



## Original article

## What just happened? Impact of on-campus activities suspension on pharmacy education during COVID-19 lockdown – A students' perspective

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## ABSTRACT

**Introduction:** COVID-19 pandemic induced lockdown, suspending all on-campus educational activities in the Kingdom of Saudi Arabia (KSA), compelling to continue the education online. We explored pharmacy students' perspective on its impact on their learning.**Methods:** A Twitter chat was organized on three consecutive days, after final examinations, inviting all pharmacy students in KSA to participate. Day 1 chat included 11 questions regarding learning and assessment, Day 2 chat included six questions about online examinations and six questions about technology use, Day 3 chat included six questions related to lessons learnt from the learning experiences during the lockdown. The questions were validated and piloted before the chat. The responses were copied, reviewed to remove any confidential information, and thematically analyzed by two teams of research students independently.**Results:** During the three-day chat, 790 responses were received in total. Thematic analysis generated 944 codes which were categorized into 43 subthemes. These subthemes were further categorized into six main themes: 'facilitators for online education', 'barriers for online education', 'online versus onsite education', 'role of technology in online education', 'suggestions for improving online education' and 'long-term impact of online education during lockdown'. Participants highlighted several facilitators and barriers which affected their education during the lockdown, compared online education with onsite education, and provided suggestions for improving online education based on their learning experiences during the lockdown.**Conclusion:** As COVID-19 pandemic and its repercussions are expected to last longer, pharmacy colleges and academic staff will find these findings useful to prepare for the coming years, ensuring pedagogical and accreditation standards.© 2020 Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The coronavirus disease 2019 (COVID-19) originated from China in December 2019 (WHO, 2020a), was declared a pandemic

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by the World Health Organization on 11th March 2020 (WHO, 2020b). In the same month, the Ministry of Education in the Kingdom of Saudi Arabia (KSA) suspended physical attendance in all the educational institutes announcing the shift of all educational activities to online (Reuters, 2020). This was soon followed by the partial to complete lockdown in the majority of the cities in the KSA until after the end of the second semester of the academic year 2019–2020. This move to distance learning, or more precisely online learning, forced the educational institutes and the academic staff to adjust their teaching and assessment methods. Although distance learning or online learning has been around for decades, unfortunately, many institutes were not prepared for this unprecedented situation. Similar to the other healthcare education pro-

grams in higher education, the pharmacy education sector was also affected. Not all courses could be easily shifted to online. Both the academic staff and the students in the pharmacy had a very limited time to adjust their lifestyle as well as the educational activities.

Challenging situations often lead to new and innovative ways (Brazeau, 2020). Pharmacy educators around the KSA and worldwide capitalized on this extraordinary time to create opportunities for them. Several pharmacy courses and teaching and assessment methods were modified to best meet the learning outcomes and the students' best interests. Final examinations were also replaced by alternative assessments in some courses. Learning Management Systems (LMS) and online video-conferencing programs have never been explored and utilized to this extent before. Fortunately, the widespread availability of technology was leveraged to meet the challenges. The pandemic has indeed propelled us into the new era of 'out-of-the-box thinking and creative problem-solving' in the context of online education (Romanelli et al., 2020).

Online education is 'the method of content dissemination and rapid learning through the application of information technology' (Zhou et al., 2020). It has also been referred to as e-learning in the literature. Salter et al conducted a systematic review examining the effectiveness of e-learning in pharmacy education. They concluded from the 17 studies that e-learning in pharmacy education significantly improves knowledge. However, in comparison, they found e-learning to be as effective as traditional learning (Salter et al., 2014). These results have been reported concurrent with the effectiveness of e-learning in other healthcare professions (Childs et al., 2005; Wong et al., 2010; Cook et al., 2010; Cook et al., 2008; Lahti et al., 2014).

