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## Digitalization plan in medical education during COVID-19 lockdown

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### ABSTRACT

**Background:** The COVID-19 pandemic has enhanced the adoption of virtual learning after the urgent suspension of traditional teaching. Different online learning strategies were established to face this learning crisis. The present descriptive cross-sectional study was conducted to reveal the different digital procedures implemented by the College of Medicine at Qassim University for better student performance and achievement.

**Methods:** The switch into distance-based learning was managed by the digitalization committee. Multiple online workshops were conducted to the staff and students about the value and procedures of such a shift. New procedures for online problem-based learning (PBL) sessions were designed. Students' satisfaction was recorded regarding the efficiency of live streaming educational activities and online assessment.

**Results:** The students were satisfied with the overall shift into this collaborative e-learning environment and the new successful procedures of virtual PBL sessions. The digital learning tools facilitated the performance of the students and their peer sharing of knowledge. The role of informatics computer technologies was evident in promoting the students, research skills, and technical competencies.

**Conclusions:** The present work elaborated on the procedures and privileges of the transformation into digitalized learning, particularly the PBL sessions, which were appreciated by the students and staff. It recommended the adoption of future online theoretical courses as well as the development of informatics computer technologies.

### 1. Introduction

Scientific technology and digitalization have a tremendous impact on escalating the efficiency and productivity of work in nearly all the fields in the modern era, from farming to health services and innovations and has proved itself as an efficient tool to make human life better and easier [1,2]. Online learning is considered a feasible and compliant method for training and scientific meetings and the sustainability of learning [3]. The expansion in global virtual learning is dependent on the availability of technology-enhanced active learning tools, and the options of online learning and their role in the field of medical education

cannot be disregarded [3,4]. The use of digital technology in medical education is now believed to have a crucial aspect of learning resources [3–5]. It does not only augment the understanding of the subject, but it also prepares the students to deal with the real-life scenario in a more practical way [6]. The pandemic of coronavirus disease 2019 (COVID-19) demands for virtual classrooms to foster creative thinking and solving problems capabilities of the students. The existing digital platform enabled communication with learners with a lower barrier and the online teaching was found to be a method that challenged our traditional approach [3–6]. A previously conducted study on twenty-two thousand students in the United Kingdom using digital

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education organization revealed that the technology as a learning tool is yet to be realized for effective pedagogy and learning [7]. Another study conducted in Australia, including more than one thousand students, revealed that digital learning was the most valuable technology for studying [8]. This study was conducted to disclose the digital resources used in teaching of the medical students at the College of Medicine at Qassim University. Currently, there are two sections for male and female students in which six hundred and seventy-four students were enrolled. The curriculum of the college of medicine is based upon the PBL system in which students gain knowledge by actively engaging in the real world and participating in personally meaningful projects. Along with the PBL system, highly skilled faculty conduct lectures and train students regarding skills used in modern-day medicine.

In December 2019, the earliest suspected case of COVID-19 from city of Wuhan situated in Hubei province of the people republic of China was reported to the World Health Organization (WHO) [9]. At that time, no one could predict that this novel virus would take a form of a deadly pandemic, which would shut down daily routine life activities and require social distancing [10]. On the 30th of January 2020 the WHO declared COVID-19 to be Public Health Emergency of International Concern and on the 11th of March 2020, it was labelled the status of a pandemic [11]. On the March 2, 2020, the first case of COVID-19 was reported in Saudi Arabia [12]. In order to prevent the spread of this infection among the population in Saudi Arabia, the Ministry of Health started the implementation of several preventive measures, which included social distancing. All the educational campuses in Saudi Arabia were closed, and educational activities were switched into a digital learning environment to avoid overwhelming the learning process. In order to follow and implement the preventive measures, the Qassim University was closed on the March 9, 2020. It was a challenging task to continue educational activities regularly; therefore activities were shifted into digitalized classrooms equipped with all forms of electronically supported learning and teaching tools, which enabled the students to share their information and to collaborate with their peers and teachers. The present study was conducted to reveal the several successful digital processes used by the College of Medicine in Qassim University for better performance and achievement in the field of medical education.

