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Online Pharmacy Education: Challenges and Perceptions from an Academic Perspective

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ABSTRACT

The digitalization of education is reshaping pharmacy instruction by integrating online learning systems. While the adoption of digital learning continues to grow, research on the perceptions, readiness, and challenges faced by students and faculty in Indonesia remains limited. Understanding these factors is essential for formulating effective strategies in online education. This study investigates the perceptions, readiness, and obstacles encountered by pharmacy students and faculty at Bali International University about online education. It further explores barriers to digital learning and their impact on development needs. Employing a sequential explanatory mixed-methods design, the study first gathered quantitative data and qualitative insights through in-depth interviews. A total of 329 respondents participated in the research. The quantitative results revealed no significant association between readiness (OR = 0.957, 95% CI = 0.869–1.055, p = 0.399) or attitude (OR = 1.059, 95% CI = 0.929–1.207, p = 0.364) and development needs. However, barriers showed a statistically significant correlation with development (OR = 1.777, 95% CI = 1.066–2.964, p = 0.027). Qualitative data, analyzed using a thematic framework, identified five central themes: accessibility, collaboration, ICT utilization, professional development, and the broader implications of digitalization in pharmacy education. This study underscores the transformative potential of digital technology and the importance of addressing existing challenges to enhance the quality and accessibility of pharmacy education. These improvements are vital to equipping future pharmacists with the competencies to thrive in global healthcare systems and effectively contribute to integrated pharmacy services worldwide.

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1. INTRODUCTION

The COVID-19 pandemic has significantly affected the healthcare systems and pharmaceutical education worldwide (Husamah et al., 2023). In its life-threatening aspects, the pandemic presented a major challenge for pharmacy education, which demanded that educators sustain the instruction blueprint and that safety came first. As modes for learning expand, challenges and opportunities remain for pharmacy education (Aljaber et al., 2023). In particular, the ever-increasing pace of digital advancements has revolutionized higher education, driving the global move to online education at a rapid pace. This shift has had clear advantages (including greater flexibility and access). However, it has also triggered a critical discourse on the efficacy, sustainability, and equity of digital education, particularly for practice-heavy professions such as pharmacy (Ashraf et al., 2021; Aljaber et al., 2023; Onesi-ozigagun et al., 2024).

Three key components are the foundation for any educational system: the curriculum, teachers, and students. Moreover, all those need synergy for a responsive and effective learning system. However, choosing and using a learning model are not easy tasks. It means balancing between the pedagogic ambitions and the practical constraints, taking into consideration what students are meant to learn, how curricula are related, what the teachers can manage, how students develop, and how students can access their learning tools as well as how the learning tools are utilized (Langelaan et al., 2024). In this digital era, they also need to facilitate critical thinking, technology literacy, and self-directed learning as they are central to contemporary pharmacy practice. Teaching complicated subjects, such as organic chemistry, pharmacognosy, and interprofessional education online, creates certain challenges. These are often hands-on and intensive, requiring lab work and clinical simulation, which is hard to replace online. Online pharmacy education is effective if supported by a digital infrastructure that is (1) reliable concerning internet access, hardware availability, and adaptable learning

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platforms to optimize educational quality. In addition, virtual environments may allow for learning theoretical concepts, but can fail to provide the hands-on experience necessary to achieve competency. Therefore, digital learning needs to be accompanied by practice learning in the form of simulation or in situ practice to facilitate professional readiness (Khamis et al., 2020; Oliveira et al., 2022).

The transition to online education also demands significant student and faculty adaptation. Students must cultivate greater self-discipline, proactive engagement, and proficiency in navigating digital resources, while educators must acquire digital competencies and redesign instructional strategies. This includes developing interactive content and employing innovative assessment techniques aligned with competency-based learning objectives. However, a critical gap persists in replicating practical and clinical experiences virtually, emphasizing the need for hybrid learning models that integrate simulation-based activities to bridge this gap (Lee et al., 2022).

The current digitalisation of pharmacy education offers a double picture of potential and peril. It provides flexibility, increased access to learning resources, and personalization of instruction, but it concerns digital equity, student engagement, and hands-on skill acquisition. In order to maximize educational outcomes, pharmacy education should be grounded in three key approaches: an adaptive curriculum, digitally literate faculty members, and a well-supported student body. It requires institutional investment in faculty enrichment, technology infusion, and student-centered support mechanisms. These are important towards equipping future pharmacists to work in the changing landscape of healthcare systems and provide a digital patient-centric practice (Alowais et al., 2024; Khafizova et al., 2023).

