Experiential pharmacy education in trying times: Lessons learned from the COVID-19 pandemic

Fouad Sakr[1,2,3] , Iqbal Fahs[1] , Ahmad Dimassi[1] , Samar Younes[1] , Nisreen Mourad[1] , Jihan Safwan[1] , Marwan Akel[1,4,5] , Mohamad Rahal[1] , Mariam Dabbous[1,6]

[1] School of Pharmacy, Lebanese International University, Beirut, Lebanon
[2] École Doctorale Sciences de la Vie et de la Santé, Université Paris-Est Créteil, France
[3] Institut Mondor de Recherche Biomédicale, UMR U955 INSERM, Université Paris-Est Créteil, France
[4] INSPECT-LB (Institut National de Santé Publique, d'Épidémiologie Clinique et de Toxicologie-Liban), Beirut, Lebanon
[5] International Pharmaceutical Federation (FIP), The Hague, The Netherlands
[6] School of Education, Lebanese International University, Beirut, Lebanon

Abstract

The COVID-19 pandemic has presented a slew of new obstacles for all health professionals, particularly those in charge of training students. Many pharmacy schools had to convert to virtual experiential learning with little to no existing literature, framework, or appropriate time for preparation. This review documents the virtual pharmacy practice training at a university in Lebanon during COVID-19 and several other colleges of pharmacy worldwide that have shared their experiences. A literature review of international publications was performed in PubMed and Google Scholar between 1 March 2022 and 30 May 2022, and relevant articles were included. The narrative offers a variety of approaches to ensure that pharmacy learners prioritise self-care, are adequately prepared to enter pharmacy practice, and reflect on their learning. However, other aspects, such as the use of a variety of online training platforms, the inclusion of more patient-centric activities, and the provision of live virtual patient experiences, should be enhanced in the future.

Introduction

The COVID-19 pandemic has brought a global change in all daily life aspects, tremendously affecting pharmacy students' personal and professional learning (Safwan *et al.,* 2022). Almost all affected countries underwent complete lockdowns to limit the spread of the disease (Chakraborty & Maity, 2020). Several primary preventive interventions had been implemented until vaccines became available, including physical distancing, home quarantine, restrictions on mass gatherings, and the closure of the entire education sector, which affected around 1.6 billion learners (Nicola et al., 2020; UNESCO, 2020).

The COVID-19 pandemic has undoubtedly challenged the delivery of pharmacy education, particularly experiential education (Thompson *et al.,* 2020). Experiential education relies on practice-based experiences that provide pharmacy students with direct contact with patients and real-life contexts training opportunities to apply taught knowledge and develop personal attributes and professional skills (Lucas *et al.,* 2018; Wilbur *et al.,* 2018). Pharmacy practice experience in community and clinical settings is an essential cornerstone of pharmacy education and training, according to international organisations, such as the Accreditation Council for Pharmacy Education (ACPE) (Thompson *et al.,* 2020). Pharmacy training offers pharmacy students with rich learning opportunities to become competent pharmacists and worthwhile members of healthcare teams (Dabbous *et al.,* 2022).

Pharmacies and health systems were addressing their own challenges associated with the pandemic (Chahine *et al.,* 2021; Sabra *et al.,* 2022; Sakr *et al.,* 2022a; Younes *et al.,* 2022). The various health systems were aiding in fighting the spread of the disease and providing care to affected patients (Aruru *et al.,* 2021). Restrictions imposed in response to the COVID-19 pandemic made student placement in training sites challenging and, in most cases, impossible (Thompson *et al.,* 2020; Aruru *et al.,* 2021). This fact resulted in fewer sites than usual available for pharmacy students and the discontinuation of on-site experiential activities (Aruru *et al.,* 2021). Hence, ACPE has provided recommendations for alternative approaches to training that eliminate the need for the physical presence of the student to avoid delays in graduation and consequent loss of employment (Thompson *et al.,* 2020). These recommendations maintain standards while granting flexibility to university pharmacy programmes in providing this educational experience (Thompson *et al.,* 2020). Schools and colleges of pharmacy programmes have developed creative and innovative e-learning and e-training virtual methods to ensure adequate experiential training (Kawaguchi-Suzuki *et al.,* 2020).

The Lebanese Ministry of Education and Higher Education had decided to suspend on-site classes and internships and use available distance learning tools for teaching and training during the COVID-19 pandemic. Hence, the school of pharmacy at the Lebanese International University (LIU) has moved to virtual training using all resources at its disposal (Dabbous *et al.,* 2022). The current review aims to document virtual pharmacy practice training at LIU during COVID-19. The experiences of other colleges of pharmacy worldwide that have shared their experiences were also reviewed. By illustrating the experiences and challenges of virtual pharmacy practice training in community and hospital settings, this review can provide a new training model that might be helpful in a future crisis.

Methods

This work is a narrative review of the literature. Documentation of experiential pharmacy education at LIU during the pandemic was done based on the data provided by the pharmacy practice department at the school of pharmacy. A literature review of international publications was performed using PubMed and Google Scholar to identify relevant English-language articles between March 01, 2022, and May 30, 2022. The database was searched using the following search terms: (COVID-19 OR coronavirus) AND (Pharmacy) AND (Experiential Education) AND (Pharmacy Practice

Experience). The search returned 396 records; retrieved articles were reviewed to ensure their relevance, and duplicates were eliminated. All titles and abstracts were independently screened and selected by the authors. Full texts were checked to determine whether the article met the eligibility criteria. When full texts were unavailable, corresponding authors were contacted by e-mail or message through ResearchGate (www.researchgate.net). References cited in all included articles were reviewed to identify any studies that might have been missed. Relevant publications (n = 21) were read and thematically narrated to give a reasonably concise yet adequately representative narration of the global literature on the experiential education of pharmacy students during COVID-19. Studies, reviews, recommendations, and guidelines that did document the experiential learning of pharmacy students during the COVID-19 pandemic were included; those that presented only pharmacotherapeutic options for COVID-19 and involved graduate students and professional pharmacists were excluded. In addition, various colleges of pharmacy websites were searched in case they reported or documented their adopted approach to virtual pharmacy training experiences during the pandemic.

Results

The LIU experiential education model in the community setting

The mission of LIU school of pharmacy is to educate and train students to become distinguished professionals in pharmacy practice, research, and community services (Akel *et al.,* 2020). The Bachelor of Pharmacy (B. Pharm.) programme at LIU is fully compliant with ACPE recommendations and quality criteria and is currently the only ACPE-certified programme in Lebanon as of August 2020 (Dabbous *et al.,* 2022).

A total of 1440 hours is allocated for healthcare practice experiences in the B. Pharm. programme. Community practices start early in the first two non-professional years of the programme and continue in the first and second professional years (third and fourth years of the programme), where it is delivered through a series of twelve-week practice experiences in each year known as Pharmacy Practice Experiences I and II (PPE I and PPE II) (Akel *et al.,* 2020). These courses introduce students to community care practice, including patient counselling, monitoring plans, and patient outcomes (Ryan *et al.,* 2019).

