinical sciences. Thematic analysis of the semi-structured interview questions was done. They reported that the advantages of E-learning were the flexibility provided by the online environment, the easy accessibility of online module materials anytime, anywhere, the ability to give online immediate constructive feedback to students on their performance, and the personalized learning experience adapted to the student's needs, learning styles, and pace.

A similar study from Indonesia reported that teachers had a positive perception of the ease of use and efficiency of online learning during the COVID pandemic, particularly in terms of designing engaging content and providing immediate feedback through e-learning platforms[24].

Another study also found that one of the critical areas for teacher and student satisfaction with online learning is the interaction between them. engagement of students had a critical role in teachers' satisfaction[25].

On the other hand, the interviewed teachers in our study perceived that the disadvantage of E-learning is that the validity of the online resources is questionable. The interaction with students in online learning is less than in traditional face-to-face learning. The workload is higher in online learning. Not meeting students face-to-face in an online setting for every class prevents them from knowing them as well as on-site students. It is more difficult to motivate and engage students in the online environment than in the traditional one.

A study found that teachers devoted more time and effort to preparing effective engaging online classes than traditional ones. However, certain modalities of teaching, such as those involving practical work, projects, and specialized lab equipment, were not well-suited for E-learning[26]. Additionally, university teachers had negative views of online learning due to inadequate faculty training and support. They felt that online classes could not replicate the emotional connection between students and teachers in traditional classrooms[27].

After COVID and the fully online learning applied during the lockdown, the blended learning approach is applied afterward based on the fully online learning experience strengths and in trial to overcome the problems by covering the clinical and practical part alongside the theoretical part.

Blended learning is applied in the form of recorded lectures, recorded videos, online references on the learning management system (Moodle), online discussions, online assignments, online interactive lectures, and E-portfolios besides face-to-face labs, clinical rounds, seminars, and interactive lectures.

Comparison between pre- (fully online learning during COVID) and post (blended learning post COVID) students' perception of the e-learning experience showed that there was no statistically significant difference in their overall perception or different constructs of e-learning which indicates sustainability and anchoring of the online learning within the faculty education system.

One of the challenges of any sort of education is quality assurance. While technology offers promising opportunities, it alone cannot guarantee effective learning. Feedback is essential for implementing corrective actions, such as further faculty development and student empowerment and making mandatory improvements to the educational system[28].

4.1 Strengths of this Study

This was the first study in designing, implementing, and evaluating the online learning system for undergraduate

students at our medical school through the academic year during the COVID period as a purely pure online learning system at the time of the lockdown and blended learning after lockdown till now.

4.2 Limitations of this Study

A small sample size hindered performing factor analysis. As the questionnaire was fulfilled online during the lockdown period with a low response rate compared to the paper format.

Students' grades couldn't be accessed to evaluate students' performance in the online module. Thus, studying the relationship between students' perception of the online learning experience and the academic achievement of students who participated in the study could be a good point to investigate.

5. Conclusions

The most prominent finding to emerge from this study is that the E-learning experience overall was perceived positively by the students and teachers at fully online learning during COVID). After COVID and the fully online learning applied during the lockdown, the blended learning approach was applied afterward based on the fully online learning experience strengths and in trial to overcome the problems by covering the clinical and practical part alongside the theoretical part which was perceived also as positive by the students.

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Annex 1

The list of the undergraduate second-term modules were divided as

1. First year modules
   A. Musculoskeletal
   B. Respiratory
   C. Cardiovascular
2. Second-year Modules
   A. Urinary
   B. Endocrine
   C. Reproduction
3. Third-year Modules
   A. Endocrine
   B. Reproduction
4. Fourth-year Modules
   A. Surgery
   B. Internal medicine
   C. Obstetrics
   D. Pediatrics
   E. Community medicine
   F. Family medicine
5. Fifth year modules
   A. Ophthalmology
   B. Orthopedics
   C. Otolaryngology
   D. Psychiatry
   E. Tropical
   F. Dermatology
   G. Forensic & Toxicology
6. Sixth-year modules
   A. Surgery
   B. Internal medicine
   C. Obstetrics
   D. Pediatrics
   E. Community medicine
   F. Family medicine

Annex 2

Module Evaluation Questionnaire

We would be grateful if you could spend a few minutes filling in the attached questionnaire.

Please inform us whether you Strongly Agree, Agree, uncertain, disagree, or Strongly Disagree with the phrases below. It is about how you evaluate the online learning module.

Name (optional): Sex:

Please tick the appropriate box.

Question	*Strongly disagree*	*Disagree*	*Neutral*	*Agree*	*Strongly agree*
1. Good memory is all that I need to solve online quizzes.					
2. Teachers utilized online platforms to keep us updated on the results.					
3. I got excessive online feedback from my teachers.					
4. Teachers' online feedback motivated us to understand more deeply.					
5. Teachers guide students' online discussion.					
6. Teachers utilized the online platforms to inform us about related module resources.					
7. Reading other students' online participation in forums' discussion boards explained the unclear points.					
8. Online teaching resources of this module are effective in illustrating the main concepts**.**					
9. Teachers' online interaction motivates us to maximize our understanding and application.					
10. Online assignments aided us to learn better**.**					
11. workload of online part of the module is difficult, demanding, and time-consuming.					
12. Teachers' online interaction encouraged me to learn better than I could do alone.					
13. Information necessary to comprehend the aim and content of online module was consolidated in a single location.					
14. I got enough time to comprehend the materials I had to study online.					
15. I didn't get sufficient online effective feedback from my teachers.					
16. I interacted with my colleagues' contributions on discussion boards.					
17. The online discussions and assignments are planned to enhance our potentials.					
18. My colleagues' online contributions aided me to understand my thoughts from a different point of view.					
19. The instructions for participating in online discussion boards were clear.					
20. The online resources are created to engage and motivate students.					
21. My colleagues' online contributions motivated me to search for new and informative resources.					
22. Workload of the online part of the module is appropriate.					
23. Online resources facilitate learning in the face-to-face part of this module					
24. Online resources were aligned with the assignments.					
25. Online assignments helped me to prepare for the face-to-face part of this module.					
26. Online resources guided and reflected the main assessment points in the module.					
27. The relations between the online sources and the module were mentioned in the module's online platform.					

28. Teachers facilitate online discussion with my peers					
29. Information required to solve assignments was cited online in the same area					
30. Teachers made sure we had continuous access to the online resources all over the module.					
31. Overall, I was satisfied with the quality and quantity of online resources.					

Advantages & Disadvantages of E-learning

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Annex 3

An open-ended questionnaire was administrated online through Google Forms to assess the perception of teachers towards e-learning experience regarding the advantages, disadvantages, challenges, and recommendations as follows,

1. Did you receive sufficient training on designing and implementing effective online modules?
2. What is your role in the e-learning experience?
3. How do you find the learning management system (MOODLE) as a facility of e-learning?
4. What are the advantages of e-learning to the teacher, the student, and the curriculum?
5. What are the disadvantages of e-learning to the teacher, the student, and the curriculum?
6. What are the challenges of the e-learning experience?
7. What are your recommendations for improving e-learning in our faculty?
8. Why do or don't you prefer to repeat the same experience the next year? And, is there anything else you would like to say?

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