Although the issue of pharmacy online education has become an international concern, only a few studies have described its process when applied in Indonesia. This paper complements this research by exploring issues related to pharmacy students' and faculty's experiences in Indonesia and better understanding challenges, coping strategies, and implications consistent with this anticipatory transformation in pharmacy education. The results of this study are expected to provide evidence for policy, lead institutional reform, and contribute to establishing a stronger, present, and effective pharmacy education system in Indonesia.

2. MATERIAL AND METHOD

Research Design and Setting

This study utilized a sequential explanatory mixed-methods study design, which we chose to create a rich, in-depth picture of the subject under study using qualitative and quantitative data (Hirose & Creswell, 2023). This design is chosen for its two-phased nature of first finding patterns in quantitative analysis, and then exploring these patterns qualitatively to conceptualize and bring depth to patterns found. This procedure ensures that the findings in analyses 1 and 2 moderately shape and enhance the interpretation of the statistical results, thereby providing a comprehensive view of attitudes of the responders and problems in distance education.

This study was conducted from May to June 2024 in the pharmacy program at Bali International University. Responses from students and faculty members from partner institutions were also obtained to broaden the sample beyond a single university and facilitate generalizability to other educational settings. To address rigor and validity, three different sources of data were triangulated: (1) questionnaires for quantitative data, (2) interviews for qualitative information, and (3) institutional documentation associated with online education practices. This triangulation enabled the cross-verification of the information collected, reducing possible biases and increasing the credibility of the findings. Data saturation was achieved, meaning no new major insights were obtained from further interviews, and data collection was stopped.

Study Selection

The sample size was calculated using the Slovin formula: $n = \frac{N}{(N.d^2+1)}$

This is commonly applied when the total population size (N) is known and a desired margin of error (d) is determined. This method allows for a statistically sound sample size estimation, ensuring representativeness while accounting for the acceptable level of sampling error. This study used the formula to determine the appropriate number of participants from the target population of pharmacy students. The participants were selected by consecutive sampling (a non-probability method), in which all eligible participants were consecutively enrolled over a certain period until the calculated sample size was reached. This strategy was adopted due to its feasibility and appropriateness of application in situations where an entire sampling frame is not easily

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obtainable. For the quantitative component, structured questionnaires were administered through Google Forms to obtain data for the survey phase.

Eligibility was limited to students currently attending a pharmacy program and participating in online lectures during the study. Students from other professions were not included to preserve the rigor and relevance of the findings. After the quantitative part, semi-structured interviews were conducted to gather qualitative data using a sequential explanatory design. These interviews were conducted to gain deeper insight into participants' perspectives, preparedness, and barriers to online pharmacy education. Both students and faculty (including lecturers and academic mentors) involved in either the design or implementation of online pharmacy education participated in the qualitative sample to promote richness and contextuality of the data gathered.

Research Instruments

The instruments for data collection were a structured questionnaire and a semi-structured interview guide. The instrument, which was based on previously developed measurement instruments (Pires, 2022; 2023), was composed of four dimensions related to e-learning: readiness, attitudes, perceived barriers, and needs for training. Responses were recorded on a four-point Likert scale ranging from "*strongly disagree*" to "*strongly agree*." To verify the face validity of the instrument, a pilot test was carried out with 30 subjects, and the Pearson correlation coefficient indicated that no item was lower than the minimum limit of $r \geq 0.349$. Cronbach's Alpha coefficient tested internal consistency; a reliability coefficient value ≥ 0.7 indicated that the items had moderate consistency.

The questionnaire consisted of two main sections. The first section consisted of demographic questions to collect demographic information from the respondents. The second section included five subsections that evaluated a single construct—the first subsection comprised eight (8) items that assessed students' preparedness for online education. The second subsection consisted of thirteen (13) items relating to attitudes towards online learning. The third subsection addressed eight (8) barriers commonly encountered in an online environment. The fourth subsection included five (5) questions about perceived needs for enhancing the online learning process. In addition, several semi-structured questions were included to capture participants' deeper perspectives regarding key issues in online pharmacy education. These open-ended questions enabled participants to respond in their own words, providing more substantive and detailed information than closed-ended questions.

The qualitative component comprised semi-structured interviews designed to obtain an in-depth understanding of the themes identified from the quantitative component. These interviews explored participants' personal experiences, difficulties faced, and recommendations for improving the quality of online pharmacy education. Recruitment and data collection continued until no new themes emerged, ensuring the range of views was broadly inclusive.