Each community practice experience course has a structured manual to guide students and preceptors to

achieve the intended learning outcomes. The manuals are made up of different modules that allow students to acquire the essential knowledge, skills, attitudes, and values to become effective and collaborative members of healthcare teams (Dabbous *et al.,* 2022). PPE I modules provide an introduction to basic pharmacy practice skills and services. These include various activities like training on procedures such as blood pressure, glucose, and cholesterol measurements. On the other hand, the PPE II course expands to more advanced topics related to patient care in community settings (Akel *et al.,* 2020).

During the 12-week period of community experiences, pharmacy students at LIU are supervised by two preceptors, i.e., the on-site community pharmacist and the faculty preceptor (Dabbous *et al.,* 2022). Preceptors serve as role models who possess leadership and professional skills (Zeitoun *et al.,* 2020). Faculty preceptors continuously communicate with on-site preceptors regarding the performance and concerns of students. They coordinate together to optimise the clinical learning environment and the development of cultural competency among students (Assemi *et al.,* 2011). Faculty preceptors utilise several assessment tools in community practice settings to evaluate students' acquisition of the required competencies (Jackson, 2015).

Assessments are done through on-site discussions and grading that rely on performance-based rubrics (Owens, 2006). Moreover, faculty preceptors conduct workshops to allow for group discussions, sharing experiences, and cooperative learning. In addition, a comprehensive case-based final written exam is done to evaluate PPE I and II students' overall knowledge, skills, and abilities and assess competencies in a planned and structured way. Continuous training and comprehensive development of on-site preceptors are provided by the school of pharmacy at LIU through live seminars, webinars, triannual newsletters, and on-site visits (Dabbous *et al.,* 2022). Together, these learning experiences provide students with adequate basic and advanced community knowledge and communication skills to engage in patient care practices and collaborate with other healthcare professionals.

The LIU experiential education model in the hospital setting

As for the third professional year (fifth year of the programme), two simultaneous practice courses known as Pharmacy Practice Experiences III and IV (PPE III and IV) are conducted within a tertiary hospital through a series of fifteen-week rotations designed to develop students' clinical skills in pharmacy practice (AbuBlan *et al.,* 2019), enabling them to practice as part of the healthcare team, interact with patients and other healthcare professionals, and provide pharmacy services such as patient care, drug dispensing, drug information, and health promotion/disease prevention. Consequently, these clinical PPE courses allow senior pharmacy students to apply their academic knowledge and skills to ensure safe, effective, and economical drug therapy (Zellmer *et al.,* 2013; Thomas *et al.,* 2019; Boyce *et al.,* 2020).

The PPE III and IV rotations consist of twelve-week clinical care rotations (one elective and three major rotations) and a three-week hospital pharmacy rotation. During the clinical care rotations, students actively participate in daily rounds with the medical team in different units, including Cardiac Care Unit (CCU), Intensive Care Unit (ICU), Internal Medicine, and Pediatrics, to complete their major rotations. Elective rotations include Oncology, Endocrinology, Infectious Diseases, Psychiatry, Nephrology, Dermatology, and Geriatric departments.

During the hospital pharmacy rotation, students prepare medications precisely and safely, illustrate a drug utilisation review and patient counselling, identify potentially significant interactions, recommend drug discontinuation or dosage alteration when indicated, provide pharmacokinetic consultation for agents requiring such monitoring, provide educational presentations, and participate in research activities (Karimi *et al.,* 2010; Cox & Lindblad, 2012).

The LIU experiential education model in Advanced Pharmacy Practice Experiences (APPEs)

The Doctor of Pharmacy (Pharm. D.) programme is a full-time practice programme that provides Advanced Pharmacy Practice Experiences (APPEs) in clinical settings. It is delivered over one academic year after the 5-year B. Pharm. programme, where each term includes community and both major and elective clinical rotations (Akel *et al.,* 2020). These APPEs offer the students a comprehensive basis in advanced clinical pharmacy practice and advanced clinical pharmacokinetics and provide the necessary research skills in drug utilisation, optimisation, and safety. The programme also gives the interns the opportunity to serve patient populations in various settings and collaborate with other healthcare professionals (Alkatheri *et al.,* 2019; Akel *et al.,* 2020).

The impact of COVID-19 on pharmacy practice experiences at LIU

In response to the COVID-19 pandemic, pharmacy training sites decided to suspend experiential education to mitigate exposure and patient contacts

(Law *et al.,* 2021). Hence, pharmacy practice shifted dramatically to explore nontraditional teaching modalities in experiential education (Fuller *et al.,* 2020). An immediate transition to virtual practice experiences was warranted to prevent delays in graduation (Law *et al.,* 2021). Distance learning is far from being a new phenomenon in higher education (Safwan *et al.,* 2022). It is delivered via technological devices to provide various learning experiences when a physical distance exists between the students and the educators (Altwaijry *et al.,* 2021).

As such, the school of pharmacy at LIU has shifted from on-site to virtual rotations using all resources at its disposal (Dabbous *et al.,* 2022). At the beginning of PPE I and II virtual training, an online orientation was done for all enrolled students, during which legislation, rules, regulations, concerns, and communication pathways were addressed. The students were provided with a brief tutorial on how to use available online tools and resources. LIU students' e-mails and Google Classroom platforms were deemed acceptable communication means between students and their preceptors.

PPE I and II already have structured manuals made up of different modules that allow students to acquire the essential knowledge, skills, and values required as effective members of the healthcare system. With the suspension of on-site practices, weekly online discussions were conducted with students via Google Meet, with a maximum of 18 students in a Google classroom. Various activities were performed to instil the needed competencies and compensate for the loss of on-site live community pharmacy training. During these online sessions, open discussions were held on the different topics of the modules included in the manual.