## 2. Methods

### 2.1. Study type and participants

This is a cross-sectional study performed on undergraduate medical students ( $n = 674$ ) from the 9th of March till the end of April 2020 in the

College of Medicine at Qassim University in KSA. Ethical approval was obtained from the Research Ethics Committee at Qassim University and the confidentiality of the information obtained was kept in consideration.

### 2.2. Formation of the digitalization committee

A committee was formed, which included faculty members of the College of Medicine and the task was given to digitalize the teaching activities through utilization of the available learning resources required to provide effectual medical education. The digitalization process was subdivided into two main functional parts. The first one was to digitalize the different learning activities, which included PBL, lectures, seminars, and assignments. The second task was to construct digital evaluation and feedback sheets. Fig. 1 summarizes the tasks assigned for the digitalization committee. The digitalization committee coordinated with the organizers of the different courses all the logistics concerned with uploading of the digitalized PBL scenarios on the Blackboard to be released to the students at a particular time.

### 2.3. PBL digitalization as a model for distance-based teaching

Students of the basic years were subdivided into groups for virtual PBL on the Blackboard with one faculty member assigned for each group for facilitating and evaluating the PBL sessions. After each session, anonymous electronic feedback from the staff about the PBL materials was sent to the PBL reviewing committee. The complete steps of the PBL digitalization are summarized in Fig. 2.

### 2.4. Digital tools used during distance-based learning

Qassim College of Medicine used Blackboard learning management system as the primary tool for virtual teaching. In case of its interruption, the Zoom Cloud Meetings platform was utilized as an alternative tool. Live webinars for the detailed instructions on the proper digitalization of educational activities were implemented to increase the competencies of the students and staff during online teaching. For any obstacle facing the students or staff during the e-learning process, different communication tools were suggested, such as using the social media application WhatsApp to respond promptly to any inquiry.

### 2.5. Evaluation of students' performance

An exam committee was formed, comprised of senior faculty

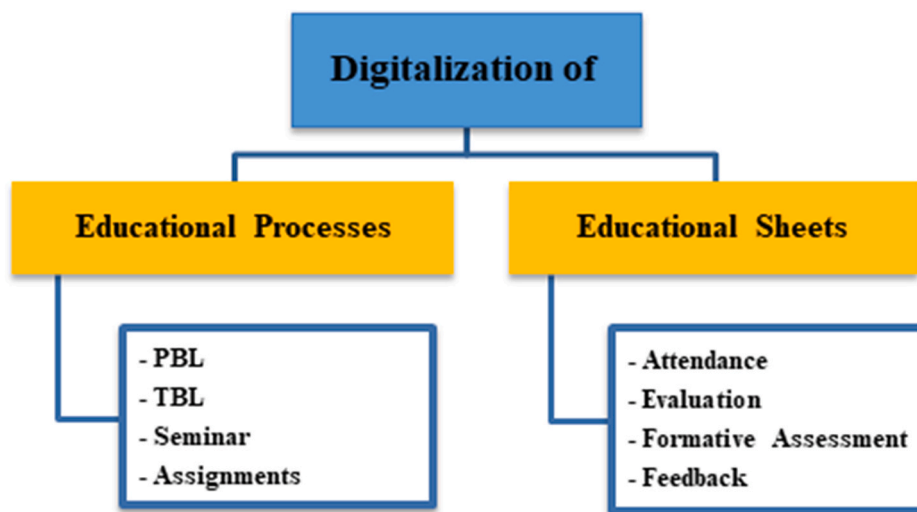


Fig. 1. Tasks assigned for the digitalization committee. PBL, Problem Based Learning; TBL, Team-Based Learning.