Data Analysis

Quantitative variables were processed using *IBM SPSS Statistics* version 24.0. Data were collected and documented by researchers IW and PS, and a second author (AS) validated the data by checking against differences and repetitions identified in the initial coding process. Subsequent analysis was conducted by IW, using *descriptive statistics* to summarize absolute frequencies and percentages. *Logistic regression analysis* analyzed the relationship between independent variables (readiness, attitudes, perceived barriers, and development needs). The estimated results were presented as *odds ratios (ORs)* and *95% confidence intervals (CIs)* to signify statistical significance.

For the qualitative part, we used a *thematic analysis framework* as explicated by Creswell (2018). The analysis consisted of three main stages: *open coding*, *category formation*, and *theme identification*. To enhance the trustworthiness of the findings and ensure *inter-rater reliability*, two researchers (IW and AS) independently coded all the material. Afterwards, the codes and themes were discussed back and forth until a consensus was reached. This procedure was implemented to maintain the consistency and robustness of the qualitative data analysis.

Ethical Consideration

Ethical approval was obtained from the Ethics Commission of Bali International University on May 13, 2024 (No. 01.046/UNBI/EC/V/2024). Informed consent was collected via Google Forms, with participants

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acknowledging their understanding of the study's purpose, procedures, and potential risks. Anonymity was maintained, and participants retained the right to withdraw at any time without consequence.

3. RESULTS

A total of 329 pharmacy students participated in this study. Demographic and relevant characteristics are summarized in Table 1. Most participants were female (n = 277; 84.2%), with the largest proportion representing the class of 2022 (n = 125; 38.0%). Most students reported attending online lectures twice per week (n = 96; 29.2%) and studying primarily from home (n = 290; 88.2%). The most commonly used devices for online learning were a combination of Android smartphones and laptops (n = 133; 40.4%). Regarding internet connectivity, most participants relied on Wi-Fi (n = 228; 69.3%) and subscribed to monthly data packages (n = 259; 78.7%). Network stability was the most influential factor in choosing an internet provider (n = 171; 52.0%).

Table 1. Participants' characteristics (n=329)

Characteristics	n	%
Gender		
Male	52	15.8
Female	277	**84.2**
Class of		
2021	89	27.1
2022	125	**38.0**
2023	115	34.9
Online lecture/week		
1x	51	15.5
2x	96	**29.2**
3x	69	21.0
4x	37	11.2
>4x	76	23.1
Study location		
On campus	5	1.5
Home	290	**88.2**
Off-campus (café, co-working space)	34	10.3
Devices		
iPhone (IOS) & laptop	90	27.4
Android & Laptop	133	**40.4**
Laptop only	106	32.2
Connection choices		
Data package	101	30.7
Wifi	228	**69.3**
Internet purchased		
Monthly	259	**78.7**
Weekly	25	7.6
Daily	14	4.3
Post-paid	9	2.7
Others	22	6.7
Provider selection		
Network stability	171	**52.0**
Internet speed	165	50.2
Cheap package prices	127	38.6
Area coverage	68	20.7
Brand Product Promotion	6	1.8
Reviews/Recommendations from others	10	3.0

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As shown in Table 2, only 40.9% of students felt ready for online learning, indicating a medium level of readiness. Regarding attitudes, 29.8% were uncomfortable with active online communication with lecturers and peers, whereas 61.7% either agreed or strongly agreed that online lectures helped them understand the theoretical content. Regarding challenges, more than half of the students (50.4%) indicated that their previous experience with online learning was insufficient, and 35.6% found it difficult to maintain motivation when studying online. Despite these issues, 51.4% of students reported a likelihood to shift to e-learning when academic holidays coincided with scheduled class days.