In addition, simulation teaching strategies were adopted. Patient-oriented simulated cases and simulated patient-prescription discussions related to the topics were performed. Case scenarios were prepared ahead of time by faculty preceptors and provided to students during the session, then discussed accordingly. Also, actual medication prescriptions from community pharmacies related to the module topics were distributed to students beforehand to analyse and discuss during the online session. Throughout the online discussions, students and their preceptors communicated through role-play, where the preceptor acted as the patient and the student acted as the community pharmacist. Such simulation practices helped students virtually apply their skills in drug dispensing practices, patient education and counselling, monitoring, screening for drug-drug, drug-disease and drug-food interactions, and professionalism (Packeiser & Castro, 2020). Moreover, an online presentation related
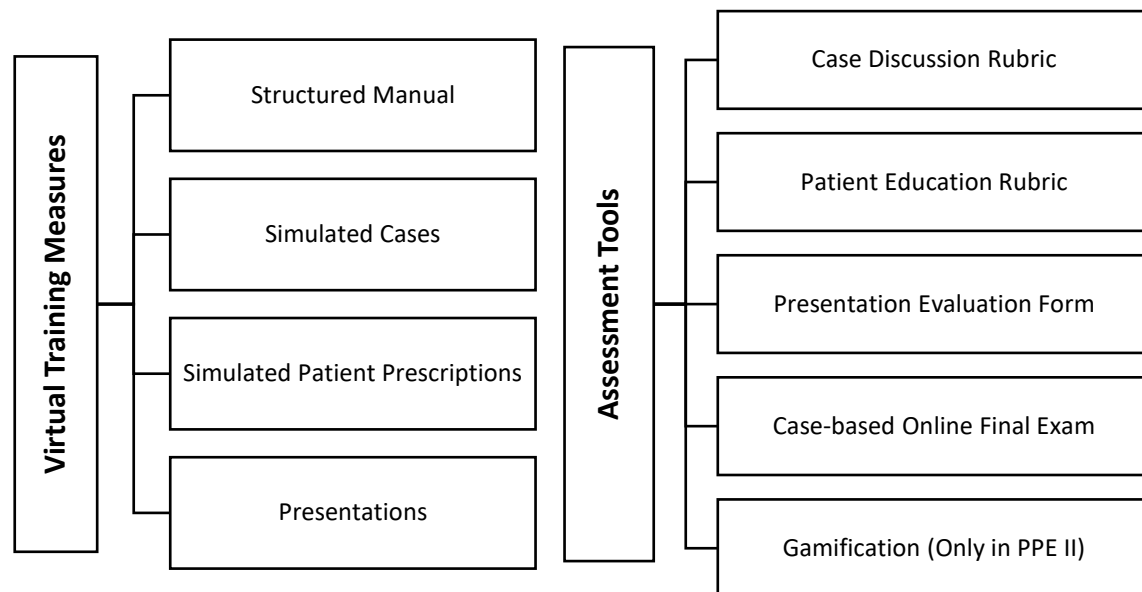
to community pharmacy topics was delivered by each student at the end of the virtual rotation to improve their professional communication and presentation skills.

Several assessment tools were used to assess PPE I and II student competencies during the online delivery of the training. The assigned faculty preceptors were provided with rubrics for case discussion and patient education for the simulated cases and prescriptions and a presentation evaluation form for online presentations. The use of the rubric allowed the standardisation of grading criteria to define an appropriate performance for students (Beck *et al.,* 1995). After each graded activity, students were provided with performance feedback to self-assess and reflect on their tasks. Another assessment tool was an online comprehensive case-based final examination to evaluate the overall knowledge and skills and assess student competencies in a structured manner. The introduction of gamification was a valuable addition to PPE II delivery (Dabbous *et al.,* 2022). Game-based learning includes the addition of game elements to non-game activities to encourage student participation (Sera & Wheeler, 2017). Indeed, a study showed that a simulated game of community pharmacy practice provided an efficient educational experience (Bindoff *et al.,* 2014). Figure 1 summarises the means of PPE I and II virtual training measures and their assessment tools at LIU during the COVID-19 pandemic.

Similarly, for PPE III and IV, orientation sessions were conducted virtually for students and preceptors to discuss the objectives, course delivery tools, and assessment activities. The online training model was conveyed through various virtual platforms like Google Classroom and Google Meet. Google Classroom was used to upload all training-related activities, including announcements, virtual cases, patient monitoring, order screenings, course manuals and syllabi, rubrics, and other material. Google Meet was used for interactive virtual discussions among student groups and preceptors.

Concerning case discussions, preceptors were provided with a pool of virtual online cases from the LIU electronic library (https://www.liu-elibrary.com/) for clinical pharmacy education; they were asked to select cases from this databank and modify contents (to avoid repetition between preceptors) before posting them on their Google Classroom for their assigned students.

Virtual clinical rotations covered all the core areas of hospital practice, including major, elective, and hospital pharmacy rotations. Moreover, the preceptors were asked to assign one case per week per student, the topic being selected in accordance with the rotation. Then the student is allotted a period of two days to prepare and discuss the cases through an online interactive group video call using Google Meet.

```
┌──────────────────┐   ┌──────────────────────────┐          ┌──────────────────┐   ┌──────────────────────────┐
│                  │   │                          │          │                  │   │                          │
│                  │───│    Structured Manual     │          │                  │───│   Case Discussion Rubric  │
│                  │   │                          │          │                  │   │                          │
│                  │   └──────────────────────────┘          │                  │   └──────────────────────────┘
│                  │   ┌──────────────────────────┐          │                  │   ┌──────────────────────────┐
│   Virtual        │   │                          │          │   Assessment     │   │                          │
│   Training       │───│     Simulated Cases      │          │   Tools          │───│   Patient Education Rubric│
│   Measures       │   │                          │          │                  │   │                          │
│                  │   └──────────────────────────┘          │                  │   └──────────────────────────┘
│                  │   ┌──────────────────────────┐          │                  │   ┌──────────────────────────┐
│                  │   │                          │          │                  │   │                          │
│                  │───│ Simulated Patient        │          │                  │───│ Presentation Evaluation   │
│                  │   │ Prescriptions            │          │                  │   │ Form                      │
│                  │   └──────────────────────────┘          │                  │   └──────────────────────────┘
│                  │   ┌──────────────────────────┐          │                  │   ┌──────────────────────────┐
│                  │   │                          │          │                  │   │                          │
│                  │───│     Presentations        │          │                  │───│ Case-based Online Final   │
│                  │   │                          │          │                  │   │ Exam                      │
└──────────────────┘   └──────────────────────────┘          │                  │   └──────────────────────────┘
                                                              │                  │   ┌──────────────────────────┐
                                                              │                  │   │                          │
                                                              │                  │───│ Gamification (Only in     │
                                                              │                  │   │ PPE II)                   │
                                                              └──────────────────┘   └──────────────────────────┘
```

Figure 1: PPE I and II virtual training measures and their assessment tools at LIU during the COVID-19 pandemic