Online education is not free from limitations. Lessons learnt from the online pharmacy education experience during the suspension of on-campus activities and/or the lockdown in this pandemic must not be wasted. Moreover, since the students experienced the direct impact of these drastic measures, it is imperative to explore their experiences and views. Engaging the students, through exploring their learning experiences, paves out the way for redesigning of pedagogy which leads to the quality education provision (Klemenčič and Chirikov, 2015). Gaining insight into the pharmacy students' experiences in this situation can help the pharmacy colleges and educators make informed decisions regarding educational transformation that is required, as the pandemic is expected to last longer and its repercussions will be felt for many years to come. This study aimed to explore the perceived impact of the suspension of on-campus activities and the lockdown had on learning and assessment in pharmacy education in the KSA from the student perspective.

## 2. Methods

### 2.1. Study design

This study adopted qualitative methodology, grounded in the constructivist paradigm (Kim, 2001), and involved gathering participants' views and responses via Twitter chat. This study was reviewed and approved by the Institutional Review Board (IRB) of Umm Al-Qura University (KSA) (Approval number: HAPO-02-K-012-2020-06-400).

### 2.2. Participants and setting

All pharmacy students from any private or government university in the KSA were invited to participate in the chat. The chat was hosted on Twitter which is one of the most widely used social media platforms, especially among the youngsters, in the KSA (GMI, 2019; AlGhamdi and Khan, 2020).

### 2.3. Development of questions

The research team comprising the research supervisor (M.A.) and six research students developed the questions, categorized under four topics, for the Twitter chat. Tables 1–3 show these topics and the associated questions. They covered a wide range of aspects related to the learning experiences of pharmacy students during the lockdown period and what impact that experiences might have had on their pharmacy learning. Another two academic staff members checked these questions for accuracy and validity. The research students then translated these questions from English into the Arabic language. Another experienced bilingual academic staff member reviewed this translation for accuracy. The research students piloted these questions with another three students, in both the languages. Minor adjustments in the wording of the questions were made.

### 2.4. Data collection

#### 2.4.1. Plan

A specific Twitter account (@TChatResearch) was created for the purpose of hosting the chat and collecting the responses of the participants. Since the number of questions developed ( $n = 29$ ) was deemed too many for one Twitter chat, we planned to split the chat over three days. A one-hour Twitter chat was organized on three consecutive days (10:00 pm on 29th June, 30th June, 1st July 2020), with the hashtag #TCR\_LIVE, after the final examinations, inviting all pharmacy students in the KSA to participate. The majority of the cities in the KSA were still under partial or complete lockdown. Tables 1–3 present the three-day Twitter chat plan.

#### 2.4.2. Promotion

We announced and promoted the chat on the Twitter account three weeks before the chat days, followed by several reminders and retweets. We also requested several pharmacy Twitter accounts, popular among pharmacy students in the KSA, to retweet our announcements, promotions, and reminders. A 'participation information sheet' (comprising a summary of the study and other relevant information) and detailed 'instructions about how to participate in the chat' were prepared for the participants, in both the Arabic and the English languages, were tweeted five days and two days prior to the chat respectively on the Twitter account and retweeted by several other accounts. We also requested the participants not to identify any individual or specific incident during the chat in any way for confidentiality. The participants were asked to send their response(s) to the questions in a private message or as a direct message (DM) to the Twitter account if they had any concerns regarding their Twitter handle or responses being seen by the other participants.

#### 2.4.3. Execution

During the chat, we posted the questions in both languages, one question after every 5–10 min. The participants could respond in either of the languages. Two research students moderated the chat each day, probing the participants appropriately as required during the chat. Participants during the Twitter chat were also encouraged to 'like' (if they agreed) and/or probe the other participants' responses. Each day after the chat, we selected by draw and announced one winner from among the participants to receive a 100 Saudi Riyal bookstore voucher, as per the announcement we made in the promotion mentioned above.

**Table 1**

Day 1 Twitter chat topic and questions.