Table 2. Perspectives of online education

Statements	Strongly disagree n (%)	Disagree n (%)	Agree n (%)	Strongly Agree n (%)
Segment 1: Student opinions about readiness for online education				
I am very ready to take part in online education	10 (3.0)	74 (22.5)	198 (60.2)	47 (14.3)
When COVID-19 emerged, I felt that campuses already supported online education	7 (2.1)	27 (8.2)	222 (67.5)	73 (22.2)
I believe that lecturers can overcome the challenges of online education	5 (1.5)	32 (9.7)	233 (79.8)	59 (17.9)
I feel comfortable studying online	33 (10.0)	105 (31.9)	147 (44.7)	44 (13.4)
I have satisfactory technology skills to handle assignments assigned online	4 (1.2)	70 (21.3)	220 (66.9)	35 (10.6)
Segment 2: Students' attitudes towards online education				
With online education, this situation does not interfere with my future	21 (6.4)	78 (23.7)	197 (59.9)	33 (10.0)
I prefer studying in the classroom because it provides much interaction with lecturers and students	17 (5.2)	81 (24.6)	137 (41.6)	94 (28.6)
Compared to face-to-face lectures, online lectures are more useful in helping me master literature and assignments	40 (12.2)	163 (49.5)	108 (32.8)	18 (5.5)
The lecturer responded quickly to all my questions online	6 (1.8)	40 (12.2)	242 (73.6)	41 (12.5)
Segment 3: Real barriers in the online education process				
Previously, I had little experience with online lectures	27 (8.2)	139 (42.2)	154 (46.8)	9 (2.7)
I feel less motivated when studying online	22 (6.7)	95 (28.9)	171 (52.0)	41 (12.5)
There are certain courses that I find difficult to digest if given online	12 (3.6)	41 (12.5)	183 (55.6)	93 (28.3)
Some lecturers avoid online lectures	12 (3.6)	82 (24.9)	217 (66.0)	18 (5.5)
I live far from campus	14 (4.3)	80 (24.3)	155 (47.1)	80 (24.3)
Segment 4: Development needs required for online education				
If the academic calendar shows holidays (red dates), students are willing to change their studies to online	64 (19.5)	105 (31.9)	138 (41.9)	22 (6.7)
I feel that the lecturers are quite competent in giving lectures online	4 (1.2)	42 (12.8)	229 (69.6)	54 (16.4)
Studying during quiet weeks is not an option to replace holidays	29 (8.8)	40 (12.2)	165 (50.2)	95 (28.9)

Table 3 presents the coefficients between readiness, attitude, perceived barriers, and development needs in the context of online education. The results of the analysis did not show a significant relationship between readiness (*OR* = 0.957; 95% *CI* = 0.869–1.055; *p* = 0.399) or attitude (*OR* = 1.059; 95% *CI* = 0.929–1.207;

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p = 0.364) and development needs. However, a significant association between perceived barriers and development needs was observed (*OR* = 1.535; 95% *CI* = 1.052–2.239; *p* = 0.027), suggesting that students experiencing higher levels of barriers are 1.5 times more likely to indicate the need for development to enhance their online learning experience.

Table 3. Variables

	n	%	*OR*	CI 95%	*p*
Preparedness					
Prepared	280	85.1	0.957	0.869-1.055	0.399
Unprepared	49	14.9	1.273	0.757-2.140	
Attitude					
Positive	242	73.6	1.059	0.929 – 1.207	0.364
Negative	87	26.4	0.848	0.577 – 1.247	
Barriers					
Low	80	24.3	1.535	1.052 – 2.239	**0.027**
High	249	75.7	0.864	0.753 – 0.991	
Development					
Need	207	62.9	-	-	-
No need	122	37.1			

Level of significance p<0.05

Semi-structured questions were employed in the qualitative phase to further inform and elaborate upon the results. Thematic analysis of the participants' comments resulted in five key themes, which are presented in Table 4: (1) flexibility and access, (2) lack of collaboration, (3) learning through ICT, (4) continuing professional development, and (5) the opportunities and challenges of digitalization for pharmacy education. These themes provide an in-depth perspective on the experiences of students and educators in transitioning to online pharmacy education.

Table 4. Themes and Sub-Themes

Themes	Quotes	Findings/Recommendations
Flexibility and Accessibility	"I can study easily and adapt to my specific schedule when I have access to study materials whenever I decide and from anywhere…"	Enables students to integrate studies with other commitments
Limited Collaboration	"Online discussion forums have helped us stay connected, but I think a more interactive platform could further improve our collaboration and teamwork..."	The development of online simulations is necessary to build practical skills.
Learning with ICT	"I can focus on material that requires more practice while deepening topics I already understand…"	Algorithms to customize the learning experience based on each student's needs, pace, and learning style
Maintaining Professional Development	"Webinars and online training allow me to continuously improve my knowledge, especially pharmacotherapy, which is very important to provide the best care to patients…"	Keep up with the latest innovations in pharmacotherapy, healthcare regulations, and patient care standards by attending webinars, online courses, or virtual conferences.
Opportunities and Implications	"It seems necessary to monitor to ensure the integrity of online assessments to prevent cheating, so that the quality of the exam can be compromised, thereby affecting the credibility of education as a whole…"	• Inhibits social relationships and the possibility of learning with peers. • The quality and integrity of online assessments and exams require the implementation of strong monitoring methods and academic integrity rules.