As for patient monitoring, the preceptors were requested to assign one patient per week by selecting the needed data from the above pool of cases and adding related medications that could be administered at the hospital, then discussing the monitoring in the video call meeting. With regard to the hospital pharmacy rotation, students covered the seven objectives of the Hospital Pharmacy Manual, and then discussed them online with their preceptors (2-3 objectives per week). They also discussed virtually one order screening per week, with a total of three order screenings per pharmacy rotation.
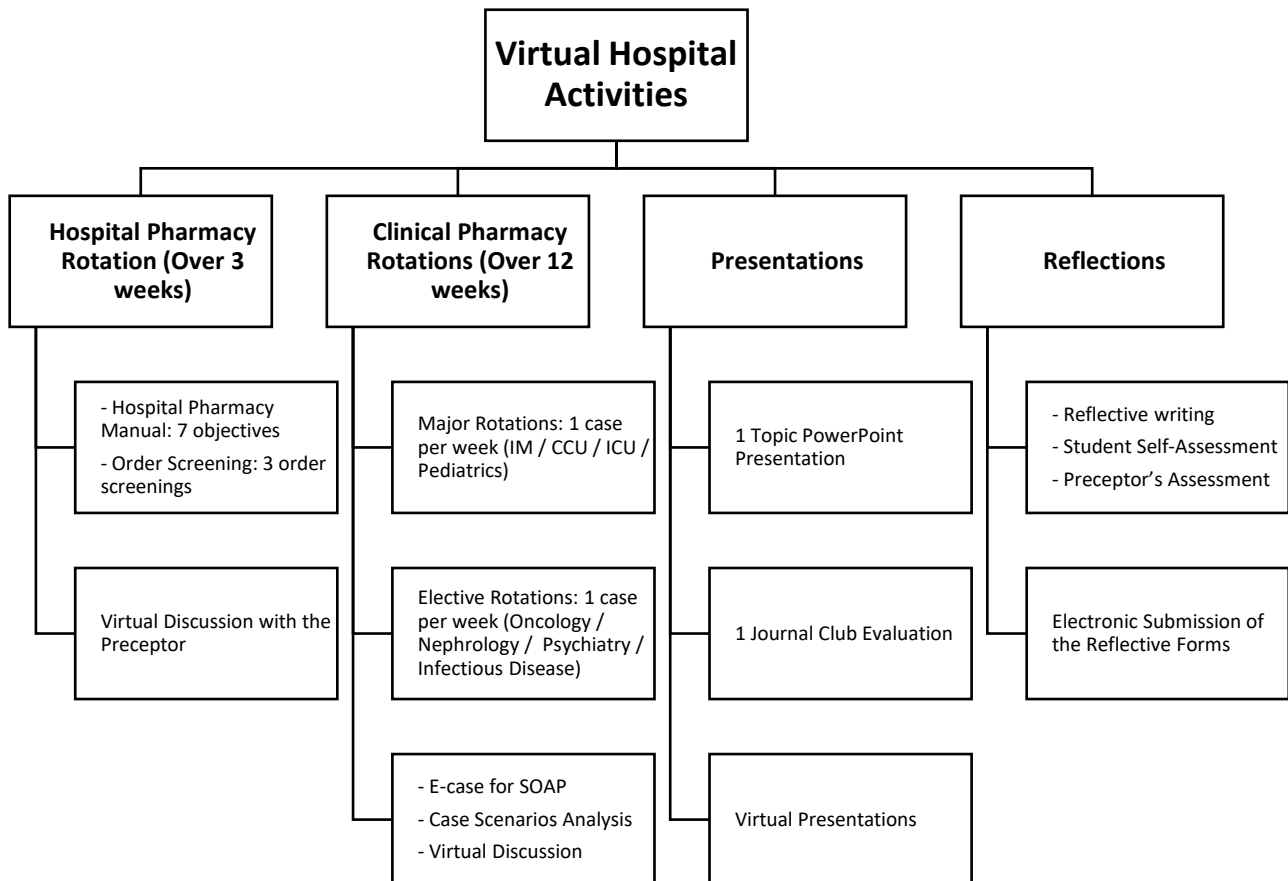
Moreover, students delivered journal club evaluations and topic PowerPoint presentations via an interactive online group video call in the presence of their preceptors and colleagues. PPE III and IV student competencies were evaluated using the same assessment tools and rubrics that were established before the pandemic, including case discussion, patient monitoring, order screening, journal club evaluation, topic PowerPoint presentation, preceptor assessment, student self-assessment, and reflective writing. However, students were exempted from the chief pharmacist and final exam assessments because it was not feasible at that time. Figure 2 summarises the engagement of the school in virtual hospital activities during the COVID-19 pandemic.

After the recession of the COVID-19 cases in Spring 2021-2022, hospitals were more accessible for students, and clinical rotations on-site were resumed gradually, where a hybrid model of experiential education was adopted. For instance, preceptors met their students virtually through an interactive live video call group discussion via Google Meet and on-site face-to-face meetings to discuss the cases collected during their rotations. Additionally, preceptors continuously filled out the course report spreadsheet for grading case discussions, patient monitoring, order screenings, topic presentations, and journal club evaluations. Moreover, students sat for an online midterm case discussion and an online final case discussion with other preceptors to expose them to different clinical approaches within the experiential team.

Furthermore, APPE has been more challenging to handle as it is composed of a one-year internship over two terms, including fall and spring, in which six hospital-based rotations and one community pharmacy rotation schedule have been adopted for all candidates. In spring 2019-2020, all APPE rotations started on-site then, during the total lockdown, the Pharm. D. department decided to switch the training method to a virtual model under the supervision of Pharm. D. preceptors, using the same platforms as other pharmacy practice experiences.

Similar to PPE III and IV, Pharm. D. students were asked to prepare one case and one monitoring per week (in accordance with their clinical rotation) that were discussed through an online interactive group video call using Google Meet. With regard to the community pharmacy rotation, students prepared a manual that covered medication lists and community topics and discussed them online. As for presentations, they were delivered virtually through an interactive online group video call.

Virtual Hospital Activities

Hospital Pharmacy Rotation (Over 3 weeks)
- Hospital Pharmacy Manual: 7 objectives
- Order Screening: 3 order screenings

Virtual Discussion with the Preceptor

Clinical Pharmacy Rotations (Over 12 weeks)
Major Rotations: 1 case per week (IM / CCU / ICU / Pediatrics)

Elective Rotations: 1 case per week (Oncology / Nephrology / Psychiatry / Infectious Disease)

- E-case for SOAP
- Case Scenarios Analysis
- Virtual Discussion

Presentations
1 Topic PowerPoint Presentation

1 Journal Club Evaluation

Virtual Presentations

Reflections
- Reflective writing
- Student Self-Assessment
- Preceptor's Assessment

Electronic Submission of the Reflective Forms

Figure 2: Virtual hospital activities engagement during the COVID-19 pandemic

During the fall and spring of 2020-2021, and due to the lockdown, the increasing numbers of COVID-19 cases, the economic crisis, and the health situation in Lebanon, the Pharm. D. department adopted a hybrid model in which students attended their rotations at the hospital two days per week and discussed their cases and patient monitoring online with their preceptors.

Later on, during the fall and spring of 2021-2022, the Pharm. D. training model remained hybrid; however, students discussed their cases, patient monitoring, and presentations online, in addition to two on-site discussions per rotation.

Pharmacy practice experiences in other pharmacy schools during COVID-19

Pharmacy practice training has long been part of the curriculum of most pharmacy schools (Khachan *et al.,* 2010; Toklu & Hussain, 2013; Akel *et al.,* 2020). However, the concept of virtual professional pharmacy training imposed by the global COVID-19 pandemic is relatively new for many colleges of pharmacy worldwide. Hence, preceptors and students were exposed to exceptional circumstances that made the

trainee learning a challenge. Universities around the world rose to the challenge of ensuring continuity of education and were ultimately forced to deliver their educational programmes online (Almetwazi *et al.,* 2020; Elnaem *et al.,* 2020; Lyons *et al.,* 2020; Nizhenkovska *et al.,* 2020; Wahab & Zainal, 2020; Khan, 2021). Professional virtual training varied across pharmacy schools, nationally and internationally, in terms of content and delivery tailored to the competency standards (Lucas *et al.,* 2019).

