Review

Barriers And Facilitators Of Using MyDispenseTM From The Student Perspective : A Systematic Review

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Review

Barriers and Facilitators of Using MyDispense™ from the Student Perspective : A Systematic Review

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Abstract: MyDispense™ is a high-fidelity, low-stakes community pharmacy simulation, allowing students to practice dispensing skills. A systematic review was conducted to identify students' perceptions regarding barriers and facilitators of MyDispense™ in pharmacy education. PubMed, CINAHL, and EMBASE databases were searched from 2015-2025 in January 2025 using combined keywords, proximity searching and Boolean operators. Studies investigating MyDispense ™ and gathering students' perceptions were included. Record screening was conducted by two independent reviewers (OC and LS). Any identified records from database searching and hand searching of included study reference lists were imported to Rayyan and subjected to independent review. Conflicts were resolved through a third party (RMcC), and discussions were held until consensus was reached. Fifteen studies were included in this review. Seven studies were conducted in USA, six in Asia, one in UK, and one in Australia. All studies utilized purposive sampling. Sample sizes ranged from 33 to 322 students. All studies were surveyed to gather student perceptions. Other data collection methods included semi-structured interviews and focus group discussions for students to further elaborate on survey responses. Identified facilitators were mapped to four overarching themes; "Develops competency", "User-Friendliness", "Engaging Learning Experience" and "Safe Learning Environment." Key barriers were encompassed to three themes; "Learning Curve" , "IT issues" and "Limited Realism and Applications". This review identified the barriers and facilitators to MyDispense™ use in students. MyDispense™ provides a novel approach by which pharmacy students can develop competency in a safe, engaging and realistic learning environment. However, significant barriers to its use includes the learning curve of the platform, technical issues, and the limited realism and applications of the platform.

Keywords: MyDispense; computer-based simulation; pharmacy education; pharmacy students

1. Introduction

Pharmacy students need to complete a curriculum aligned with accreditation standards to ensure they demonstrate the competencies required as a pharmacist[1,2]. Pharmacy practice can be simulated through a wide range of pedagogical methods e.g.) workshops, experiential learning opportunities and using standardised patients in observed structured clinical examinations (OSCEs). Logistical challenges associated with incorporating actors as patients to simulate clinical practice, however, may limit their applications and novel approaches are required to meet pharmacy curricular outcomes[3].

Pharmacy education has evolved with technological advancements. The COVID-19 pandemic drove a shift for educators to implement virtual pedagogical methods into pharmacy curricula e.g.) computer-based simulations (CBS), which enhance digital literacy and provide engaging learning experiences[4–7]. CBS can be defined as an interactive computer simulation model of patient-clinician interactions, that allow learners to emulate healthcare professional roles to obtain a full patient history, conduct physical health check-ups and to make appropriate diagnostic and therapeutic

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decisions[8]. Active learning methods e.g.) CBS can be more effective at improving student performance in formal assessments relative to passive learning methods[9]. Alternative learning methods are particularly important for Generation Z (those born between 1997 and 2012[10]) who are currently the primary demographic cohort of students within third-level education. This digitally literate generation tends to benefit from blended learning approaches[11].

MyDispense™ is a high-fidelity, low-stakes, web-based, community pharmacy simulation developed by the Faculty of Pharmacy and Pharmaceutical Sciences at Monash University in Queensland, Australia[12]. MyDispense™ has a global reach, being implemented in over 200 institutions across 30 countries worldwide[12]. MyDispense™ allows students to develop their dispensing and counselling skills without the risk of patient harm in a virtual pharmacy sandbox environment[13,14]. MyDispense™ can also be used in senior years of pharmacy programs as a supplementary learning resource to prepare students for OSCEs and pre-registration assessments[6].

Virtual patients act as a novel nexus between clinical theory and practical applications for students, acting as an accessible alternative to standardised patient actors and experiential learning opportunities, whereby recruitment and scarce placements can pose logistical challenges[15]. MyDispense™ supports active self-learning by providing instant feedback and repeat exercises, reinforcing critical thinking, clinical reasoning and problem solving skills[16]. These skills align with Kolb's learning model and Miller's learning framework, meeting pharmacy program outcomes[16]. Despite these advantages, the use of virtual patients in pharmacy education appears to be relatively low, possibly due to implementation barriers[17].

A gap in the literature is present exploring the student perspective on barriers and facilitators of MyDispense™ in pharmacy education. Therefore, to guide future research and implementation strategies for educators the aim of this systematic review is to synthesize relevant literature to identify students' views regarding the barriers and facilitators of MyDispense™ in pharmacy education.

2. Materials and Methods

2.1. Search Strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used to conduct this systematic review (Appendix A) [18]. The PICO (P: Population; I: Intervention; C: Comparisons; O: Outcomes;) framework was applied to further define our research question and identify relevant search terms (Table 1).

Table 1. PICO definitions.