Questions
<p><i>Day 1 Twitter chat</i></p> <p><i>Topic 1: Pharmacy learning &amp; assessment during lockdown</i></p> <ol style="list-style-type: none"> <li>1. Do you agree, that learning about the content of the courses (lectures or practicals) in the semester was easier due to lockdown? (e.g. the timing of the online activities/lectures was suitable, the internet connection was good, voice and video were clear in live online activities/lectures, recordings were provided, there was more time etc.). If YES, how? If NO, why?</li> <li>2. Was it easier to ask questions from and communicate with the university doctors during live online activities/lectures as compared to activities/lectures in a classroom in the university? If YES, how? If NO, why?</li> <li>3. Do you agree, that you have learnt more about the content of the courses (lectures or practicals) in the semester due to lockdown? (e.g. did you understand the lectures better, you had more time etc.) If YES, how? If NO, why?</li> <li>4. About practical work in the labs, do you think the alternative activities which were provided during the lockdown, were appropriate for learning (e.g. easier to follow, similar to the ones in actual labs, you learnt equally the same skills which you would have learnt in the actual lab)?</li> <li>5. Do you think that there are some skills and knowledge you would have achieved better if the university was open (i.e. if there was no lockdown)?</li> <li>6. Do you think you spend more time on learning the same content of the course (lectures or practicals) in the semester as well as assignments, due to lockdown as compared to if the university was open (i.e. if there was no lockdown)?</li> <li>7. Do you think you spend more money on learning the same content of the course (lectures or practicals) as well as assignments in the semester, due to lockdown as compared to if the university was open (i.e. if there was no lockdown) (e.g. spent money on good electronic devices, good internet network for online activities/lectures etc.)</li> <li>8. If you were given alternative assignments to do due to lockdown, was there sufficient information provided about how to work on and submit these assignments?</li> <li>9. If you were given alternative assignments to do due to lockdown, how do you compare them with the original assignments if the university was open (i.e. if there was no lockdown) (e.g. achieved more marks, easier, took less time etc.)?</li> <li>10. Did you receive appropriate feedback on your work, learning, assignments and/or exams from the university doctors? If YES, please comment on it (e.g. sufficient, relevant, easier to understand, quick &amp; prompt etc.)? If NO, what feedback would you like to have from the university doctors on your work, learning, assignments and/or exams?</li> <li>11. What effect the online education or e-learning, due to lockdown, had on your grades and GPA?</li> </ol>

GPA = Grade Point Average.

**Table 2**

Day 2 Twitter chat topics and questions.

Questions
<p><i>Day 2 Twitter chat</i></p> <p><i>Topic 2: Online exams during lockdown</i></p> <ol style="list-style-type: none"> <li>1. About the online exams, what do you think about the marks distribution (e.g. 20% for the online exam)?</li> <li>2. For the online exam, do you think enough time was provided to you to study for the exam?</li> <li>3. For the online exam, do you think sufficient information was provided to you about how to attempt the exam?</li> <li>4. About the online exams, due to lockdown, how was your environment around you at home to attempt the exams (e.g. appropriate, comfortable, quiet, etc.)?</li> <li>5. Do you think that the online exam helped the students cheat or copy during the exam, which they could not have done if the exam was in the university (i.e. if there was no lockdown)? If YES, please explain.</li> <li>6. How do you compare the online exams, due to lockdown, in general, with the exams conducted in the university (i.e. if there was no lockdown) (e.g. achieved more marks, easier, more time was allowed, took less time to finish, etc.)?</li> </ol> <p><i>Day 2 Twitter chat</i></p> <p><i>Topic 3: Use of technology during lockdown</i></p> <ol style="list-style-type: none"> <li>1. Which electronic device (iPad, tablet, laptop or notebook, desktop computer, mobile phone, etc.) did you use, the majority of the time, for your online education during the lockdown?</li> <li>2. Do you think your electronic device was appropriate for your online education? If YES, how? If NO, why?</li> <li>3. Which education medium (blackboard, moodle, canvass, zoom, cisco webex, microsoft meeting, etc.) was used, majority of the time, for your online education &amp; how easy was it to use for you?</li> <li>4. Do you think sufficient information was provided to you about how to use the education medium (blackboard, moodle, canvass, zoom, cisco webex, microsoft meeting, etc.) by the university or the university doctors?</li> <li>5. Do you think you had appropriate technology skills that were required for your online education during the lockdown?</li> <li>6. Do you think the presenters or the university doctors had the necessary technical skills required to handle overall online education?</li> </ol>

**Table 3**

Day 3 Twitter chat topic and questions.