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4. DISCUSSION

This study aimed to identify respondents' attitudes regarding online pharmacy professional education and the main factors that influenced its growth. It aimed to explore students' preparedness, perception, perceived barriers, and potential for educational development within the wider context of global health systems. The results emphasize the potential and challenges generated by the digitalization of pharmacy education, especially in the Indonesian context. Readiness (p = 0.399) and attitudes (p = 0.364) were not significantly associated with outcomes, but a significant association was found between barriers and outcomes concerning development (p = 0.027). This indicates that barriers affect the formation of students' developmental demands in online environments. These findings are consistent with previous research, which showed generally positive student attitudes toward distance education while highlighting the need to improve accessibility, infrastructure, and pedagogical support (Altwaijry et al., 2021; Muhaimin et al., 2023).

Flexibility and Accessibility

More than 60% of students believed that the flexibility of e-learning has positively affected their academic performance. The flexibility of online materials, available anytime, enabled students to balance study with work and family commitments. This finding echoes broader patterns in digital education, where flexible scheduling has been shown to enhance time management and learner autonomy (Crawford et al., 2020; Garnier et al., 2023; Gharib et al., 2023). However, although flexibility is beneficial, it is not universally accessible. Some students cannot participate effectively and equally in online education due to various factors, including unstable internet access, limited access to modern digital devices, and low levels of digital literacy. This challenge is particularly evident in low-resource environments, where such disparities may exacerbate inequalities in learning achievement and limit the overall effectiveness of digital education (Nichuhovska et al., 2023). Addressing these inequities requires comprehensive structural reforms, including infrastructure development, digital skills training, and targeted institutional support to ensure equitable access to high-quality online pharmacy education for all students.

Limited Collaboration

Students and lecturers reported interaction and collaboration during online learning; however, it was perceived as more effective when conducted in smaller groups. This finding is consistent with previous studies showing that, in virtual settings, pharmacy students are less likely to have access to cross-disciplinary collaboration, which can limit the development of necessary social and communication skills (Mohammed et al., 2021; Shakhman et al., 2020). Deeper analysis indicates several impediments to successful collaboration, such as the restricted functionality of digital platforms, students' lack of engagement, and insufficient institutional support. Some students experienced delays due to the lack of synchronous communication tools, while others had difficulties participating because of limited prior experience with distance education. This aligns with the quantitative findings showing that more than half of the students (50.4%) reported relatively low experience with online education, potentially limiting their ability to engage effectively in virtual group-based activities. Given these limitations, respondents strongly desired virtual simulations that more realistically reflect clinical environments. Providing students with vivid environments to apply their knowledge could bridge the gap between theoretical instruction and practical experience. This view is consistent with recent literature and other reports recommending the use of digital tools to foster collaboration with diverse actors and advocating for virtual simulation and gaming to enhance the development of interprofessional practice competencies (Dedeilia et al., 2020; Ernawati & Utami, 2020; Seifman et al., 2022).

Learning with ICT

Participants stressed the need for personalized learning and adaptive technologies as key elements for today's online pharmacy education. Algorithms on learning platforms make it possible to tailor content to follow each student's rhythm, interests, and achievements. Previous studies have shown the effectiveness of such personalization; personalized learning strategies may accelerate learning, increase engagement, and improve retention of knowledge (Gligorea et al., 2023; Leoncio et al., 2022). To ensure the achievement of such outcomes, *Information and Communication Technology* (ICT) tools are essential to develop an interactive and responsive

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learning environment, especially for specialized subjects in pharmacy education (Dhawan, 2020; Gao et al., 2022; Laksmi et al., 2022). The preference for algorithmic personalization also aligns with the general trend in higher education toward flexible, learner-centered education models (Cain et al., 2023).

A closer look at the numbers reveals some inequities among students in adjusting to online education. Some students flourished in the digital space, but others did not, particularly concerning collaboration and ICT integration. These challenges corroborate the quantitative results, which indicated that 50.4% of respondents had little experience with online learning. In addition, accessibility barriers and the risks disproportionately faced by students in rural areas further deepened learning inequities, directly confirming the significant positive association between barriers and developmental needs. These findings emphasize the necessity of enhancing digital infrastructure, adopting participation-based and interactive teaching methods, and applying specific support measures to eliminate the digital divide in pharmacy education.

Maintaining Professional Development

The findings of this study also highlight the importance of educators elevating the standards for online pharmacy education by adapting to new teaching methods and being proactive learners. Teachers need to explore creative teaching methods to make learning in the virtual setting more efficient and inspiring, and work to develop their digital competencies further. Existing studies have demonstrated that problem-based learning and interactive cases can promote student engagement and help to make online education more dynamic and effective (Sistermans, 2020).