Many universities across the United States closed in March 2020 in response to COVID-19 restrictions. Pharmacy colleges were forced to adapt quickly as their curricular content was shifted to a primarily online format (AACP, 2020). Experiential training has been significantly affected as practice settings have restricted student interactions with patients or stopped allowing students on-site altogether. Nova Southeastern University College of Pharmacy (NSU COP) has adapted its experiential curriculum and has developed strategies to deliver community and clinical rotations through virtual formats (Moreau *et al.,* 2021). For instance, community pharmacies offered live/virtual hybrid rotation options where faculty

members and preceptors developed virtual and simulated experiences to supplement on-site activities to ensure students meet the objectives and competencies of their training. Role-playing exercises were employed so that students could practice obtaining a medication history from patients and providing education to them, in addition to communicating therapeutic recommendations to a provider (Moreau *et al.,* 2021).

This method could help promote the prospect of telehealth initiatives that can expand pharmacy-provided services in the future. Moreover, preceptors utilised pharmacy students as a drug information resource for patients and medical staff regarding the transmission, prevention, and potential treatment of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (Moreau *et al.,* 2021). Concerning clinical rotations, they were re-designed to a live/virtual hybrid format in which students spent half of the rotation on-site and the other half completing self-paced learning modules on topics such as clinical pharmacy operations and medication safety. Additionally, preceptors engaged students in the inter-professional patient care process through "virtual rounding" and remote patient workups (Moreau *et al.,* 2021). APPE interns at the NSU COP were re-assigned to sites accepting students, virtual rotations, or other health systems offering live/virtual hybrid options. Thus, students spent some days working remotely and some others working on-site with their preceptors. Accordingly, the faculty and preceptors created virtual and/or simulated experiences to meet the objectives and competencies of their rotations in a non-traditional learning environment (Moreau *et al.,* 2021).

The Department of Clinical Pharmacy and Pharmacology at Ras Al Khaimah College of Pharmaceutical Sciences, United Arab Emirates, shifted their on-site experiential training for final year Bachelor of Pharmacy students into a virtual online experience to ensure educational continuity in response to the COVID-19 pandemic (Rabbani *et al.,* 2021). Virtual community and hospital pharmacy rotations were conducted over two weeks with faculty members as preceptors. They were delivered via different platforms like Google Classroom, Google Meet, Google Forms, and Google Docs. Regarding the community pharmacy experience, daily online one-to-one meetings were held with the preceptors. Different e-activities and tasks were given, including e-case scenario analysis and interpretation, e-prescription screening, and virtual patient education. The students were given a virtual tour of a model community pharmacy with 3-D animated videos and were provided with reading materials covering different aspects of community pharmacy (Rabbani et al., 2021). Concerning virtual

hospital rotations, they covered all the core areas of hospital practice, such as Internal Medicine, Cardiology, Neurology, Nephrology, Psychiatry, Nutrition, Hospital Pharmacy, and Drug Information. The students were given one case scenario for writing a pharmaceutical care plan and one case scenario for analysis and interpretation of each of the core areas that were discussed virtually with the preceptor using Google Meet. Moreover, the students watched explanatory videos about the different hospital pharmacy services, roles, and responsibilities of a hospital pharmacist, storage of medications in hospital pharmacy, and various inpatient and outpatient hospital pharmacy services (Rabbani *et al.,* 2021).

The community pharmacy training at the International Islamic University of Malaysia is four-week experiential learning conducted in the community pharmacy setting. Due to the COVID-19 pandemic, live community pharmacy training was suspended, and the course was re-designed to be delivered as an online remote training experience (Rahman *et al.,* 2020). The on-site community pharmacy internship was replaced with synchronous discussions and consultation sessions held twice weekly for three weeks using Google Meet and Google Classroom platforms by faculty preceptors. Students were asked to complete all tasks proposed in the community pharmacy logbook. They used MyDispense and Access Pharmacy (McGraw-Hill) to practice their dispensing skills and familiarise themselves with non-prescription medications. MyDispense is a free online community pharmacy simulation programme designed to help pharmacy students develop their outpatient pharmacy skills and competencies in dispensing medicinal products systematically, safely, and accurately (MyDispense, 2022). Virtual sessions were conducted with about 37 students and two lecturers per session to ensure unified information delivery for students. However, this limited the active participation of students and made it difficult to handle a large group in an online discussion. Several assessment tools were utilised, including a logbook, preceptor assessment, and an online objective structured clinical examination (OSCE) (Rahman *et al.,* 2020).

At the faculty of pharmacy of Applied Science Private University in Jordan, senior fifth-year pharmacy students are offered a community pharmacy experience "Training II" course (Barakat *et al.,* 2021). During the pandemic, the course was restructured, where five accredited and certified community pharmacists selected by the faculty of pharmacy recorded different videos related to various topics, including the cardiovascular system, respiratory system, endocrine system, infectious diseases, and gastrointestinal system. The videos covered

information related to drugs and were recorded in the community pharmacy setting to simulate the actual practice and the pharmacy layout. Prior to submission to students, the videos were evaluated by expert academics in the field of pharmacy practice and then uploaded via the educational platform (Microsoft Teams). Discussion with students, which was led by the course instructor, was completed to achieve the course learning outcomes. The absence of eye contact during the training process was the most relevant barrier reported by students (Barakat *et al.,* 2021). Recorded video tutorials were described as effective and supportive tools for pharmacy education (Farha *et al.,* 2020). However, using them solely might not be as effective, requiring a blended learning style to be more comprehensive (Baumann-Birkbeck *et al.,* 2017). Hence, the combination of virtual and conventional techniques for future training would improve training outcomes.

The College of Pharmacy, King Saud University, Riyadh, Saudi Arabia, transferred their introductory pharmacy practice experience (IPPE) training to a virtual dispensing platform under the supervision of their preceptors, and IPPE trainees were evaluated according to the Experiential Training Unit manual (Almetwazi *et al.,* 2020). APPE interns were requested to attend the WHO Infection Control course named emerging respiratory viruses, where they practiced how to detect, prevent, respond, and control COVID-19. Moreover, all interns' schedules were updated to be within King Saud University Medical City (KSUMC) services. Some rotations were also switched to virtual platforms or were conducted remotely, and interns kept up with regular meetings, discussed clinical cases, and presented through virtual platforms (Almetwazi *et al.,* 2020).

As for the IPPE course offered by the School of Pharmacy and Pharmaceutical Sciences, University of Colorado Skaggs, it was delivered online through Zoom videoconference software that was utilised for synchronous preceptor-student interactions, in addition to the Epic electronic health record (EHR) system to access patient health records. Also, students received a synchronous tour of the department of pharmacy at the University of Colorado hospital, where they were introduced to the basics of dispensing operations, automated dispensing cabinets, medication storage, labelling, and distribution. Differences between centralised staffing and unit-based clinical pharmacy staffing were outlined to students. As they progressed through the course, students were given access to patient charts from the internal medicine and critical care settings to evaluate the effectiveness of collaborative practice agreements regarding pharmacy-directed dosage adjustments

through a live Zoom reflection session with their preceptors (Reynolds *et al.,* 2021).