Questions
<p><i>Day 3 Twitter chat</i></p> <p><i>Topic 4: What we have learnt from the experience</i></p> <ol style="list-style-type: none"> <li>1. What did you like most about online education in lockdown OR what do you think were the advantages of online education in lockdown?</li> <li>2. What did you dislike most about online education in lockdown OR what do you think are the disadvantages of online education in lockdown?</li> <li>3. How was your communication with the university doctors affected during the lockdown period?</li> <li>4. During the lockdown, which resource (and how) did you find most helpful for your education (e.g. any website, book, app, social media account, etc.)?</li> <li>5. What new skills regarding your education do you think you have learnt or acquired (e.g. new ways of communication, technology skills, time management, energy management, better study plan, etc.) during the lockdown period which you could not have acquired if there was no lockdown?</li> <li>6. About online education during the lockdown, did you have the opportunity to raise your voice (i.e. give suggestions and any feedback to the university and the university doctors, make complaints, etc.)? If YES, was your voice heard and acted upon?</li> </ol>

## 2.5. Data analysis

### 2.5.1. Preparation

After the chat, the responses were copied as a transcript for thematic analysis. We removed the respondents' identities for anonymity and also any confidential information from the responses that could be attributed to any particular individual or incident. We also planned to remove irrelevant responses and the responses of any participant whom we doubted to be a pharmacy student from the KSA, however, this was not required as all the responses were relevant and seemed to be from the pharmacy students in the KSA.

### 2.5.2. Execution

Two teams of the research students were created for performing thematic analysis, using the inductive approach, of the qualitative data (participants' responses) independently. The data analysis was conducted manually and the process included familiarization with the data, generation of codes, categorization of codes into subthemes, and then categorization of subthemes into the themes. The two teams then met and resolved the variations through discussion. The research supervisor further reviewed and modified the codes, subthemes, and themes, following several discussions with the teams. Some similar subthemes as well as the themes were combined during the process. Since the questions were already grouped under specific topics, these topics provided 'a priori' subthemes further facilitating the process of thematic analysis. Additional subthemes were also identified from the generated codes.

## 3. Results

Over the three-day chat, we received a total of 790 responses to 29 questions. The total number of responses received for each topic is presented in Table 4. The majority of the participants responded in the Arabic language and in the main thread (as opposed to responding as DM). For the purpose of analysis, the responses were not translated back into the English language in order to preserve the essence of the meaning and expression of the original language. However, the codes, subthemes, and themes were generated in the English language by the bilingual research students. Thematic analysis generated 944 codes which were categorized into 43 subthemes. These subthemes were further broadly categorized into six main themes: 'facilitators for online education during lockdown', 'barriers for online education during lockdown', 'online versus onsite education', 'role of technology in online education during lockdown', 'suggestions for improving online education' and 'long-term impact of online education during lockdown'. Some subthemes were categorized into more than one theme. These themes, with the number of associated subthemes and codes, are presented in Table 5. Table 6 shows specific student comments,

**Table 4**  
Number of responses received for each question in each topic.

Topic 1	Number of responses	Topic 2	Number of responses	Topic 3	Number of responses	Topic 4	Number of responses
Q1	28	Q1	33	Q1	28	Q1	34
Q2	28	Q2	31	Q2	26	Q2	32
Q3	28	Q3	30	Q3	27	Q3	28
Q4	27	Q4	31	Q4	25	Q4	27
Q5	24	Q5	32	Q5	26	Q5	27
Q6	25	Q6	29	Q6	25	Q6	29
Q7	26	Total	186	Total	157	Total	177
Q9	22						
Q10	21						
Q11	18						
Total	270						

**Table 5**  
Themes with the number of associated subthemes and codes.

Theme	Number of associated subthemes	Number of associated codes
1. Facilitators for online education during lockdown	14	365
2. Barriers for online education during lockdown	13	297
3. Online versus onsite education	9	106
4. Role of technology in online education during lockdown	3	86
5. Suggestions for improving online education	3	10
6. Long-term impact of online education	4	80

translated from the Arabic language for the purpose of presentation in this table, supporting each of the themes.

