Effects of COVID-19 Lockdowns on Pharmacy Education via Virtual Gamified Simulations

Dr. Mia Hansen[1], Dr. Lars Nielsen[2]
[1]Department of Pharmacy, University of Copenhagen, Copenhagen, Denmark
[2]Faculty of Pharmaceutical Sciences, Aarhus University, Aarhus, Denmark

Received: 09-04-2025; Revised: 15-05-2025; Accepted: 27-05-2025; Published: 10-06-2025

Abstract

The COVID-19 pandemic caused big changes in how healthcare education was delivered, leading to the fast adoption of online classes. Virtualized gamified pharmacy simulations became a key way to help pharmacy students maintain their learning despite outside factors. This research examines how virtual gamified simulations were introduced in pharmacy education, what the effects were and what students thought. By organizing virtual games in place of the lab and classroom, institutions allowed students to experience the same important clinical situations and make key decisions when learning from a distance. Researchers bring together evidence from leading institutions worldwide to explore the effects on students' memory, real-life learning, satisfaction and successful learning. In addition, the research examines what learning theories underlie gamification, the programs used and the obstacles faced when introducing it. Evidence reveals that virtual games for pharmacy education, introduced because of the pandemic, may also help create new hybrid methods for teaching and learning. The study ends by suggesting the inclusion of gamified digital tools in pharmacy programs to boost resilience, more engaging learning and student results everywhere.

Keywords: ***Virtual simulation, gamified learning, pharmacy education, COVID-19, online learning, digital pedagogy, experiential learning, pharmaceutical training, distance education, healthcare simulation.***

1.Introduction

The education of pharmacists was quickly reshaped when health worries worldwide meant converting earlier hands-on courses to online forms. All over the world, pharmaceutical education programs faced difficulties turning elaborate simulation activities into online classes that would not disappoint students or instructors. Basically, this shift went past installing new systems; it guided the development of important clinical, professional and collaborative skills online for future pharmacists(1).

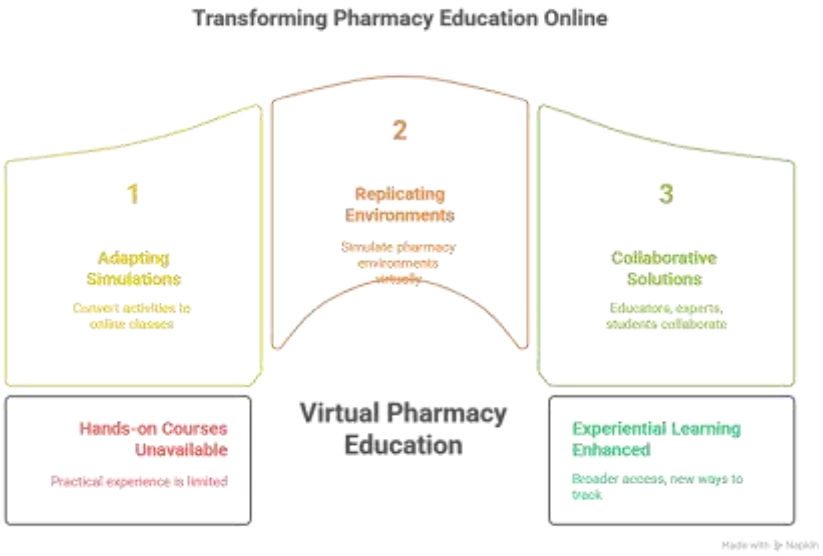

FIGURE 1 Transforming Pharmacy Education Online

The Pharmacy Game which was developed by the University of Groningen as an actual game played in class, became a main source of experience-based learning all over the world. For many years, pharmacy students had to use simulated tools to take on the responsibilities of a pharmacist and work directly with both simulated patients and healthcare professionals for long periods. By replicating pharmacy environments, the simulation gave students opportunities to work through difficult decisions, enhance their ability to speak and listen and see the outcomes of their decisions in a safe way.

Due to the emergency move to remote teaching during the pandemic, educators had to find ways to keep the creativity and transformative aspects while working only online. Because of the lockdowns, Australian universities began to explore virtual pharmacy education and found ways to keep experiential learning going, using innovative technology. Because things happened so quickly, educators, technology experts and students had to quickly come up with new solutions together to ensure student learning and safety(2).