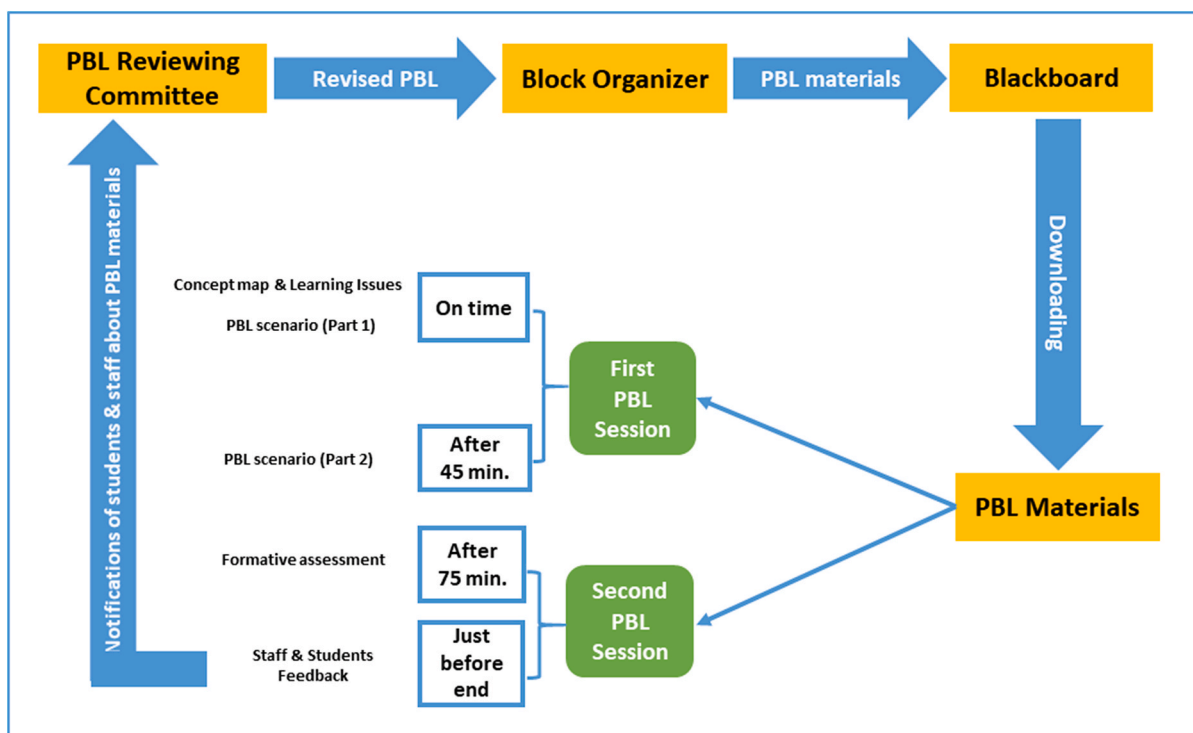


Fig. 2. Steps of PBL digitalization. PBL, Problem Based Learning.

members. The task for the committee was to design digital exams composed of clinical scenario-based multiple-choice questions, which were prepared through the contribution of the relevant department of the Medical College. The students’ performance was evaluated after online exams based upon the marks they obtained. In order to assess the clarity, difficulty level, and quality of the digital evaluation activity, students were provided with online feedback.

2.6. Faculty and administration meetings

After the suspension of study due to the COVID-19 pandemic, all college meetings were conducted using Blackboard Collaborate Ultra for web conferencing. In case of any technical issue facing the live streaming via Blackboard, Zoom Cloud Meetings was purchased by Qassim University, and the login details using university domain identification were provided to each faculty member was used as an alternative for conducting the meetings.

2.7. Data collection and analysis

An online satisfaction survey was performed to collect the student’s perception of the whole online learning process using a 5-points Likert scale. Analysed data were revised and analysed by an independent investigator.

3. Results

A total of 650 online distant learning activities, 314 lectures and 336 tutorials, including 35 case discussions, 247 PBL sessions, and 54 seminars, were conducted through the virtual classrooms. Five hundred ten educational activities were conducted through the Blackboard, while just 140 activities were conducted through Zoom platform. The total duration of activities conducted digitally was 1150 h. The overall number of students participating in different online learning activities was 19050 with an attendance rate of 87%. Specifically, 15709 students attended the lectures and their attended rate was 76%, while 3341

students attended the different tutorial sessions and their attendance rate was 98%. The total number of administrative meetings conducted digitally was 22; 15 departmental meetings and seven college council meetings. Online platforms powered the virtual learning sessions that were used in collaboration with different health colleges in Qassim University, such as dentistry and nursing colleges (Table 1).