The main themes to which the majority of the codes and subthemes were associated, were 'facilitators for online education during lockdown' and 'barriers for online education during lockdown'. The recurring subthemes that were categorized as facilitators were: easier and frequent communication, more availability of time at home during the lockdown, students' technology skills, the support provided by the academic staff, and the time and money saved from not having to travel to the campus; and those that were categorized as barriers were: technology problems, lack of effective interaction with the academic staff, inappropriate teaching and assessment methods, unsuitable timing of rescheduled 'live' online lectures and examinations, and increased number of assessments. The subthemes, such as technical skills of the academic staff and rearrangement of marks distribution in the courses during the lockdown period, had mixed codes and were categorized as both the facilitators as well as the barriers. These themes and the other themes, with the corresponding subthemes, are presented in the Appendix and discussed in the next section.

## 4. Discussion

### 4.1. Theme 1: Facilitators for online education during lockdown

The participants highlighted several issues that facilitated online learning during the lockdown period. Easier and frequent communication with the academic staff was the most mentioned facilitator. Effective communication is the core of successful learning and teaching in the online environment (Farmer, 2004). Whether the online course is synchronous or asynchronous, it is the effective communication between the teacher and the learners that keeps them engaged and motivated for learning. Technology in this age plays a critical role in enhancing communication. Nicol et al argued that any type of online communication, face-to-face or

**Table 6**  
Student quotes supporting the themes.

*Theme 1: Facilitators for online education during lockdown*

- “Yes, was easier especially when asking questions in chat”
- “Don't require the presence of the student at the same town where the university is located and it saves time, effort and cost of transportation”
- “Most of the doctors do a pilot exam for students to practice how to attempt online exams”
- “I had more time because of staying at home all day. And lockdown gave me more time to study”
- “Electronic assignments led me to acquire new skills”
- “Yes, honestly thanks to faculty members and supervisors, they clarified everything by sending the instruction in all applications”
- “Distribution of marks was appropriate because learning outcome not measured only by exams but also by other semester activity”

*Theme 2: Barriers for online education during lockdown*

- “Interaction is not the same”
- “Bad internet connection”
- “Not suitable lecture and study timing was a major factor in my not doing well in this semester”
- “Most of the practicals require to be in lab”
- “Online exams made it easier to ask the help of colleagues or copy answers from different websites”
- “The disadvantage was not understanding the lectures clearly and assignments were too many”
- “Lack of discussion and share of information between colleagues during the lectures”

*Theme 3: Online versus onsite education*

- “Online is not good and comfortable, onsite was better due to the quiet environment”
- “I can go through assignments onsite with faculty members and understand the instructions but in online I can't discuss with doctor appropriately and find out where my missed points are”
- “Online exam environment is very comfortable”
- “The advantage was that there was enough time to attempt the online exam, without any anxiety or stress which led to high marks as compared to the onsite exam”

*Theme 4: Role of technology in online education during lockdown*

- “I used iPad or laptop most of the times”
- “Electronic exam was good, it reduced time when you are writing in your exam”
- “Blackboard was good but sometimes problems with audio occurred and required specific application to correct the problem”
- “Calls and social apps were distractions when using the phone”
- “Usually used iPad because easy to handle and take anywhere”

*Theme 5: Suggestions for improving online education*

- “Some doctors, but not all, I think need technical skills courses”
- “Video record the lectures to make them easily accessible at any time”
- “Reduce the marks for assignments and increase the marks for the exam, there was too much content in the exam”

*Theme 6: Long-term impact of online education*

- “Positive effect, most students get high grades”
- “New skills I learned in the time of distance learning”
- “Lack of presentation skills and it should be in front of the audience to acquire this skill”

text-based, synchronous or asynchronous, positively affects online learning and the educators must leverage the available technologies for this purpose (Nicol et al., 2003).