For educational tasks both simple and complex, a full change in thinking was needed as programs moved from physical to simulated learning. Teachers had to juggle many tasks at once such as maintaining their lessons while figuring out complex new ways of teaching through technology. It showed that there are pluses and minuses to using digital educational tools which gave us important details about the future of teaching pharmacy post-pandemic. This experience made it clear that virtual settings allowed for similar learning, but also introduced new ways to track learning, increase access and expand learning to broader groups than ever before in physical environments.

2.Theory behind their teaching and their approach to education

Virtual pharmacy simulation draws its conceptual base from well-established ideas from experiential learning theory, constructivist education and methods highlighting learning through authentic situations. Kolb's learning cycle was used as the main reference for setting up virtual environments that kept the main aspects of concrete experience, observation, concept formation and trying out activities online. With this approach, it was guaranteed that technology benefited the way students learned and didn't just show off what was possible.

Because constructivist learning theory holds that students learn best by making sense of their virtual world, it played a key role in shaping the virtual pharmacy environments to encourage active engagement with patients, scenarios and interaction with teams. For the virtual environment to be useful, it had to include a variety of challenging problems, unclear conditions and real world difficulties that would motivate learners. Instead of just moving lessons online, educators decided to rethink how knowledge is built in the virtual environment, taking advantage of unique technology tools to do more than repeat traditional learning approaches.

The theory of situated learning pointed out that real situations should guide professional learning, so virtual simulation creators were urged to replicate how pharmacy settings work in reality. This meant that great care had to be taken to include social, cultural and professional aspects, so that virtual discussions had the same layers and detail as face-to-face talks between patients and pharmacists. The issue was to program virtual characters that mimicked the actions of actual patients and professionals, while giving the students useful feedback about the results of their clinical management(3).

Introduction of game principles into virtual simulation gave designers additional evidence that incorporating game elements in digital environments encourages greater enthusiasm, active engagement and better recall of information. Even though students were learning online, features like competitions, fast response checks, scoreboards and group challenges encouraged them to remain involved. Even so, using gamification effectively required finding the right balance, so the extra excitement from games only rewarded serious learning, while still keeping education professional in healthcare.

According to social learning theory, working with peers, solving tasks as a team and reviewing successes and failures, are all important aspects of learning for professionals. Special virtual settings were put in place to help team members bond and learn the communication, leadership and teamwork skills required in current pharmacy roles. For this to happen, technical resources had to ensure that teams could interact at the same time or asynchronously, giving students several choices to work and support the social aspects that support group learning.

3.Bringing Together Technological Resources and Platforms

For virtual pharmacy simulation systems to work well, the necessary technological architecture had to ensure security and support many learners using the system at the same time. Because Microsoft Teams can handle many types of communications, manage files well and be used with other Microsoft 365 apps, it was chosen as our main platform. Ultimately, deciding on Teams was about more than programs; it reflected decisions that would decide how familiar teachers were with the technology, whether the school could afford licenses, its flexibility and whether the system could last(4).