Institutional assistance is key in facilitating this change. Universities should establish structured faculty development programs—including training courses, workshops, and mentoring schemes—to improve instructors' digital teaching competencies. Such programs should focus on interactive course design, technology-facilitated assessment methodologies, and strategies to maintain learner engagement in an online environment. Participants also cited that the online platform allowed them to further their professional development by offering webinars, virtual conferences, and courses in new areas of practice, including pharmacotherapy, regulatory updates, and best practices with patients (Busch et al., 2024; Cain et al., 2023). This result is consistent with previous findings on the importance of digital learning in enabling pharmacy students and practitioners to compete in an increasingly dynamic healthcare environment (Pires, 2022; Pires, 2023). With investment in faculty development and institutional support, universities can succeed in delivering more efficient, improved online learning to train future pharmacists to excel in a digitally driven, patient-centered healthcare environment.

Opportunities, Challenges, and Implications

They realized that online pharmacy education offered multiple advantages, but several key points of concern were expressed among participants as well. The reduced socialization and peer interaction in the virtual environment were identified as a major issue. Given the importance of collaboration between professionals to achieve the best patient results in healthcare education, the absence of face-to-face contact may hinder the development of interpersonal and teamwork skills (Tur et al., 2024). In addition, the trustworthiness and the value of the online tools used to collect data emerged as another concern. Several students disagreed that online tests and exams truly reflect their capabilities and knowledge. This concern is consistent with previous studies that identified widespread problems related to maintaining academic integrity during online assessments, including instances of cheating and a lack of common proctoring tools (Busch et al., 2024; Lee & Fanguy, 2022; Onesi-Ozigagun et al., 2024; Sabrina et al., 2022).

To maintain high academic and professional standards in online pharmacy education, three key areas should be given priority by universities: (1) educators' need to foster interactive behavior through the application and mastery of social and facilitation skills; (2) the need to ensure assessment integrity by committing to implementing adequate solutions; and (3) providing students with practical elements during their training, such as simulations and hybrid clinical placements, to ensure the achievement of hands-on competencies. In response to these key issues, the educational approaches described in this paper provide opportunities to enhance the quality of digital education in alignment with real-world practice expectations and the Real World Relations (RWR) gateways, consistent with the IWF framework and the contemporary ethical practice standards expected of pharmacy graduates.

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Limitations of the Study

There are several limitations to this study. First, the sample was limited to pharmacy students, potentially limiting the generalisability of the findings to students in other healthcare disciplines. Second, the data were collected amid a transition after COVID-19 necessitated the move to online learning, which might have affected participants' perceptions and introduced biases unique to this context. Moreover, using self-reported data can introduce the possibility of response bias, as participants may provide answers based on what they feel is socially acceptable or desirable. Given these findings, longitudinal studies are suggested to explore the long-term effects of online and hybrid education on theoretical knowledge, practical skills, and clinical preparedness in MD and other healthcare programs.

5. CONCLUSION

This study highlights the need for students and faculty to adapt to the evolving demands of online pharmacy education by embracing digital innovation and evidence-based practices to enhance healthcare outcomes. While readiness and attitudes showed no significant association with development, perceived barriers—particularly limited prior experience with online learning and collaboration—played a critical role. Academic integrity concerns in virtual assessments further emphasize the need for structured evaluation mechanisms and enhanced oversight. These findings underscore the importance of integrating technological infrastructure with pedagogical improvements to ensure quality learning experiences. Despite offering key insights, this study is limited by its short-term design and regional focus. Future longitudinal and cross-disciplinary research is needed to assess the long-term impact of online and hybrid learning on professional preparedness. To address existing challenges, institutions should adopt hybrid learning models, expand the use of clinical simulations, and invest in faculty development programs. These strategies will help ensure that pharmacy education remains effective, equitable, and aligned with the expectations of a digitally driven healthcare system.

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7. REFERENCES

Aljaber, N., Alsaidan, J., Shebl, N., & Almanasef, M. (2023). Flipped classrooms in pharmacy education: A systematic review. Saudi Pharmaceutical Journal, 31(12), 101873. https://doi.org/10.1016/j.jsps.2023.101873

Alowais, M., Rudd, G., Besa, V., Nazar, H., Shah, T., & Tolley, C. (2024). Digital literacy in undergraduate pharmacy education: a scoping review. Journal of the American Medical Informatics Association, 31(3), 732–745. https://doi.org/https://doi.org/10.1093/jamia/ocad223

Altwaijry, N., Ibrahim, A., Binsuwaidan, R., Alnajjar, L. I., Alsfouk, B. A., & Almutairi, R. (2021). Distance education during the COVID-19 pandemic: A college of pharmacy experience. Risk Management and Healthcare Policy, May 21, 2099–2110. https://doi.org/10.2147/RMHP.S308998