Communication between the learners and educators was also a dominant factor highlighted by the students in a survey conducted by Armstrong about their perception of online education. It echoed that communication in online learning, when lacking, leads to surface learning (Armstrong, 2011). Another aspect of communication not highlighted by the participants in our study is communication with fellow classmates. More recently, an American nationwide survey of students' perceptions regarding online learning in pharmacy conducted by Hamilton et al showed that the majority of the students communicate with the classmates about their coursework (Hamilton et al., 2020), and we know that this online collaboration among the students enhances their learning achievement (Zhu, 2012).

An important factor that might have contributed in this regard is more availability of time during the lockdown. The academic staff, during the lockdown period, might also have sufficient time at home to communicate with their learners which they may not have otherwise. Nevertheless, this experience should enlighten the academic staff with the importance of effective communication and its positive effect in promoting deep learning. Regarding the time, the majority of the participants also mentioned that they had ample spare time available at home during the lockdown that they were able to dedicate to their studies, and they regarded it as a facilitator for their online learning during the lockdown.

The academic staff interacts with the millennial generation of students, the majority of whom are already equipped with excellent technology skills (Au-Yong-Oliveira et al., 2018). This facilitates online education to a great extent, which is dependent on technology (Cotton, 2008). The participants in our study also res-

onated with this aspect and mentioned that their technology skills assisted in attending the online lectures, accessing the resources, attempting the online examinations, and thus in the overall online learning. Student experience in online education is often shaped by the support they receive (LaPadula, 2003). The participants in our study recognized that the support provided by the academic staff, such as instructions to use the online resources and feedback on the coursework, was another facilitator for their online learning. Some participants also highlighted that the time and the money saved, from not having to travel to the university campus during the lockdown period, were some of the other positive factors that accrued from online education during the lockdown period. This is similar to the findings from a survey by Almuraqab which reported that the majority of the United Arab Emirates students believe that distance learning saved time and efforts to reach the campus during the suspension of on-campus activities (Almuraqab, 2020).

#### 4.2. Theme 2: Barriers to online education during lockdown

In addition to the facilitators, the participants also mentioned several factors that made their online learning unpleasant and difficult. The most commonly encountered were the technology problems such as glitches in the LMS, unstable internet connection, technical issues with 'live' online teaching sessions, and the inability of the academic staff to use the technology appropriately. As mentioned above, online education hinges around technology. User-friendly technology is among the best ten practices reported by Margolis et al for implementing blended learning in pharmacy education (Margolis et al., 2017). The academic staff must also consider that the new millennial generation of students has more expectations from technology, and any unpleasant experience with technology can impact their online learning. To keep pace with the

new generation of students, learning about the technology, including the appropriate use of the LMS as well as troubleshooting the technology problems whenever required, is imperative for the academic staff of this age.

Another important factor that affected the participants' online learning is also related to the limitation of the technology. The participants were of the opinion that the interaction with the academic staff during online education was not the same as compared to the interaction when they are at the campus. Although the advancement in technology allows video features mimicking face-to-face interactions, it still can never replace physical face-to-face interactions. Wuensch et al in their report on pedagogical characteristics of online and face-to-face classes, have resonated with this issue and reported that this can adversely affect the learners' online learning experience (Wuensch et al., 2008). Comer and Lenaghan, and Castle and McGuire have presented some recommendations to enhance the interactions and thus the learners' learning experience in online education (Comer and Lenaghan, 2012; Castle and McGuire, 2010).