PICO	Definitions
Population (P)	Pharmacy Students
Intervention (I)	Any study that collects pharmacy students' opinion, perception, satisfaction or attitudes on using MyDispense™ in a recognized pharmacy course
Comparison (C)	Both types of study i.e. with/without a comparison group
Outcomes (O)	Pharmacy students' perceptions on the barriers and facilitators to using MyDispense™

A systematic search of PubMed, CINAHL and EMBASE from 2015-2025 was performed in January 2025 using combined keywords, indexing terms and proximity searching. Boolean operators (AND, OR) were used to refine the search, as were Medical Subject Headings (MeSH) terms in PubMed and CINAHL plus Emtree terms in Embase. Common search terms used across all three databases in this systematic review were "MyDispense", "computer simulation", "patient simulation", "pharmacy students", "perceptions", "facilitators", "enablers", "barriers", and "pharmacy education". Examples of the search strategy used across all the databases can be found in Appendix B. Manual hand-searching of included studies reference lists, identified from database searching was performed to seek out any further additional relevant studies to be included for review.

 doi:10.20944/preprints202506.0681.v1

2.2. Eligibility Criteria

Articles were included if they were:

1. primary research sources
2. published between January 2015 and January 2025
3. qualitative, quantitative and/or mixed methods articles examining pharmacy students' perceptions of MyDispense™
4. published in English.

Articles were excluded if they were:

1. reviews, conference abstracts, meta-analyses, commentary studies, grey literature
2. not published in English
3. not investigating the use of MyDispense™
4. did not include a pharmacy student population.

2.3. Study Selection

References from all three databases were imported into Rayyan [19]. Any duplicate articles were removed. Title/abstract screening was conducted by two independent reviewers (OC & LS) against the pre-determined inclusion and exclusion criteria. Thereafter, full text articles were retrieved for screening by two independent reviewers (OC & LS) for inclusion. Any identified articles from reference list searching were imported to Rayyan and subject to full-text screening by the reviewers (OC & LS) for inclusion. Any conflicts that arose were resolved through a third party (RMcC) with discussions being held until consensus was reached.

2.4. Data Extraction and Synthesis:

Thematic analysis by the specific approach outlined by Braun and Clarke was performed to identify barrier and facilitator themes to provide further insight on student perceptions[20]. Full texts were imported into NVivo 15.1.1 to facilitate thematic analysis. Data extraction was conducted by OC on all included studies. This was cross-checked, on a specified sample of 20%, by LS for accuracy. Qualitative and quantitative results (with a degree of qualitative insight) from included articles were coded to identify possible barrier/facilitator themes. All study characteristics (author(s), year of publication; jurisdiction; study design; outcomes; participants; data collection methods; facilitators; barriers) were collected and presented in Table 2 for summary and comparison purposes.

Table 2. Characteristics of included studies (listed chronologically, according to most recent year of publication).

Author (Year) ; Country	Description of study design	Study Participants	Study Outcomes	Method(s) of data collection	Identified Barrier(s)	Identified Facilitator(s)
Waghel *et al.* (2025) USA	Mixed-methods, Cross-sectional	Y1 PharmD students enrolled in a pharmacy skills lab course (n = 71)	To evaluate the correlation between pharmacy experience and performance on MyDispense™ E&O activities To evaluate students perceptions of MyDispense™ E&O activities	Questionnaire investigating prior pharmacy experience and MyDispense™ perceptions	Initial learning curve to use software IT incompatibilities	Provides high fidelity learning interactive environment Provides immediate feedback Easy to navigate
Phanudulkitti *et al.* (2024) Thailand	Mixed-methods, Longitudinal	Y4 Pharmacy students enrolled in a Pharmacotherapeutic I course (n = 136)	To evaluate MyDispense™ impact on pharmacy students' learning outcomes To evaluate students' perceptions and instructors' views of MyDispense™	Five-part questionnaire Part three comprised of five closed-ended questions regarding MyDispense™ and one item for additional student feedback	Learning how to use software initially	Can practice dispensing skills at any time or place Provides feedback instantly at end of exercises
Al-Diery *et al.* (2024) Qatar	Quantitative, Longitudinal	Y1 pharmacy students enrolled in a Professional Skills II course (n = 55)	To evaluate impact of MyDispense™ on students' self-reported reaction, learning and accuracy in dispensing tasks	Pre-post intervention seven-point Likert scale questionnaire based on Kirkpatrick's Model	Does not simulate true patient-practitioner interactions	Offers immediate feedback Allows for practice in a safe virtual dispensing environment