Perry and colleagues conducted a retrospective review of existing educational records to evaluate the effectiveness of the interinstitutional COVID-19 simulation activity at the universities of Pittsburgh and Duquesne, USA. During the COVID-19 outbreak, APPE rotations were switched remotely through an interinstitutional COVID-19 simulation activity, which involved the use of several technology platforms, including video conferencing software (Zoom) to conduct meetings and interactions between students and faculty, Blackboard to administer baseline and post-activity knowledge tests, and Qualtrics to administer the pre-and-post student perception surveys. Additionally, the Flipgrid video discussion platform was used to help students create 10-minute patient presentation videos, which were graded at a later time by facilitators. Patient simulation software like Laerdal SimMan Software was utilised without a mannequin to provide students with a live view of a simulated patient monitor via screen sharing during the videoconference (Perry *et al.,* 2022).

Discussion

Lessons learned

Given this unforeseen COVID-19 situation, the virtual experiences provided an alternative solution for the on-site experiential training in the COVID-19 restrictions. It is also clear that the pandemic has created the demand for expanding existing programmes and introducing new services. It is worth mentioning that some students supported the national COVID-19 vaccination campaign by volunteering to prepare and dispense vaccines within pharmacy teams. Their role was extremely important to ensure accurate doses, precise dilution, and proper storage and distribution.

Moreover, new tasks, such as disease presentations, role-plays, and patient case discussions, helped the students build essential skills that may have otherwise not been emphasised during a traditional rotation. These include cooperation and teamwork to complete an assignment or drug information presentation. The preceptors may use this opportunity to integrate new learning activities that can be completed remotely and can support student career development. In addition, the success of the simulation activity in virtual rotations has allowed it to be considered during in-person simulated settings or workshops within the didactic curriculum.

Future training programmes should be organised to overcome the challenges and maximise the benefits of training experiences. For instance, benefits from our APPE training model helped improve our IPPE model from purely online to a hybrid one. Moreover, future IPPE training does not need to be limited to traditional training but can be a mix of virtual and traditional methods to overcome the limited availability of training places in hospitals and limit the number of trainees per preceptor.

Many challenges were experienced during the virtual training, including maintaining active engagement and participation, technical issues, increased screen time, and a higher number of online tasks and assignments. Furthermore, from the preceptors' point of view, the virtual training was well-planned and organised despite the abrupt shift to the virtual model, which increased the time of online sessions and case preparations.

Implications for experiential education

Virtual education has become the new model, yet students' needs are not addressed properly, remotely. Therefore, below are several suggested recommendations to deal with similar situations in the future:

- Schools of pharmacy need to acquire new tools and techniques, such as telehealth, blackboard, virtual classes, Microsoft Teams, and Zoom software, to engage students, develop pharmacy-provided services in the future, and assist providers as they adapt to an evolving virtual healthcare environment.

- Follow-up reports should be submitted weekly to the school's administration to accelerate the resolution of conflicts or misunderstandings when applying the newly enforced assessment methods.

- Virtual rotations could be used to meet the needs for training and maximise the experiential pharmacy practice benefits. Even in post-pandemic times, future training programmes may incorporate online resources and simulation into the traditional experiential methods; this integrated model will enhance on-site experiential training and make the training future-ready.

- Schools of pharmacy could sign contracts with new sites that offer remote opportunities for students with structured objectives and outcomes. Potential contacts may include immunisation authorities and/or state emergency management.

- Assigning APPE students more often to administer courses and/or training for their fellow students would improve learning outcomes and provide APPE students with the experience of supervising and training other pharmacy students after graduation.

- Efforts should be made to integrate artificial intelligence-based technologies into experiential training. This integration will expand student exposure and give a new dimension to experiential training in this pandemic era.

- Providing mental health support to students during virtual training is paramount to overcoming tremendous stress.

Conclusion

The COVID-19 pandemic made student teaching and learning a challenge. Schools of pharmacy worldwide were forced to shift their programmes and experiential education into virtual or hybrid formats to ensure continuity of education. The Department of Pharmacy Practice at LIU re-designed their experiential training into a virtual experience amid COVID-19 restrictions. A similar re-designing of the experiential training was established by several pharmacy schools globally. Virtual training experiences successfully achieved the desired learning outcomes and were well received by students. However, there are several areas for future improvements, such as using diverse online training platforms to cover a range of practice-based activities, the inclusion of more patient-centred activities, and provisions for live virtual patient encounters.

Conflict of interest

The authors declare no conflict of interest.

Source of funding

The authors did not receive any funding.

References

AbuBlan, R. S., Nazer, L. H., Jaddoua, S. M., & Treish, I. M. (2019). A Hospital-based Pharmacy Internship Program in Jordan. *American Journal of Pharmaceutical Education, 83*(3), 6547. https://doi.org/10.5688/ajpe6547

Adapting to Unprecedented Circumstances | AACP. (2020). https://www.aacp.org/article/adapting-unprecedented-circumstances

Akel, M. E., Rahal, M., Dabbous, M., Mourad, N., Dimassi, A., & Sakr, F. (2020). Experiential Education in Pharmacy Curriculum: The Lebanese International University Model. *Pharmacy (Basel, Switzerland), 9*(1), 5. https://doi.org/10.3390/pharmacy9010005

Alkatheri, A. M., Albekairy, A. M., Khalidi, N., Phelps, S. J., Gourley, D. R., Al Jeraisy, M., & Qandil, A. M. (2019). Implementation of an ACPE-Accredited PharmD Curriculum at a Saudi College of Pharmacy. *American Journal of Pharmaceutical Education, 83*(9), 6237. https://doi.org/10.5688/ajpe6237

Almetwazi, M., Alzoman, N., Al-Massarani, S., & Alshamsan, A. (2020). COVID-19 impact on pharmacy education in Saudi Arabia: Challenges and opportunities. *Saudi Pharmaceutical Journal, 28*(11), 1431–1434. https://doi.org/10.1016/j.jsps.2020.09.008

Altwaijry, N., Ibrahim, A., Binsuwaidan, R., Alnajjar, L. I., Alsfouk, B. A., & Almutairi, R. (2021). Distance Education During COVID-19 Pandemic: A College of Pharmacy Experience. *Risk Management and Healthcare Policy, 14*, 2099–2110. https://doi.org/10.2147/RMHP.S308998

Aruru, M., Truong, H.-A., & Clark, S. (2021). Pharmacy Emergency Preparedness and Response (PEPR): A proposed framework for expanding pharmacy professionals' roles and contributions to emergency preparedness and response during the COVID-19 pandemic and beyond. *Research in Social and Administrative Pharmacy, 17*(1), 1967–1977. https://doi.org/10.1016/j.sapharm.2020.04.002

Assemi, M., Corelli, R. L., & Ambrose, P. J. (2011). Development Needs of Volunteer Pharmacy Practice Preceptors. *American Journal of Pharmaceutical Education, 75*(1), 10. https://doi.org/10.5688/ajpe75110

Barakat, M., Qudah, R., Abu Farha, R., Alsalamat, H., & Akour, A. (2021). Perception of Jordanian Pharmacy Students towards Community Pharmacy-Virtual Training Experience during COVID-19 Outbreak. https://doi.org/10.21203/rs.3.rs-268142/v1

Baumann-Birkbeck, L., Florentina, F., Karatas, O., Sun, J., Tang, T., Thaung, V., McFarland, A., Bernaitis, N., Khan, S. A., Grant, G., & Anoopkumar-Dukie, S. (2017). Appraising the role of the virtual patient for therapeutics health education. *Currents in Pharmacy Teaching & Learning, 9*(5), 934–944. https://doi.org/10.1016/j.cptl.2017.05.012