Other factors that affected participants' online learning were found to be inappropriate teaching and assessment methods, and unsuitable timing of rescheduled 'live' online lectures and examinations during the lockdown period. Online education shares some attributes with traditional education, however, it has some unique techniques that must be considered carefully by the academic staff in order to adapt their teaching and assessment methods (Keengwe and Kidd, 2010; Johnson, 2008; Panda and Mishra, 2007; Kurzweil and Marellas, 2008; Lee and Busch, 2005). Academic staff should also be more flexible regarding rescheduling the 'live' online lectures and examinations in order to provide relief to already stressed students in this unprecedented time. Some participants also commented that due to the sudden shift to online mode, there was a rearrangement of course assessments, which resulted in an increased number of assessments for the students in some courses, further increasing the pressure on them. The academic staff must reconsider the assessment strategies in an attempt to reduce the number of assessments without compromising the learning outcomes and pedagogical considerations. Some participants mentioned that 'cheating' or 'copying' was easier in the majority of the online examinations as compared to if the examinations were at the campus. This is inevitable in most cases of online education. However, the academic staff can either consider designing open-book examinations or replacing them with activities that promote deep learning and meet the same learning outcomes. Deep learning is defined as critically examining the new knowledge, linking it with the existing knowledge, and attempting to make connections between different facts and concepts (Rosie, 2000).

#### 4.3. Theme 3: Online versus onsite education

We received mixed opinions under this theme when participants compared online learning with onsite education based on their experience during the lockdown period. The majority of the participants mentioned that onsite learning and teaching, onsite interaction with the academic staff, onsite feedback from the academic staff on their coursework, and the onsite examinations are better than in online education. However, some participants opined that online learning is better than onsite learning. This difference in opinion may be attributed to different experiences that the participants might have had with various courses and/or with different academic staff. Armstrong reported in his survey that online education is mainly impacted by factors such as the role of communication with the academic staff, which determines students' perceptions and actions in online education, the role of technology and how it is used, and the role of course organization designed for students success by the academic staff (Armstrong, 2011). In contrast, we also had some

participants who found no significant difference between online and onsite learning. Berman articulated in the context of higher education "that teaching is both art and science" and that "good teaching is good teaching regardless of the learning environment or the subject to be explored" (Berman, 2015).

The participants who preferred onsite education attributed it to their preference for the traditional face-to-face educational environment, which, in their view, is irreplaceable by the online educational environment, especially where the learning of more practical (including the laboratory work) and hand-on skills are required. Appana argued in a review encompassing the benefits and limitations of online learning that not all courses and teaching sessions are suitable for transforming into distance or computer-based learning (Appana, 2008). The participants also raised the concern that, although online education is safer during the pandemic, sitting in front of and focussing on electronic devices for more extended periods is not good for their health. Moreover, they found it difficult to maintain the concentration in the online lectures as compared to the onsite lectures.

Those who preferred the online mode of learning attributed it to the factors such as the teaching sessions can be attended and the examinations attempted from the ease of their homes without having to travel to the university campus, and recorded lectures and resources can be accessed at any time of their convenience. Notably, in the recent survey by Hamilton et al, the majority of the students preferred 'live' lectures in their online pharmacy education (47%) followed by a hybrid of 'live' and recorded lectures (30%) (Hamilton et al., 2020).

#### 4.4. Theme 4: Role of technology in online education during lockdown

Although the role of technology has been covered above as a facilitator as well as a barrier, this theme included the participants' views about technology devices and electronic platforms used for their online learning during the lockdown period. The majority of the participants used tablets, laptops, and smartphones for their online learning. Smartphones and tablets were also found to be the most widely used devices by the students in the survey by Hamilton et al, in which the participants also added that they find these devices very valuable for their online learning (Hamilton et al., 2020). The participants in our study also mentioned that these electronic devices are easier to use, suitable for online learning, portable, faster to work with, and helpful in storing and researching the stored or online resources.

Blackboard was found to be the most widely used electronic platform, although some participants mentioned that the ZOOM application is better for online meetings. The participants found these technology devices and electronic platforms easier to navigate through due to their already existing technology skills and detailed instructions provided by the academic staff. However, the participants highlighted that some academic staff's knowledge and skills regarding these technology devices and electronic platforms were not up to par, which negatively affected their learning experience. As this has been echoed before, the millennial generation of our students has higher expectations from the academic staff in this regard. Moreover, online teaching requires new teaching skills which, unfortunately, some academic staff is not currently prepared for (Castle and McGuire, 2010). Academic staff, therefore, must be well aware of the devices and platforms available and how they can be effectively used to maximize the online learning experience of the students.