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Nguyen *et al.* (2023) Vietnam	Mixed methods, Longitudinal	Y4 and Y5 pharmacy students enrolled at UMP Vietnam (n = 69) Pharmacists with at least one year clinical practice experience (n = 23)	To investigate learners' perspective on effectiveness of MyDispense™ in learning dispensing skills To investigate the suitability of MyDispense™ integration into Vietnamese pharmacy curricula	Online five-point Likert scale questionnaire Semi-structured interviews	Complicated learning process Inconsistent quality of product images	High degree of user interactivity Ability to self-learn by immediate feedback Diverse medication database
Rude *et al.* (2023) USA	Quantitative, Longitudinal	Y1 PharmD students enrolled at NDSU and VCU (n = 142)	To assess the impact of MyDispense™ on students' knowledge and confidence of OTC medications To assess overall student perceptions of MyDispense™ activities	Pre-post questionnaire with closed-ended demographic, confidence and knowledge-based questions A five-point modified perception scale was added to post-questionnaire.	May not be as effective as traditional learning methods	Effective way to learn new information Encourages active thinking
Tabulov *et al.* (2023) USA	Quantitative, Longitudinal	Y1 PharmD students enrolled in a pharmaceutical skills 1 course (n = 64)	To describe a paediatric simulation on MyDispense™ completed by first year students To review student perceptions on confidence and knowledge after using MyDispense™	Pre-post online questionnaire with yes/no items and five-point Likert scale	Initial learning curve	Low-stakes environment that allows students to make mistakes without harm More realistic than paper-based case learning
Slater *et al.* (2023) United Kingdom	Mixed methods, Cross-sectional	Y2 MPharm students enrolled in a pharmacy law and ethics module (n = 147)	To evaluate MyDispense™ impact on assessment performance To evaluate student perceptions of MyDispense™	24 item questionnaire consisting of closed and open-ended questions and five point Likert-scale	User interface could be improved Difficulties navigating software initially	Highly accessible and can practice dispensing skills from home Provides opportunity to repeat exercises
Faller *et al.* (2022) Philippines	Mixed methods, Cross-sectional	Y2 and Y3 pharmacy students across four universities (n = 322)	To determine learners perceptions of MyDispense™	Three-part questionnaire including demographics, a five-point Likert scale and open-ended questions on student perceptions	Technical and internet connectivity issues	High-fidelity learning environment without patient harm
Amirthalingam *et al.* (2022) Saudi Arabia	Mixed-methods, Cross-sectional	Y4 pharmacy students enrolled in an Introductory Pharmacy Practice Experience 2 course (n = 69)	To compare pharmacy students' performance on MyDispense™ vs. in-person OSCEs To explore students' perceptions of MyDispense™	Post-simulation questionnaire with five-point Likert scale and open-ended questions	Can be complicated to use Interactions are robotic in nature	Helps improve patient communication skills Enhances student confidence in patient care
Deneff *et al.* (2021) USA	Qualitative, Cross-sectional	Y3 PharmD students enrolled in a pharmacy law and ethics course in 2017 (n = 38) and 2018 (n = 28)	To evaluate the utility of MyDispense™ for pharmacy law instruction To evaluate students' perceptions of MyDispense™ for pharmacy law instruction	Questionnaire with close-ended questions graded on a four and five-point Likert Scale in 2017 and 2018, respectively, and open-ended questions	Initial learning curve Some pharmacy law exercises may not be suitable for MyDispense™	More engaging than traditional classroom teaching
Ambroziak *et al.* (2018) USA	Quantitative, Longitudinal	Y1 PharmD students enrolled in a Pharmacy Practice Skills 1 course (n = 85)	To implement MyDispense™ cases into a first year PharmD course To assess student perceptions of their learning using MyDispense™	Pre-simulation questionnaire investigating prior pharmacy experience Post-simulation questionnaire investigating perceptions of MyDispense™ using open and closed-ended questions	Learning how to navigate program	Effective tool to learn dispensing skills e.g.) analysing prescriptions
Ferrone et al. (2017) USA	Mixed-methods, Cross-sectional	Y1 and Y3 PharmD students enrolled in UCSF, UConn, STLCOP (n =241)	To implement MyDispense™ simulation into US pharmacy curricula To assess students' satisfaction of MyDispense™	Questionnaire with five-point Likert scale, demographics on pharmacy experience and open-ended questions on MyDispense™ perceptions	Can be difficult to learn at first May need to be adapted for different regions to be more culturally appropriate	Straightforward to learn Affords opportunity to make mistakes More realistic than paper based cases
Shin *et al.* (2016) USA	Quantitative, Longitudinal	Y2 PharmD students enrolled in a Therapeutics II course (n = 117)	To demonstrate feasibility of integrating MyDispense™ into a therapeutics course To measure students' perceptions on MyDispense™ and its impact on learning	Three post-intervention questionnaires consisting of 10 to 17 items	Limited capacity to simulate interactions with prescribers and patients	Provides immediate feedback Can practice cases at any time / place Safe, low stakes practice environment
McDowell *et al.* (2016) Australia	Mixed methods, Cross-sectional	Y1 BPharm students enrolled in PAC1311 and PAC1322 modules at Monash University (n = 199)	To develop MyDispense™ for students to learn dispensing skills in a low-stakes environment To explore students' perceptions of MyDispense™	38 item questionnaire with five point Likert-scale questions and open ended questions	User interface is not responsive Technical and server connectivity issues	Allows for "safe" dispensing without patient harm Stimulating learning environment
Dameh (2015) UAE	Mixed-methods, Cross-sectional	Y2 female pharmacy students enrolled at FCHS (n = 33)	To report pharmacy students' experience after using MyDispense™	Questionnaire consisting of five point Likert-scale and open ended questions on student perceptions Focus group discussion to allow students to elaborate perceptions	Technical issues cause student frustration	Highly accessible for students Gives dispensing practice prior to working in real-life scenarios