Beck, D., Boh, L., & O'Sullivan, P. (1995). Evaluating Student Performance in the Experiential Setting with Confidence. *American Journal of Pharmaceutical Education, 59*, 236-249

Bindoff, I., Ling, T., Bereznicki, L., Westbury, J., Chalmers, L., Peterson, G., & Ollington, R. (2014). A Computer Simulation of Community Pharmacy Practice for Educational Use. American Journal of Pharmaceutical Education, 78(9). https://doi.org/10.5688/ajpe789168

Boyce, E. G., Harris, C. S., Bingham, A. L., Chan, E., Chapman, S. A., Chilbert, M. R., Dy-Boarman, E., Haines, S. T., Heavner, M. S., Marcus, K. B., Smith, S. E., Strnad, K., & Yunker, N. S. (2020). Striving for excellence in experiential education. *Journal of The American College of Clinical Pharmacy, 3*(3), 678–691. https://doi.org/10.1002/jac5.1240

Chahine, B., Cherfane, M., Sakr, F., Safwan, J., Dabbous, M., Akel, M., & Rahal, M. (2021). Community pharmacists' perceptions and role in the management of common dermatological problems in Lebanon: A cross-sectional study. *International Journal of Pharmacy Practice, 29*(6), 573–579. https://doi.org/10.1093/ijpp/riab056

Chakraborty, I., & Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, global environment and prevention. *Science of The Total Environment, 728*, 138882. https://doi.org/10.1016/j.scitotenv.2020.138882

Cox, C. E., & Lindblad, A. J. (2012). A Collaborative Approach to Improving and Expanding an Experiential Education Program. *American Journal of Pharmaceutical Education, 76*(3), 53. https://doi.org/10.5688/ajpe76353

Dabbous, M., Kawtharani, A., Fahs, I., Hallal, Z., Shouman, D., Akel, M., Rahal, M., & Sakr, F. (2022). The Role of Game-Based Learning in Experiential Education: Tool Validation, Motivation Assessment, and Outcomes Evaluation among a Sample of Pharmacy Students. *Education Sciences, 12*(7), 434. https://doi.org/10.3390/educsci12070434

Elnaem, M. H., Nazar, N. I. M., & Rahman, N. S. A. (2020). Pharmacotherapy virtual attachment during COVID-19 pandemic: Use of online experiential assessment in a Malaysian pharmacy school. *Pharmacy Education, 20*(2), 23–24. https://doi.org/10.46542/pe.2020.202.2324

Farha, R. K. A., Rashad, M., Hasen, E., Mukattash, T., Al-Hashar, A., & Basheti, I. A. (2020). Evaluation of the effect of video tutorial training on improving pharmacy students' knowledge and skills about medication reconciliation. *Pharmacy Practice, 18*(1), 1711. https://doi.org/10.18549/PharmPract.2020.1.1711

Fuller, K. A., Heldenbrand, S. D., Smith, M. D., & Malcom, D. R. (2020). A Paradigm Shift in US Experiential Pharmacy Education Accelerated by the COVID-19 Pandemic. *American Journal of Pharmaceutical Education, 84*(6), ajpe8149. https://doi.org/10.5688/ajpe8149

UNESCO. (2020, March 4). Education: From disruption to recovery. https://en.unesco.org/covid19/educationresponse

Jackson, L. D. (2015). Strategies pharmacy students can use to ensure success in an experiential placement. *Canadian Pharmacists Journal: CPJ, 148*(6), 308–313. https://doi.org/10.1177/1715163515608775

Karimi, R., Arendt, C. S., Cawley, P., Buhler, A. V., Elbarbry, F., & Roberts, S. C. (2010). Learning Bridge: Curricular Integration of Didactic and Experiential Education. *American Journal of Pharmaceutical Education, 74*(3), 48. https://doi.org/10.5688/aj740348

Kawaguchi-Suzuki, M., Nagai, N., Akonoghrere, R. O., & Desborough, J. A. (2020). COVID-19 Pandemic Challenges and Lessons Learned by Pharmacy Educators Around the Globe. *American Journal of Pharmaceutical Education, 84*(8), ajpe8197. https://doi.org/10.5688/ajpe8197

Khachan, V., Saab, Y. B., & Sadik, F. (2010). Pharmacy education in Lebanon. *Currents in Pharmacy Teaching and Learning, 2*(3), 186–191. https://doi.org/10.1016/j.cptl.2010.04.003

Khan, T. M. (2021). Use of social media and WhatsApp to conduct teaching activities during the COVID-19 lockdown in Pakistan. *International Journal of Pharmacy Practice,* **29**(1), 90. https://doi.org/10.1111/ijpp.12659

Law, E., Scott, M. C., Moon, Y. S. K., Lee, A. J., Bandy, V. T., Haydon, A., Shek, A., & Kang-Birken, S. L. (2021). Adapting pharmacy experiential education during COVID-19: Innovating remote preceptor resources, tools, and patient care delivery beyond virtual meetings. *American Journal of Health-System Pharmacy: AJHP: Official Journal of the American Society of Health-System Pharmacists,* **78**(18), 1732–1738. https://doi.org/10.1093/ajhp/zxab192

Lucas, C., Williams, K., & Bajorek, B. (2019). Virtual Pharmacy Programs to Prepare Pharmacy Students for Community and Hospital Placements. *American Journal of Pharmaceutical Education,* **83**(10), 7011. https://doi.org/10.5688/ajpe7011

Lucas, C., Williams, K., Tudball, J., & Walpola, R. L. (2018). Community, hospital and industry preceptor perceptions of their role in experiential placements- the need for standardization of preceptor responsibilities and evaluations on students. *Currents in Pharmacy Teaching and Learning,* **10**(11), 1447–1455. https://doi.org/10.1016/j.cptl.2018.08.002

Lyons, K. M., Christopoulos, A., & Brock, T. P. (2020). Sustainable Pharmacy Education in the Time of COVID-19. *American Journal of Pharmaceutical Education,* **84**(6), ajpe8088. https://doi.org/10.5688/ajpe8088

Moreau, C., Maravent, S., Hale, G. M., & Joseph, T. (2021). Strategies for Managing Pharmacy Experiential Education During COVID-19. Journal of Pharmacy Practice, **34**(1), 7–10. https://doi.org/10.1177/0897190020977730

MyDispense – Shaping Pharmacy Education. (2022). https://info.mydispense.monash.edu/

Nicola, M., O'Neill, N., Sohrabi, C., Khan, M., Agha, M., & Agha, R. (2020). Evidence based management guideline for the COVID-19 pandemic—Review article. *International Journal of Surgery,* **77**, 206–216. https://doi.org/10.1016/j.ijsu.2020.04.001

Nizhenkovska, I., Kuznetsova, O., & Narokha, V. (2020). Organising distance learning for Master's in Pharmacy in Ukraine during COVID-19 quarantine. *Pharmacy Education,* **20**(2), 59–60. https://doi.org/10.46542/pe.2020.202.5960