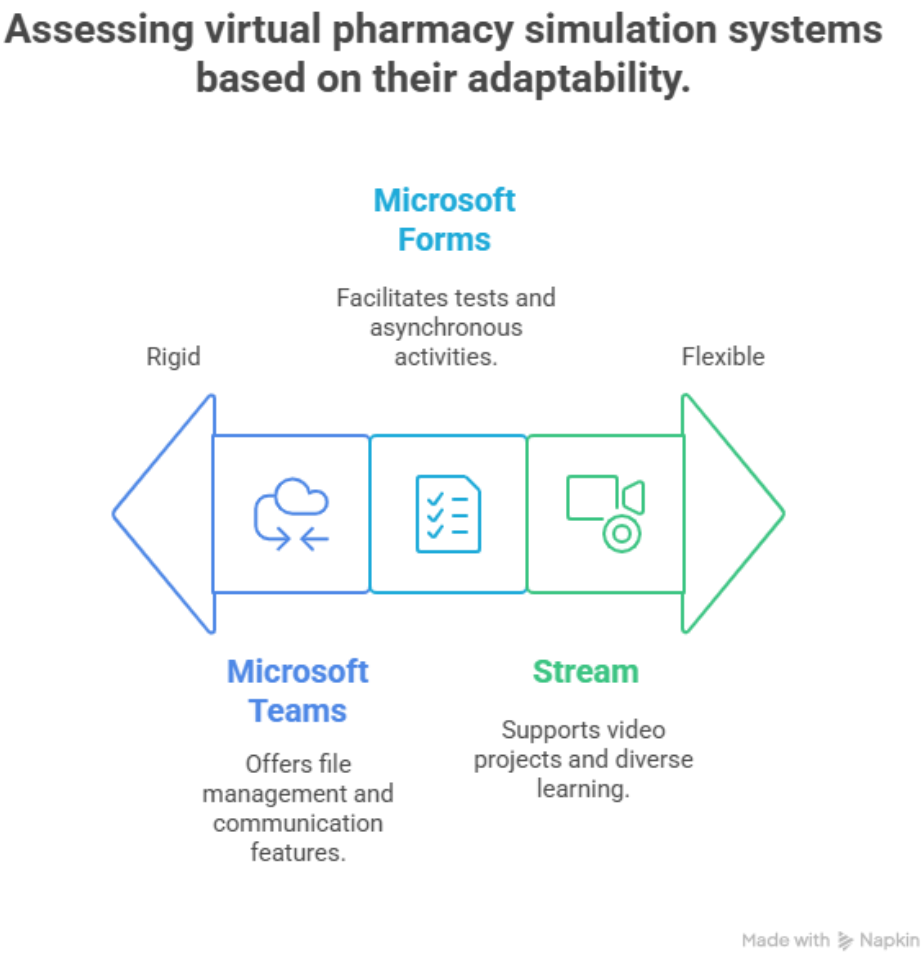

FIGURE 1 Assessing virtual pharmacy simulation systems based on their adaptability

Systems were required to allow multiple teams to operate at the same time with separate online pharmacy systems, private channels for quick communication and independent file storage as well as isolation for their work evaluations. To accomplish this, the space was designed so that teams could remain separate, but instructors would still be able to help as required(5). The architecture had to include features for students that are easy to use and at the same time provide advanced tools for educators.

In trying to combine software platforms, it was found that their differences in how they worked, what they could do and how they looked made the process difficult. Using Teams for messages, Forms for tests, Stream for video projects and Big Interview for asynchronous activities caused students difficulties and slowed down their learning. To solve this issue, we set up easy-to-follow navigation rules, created training programs for using the platforms and designed support systems that quickly tackled site-specific problems without disrupting learning environments.

It was very important to guarantee security and privacy when using student assessment data, videos of healthcare interactions and shared chats about educational topics. The technological setup required for following educational privacy regulations and still allowing teachers to offer assessment and feedback. For this reason, schools needed advanced privacy mechanisms, secure record-keeping systems and systems that kept a record of what users do.

Meeting the organization's plans for future class sizes and different programs meant the solution had to be scalable. The learning platform had to be flexible to serve all kinds of schedules, cater to students in different parts of the world or with differing technology and deliver the same materials to all. So, we needed solid cloud options, multiple systems for vital activities and flexible screens that function everywhere and on any connection(6).

4.Innovations in Teaching and Planning Learning

For pharmacy simulations to become virtual learning experiences, a thorough reconstruction of traditional teaching strategies was needed, instead of just making previous activities digital. This work included looking at the goals for learning, figuring out the important activities and finding new ways to teach them online. Ensuring the material stayed accurate to real pharmacy and that important learning topics really were taught is key, even with the phased-out resources found in games.

It was important to include synchronous and asynchronous components in the design, as virtual lessons can be set up differently in time than physical face-to-face learning. Live activities gave students the ability to talk with others in real time which is important for developing their communication, while online activities gave everyone time to prepare carefully and fit into their own timetables. How the schedule was built helped ensure students learned well and engaged with the course by keeping them active in group assignments.

Redesigning the assessment strategy was a main teaching challenge, as previously seen through observation had to be checked digitally so that evaluation still measured student achievements and gave feedback for progress. To do this, I built new ways to assess students in virtual classes, provided several routes for assessment to honor different students' needs and skills and set up systems to analyze student behavior from online learning. Innovative methods to ensure the same levels of academic challenge when using virtual delivery methods had to be developed(7).

Recreating real patient situations in a virtual space involved using original methods to demonstrate how meetings with patients can be complex, unexpected and emotionally engaging. They worked to design detailed virtual patients, write flexible clinical situations and design clinic backgrounds that would guide students towards correct procedures because others were not physically present. It was challenging to continue simulating the same emotional and workable conversations with patients, based on the technologies now available.