The feedback of the students on their perception about the whole digitalization process was recorded through an online survey (Fig. 3). 67.30% of the students were satisfied with online teaching for all theoretical courses. About 64% agreed that the live-streaming sessions, through the Blackboard, were sufficient for open discussion and interaction. Most of them (88.93%) were satisfied with the digitalization of the educational activities in the achievement of the intended learning outcomes. Staff experiences for the proper moderation of the virtual classroom were unsatisfactory for 55.78% of the students. 72.97% expressed their enthusiasm to implement online courses in subsequent years. Approximately 83% of the students appreciated the instructions uploaded on the learning management system about the logistics of the online exams, the ability of such online assessment in the proper evaluation of their knowledge levels. Similarly, the students were impressed

Table 1  
Virtual classrooms after suspension of study due to the COVID-19 pandemic.

Parameters	No. (%)
<b>No. of Students</b>	19050
<b>Duration (h.)</b>	1150
<b>Total theoretical sessions</b>	650
<b>Digital tools utilized</b>	
Blackboard	510 (78.5)
Zoom Cloud Meeting	140 (21.5)
<b>Type of educational sessions</b>	
Lectures	314 (48.3)
PBL Sessions	247 (38)
Case discussions	35 (5.4)
Seminars	54 (8.3)
<b>Official Meetings</b>	
Departmental Meetings	15 (68.2)
College Council Meetings	7 (31.8)