#### 4.5. Theme 5: Suggestions for improving online education

The most recurring aspect in the participant's responses regarding improving the online learning experience was the provision of

recorded lectures and the availability of recordings of 'live' lectures, which the students can refer to for revision of complex concepts. Although this is feasible for students and may result in higher student satisfaction (Taplin et al., 2011), the academic staff should be careful as this can negatively affect the student attendance in 'live' teaching sessions (Leadbeater et al., 2013). The second most commonly mentioned suggestion was for the academic staff to modify their teaching techniques for a better explanation of the complicated concepts in online pharmacy education. As it has been discussed before, the online venture is different from traditional education, and the academic staff must adapt their teaching methods to better suit this medium (Keengwe and Kidd, 2010; Johnson, 2008; Panda and Mishra, 2007; Kurzweil and Marellas, 2008; Lee and Busch, 2005). Some participants, who seemed to be unsatisfied with the course marks distribution that had to be readjusted due to the suspension of on-campus activities, also suggested the academic staff reconsider this aspect in future online pharmacy education as this can have a crucial impact on their grade point average (GPA) and degree classification.

#### 4.6. Theme 6: Long-term impact of online education during the lockdown

The overwhelming majority of the participants mentioned that online education during the lockdown period improved their GPA. This could be attributed to different factors such as readjustment of course or module marks distribution, implementation of alternative assessment methods, or more time available to the participants during the lockdown. The participants highlighted the skills they had learnt during the lockdown period related to online education; multitasking in a short time, academic writing, extracting and summarizing scientific information, time management, working under pressure, communication using technology, self-learning, studying as a group using ZOOM application and dealing with overwhelming resources of information. The participants also commented regarding the skills they could have learnt better in onsite education; practical/hands-on skills, oral communication, presentation skills, team working, and group communication. In the light of the advantages and disadvantages of online education and onsite education as well as the safety measures during the pandemic, which is still active, the participants viewed the future of pharmacy education as a hybrid of online and onsite learning where the lectures can be conducted online, and practical sessions (such as laboratory work, tutorials, workshops) and examinations can take place at the campus with appropriate precautionary measures.

#### 4.7. Limitations

Our findings are based on the pharmacy students' experiences of online education, which was enforced during the lockdown period due to the COVID-19 pandemic. Many pharmacy colleges and the academic staff were not prepared for this and were compelled to improvise their teaching and assessment. The participants in our study were only from the KSA where the regional and cultural differences might have impacted their experiences that shaped their views. Additionally, our study included responses from Twitter users only. Therefore, the opinions should be viewed with caution for the application of widescale transformation. Moreover, we acknowledge that the demographic data collection might have provided useful information, however, due to the unique nature of the data collection method (via social media) where the open responses could be read by the other participants as well as the general public, it was not deemed ethical to collect the demographic data. Furthermore, our Twitter chat did not cover some other related topics such as the impact of lockdown on experiential

learning (i.e. summer training, rotations, internship, etc.) in pharmacy education, the economic impact of lockdown on pharmacy education, and mental/cognitive impacts of lockdown on pharmacy students. These topics are open to being explored in future research.

## 5. Conclusion

Distance education or online education has existed for decades. However, the COVID-19 pandemic has revived the need for it in every field of education and every part of the world. In our study, the pharmacy students, based on their pharmacy education experiences during the lockdown period, provided valuable views that have implications for transforming the future of pharmacy education, which has been proposed by them, to be a hybrid of online and onsite learning activities. Pharmacy colleges and the pharmacy academic staff around the world can find these findings useful to prepare for the coming years, ensuring the pedagogical and accreditation standards. Further research should provide an insight into how and to what extent pharmacy students' knowledge, skills, and attributes are affected due to the educational transformation during and post-pandemic.

## 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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## Authors' contributions

MA designed the study. All authors were involved in data collection, analysis, and interpretation, and contributed to the drafting and critical review of the manuscript. All authors have approved the final draft of the manuscript.

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