P PharmD :Doctor of Pharmacy; MPharm :Masters of Pharmacy; Y1 :Year 1; Y2 :Year 2; Y3 :Year 3; Y4 :Year 4; E&O : Errors and omissions; OSCE :Objective Structured Clinical Examination; UMP :University of Medicine & Pharmacy Ho Chi Minh City; NNDSU : North Dakota State University; VCU : Virginia Commonwealth University; UCSF :University of California, San Francisco; UConn :University of Connecticut; STLCOP :St. Louis College of Pharmacy; FCHS : Fatima College of Health Sciences; PAC1311; Pharmacy, Health and Society I; PAC1322 : Pharmacy, Health and Society II.

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3. Results

3.1. Articles Eligible for Inclusion

Initial database searches yielded 153 records, following duplication removal. 18 studies met eligibility criteria and were included for full-text screening. Following independent review, seven of the 18 full texts were excluded. 17 papers were identified from manual hand-searching of included full-text citation lists and four papers were included in the review. A diagram outlining the flow of studies within this review can be seen in Figure 1.

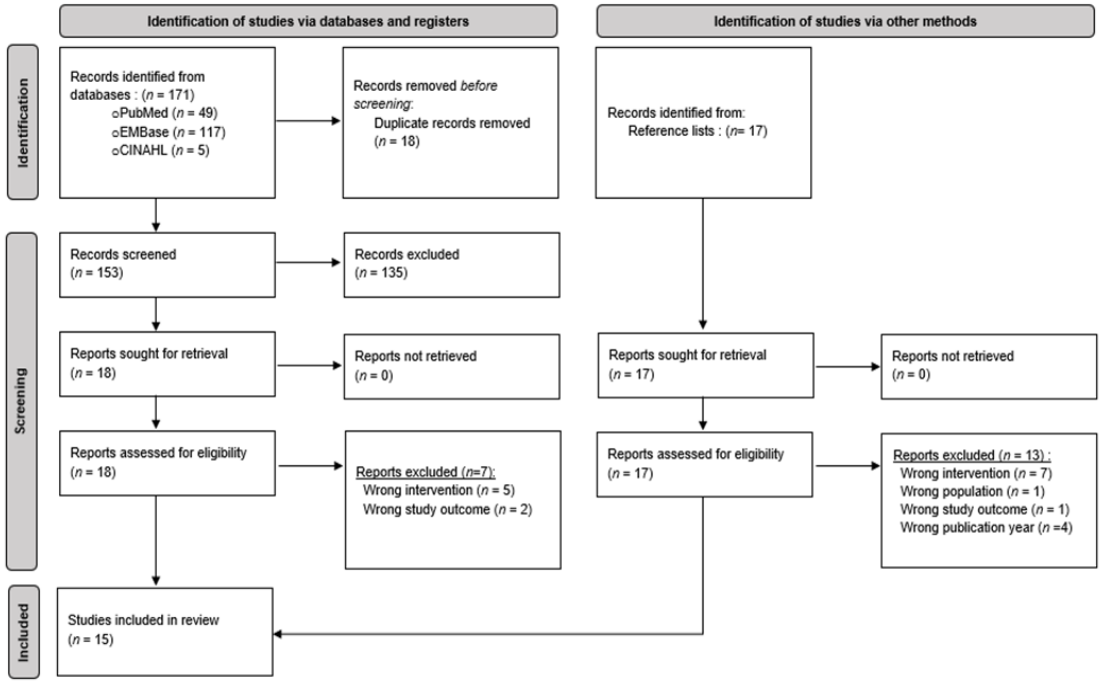

Figure 1. PRISMA flow chart.

3.2. Characteristics of Included Studies

Fifteen studies were included in this review. Seven of the fifteen studies were conducted in USA[21–27], six in Asia[28–33], one in UK[34], and one in Australia[16]. All studies used purposive sampling. Sample sizes ranged from 33[33] to 322[31] students. The average number of participants across all studies was 121 students. Nine papers employed a mixed-methods approach[16,21,26,28,30–34], five papers used a quantitative methodology[22,23,25,27,29] and one paper was qualitative in nature[24]. All studies were questionnaire–based using closed-ended, open-ended and Likert-scale questions to gather student perceptions. Other data collection methods included semi-structured interviews[29] and focus group discussions[33]. Seven studies were longitudinal[22,23,25,27–30] and eight studies were cross-sectional in nature[16,21,24,26,31–34]. All studies included pharmacy students. One study included pharmacy instructors[28] and another included pharmacists with one year experience[30] in the study population. An overview of study characteristics can be found in Table 2.

3.3. Summary of Identified Facilitators

Facilitators identified include improved dispensing and counselling skills and a deeper understanding of pharmacy legislation. MyDispense™ is an accessible, interactive and engaging learning environment for students. Instant feedback at the end of exercises promotes active learning. Students appreciated the risk free environment of MyDispense™. The outlined facilitators identified

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in this review were mapped to the four themes; 1) *Develops Competency* 2) *Accessibility* 3) *Engaging Learning Experience* 4*) Safe Learning Environment*. These themes are presented alongside supporting quotations in Table 3.