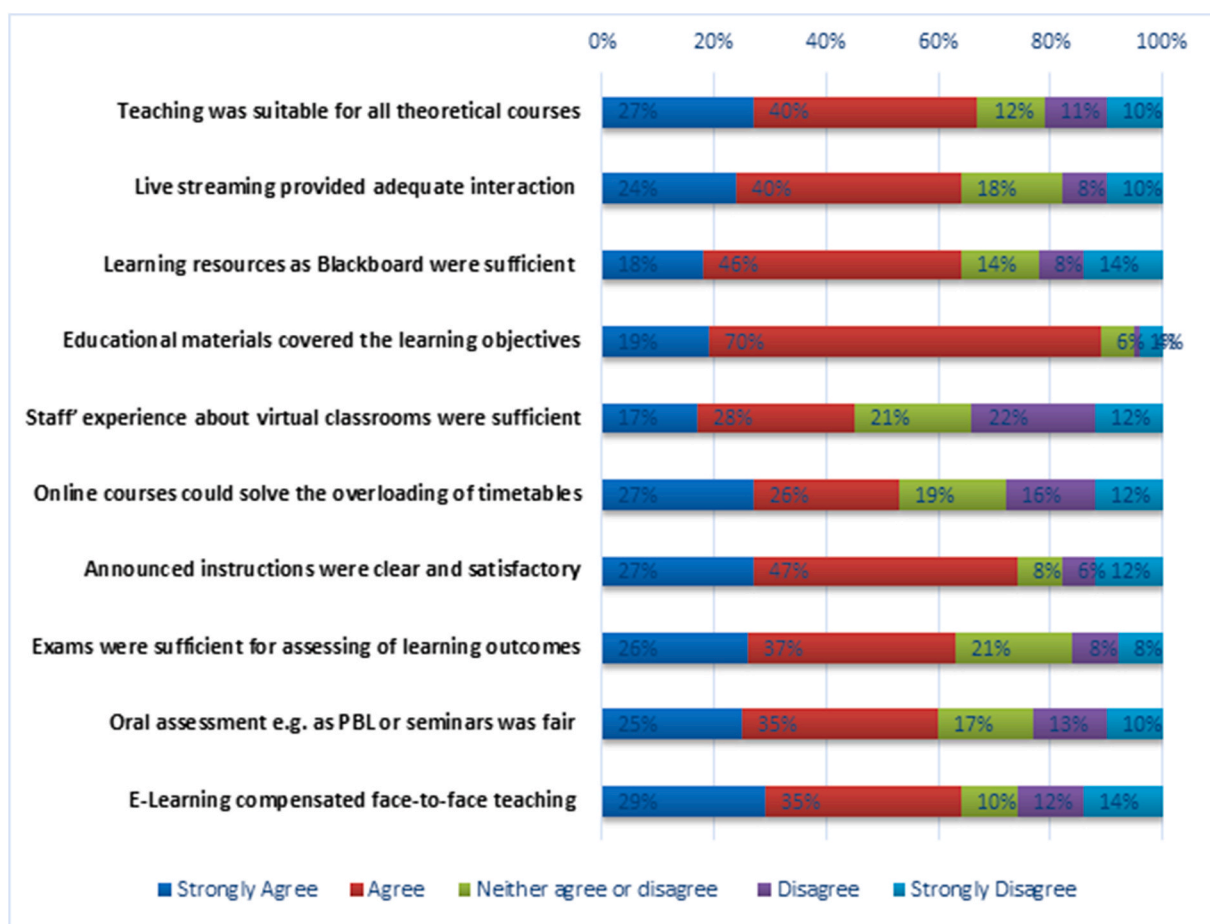


Fig. 3. Students' satisfaction survey of e-learning process during COVID-19.

with the new procedures of implementation of the online PBL. 84.22% of the students reflected a positive response towards the overall e-learning and online assessment performed during the COVID-19 pandemic.

#### 4. Discussion

This study described the procedures of the transformation from the traditional medical learning into the digital during the complete lockdown of COVID-19 pandemic. As the world is converting into a global village, technology has a tremendous contribution, especially in health sciences and medical care [13]. The COVID-19 pandemic has enhanced the adoption of virtual learning being the only safe and satisfactory educational option to ensure students' engagement, fulfilling their knowledge gaps as well as competencies of the health professional educators [14]. According to the current needs, it is a vital step to prepare the medical students and staff to cope with the modern technological innovations. Medical education is speedily upgraded under the influence of various factors that included the diversity in societal prospects and the health care system [15,16]. In concretion to this vision, the College of Medicine at Qassim University adapted the pathway of virtual classrooms under the supervision of the digitalization committee. The success of this committee in the organization of logistics and procedures of the distant learning and online evaluation was conveyed from the positive reflection of the students regarding the live-streaming sessions, online assessment, and overall satisfaction. In this scope, the accomplishment of virtual learning began with the obligatory social distancing due to the COVID-19. Most importantly the financial support provided by Qassim University to all students and high standard living status of Saudi society through which they utilized high-speed Internet services played a vital role for the successful implantation of the digitization plan

during this pandemic. Digitalization of educational materials has a considerable impact on the environment in which medical students learn [16]. The present study elaborated that Blackboard was the main software utilized for conducting most of the teaching activities. The rest of the live streaming session was conducted via Zoom Cloud Meetings as an alternative online platform utilized if the access to the official Blackboard was non-feasible. This was made possible due to our staff and students as they were accustomed previously by handling the various online activities such as they were officially using Blackboard, an official learning management system for the last three years. In addition, the faculty development unit organized multiple training sessions every year for the effective utilization of the e-learning, and switch to cope with the advance in the informatics and distant learning. Moreover, the expert staff was also selected in dealing with the online teaching, particularly in the first week of practicing the e-learning. In spite of these, the staff experiences were unsatisfactory for about 56% of the students. This could be due to the overloaded burden of both the staff and students to prepare didactic materials and to adopt the online learning process in a very short period of time. Different medical colleges around the globe utilized a variety of digital software for distance-based learning. The University of Sarajevo, located in Bosnia and Herzegovina, had implemented the virtual classrooms as a learning strategy on their e-learning website [4]. Our newly designed steps of the online PBL sessions were effective and enhanced the performance of students and tutors, which was evident from the students' perception. This successful application of distant learning and assessment motivated the College to construct efficient online procedures for other educational activities such as Team-Based Learning (TBL) and the digital learning tools facilitated the performance of the students and their peer sharing of knowledge.