Helping students learn collaboratively called for unique ways to manage teams, support leadership development and engage students as peers through online spaces. Since team building couldn't be held in person, the same activities had to be adjusted, placing special emphasis on helping each individual take part, regardless of their online skills. It was important for the course design to supply more than one way for students to collaborate, allow participants to join in various ways and maintain the mechanisms that encourage teams to perform well in healthcare.

5.Building Your Online Identity and Learning Workplace Behaviors

Professional socialization in virtual learning environments is different from what happens in traditional pharmacy training. Virtual settings change the process by which students learn to share professional values, reason ethically and identify with the field of pharmacy. With everyone learning online, it is important to plan digital experiences that can connect people, resulting in the same kind of deep personal transformation found in face-to-face professional education.

Usually, professionals become socialized by having untaught experiences, interacting with seniors, watching leaders and gradually experience real work settings. If virtual simulations are to succeed, they should include carefully crafted activities that give students practice in following professional behaviors. So, it's important to set up virtual mentorships, replicate scenarios where students role-play as peers and use reflection tools that clarify both the role of a pharmacist and their impact on patient care(8).

It is necessary to make sure digital professionalism, good communication and usual business behaviors are part of virtual meetings. Pharmacy students must show they are confident, empathetic and have authority online, while keeping the strong relationships important for effective pharmaceutical work. To do this, they learn new ways to

communicate virtually, explore what can and cannot be done in digital patient care and alter their traditional skills to fit new technology.

To help students form their identity in virtual learning, teachers must intentionally guide students in making peer, workplace and mentor relationships that will give them ongoing guidance and support. Virtual learning allows students to explore different career personas, hear feedback from their mentors and interact with a range of role models who might not be around in their everyday learning environments. It all starts with making virtual experiences that seem real instead of fake or shallow.

To understand the development of professional identity when people interact online, we need to use advanced methods that pick up on the hidden aspects of improvement, thinking logically and embracing values that traditional observation could overlook. You should adopt different portfolios, writing assignments, ways for students to assess each other and ongoing systems to make sure you can see changes in how students view their professional role and duties. It is possible to study and examine how students talk to each other, decide on various things and share information in virtual environments which both guides individual feedback and supports changes within the program(9).

6.Learning systems that are adaptive and personalized

Integrating adaptive learning technologies in virtual simulations of pharmacies allows each person to get personalized training that changes to match their needs, habits and how well they learn. Unlike standard educational plans, adaptive systems are capable of modifying the information given, the style taxes are given, tests, support and control features according to student performance continuously. With this type of technology, educational plans can be created to fit all students, while keeping programs organized, strengthening their foundation and maintaining required competency levels for each learner.

Through the use of technology, educators can assess a large amount of student data, notice learning trends, predict future challenges and react in advance to the students' needs. These systems find out if students are having problems with particular content, like stronger performance with a different method of studying or are showing readiness for more complex tasks. Adaptive learning systems are being improved so they can offer more flexible solutions to the many issues that can affect learning.

Making virtual pharmacy simulations personal means consideration of cultural backgrounds, catering to a wide range of abilities and considering people's specific career ambitions. Adaptive tools can display cases that match a range of cultures, offer customized communication depending on students' needs and offer specific educational materials picked by students. With this kind of personal approach, all learners can relate to their studies and they learn to become culturally competent when serving a wide variety of patients.

When adaptive learning technologies are introduced, it is important to address the concerns related to privacy, equity and transparency that happen when educational algorithms control student planning. It is important for students to aware of how these systems operate, be active in their education and be capable of modifying any algorithmic suggestions that missed their individual learning expectations. Schools need to make certain that adaptive technology does not lead to unfairness because of a student's race, ethnicity, gender or earlier education.

Analysis of students' data by adaptive learning unlocks valuable information on learning methods, successful education and areas where programs can be improved for student and school use. By analyzing data, we find which ways of teaching work best for different learners which themes cause students difficulties and which methods improve results and could be rolled out to more people(10). Yet, to make this data useful, educators need to have advanced understanding and want to focus on improving teaching and learning with facts, not simply retrieve them.