Table 3. Supporting student quotations for facilitator themes to using MyDispense™.

Facilitator theme(s)	Description of facilitator theme(s)	Supporting Quotations
Develops Competency	Enhanced patient communication skills Increased confidence in dispensing process Diverse medication database allows students to familiarise themselves with brand names	*"I think this is a neat and useful tool for pharmacy students to learn before their community pharmacy rotation, especially for those who have never had experience in a community pharmacy before"*[26] *"Gave those w/o experience a simulation of experience"*[21] *"It helps me get used to some brand names, because its less common when I'm studying"*[30]
Accessibility	Ability for students use software at any suitable time and/or place Can be used on several devices e.g.) tablets, phones, laptops	*"I liked that MyDispense™ can be used in my phone so I can do it anywhere when I have time"*[30] *"I think this program is great. I can practice dispensing skills during my free time"*[28]
Engaging Learning Experience	Realistic learning environment Lively, virtual patients Prompt feedback supports active learning More engaging than paper-based cases	*"One function that I find very cool is the feedback, which helps me have the ability to self-study and self-check whether the prescription I give to the patient is incorrect or not"*[30] *"I could observe patient appearance including their ages, gender and other special features such as pregnant women, so it helps me visualise better"*[30]
Safe Learning Environment	Low-stakes learning environment without patient risk Ability to repeat exercises reinforces student learning	*"MyDispense is good because it gives us the experience and practice of realistic dispensing without having to place any risk on real patients in our community."*[16] *"We can practice as many [times] as we want, as many times as we wish"*[31]

3.3.1. Facilitator Theme I: Develops Competency

Students recognised MyDispense™ enabled them to practice skills needed to correctly and safely dispense medications e.g.) appropriate labelling[21,22], verifying patient identities[21–30], identifying prescription errors and omissions[21,25,26] and referencing appropriate information sources[24,30,31]. MyDispense™ helps students systematically organise their thoughts when dispensing, which fosters best practice habits[32]. Most students (97.1%) agreed/strongly agreed MyDispense™ helped them better understand steps required to dispense prescriptions safely[16].

MyDispense™ develops patient communication skills[22,23,28,30,31,34]. A majority (71.1%) of first year students reported increased OTC knowledge and counselling skills upon completing MyDispense™ exercises[34]. Positive perceptions were also observed in senior years of pharmacy programs as 70.1% of fourth and fifth year students felt it was effective for counselling skills development [30].

Four articles implemented MyDispense™ to support pharmacy law skill development[21,24,26,34]. The vast majority (86.9%) of students across two years of a PharmD program agreed MyDispense™ helped active recall of pharmacy laws from didactic lectures and most (73.2%) felt this application of MyDispense™ enabled them to enhance their understanding of pharmacy law[24]. MyDispense™ allows students to become familiar with brand-names of medicines encountered frequently in practice within their jurisdiction [23,30,34], which may provide a smoother transition to practice.

 doi:10.20944/preprints202506.0681.v1

3.3.2. Facilitator Theme II: Accessibility

MyDispense™ is widely accessible, allowing students to practice exercises in their own time and from any location [22,29,31,33]. Three papers highlighted its remote accessibility and use during COVID-19[28,31,34]. One third of students in one study felt able to practice dispensing at any place or time was one of its most useful features [27]. MyDispense™ can be accessed from mobile devices which further facilitates its remote use in students [30,31].

3.3.3. Facilitator Theme III: Engaging Learning Experience

Pharmacy students expressed appreciation for the realism of the simulation experience[32]. MyDispense™ offers a high-fidelity, virtual pharmacy learning environment to support students, particularly for those with no prior pharmacy experience[24–26,28,30,31]. Nearly three in four PharmD students across three US institutions agreed/strongly agreed MyDispense™ was more realistic than paper-based cases[26]. Additionally, 84.4% of students in one study reported MyDispense™ was a stimulating learning environment[16].

Students can actively learn from the instant feedback feature of MyDispense™ [16,21,27,28,30,33]. This increases student confidence as they can use such feedback to change their approach in subsequent exercises[16]. Most (83.4%) students expressed agreement that prompt feedback was helpful for improving their understanding[16]. Likewise, 83.6% of students in another survey reported prompt feedback provided by MyDispense™ as one of its most useful features[29].

3.3.4. Facilitator Theme IV: Safe Learning Environment

Seven papers reported students felt that MyDispense™ provided a controlled learning environment whereby they can make mistakes[16,23,26–28,30,31]. Two studies reported that providing a safe environment to practice was one of the commonly cited facilitators by students, particularly for novice students prone to mistake[27,29]. Students also reported appreciation for the ability to repeat exercises, which can facilitate active learning from mistakes and reinforce learning from exercises[16,30,31,34]

3.4. Summary of Identified Barriers

Barriers identified include the initial difficulties of navigating MyDispense™ and some students felt the user interface (UI) could be improved to provide a more interactive experience. Technical issues also caused student frustration. MyDispense™ only replicates community pharmacy practice and students felt patient-prescriber interactions were not authentic because oral communication is not a platform feature. The outlined barriers highlighted in the review were aligned to three themes; 1) *Learning Curve* 2) *IT issues* 3*) Limited Realism and Applications*. These themes are presented alongside supporting quotations in Table 4.