Owens, K. R. (2006). A Review of "Introduction to Rubrics: An Assessment Tool to Save Grading Time, Convey Effective Feedback and Promote Student Learning." *Community College Journal of Research and Practice,* **30**(1), 72–74. https://doi.org/10.1080/10668920500420782

Packeiser, P. B., & Castro, M. S. (2020). Evaluation of simulated drug dispensing and patient counseling in the course of pharmaceutical improvement: 2009 to 2015. *Pharmacy Practice,* **18**(4), 1865. https://doi.org/10.18549/PharmPract.2020.4.1865

Perry, M. W., Kobulinsky, L. R., Seybert, A. L., Kreider, M. S., Williams, V., & Smithburger, P. L. (2022). Interinstitutional simulation of patients with COVID-19 during a remote acute-care advanced pharmacy practice experience. *Journal of the American College of Clinical Pharmacy,* **5**(4), 442–449. https://doi.org/10.1002/jac5.1596

Rabbani, S. A., Wadhwa, T., Sridhar, S. B., Shareef, J., Ali, A. A., & Rao, P. G. (2021). PROGRAMME DESCRIPTION: Experiential training during COVID-19 pandemic: a virtual attachment experience from a college of pharmaceutical sciences in the United Arab Emirates. *Pharmacy Education,* **21**(1), 51–55. https://doi.org/10.46542/pe.2021.211.5155

Rahman, N. S. A., Nazar, N. I. M., & Elnaem, M. H. (2020). Experiential learning in community pharmacy: Online and remote teaching experience in Malaysian higher education: Innovation in experiential learning or assessment. *Pharmacy Education,* **20**(2), 29–30. https://doi.org/10.46542/pe.2020.202.2930

Reynolds, P. M., Rhein, E., Nuffer, M., & Gleason, S. E. (2021). Educational Methods and Technological Innovations for Introductory Experiential Learning Given the Contact-Related Limitations Imposed by the SARS-CoV2/COVID-19 Pandemic. *Pharmacy (Basel, Switzerland),* **9**(1), 47. https://doi.org/10.3390/pharmacy9010047

Ryan, T. J., Grimes, T., Henman, M. C., Sheachnasaigh, E. N., O'Dwyer, M., Roche, C., Ryder, S. A., Sasse, A., Walsh, J. J., & D'Arcy, D. M. (2019). Design and Implementation of an Integrated Competency-Focused Pharmacy Programme: A Case Report. *Pharmacy (Basel, Switzerland),* **7**(3), 121. https://doi.org/10.3390/pharmacy7030121

Sabra, R., Safwan, J., Dabbous, M., Rida, A., Malaeb, D., Akel, M., & Sakr, F. (2022). Assessment of knowledge, attitude and practice of Lebanese pharmacists in providing patient counseling on urinary tract infection and its treatment. *Pharmacy Practice,* **20**(2), 01–10. https://doi.org/10.18549/PharmPract.2022.2.2653

Safwan, J., Cherfan, M., Dabbous, M., Hammoudi, D., Akiki, Z., Saade, F., Akel, M., Younes, S., Rahal, M., Bouraad, E., & Sakr, F. (2022). Faculty perceptions on online education in a school of pharmacy during the COVID-19 pandemic. *Pharmacy Education,* **22**(1), 450–457. https://doi.org/10.46542/pe.2022.221.450457

Sakr, F., Akiki, Z., Dabbous, M., Salameh, P., & Akel, M. (2022a). The Role of Pharmacists in Providing Immunization to the General Population: Are Lebanese Pharmacists Ready for this Role? *Pharmacy Practice,* **19**(4), 01–08. https://doi.org/10.18549/PharmPract.2021.4.2565

Sakr, F., Dabbous, M., Akel, M., Salameh, P., & Hosseini, H. (2022b). Adherence to Post-Stroke Pharmacotherapy: Scale Validation and Correlates among a Sample of Stroke Survivors. *Medicina,* **58**(8), 1109. https://doi.org/10.3390/medicina58081109

Sakr, F., Haddad, C., Zeenny, R. M., Sacre, H., Akel, M., Iskandar, K., Hajj, A., & Salameh, P. (2022c). Work Ethics and Ethical Attitudes among Healthcare Professionals: The Role of Leadership Skills in Determining Ethics Construct and Professional Behaviors. *Healthcare,* **10**(8), 1399. https://doi.org/10.3390/healthcare10081399

Sera, L., & Wheeler, E. (2017). Game on: The gamification of the pharmacy classroom. *Currents in Pharmacy Teaching & Learning,* **9**(1), 155–159. https://doi.org/10.1016/j.cptl.2016.08.046

Thomas, D., Marriott, J., Vadlamudi, R., Efendie, B., & Maine, L. L. (2019). Chapter 1—Introduction to Clinical Practice, Research, and Pharmacy Education. In *Clinical Pharmacy Education, Practice and Research* (pp. 1–9). Elsevier. https://doi.org/10.1016/B978-0-12-814276-9.00001-5

Thompson, M., Kanmaz, T., Cheryl, C., & Tanzer, K. (2020). Recommendations for participation in experiential education activities during a national, regional or local crisis. *Acreditation Council For Pharmacy Education.* https://www.acpe-accredit.org/wp-content/uploads/Experiential-Education-ACPE-Proposal-Response-Final.pdf

Toklu, H. Z., & Hussain, A. (2013). The changing face of pharmacy practice and the need for a new model of pharmacy education. *Journal of Young Pharmacists: JYP,* **5**(2), 38–40. https://doi.org/10.1016/j.jyp.2012.09.001

Wahab, I. A., & Zainal, Z. A. (2020). Ensuring Continuity of Undergraduate Clinical Pharmacy Teaching and Learning Activities During Crisis. *Education in Medical Journal,* **12**(2), 69–73. https://doi.org/10.21315/eimj2020.12.2.7

Wilbur, K., Wilby, K. J., & Pawluk, S. (2018). Pharmacy Preceptor Judgments of Student Performance and Behavior During Experiential Training. *American Journal of Pharmaceutical Education,* **82**(10). https://doi.org/10.5688/ajpe6451

Younes, S., Mourad, N., Safwan, J., Dabbous, M., Rahal, M., Al Nabulsi, M., & Sakr, F. (2022). Chronic kidney disease awareness among the general population: Tool validation and knowledge assessment in a developing country. *BMC Nephrology,* **23**(1), 266. https://doi.org/10.1186/s12882-022-02889-2

Zellmer, W. A., Vlasses, P. H., & Beardsley, R. S. (2013). Summary of the ACPE Consensus Conference on Advancing Quality in Pharmacy Education. *American Journal of Pharmaceutical Education,* **77**(3), 44. https://doi.org/10.5688/ajpe77344

Zeitoun, A., Sacre, H., Hallit, S., Zeenny, R. M., Sili, G., & Salameh, P. (2020). Clinical preceptor competencies for a better pharmacy education: a suggested framework for Lebanon. Journal of pharmaceutical policy and practice, 13, 21. https://doi.org/10.1186/s40545-020-00217-3