7.The Topics of Ethics and Digital Equity

Since moving to online pharmacy courses, it has become clear that ethical issues in health education now include digital equity, accessibility and whether technology helps or worsens inequality. Access to reliable internet, suitable tools, peaceful learning places and technical help is not equal among students from all backgrounds, places of residence and cultural groups. It is the job of educational institutions to detect inequities and address them so that all qualified students can still take online learning courses.

Since students in virtual learning have different technological skills and knowledge, digital literacy adds a new aspect to educational justice. A few students might have trouble understanding the simple parts of the platform, whereas others know all the advanced functions early on which might lead to differences in their results and interactions with classmates. Programs should teach various engineering topics well, offer additional support and let everyone participate, all without decreasing the educational standards(11).

It gets complicated to protect privacy and data when everything students do and say in an online class, including their test results and conversations, is generally captured and saved for education or research. Students must understand which data is collected about them, how it will be accessed and used, who can access it and the rights they have regarding it. When using data for education, institutions have to ensure that students' privacy and freedom are not compromised, so solutions do not become oppressive.

The ability for virtual classrooms to increase monitoring, decrease human contact or cut down on relationship-building prompts us to rethink what learning should involve and which values we want to encourage in the future workforce. Educational leaders ought to review if using technology gives students the opportunity to practice the people skills needed for successful health care, including empathy, emotional understanding and relating well with patients.

Because virtual education promotes teamwork globally, it becomes necessary to think about how cultural differences in communication, education and professional methods may be overlooked. Pharmacy education programs offered online should respect different cultures, note the differences between healthcare systems and appreciate that how professional pharmacy works can change according to one's culture or country. It demands the use of many different perspectives, teaching methods that fit a range of cultures and understanding that effective virtual classes are both internationally focused and locally relevant.

How Will This Change Impact Future Generations?

Emergency virtual education for pharmacy during the pandemic has suggested that future growth of the field may involve hybrid models, make education more accessible and introduce innovative approaches well beyond this crisis response. Instead of returning to how schools worked before the pandemic, institutions can choose which virtual improvements will help and address the issues they found during virtual learning.

Using both virtual and physical ways of teaching together may address various needs in pharmacy education by using each type's advantages and reducing its drawbacks. While some forms of coursework like case-based learning, teamwork and activities requiring thought are better done in virtual settings, practice in laboratories, direct exams and dealing with patients often call for face-to-face classes. The right approach is to pay attention to data and choose the right educational components to use with physical or virtual methods, rather than relying only on traditional or total use of online classes.

Considering sustainability requires thinking about how to reduce travel and the need for physical infrastructure as well as planning for money, additional development for teachers and staff and future technological upkeep at the institution. Although online education helps save some costs, it results in others for licensing technology, handling problems with technology, training the faculty and developing digital resources. Virtually supporting education requires institutions to analyze what the education system will gain and lose both now and in the future.

The ability of virtual education technologies to grow allows for sharing resources, teaming up for developing programs and connecting students with professional expertise from various parts of the country or world. A virtual simulation built at any institution could be used and updated by another, encouraging collaboration and saving resources. Still, these arrangements must be managed with due respect to intellectual property, make sure the work is of high quality and make sure the material is adapted to various institutions and students.

Development for pharmacy educators involves going beyond easy use of technology to look at advising, checking progress and communications with students in virtual classes. Their success in online teaching relies on their learning more about conducting lessons online, managing student connection and using digital approaches. Building such skills for their staff is a key factor institutions must plan into their long-term goals for virtual learning.

8.Conclusion and Future work

Adopting virtual simulation technologies in pharmacy education shows how far healthcare professionals can come when faced with unexpected difficulties and how steadfast and adapting our educational institutions are. All the

points made here point to virtual pharmacy education becoming a key aspect in developing the expertise and professional character necessary for new pharmacists to work in an expanding digital healthcare sector. How virtual simulations are being used has shown that real learning doesn't always require being in the same room, paving the way for creative changes that exceed just emergency training.

Experience shows that digital environments can keep and improve the valuable learning experiences gained in traditional hands-on training. In virtual simulations, students have successfully gained skills in critical thinking, communication, collaboration and self-confidence at levels similar to those they would get from face-to-face methods. Virtual environments now give access to educational analytics, individualized learning paths and accessibility that were never before available in regular education systems. Because of these innovations, more students can join in pharmacy education and there is now a greater chance for schools to improve their overall effectiveness.