Table 4. Supporting student quotations for barrier themes to using MyDispense™.

Barrier theme(s)	Description of barrier theme(s)	Supporting Quotation
Learning curve	Complicated to learn initially User Interface (UI) can be complicated and difficult to navigate	*"I need more time to learn and explore with the program system and functions"* [28] *"A tutorial version of these cases where you learn as you go instead of after you finish the entire case may be helpful"*[24] *"Improvement of the design of the user interface of MyDispense for easier navigation and better appearance of the application for the user"*[31]
IT issues	Software "bugs" and compatibility issues using certain web browsers Internet connection issues	*"Reloading of the website whenever the internet connection is slow … reforms the activity or exercise I am doing"*[31] *"Program system may not be quite stable"*[28] *"We had to use a certain web browser and it would become very confusing when trying to back out or submit medication"*[21]

 doi:10.20944/preprints202506.0681.v1

Limited realism and applications	Perceived limitations in physical fidelity Lack of oral communication features with patients and prescribers Simulation is restricted to community practice settings	*"It's a bit robotic"*[32] *"There were some limitations in discussing with patients"*[28] *"A possible improvement is the option to be exposed to different kinds of pharmaceutical workplace settings, like the option to pick between settings like Hospital Pharmacy or Community Pharmacy"*[31]

3.4.1. Barrier Theme I: Learning Curve

Eight articles reported students felt MyDispense™ was difficult to use initially[21,25,26,28,30–32,34]. Students highlighted the need for training on the platform to facilitate its use[26]. In one study, a third of students (33.8%) felt more instructions were required prior to use. Similarly, only a half of Vietnamese pharmacy students agreed/strongly agreed MyDispense™ was straightforward to use[30,34].

Students highlighted the design and appearance of the user interface (UI) could be improved to provide a more learner-friendly experience[16,30,31,34]. Label fonts were reportedly difficult to read and product images were occasionally of poor resolution, negatively impacting simulation fidelity[28,30,31]. The UI was not optimised for Thai and Vietnamese learners, as English was the only available language in MyDispense™ [28,30].

3.4.2. Barrier Theme II: IT Issues

Three studies highlighted students had limited MyDispense™ access due to internet connectivity issues[16,28,31]. One study reported a significant relationship between internet connectivity and MyDispense™ use ($p=0.000$), whereby an increase in internet connectivity is associated with a higher percentage of student MyDispense™ participation[31]. Students also faced minor technical issues and highlighted MyDispense™ was incompatible with certain devices and web browsers, limiting its use and negatively impacting the overall learning experience of the simulation[16,21,25,31,33].

3.4.3. Barrier Theme III: Limited Realism & Applications

Within four articles, students felt MyDispense™ was limited as it only simulates community pharmacy practice[27,29,31,34]. Two studies identified this feature as one of the least useful design aspects, as reported by students[27,29]. Students also wanted more varied exercises e.g.) veterinary prescription exercises, for a more comprehensive and integrated learning experience[34]. Students suggested MyDispense™ could be more relevant to practice by including a commercially available dispensing software within the simulation[16,34].

Four studies revealed students felt patient and prescriber interactions within MyDispense™ were limited in nature[27,29,32,34]. Students felt interactions did not feel authentic , as oral communication is not a feature of MyDispense™ [32]. 38% of students felt limited interactions were one of the least useful features of MyDispense™ [27]. Likewise, nearly three in five students in another survey agreed MyDispense™ has limited interactions[29].

4. Discussion

This review identified multiple facilitators to MyDispense™ use which were categorized into four themes; 1) *Develops Competency*, 2) *Accessibility*, 3) *Engaging Learning Experience* and 4) *Safe Learning Environment*. Identified barriers were encompassed by three themes; 1) *Learning Curve*, 2) *IT issues* and 3) *Limited Realism and Applications.*

This review explored MyDispense™ across a range of areas e.g.) pharmacotherapy and pharmacy law courses[16,21–34]. One facilitator which emerged was that MyDispense™ developed the required competencies for practice. Previous reviews also identified CBS can support competency and practical skill development in pharmacy students[17,28,35]. Pharmacy simulations act as low-demand alternatives to OSCEs, as they facilitate knowledge acquisition ("Knows How") and knowledge applications ("Shows How") in realistic scenarios, aligning with Millers educational

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framework[36,37]. Students can struggle to apply counselling skills in real-life scenarios when not provided with opportunities to practice in a high-fidelity environments[38], however, the use of MyDispense ™ can possibly overcome these issues to improve overall confidence in practice[39].