Ashraf, M. A., Yang, M., Zhang, Y., Denden, M., Tlili, A., Liu, J., Huang, R., & Burgos, D. (2021). A systematic review of systematic reviews on blended learning: Trends, gaps and future directions. Psychology Research and Behavior Management ISSN: 1525–1541. https://doi.org/10.2147/PRBM.S331741

Busch, F., Hoffmann, L., Shpati, K., Truhn, D., Palaian, S., Makowski, M. R., & Adams, L. C. (2024). International pharmacy students' perceptions towards artificial intelligence in medicine - A multinational, multicentre cross-sectional study. British Pharmaceutical Society, 90(3), 649–661. https://doi.org/10.1111/bcp.15911

Cain, J., Malcom, D. R., & Aungst, T. D. (2023). The role of artificial intelligence in the future of pharmacy education. American Journal of Pharmaceutical Education, 87(10), 100135. https://doi.org/10.1016/j.ajpe.2023.100135

Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Magni, P. A., & Lam, S. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. Journal of Applied Learning & Teaching, 3(1), 9–28. https://doi.org/https://doi.org/10.37074/jalt.2020.3.1.7

Creswell, J. W. (2018). Qualitative inquiry & research design: Choosing among five approaches. In SAGE Publications, Inc. (3rd Ed.). Sage Publications, Inc. https://doi.org/10.1017/CBO9781107415324.004

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i1.98016

Dedeilia, A., Sotiropoulos, M. G., Hanrahan, J. G., Janga, D., Dedeilias, P., & Sideris, M. (2020). A systematic review of medical and surgical education challenges and innovations in the COVID-19 era. In Vivo, 34(3 suppl), 1603–1611. https://doi.org/10.21873/invivo.11950

Dhawan, S. (2020). Online learning: A panacea in the time of the COVID-19 crisis. Journal of Educational Technology Systems, 49(1), 5–22. https://doi.org/10.1177/0047239520934018

Ernawati, D. K., & Utami, D. K. I. (2020). The impact of interprofessional education on health students' collaborative competencies. International Journal of Evaluation and Research in Education, 9(3), 660–664. https://doi.org/10.11591/ijere.v9i3.20489

Gao, M., Cui, Y., Chen, H., Zeng, H., Zhu, Z., & Zu, X. (2022). The efficacy and acceptance of online learning vs offline learning in medical student education: A systematic review and meta-analysis. Journal of Xiangya Medicine, June 30(7). https://doi.org/10.21037/jxym-22-3

Garnier, A., Vanherp, R., Bonnabry, P., & Bouchoud, L. (2023). Use of simulation for education in hospital pharmaceutical technologies: A systematic review. European Journal of Hospital Pharmacy, 30(2), 70–76. https://doi.org/10.1136/ejhpharm-2021-003034

Gharib, A. M., Bindoff, I. K., Peterson, G. M., & Salahudeen, M. S. (2023). Computer-based simulators in pharmacy practice education: A Systematic narrative review. Pharmacy, 11(1), 8. https://doi.org/10.3390/pharmacy11010008

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H., & Tudorache, P. (2023). Adaptive learning using artificial intelligence in e-learning: A literature review. Education Sciences, 13(12), 1216. https://doi.org/10.3390/educsci13121216

Hirose, M., & Creswell, J. W. (2023). Applying core quality criteria of mixed methods research to an empirical study. Journal of Mixed Methods Research, 17(1), 12–28. https://doi.org/10.1177/15586898221086346

Husamah, H., Suwono, H., Nur, H., Dharmawan, A., & Chang, C.-Y. (2023). The existence of environmental education in the COVID-19 pandemic: A systematic literature review. Journal of Mathematics, Science and Technology Education, 19(11), em2347. https://doi.org/10.29333/ejmste/13668

Khafizova, A. A., Galimov, A. M., Kharisova, S. R., Grebenshchikova, L. Y., Yagudina, R. I., & Smirnova, L. M. (2023). The impact of healthcare digitalization on the medical education curricula and programs : Points of convergence and divergence. Contemporary Educational Technology, 15(4), ep479. https://doi.org/10.30935/cedtech/13768

Khamis, S., Abdi, A. M., & Basgut, B. (2020). Preparing lifelong learners for delivering pharmaceutical care in an ever-changing world : a study of pharmacy students. BMC Medical Education, December(20), 1–13. https://doi.org/10.1186/s12909-020-02394-w

Laksmi, I. C., Hatta, P., & Wihidayat, E. S. (2022). A systematic review of IoT platforms in educational processes. Proceedings of the International Conference on Industrial Engineering and Operations Management, 5265–5274.