Virtual pharmacy education has a powerful technological base that will support further development and a lasting positive impact after pandemic-related restrictions finish. Bringing together communication platforms, assessment tools, artificial intelligence and adaptive learning technology has raised the bar for educational technology which can now guide future changes in healthcare education. Experiences with decision-making, preparation of users, technical assistance and connecting systems provide institutions with useful directions in improving education with technology when planned and not only in emergencies.

And yet, virtual pharmacy education has highlighted many issues that must be recognized and corrected as we look forward. The topics of digital equity, being able to use technology and maintaining connections among learners in education keep appearing and thus require ongoing efforts and attention. The fact that some aims of pharmacy education cannot be achieved through web-based instruction requires schools to plan which meetings should use virtual methods and which need to take place in person. Progress in education will result from carefully choosing which virtual methods to use together with tried-and-true methods already in place.

Virtual pharmacy education influences not just learning but also future questions about how pharmacists are trained, how care is provided and how different technologies become part of human services. Those training online for pharmacist courses are likely to adapt smoothly to the growing use of technology, digital patient care and telehealth. At the same time, they are required to keep the empathy, open-mindedness and communication needed for successful human relationships on the therapy side. In the future, pharmacy education aims to readiness its students to make the most of technology while maintaining the important principles of human-centered healthcare practice.

Research and innovation prompted by the use of virtual pharmacy education are now making it possible for everyone involved in pharmacy education to collaborate better, swap resources and explore additional research. Creating a library of successes in virtual simulation strategies, technology and teaching methods allows educational improvements to move beyond a single school or institution. Going forward, virtual pharmacy education should count on teamwork, help drive new developments and ensure that the use of technology is focused on learning rather than being the ultimate goal.

As we plan for the future, combining traditional and online learning forms could result in pharmacy education that is easier for students to access, remain challenging and fit various needs. The knowledge gained through moving to virtual education during the pandemic teaches us how to intentionally combine virtual and face-to-face teaching in new hybrid models. It will be important for virtual pharmacy education to keep improving, refining and innovating as changes happen in healthcare.

Virtual simulation in pharmacy education isn't only a technological leap; it also shows that solid design and good implementation can make learning more flexible and effective anywhere. With the ongoing progress of pharmacy education, virtual simulation will support future changes in healthcare training, helping to make healthcare education more flexible, suitable for many and effective for everyone.

Acknowledgement: Nil

Conflicts of interest

The authors have no conflicts of interest to declare

References

1. Gentry SV, Gauthier A, Ehrstrom BL. Serious gaming and gamification education in health professions: Systematic review. J Med Internet Res. 2019;21(3):e12994.
2. Guillot A, Viau A, Courtois R. Gamification in pharmacy education: Implementation and student perception during COVID-19. Am J Pharm Educ. 2021;85(6):873–879.
3. Baptista G, Oliveira T. Gamification and serious games: A literature review. Comput Hum Behav. 2019;92:306–328.
4. Hamilton LA, Franks AM, Heidel RE. Incorporating simulation and gamification into pharmacy education. Curr Pharm Teach Learn. 2020;12(2):187–194.
5. Galal SM, Patel RA, Thai CL. Gamified e-learning in pharmacy education: Student engagement and performance outcomes. Innov Pharm. 2020;11(3):1–10.
6. Almalag HM, Al-Katheri AA, Alhumaidan AS. Effectiveness of gamified virtual simulation in pharmacy education during the COVID-19 pandemic. Saudi Pharm J. 2021;29(7):730–736.
7. Fens T, Heijne-Penninga M, Tichelaar J. Virtual simulations in pharmacy: A COVID-19 necessity turned future opportunity. Br J Clin Pharmacol. 2021;87(5):2105–2109.
8. Scoular S, Amini R, Dolan B. Impact of virtual gamified simulations on student learning outcomes in pharmacy during the pandemic. J Educ Eval Health Prof. 2022;19:10.
9. Gorbanev I, Agudelo-Londoño S, González RA. A systematic review of serious games in medical education: Quality of evidence and pedagogical approach. Med Educ Online. 2018;23(1):1438718.
10. Lim EC, Oh VM, Koh DR. The impact of e-learning with gamification in pharmacy clinical education: A case study. Med Teach. 2021;43(5):529–536.
11. Cutumisu M, Brown M, Fray C. Adaptive virtual simulations improve clinical decision-making skills in pharmacy students. Simul Healthc. 2020;15(3):183–189.