MyDispense™ provides an engaging, realistic learning experience with immediate feedback[16,28,30,31]. MyDispense™ is more engaging for students relative to didactic teaching methods[26]. In a global survey, 72.4% and 77.6% of expressed agreement, respectively, that simulation provides both an enjoyable and engaging learning experience[40]. Evidence also suggests active learning methods can increase student engagement with lecture materials and performance in assessments[9]. Prompt feedback which is a MyDispense™ feature, does not appear to increase student assessment performance, relative to traditional delayed feedback[41]. However, receiving such feedback in a timely manner can enhance student self-learning and metacognition, thereby promoting productive failure[16,42].

MyDispense™ was commonly employed during COVID-19, as educators explored innovative methods to substitute for traditional face-to-face teaching[28,31,34]. Virtual patients enable educators to provide a flexible, accessible, remote learning environment for students[43]. However, pharmacy students can feel socially isolated when online pedagogy is used and usually preference in-person learning, suggesting a balance needs to be struck by pharmacy educators and a blended learning approach should be employed when implementing MyDispense™ to meet student needs[44].

MyDispense™ provides a safe-learning environment for students where they can make mistakes and repeat exercises without facing real-world repercussions[16,23,26,28,30,31]. This may be a useful feature for pharmacy students, who tend to be self-orientated perfectionists, as it provides them with ample opportunity to repeat exercises and correct mistakes[39,45]. This theme echoes the findings of a past review, concluding high-fidelity simulations must provide a controlled environment to allow learners to focus on clinical skills without distraction whilst also having the opportunity for repetition to learn from mistakes to ensure an effective learning experience[46].

The initial learning curve of the simulation and IT issues were two barrier themes identified in this review. Initial difficulties appear to be common for other simulations used in pharmacy education[47]. Platform learning curves may be associated with inadequate digital literacy, as research underlined that enhanced digital competencies, improve student adaptability and assessment performance in blended-learning environments[48]. Internet connection issues were most commonly reported by Vietnamese and Filipino students, suggesting this may be a sociodemographic barrier to MyDispense™ [30,31]. This is supported by a recent survey reporting that only half of educators in the Western Pacific Region (WPRO) agree that their institution provides adequate technical support[40]. This indicates students in such regions may have limited resources. Minor technical issues however, appear to be universal to simulations used in pharmacy education[49,50]. Four in five pharmacy students consider ease of use and bug free experiences as essential features for simulations, emphasising how technical issues can serve as prominent barriers[17]. Institutions should employ technicians for platform troubleshooting and provide user guides for students to overcome such initial learning curve barriers, however, the establishment of such infrastructure can be costly and demanding for educators[40].

MyDispense™ only simulates community practice and limited aspects of hospital practice e.g.) discharge prescriptions, which is a barrier for student engagement and educational applications[16]. Other simulations e.g.) SimPharm™ can simulate hospital pharmacy and can facilitate interprofessional learning (IPL) activities[6,51,52]. A previous review on CBS used in pharmacy education found interaction elements of multiple simulations do have limited realism capabilities[15]. Despite this, MyDispense™ was purpose-designed to simulate community pharmacy[16] and to support teaching of communication skills, therefore, educators should make students aware of its intended uses in pharmacy education prior to implementation.

 doi:10.20944/preprints202506.0681.v1

4.1. Limitations

A critical appraisal was not performed on articles in this review. However, appraisal of qualitative research is inherently biased and subjective in nature with certain appraisal tools placing more weight on different aspects of qualitative methodology over others[53]. Another limitation of this review was articles published prior to 2015 were not included, however, it is unlikely these articles would add significantly our findings as MyDispense™ is a novel simulation developed by Monash University in 2011[16].

4.2. Future Implications

The findings of this review suggest while pharmacy students perceive facilitators to using MyDispense™, various factors can act as barriers to its adoption. The UI requires further work to provide a more-learner friendly experience. Opportunities could be explored by stakeholders to adapt MyDispense™ to wider cultural contexts and ensure its sustainability as a platform, by expanding the language database for international learners. Further research is warranted to explore stakeholders' views on the barriers and facilitators to implementing simulations e.g.) MyDispense™ into pharmacy curricula. Identifying such challenges is the first step to inform future educators on successful implementation strategies to promote technology-enriched, diverse learning experiences for pharmacy students.

5. Conclusions

This review identified the barriers and facilitators to MyDispense™ use in students. MyDispense™ provides a novel, accessible approach by which pharmacy students can develop competency in an engaging high-fidelity, low-stakes learning environment. MyDispense™ allows for mistakes without facing real-life consequences which facilitates its use in pharmacy education. Barriers to its use however, included the initial learning curve necessary to navigate the platform, technical issues and the limited realism of some of the content and applications of the platform. Suggested improvements for MyDispense™ identified from this review were highlighted, and further development of the software is encouraged to enhance student engagement in future pharmacy education. The outcome of this review provides an understanding to educators of key factors to consider from the students' perspective when implementing MyDispense™ into pharmacy curricula globally and may be useful for stakeholders in education when considering implementation and use of MyDispense™ in the future.