Langelaan, B. N., Gaikhorst, L., Smets, W., & Oostdam, R. J. (2024). Differentiating instruction: Understanding the key elements for successful teacher preparation and development. Teaching and Teacher Education, 140(November 2023), 104464. https://doi.org/10.1016/j.tate.2023.104464

Lee, K., & Fanguy, M. (2022). Online exam proctoring technologies: Educational innovation or deterioration? British Journal of Educational Technology, 53(3), 475–490. https://doi.org/10.1111/bjet.13182

Lee, K., Fanguy, M., Bligh, B., & Lu, X. S. (2022). Adoption of online teaching during the COVID-19 Pandemic: A systematic analysis of changes in university teaching activity. Educational Review ISSN:, 74(3), 460--83. https://doi.org/10.1080/00131911.2021.1978401

Leoncio, J., Muñoz, R., Ojeda, F. M., Lizbeth, D., Jurado, A., Fritz, P., Peña, P., Paolo, C., Carranza, M., Berríos, H. Q., Molina, S. U., Farfan, A. R. M., Arias-Gonzáles, J. L., & Vasquez-Pauca, M. J. (2022). Systematic review of adaptive learning technology for learning in higher education. Eurasian Journal of Educational Research, 98, 221–233. https://doi.org/10.14689/ejer.2022.98.014

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i1.98016

Mohammed, C. A., Anand, R., & Ummer, V. S. (2021). Interprofessional education (IPE): A framework for introducing teamwork and collaboration in health professions curriculum. Medical Journal Armed Forces India, 77, S16–S21. https://doi.org/10.1016/j.mjafi.2021.01.012

Muhaimin, M., Habibi, A., Riady, Y., Alqahtani, T. M., Chaerunisaa, A. Y., Wijaya, T. T., Milanda, T., Yusop, F. D., & Albelbisi, N. A. (2023). Covid-19 distance and online learning: A systematic literature review in pharmacy education. BMC Medical Education, 23(1), 367. https://doi.org/10.1186/s12909-023-04346-6

Nichuhovska, L., Nikolenko, L., Bondarenko, Z., Motorina, V., & Prykhodko, T. (2023). Challenges and prospects of online education in the context of barrier-free access. Multidisciplinary Reviews, 6(2023). https://doi.org/10.31893/multirev.2023spe020

Oliveira, R. De, Silva, S., Carlos, D., Anacleto, S., Pedro, D. A., & Menezes, S. (2022). Digital pharmacists: The new wave in pharmacy practice and education. International Journal of Clinical Pharmacy, 44(3), 775–780. https://doi.org/10.1007/s11096-021-01365-5

Onesi-ozigagun, O., Ololade, Y. J., Eyo-udo, N. L., & Ogundipe, D. O. (2024). Revolutioning education through AI: A Comprehensive review of enhancing learning experiences. International Journal of Applied Research in Social Sciences, 6(4), 589–607. https://doi.org/10.51594/ijarss.v6i4.1011

Pires, C. (2022). Perceptions of Pharmacy Students on the E-Learning Strategies adopted during the COVID-19 pandemic: A systematic review. Pharmacy, 10(1), 31. https://doi.org/https://doi.org/10.3390/pharmacy10010031

Pires, C. (2023). A SWOT analysis of pharmacy students' perspectives on e-learning based on a narrative review. Pharmacy, 11(3), 89. https://doi.org/10.3390/pharmacy11030089

Sabrina, F., Azad, S., Sohail, S., & Thakur, S. (2022). Ensuring academic integrity in online assessments: A literature review and recommendations. International Journal of Information and Education Technology, 12(1), 60–70. https://doi.org/10.18178/ijiet.2022.12.1.1587

Seifman, M. A., Fuzzard, S. K., To, H., & Nestel, D. (2022). COVID-19 impact on junior doctor education and training: A scoping review. Postgradruate Medical Journal, 98, 466–476. https://doi.org/10.1136/postgradmedj-2020-139575

Shakhman, L. M., Omari, O. Al, Arulappan, J., & Wynaden, D. (2020). Interprofessional education and collaboration: Strategies for implementation. Oman Medical Journal, 35(3), e160. https://doi.org/10.5001/omj.2020.83

Sistermans, I. J. (2020). Integrating competency-based education with a case-based or problem-based learning approach in online health sciences. Asia Pacific Education Review, 21(4), 683–696. https://doi.org/10.1007/s12564-020-09658-6

Tur, G., Castañeda, L., Torres-kompen, R., & Carpenter, J. P. (2024). A literature review on self-regulated learning and personal learning environments: Features of a close relationship. Interactive Learning Environments, 32(4), 1402–1421. https://doi.org/10.1080/10494820.2022.2121726

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i1.98016