The evaluation of students is an integral step in assessing the knowledge they have gained during the learning process. Putten et al. in their study, found that conducting the online assessments by digital means is a beneficial strategy [17]. In view of these, the College of Medicine at Qassim University conducted all exams via digital means on Blackboard software. During digital learning, the students were evaluated not only on the basis of their performance in the summative exams built on multiple choice questions, but their evaluation was also conducted on the basis of various other modalities such as PBL. The students were evaluated in the PBL sessions according to their peer interaction, commitment, team spirit, problem solving and critical thinking. In addition, the evaluation of the presentation skills and cognitive learning domains were performed through their seminars. Enthusiasm among the students who are attending the distance-based learning courses is also an important aspect, since if the students are not mounting interest, it will lead to a high dropout rate [18]. A few students were inconvenienced with the online assessment to test their knowledge precisely. This could be explained by the fact that the students were not adapted yet to online exams, being the first time they were assessed by such a method. According to a recent perception survey performed by the Imperial College London, some students mentioned that online exams were imperfect as they did not have a quiet surrounding environment at their homes while giving a timed online exam [19]. Routine online surveys and feedback were taken from the students in order to become aware and overcome the deficiencies in virtual teaching. The motivation of most of the students to implement online theoretical courses in the future was observed. However, the psychomotor skills performed in the practical and clinical settings required direct hands-on training as in real life. The students have to deal with practical laboratory procedures and real patients that require direct human interaction. According to a study conducted by Warnecke et al. most medical students looked on e-learning as a pleasurable and efficient mode of learning; however, they do not perceive it as a replacement of traditional educational methods [20]. Another study, conducted on medical students, had shown that learning was comparatively superior in a blended learning environment in which both e-learning and traditional teaching was merged [21]. Conversely, this contentment is not correlated with exam scores in which there was no significant distinction between the two pedagogic methods [22]. The level of satisfaction of the students about the interaction and open discussion during the live streaming sessions was average as it depended upon the type of educational activity as well as the role of faculty member moderating this activity [16]. This also could be attributed to the urgent switch into this new teaching modality. During this digitalization based learning, we also encountered several limitations including insufficient learning resources, such as the overload on the official learning management system that necessitated sustained upgrade and maintenance. In addition, there was a lack of information technologists as well as a lack of optimal online learning experience of staff and students. These could be overcome by developing and integrating informatics computer technologies in the field of medical education, collaboration with other universities having a good practice of distance-based teaching methods, and enhancement of digital literacy among students as well as faculty.

## 5. Conclusions

The current work elaborated on the procedures, privileges, and challenges of the shift into distance-based learning, particularly online PBL. This switch was appreciated by both students and staff. The study recommended the development of informatics computer technologies to promote technologically-enhanced learning and the implementation of online courses in subsequent years.

## 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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## Abbreviations

COVID-19	coronavirus disease 2019
PBL	problem-based learning
TBL	Team-Based Learning
WHO	World Health Organization

## Authors' contributions

Mohammad S. Alkhowailed: Data collection and interpretation and manuscript drafting. Ali Shariq: Data collection and interpretation and manuscript drafting. Ahmed Elzainy: Data collection and interpretation and manuscript drafting. Abir El Sadik: Data collection and interpretation and manuscript drafting. Zafar Rasheed: Data interpretation and manuscript drafting. Abdullah Alkhamiss: Data collection and interpretation and manuscript drafting, Ahmed M Alsolai: Data collection and interpretation and manuscript drafting. Sharifa K. Alduraibi: Data collection and interpretation and manuscript drafting. Alaa Alduraibi: Data collection and interpretation and manuscript drafting. Ahmad Alamro: Data collection and interpretation and manuscript drafting. Homaidan T. Alhomaidan: Data collection and interpretation and manuscript drafting. Waleed Al Abdulmonem: Conceptualization, data collection and interpretation and manuscript drafting.

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