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Informed Consent Statement: Not applicable.

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Conflicts of Interest: The authors declare no conflict of interest.

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Appendix A. PRISMA Checklist

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	No
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	No
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	No
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	No
Registration	12	Provide the register name and registration number.	No

Figure A1. PRISMA 2020 Checklist for Abstract.

 doi:10.20944/preprints202506.0681.v1

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	p. 1 ; Cover Sheet
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	p. 5-6 ; Introduction
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	p. 6 ; Introduction
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	p. 8 ; Eligibility Criteria
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	p. 7 ; Search Strategy
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Appendix A
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	p. 8 ; Study Selection
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	p. 8 ; Data Extraction & Synthesis
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	p. 7 ; Table 1

 doi:10.20944/preprints202506.0681.v1

	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	p. 7 ; Table 1
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Not reported.
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	p. 8 ; Data Extraction & Synthesis
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	p. 8 ; Data Extraction & Synthesis
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	p. 8 ; Data Extraction & Synthesis
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	p. 8 ; Data Extraction & Synthesis
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	
RESULTS			

 doi:10.20944/preprints202506.0681.v1

Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	p. 9 ; Articles Eligible For Inclusion
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	p. 9 ; Fig 1
Study characteristics	17	Cite each included study and present its characteristics.	p. 11-13 ; Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Not reported
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not reported
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	p. 19 - 21 ; Discussion
	23b	Discuss any limitations of the evidence included in the review.	p. 21 ; Limitations
	23c	Discuss any limitations of the review processes used.	p. 21 ; Limitations
	23d	Discuss implications of the results for practice, policy, and future research.	p. 21-22 ; Future Implications

 doi:10.20944/preprints202506.0681.v1

OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	p. 22 ; Review Protocol & Registration
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p. 22 ; Review Protocol & Registration
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	p. 22 ; Funding
Competing interests	26	Declare any competing interests of review authors.	p. 23 ; Conflicts of Interest
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	p. 23 ; Data Availability

Figure A2. PRISMA 2020 Checklist for Systematic Reviews.

Appendix B. Search Strategy

A search on the PubMed, CINAHL and Embase databases were performed in January 2025 with four search strings (S1, S2, S3, S4) combined using the Boolean operator "AND" with the following limits set: year of publication 2015-2025. An example of the search and terms used for PubMed, CINAHL and Embase can be found, respectively, in Tables A1–A3

Table A1. PubMed Search Strategy.

Database	Date of Search	Search Strings	Terms Used	Results
PubMed	28th January 2025	S1	(perception[MeSH Terms]) OR (attitude[MeSH Terms])) OR (facilitator)) OR (enabler)) OR (barrier)) OR (obstacle)) OR (challenge)	4,224,261
		S2	("MyDispense") OR (computer simulation[MeSH Terms])) OR (patient simulations[MeSH Terms])) OR (educational technologies[MeSH Terms])) OR ("virtual patient simulator"[tiab:~3])) OR ("dispensing simulation")	440,869
		S3	((students[MeSH Terms]) OR (pharmacy students[MeSH Terms]))	185,856
		S4	((pharmacy[MeSH Terms]) OR (pharmacy education[MeSH Terms]))	26,507
		S5	S1 AND S2 AND S3 AND S4	49

 doi:10.20944/preprints202506.0681.v1

Table A2. CINAHL Search Strategy.

Database	Date of Search	Search Strings	Terms Used	Results
CINAHL	28th January 2025	S1	(MM "Attitude") OR "beliefs" OR "views" OR "opinions" OR "barriers" OR "challenges" OR "obstacles" OR "facilitators" OR "enablers"	567,858
		S2	"Mydispense" OR "patient simulation" OR "virtual simulation" OR "computer simulation" OR "simulation" N2 ("patient" OR "virtual" OR "dispensing")	27,672
		S3	(MH "Students") OR (MH "Students, Pharmacy")	22,056
		S4	(MH "Education, Pharmacy") OR "pharmacy"	13,743
		S5	S1 AND S2 AND S3 AND S4	5

Table A3. Embase Search Strategy.

Database	Date of Search	Search Strings	Terms Used	Results
Embase	28th January 2025	S1	'attitude'/de OR 'attitude' OR 'beliefs'/de OR 'beliefs' OR 'perception'/de OR 'perception' OR 'challenge'/de OR 'challenge' OR 'obstacles'/de OR 'obstacles' OR 'barriers'/de OR 'barriers' OR 'facilitator'/de OR 'facilitator' OR enablers	2,003,993
		S2	'mydispense' OR 'computer simulation'/exp OR 'computer simulation' OR 'patient simulation'/exp OR 'patient simulation' OR ((virtual OR patient OR dispensing) NEAR/2 simulation)	197,410
		S3	'student'/exp OR 'student' OR 'pharmacy student'/exp OR 'pharmacy student'	617,087
		S4	'pharmacy'/exp OR pharmacy OR 'pharmacy education'/exp OR 'pharmacy education'	1,299,905
		S5	S1 AND S2 AND S3 AND S4	117

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