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A Review on Virtual Simulation Mydispense on Pharmacy Education

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ABSTRACT

The requirement to combine academic training with practical skill development is one of the challenges pharmacy schools across the globe encounter. Mydispense, a virtual pharmacy environment with interactive dispensing stimulus designed to imitate patient-based settings, is employed in this situation. However, there exists little systematic research on the efficacy of its application. Hence, this study aims to review the available research data on the global influence of Mydispense in Pharmacy instruction.Google Scholar, Science Direct, PubMed, CORE, and Cochrane databases were used as data sources and articles published between 2016 and 2022 were identified using the following keywords: "Mydispense", "Virtual Simulation", "Pharmacy Education", "Impact of Mydispense", or combinations of these keywords. A popular method for extraction known as Rapid Automatic Keyword Extraction (RAKE) was employed. A total of twenty-two articles that satisfied the eligibility requirements were subjected to data extraction and analysis.Based on the results, pharmacy students regardless of whether they had any prior field experience, unanimously agreed that Mydispense virtual simulation benefited their learning process. However, continuous review and adoption of best practices based on the student's country, academic achievement, and innovative tactics are essential for its improvement.

Introduction

The pharmacy profession in the Philippines has become more integrated with innovative teachings. Pharmacists today have more significant obligations and commitments to enhance their practice, demonstrating how the pharmacy profession grows more dynamic with each passing day. The entire role of pharmacists is now more patient-centered and outcome-oriented than it was in the past. It is critical to building evidence-based practice, including services for pharmaceutical care (Abu et al., 2021). As stated by Aksoy (2021), the introduction of coronavirus pandemic disease (COVID-19) and the lack of preparatory measures which led to traditional socializing, artificial intelligence, and simulation to become crucial parts of world demand. To maximize students' competence and professional identity development despite restricted work-based educational opportunities, pharmacy schools can use simulation methodologies whenever possible and explore their features. Simulation in dispensing can range from low-fidelity simulations of patient prescriptions to high-fidelity activities like the recently disclosed MyDispense virtual learning environment (Nazar et al., 2021). This program is developed by Australia's Monash University's Faculty of Pharmacy and Pharmaceutical Sciences, depicts community pharmacy and hospital pharmacy practice (San, 2022).

The requirement to combine academic training with practical skill development is one of the challenges pharmacy schools confront worldwide. MyDispense helps students develop the professional pharmacy's skills, from beginner to advanced, in a fast, safe, and virtual setting. Students must complete scenarios in which patients might request prescription medication or self-care, as well as validation assignments requiring them to check the accuracy, validity, and medication safety of the work of virtual colleagues (Mak et. al, 2021). Virtual simulation is increasingly used in pharmacy schools to provide a safe and realistic setting in which students can practice critical patient care abilities (Phanudulkitti, Kebodeaux, & Vordenberg, 2022).

Methodology

2.1 Search strategy

The review was conducted while utilizing several journal databases such as Google Scholar, Science Direct, PubMed, CORE and Cochrane. A few limitations were applied to each database, such as language must be limited to English and must be published within the year 2016 - 2022. Both quantitative and qualitative studies were included. A popular method for extraction referred to as Rapid Automatic Keyword Extraction (RAKE), finds

the text's most important words or phrases by utilizing stopwords list and phrase delimiters. Instead of enabling PubMed to execute the search through automated mapping, search terms and phrases using field tags to lessen errors. That said, the search parameters were Mydispense, Virtual Simulation, Pharmacy Education, Impact of Mydispense, or combinations of these keywords. The search commenced on October 18, 2022 (Bramer et al., 2018; Salvador et al., 2018; Ossom et al., 2019; Wang et al., 2020).

Literature in which no undergraduate pharmacy students participated as well as those that investigated pharmacy aid virtual simulation aside from Mydispense (such as SimPharm and Pharmacy Simulator) were omitted. Furthermore, research conducted that utilized Mydispense but did not tackle on the learning outcomes and perceptions of undergraduates and those that were not conducted in English, were eliminated.

2.2 Study Selection

The studies selected for screening will be works of literature that report primarily about Mydispense and its impact on Pharmacy Education, articles related to virtual simulation on Pharmacy Education across Asia, and articles and studies in other countries outside Asia utilizing Mydispense. The study design, risk of bias, and data analysis are further factors evaluated while screening these journal articles. (Deneff et al, 2021; Korayem et al, 2022; Ezekiel et al, 2017; Probst et al, 2016; Drucker et al, 2016; Mcdowell et al, 2016). 22; Ezekiel et al, 2017; Probst et al, 2016; Drucker et al, 2016; Mcdowell et al, 2016). The learning outcomes are focused on outcomes of this review (utilizing academic accomplishment served as the basis) and attitudes of students taking up pharmacy toward utilizing Mydispense (satisfaction, perceptions, and engagement as the fundamentals).

2.3 Screening Process

Two reviewers had independently screened the articles' title and their complete abstract for potential relevance and eligibility with the inclusion criteria. All articles that did not meet any of the conditions were disregarded. During the screening, discrepancies will be resolved by a third reviewer. After the initial screening, full-text screening was applied to articles that had passed. Only those publications that satisfied all of the inclusion criteria after being thoroughly examined were chosen and included in this systematic review. These publications underwent data extraction and analysis following the second screening.

3.Results and Discussion

3.1 Literature Search

After conducting a thorough search on databases according to the criteria, there were 19 eligible articles included in this review.

Table 1

AUTHORS	**METHODS**	**RESULTS**
1. Johnson et al. (2021)	Every first-year student pharmacist for academic years 2015 - 2016 and 2016 - 2017, undertaking Community Pharmacy were qualified to participate in the research. Only 56 out of 177 pharmacy students participated. Each student's community pharmacy preceptor was also eligible to participate in the study. Using Qualtrics software, the researchers created a 16-item self-administered electronic survey.	ICompared to a paper-based case, it resulted in an increase in satisfaction of 71% to a virtual patient case, while 75% for realism and 60% for knowledge acquisition.
2. McDowell et al. (2016)	The research included 199 pharmacy students who are in their first year. The study method employed was a Cohort Mixed methods study utilizing Likert and open-ended questions as instruments.	According to typical replies on the questionnaire, the finest features of MyDispense were the students' enhanced comprehension and confidence in dispensing, especially in a safe atmosphere. In contrast, the negative remarks were primarily about software faults.

3. Chuang et al. (2021)	The research included 565 first-year pharmacy students. The study gathered information from three pharmacy student batches from 2017 to 2019. A Retrospective design-Mixed methods study design was adopted in this study.	The most prevalent dispensing mistakes among first-year pharmacy students were found in the label directions, which had inconsistencies in the method of administration, content, and frequency of dosing.
4. Rude et al. (2022)	The research involved 142 first-year pharmacy students. The researchers obtained the data using a questionnaire.	Student perceptions were largely positive, showing significant variations with only the statement "I learn better in this approach rather to a typical class discussion". After finishing the OTC simulation, all five confidence statements drastically increased.
5. Kayla et al. (2018)	The research included 57 first-year pharmacy students. The researchers ran a survey in order to collect data.	Virtual simulation allowed pharmacy students to strengthen their teaching skills. The most significant barrier to implementation was the necessary effort to construct and analyze each activity. Students, whether those who have pharmaceutical experience or none, agreed that the simulation aided their learning.
6. Ferrone et al. (2017)	The study included 241 first- and third-year pharmacy students. The researchers performed a (satisfaction) survey to obtain data.	176 (73%) of participants unanimously acknowledged that MyDispense was far more authentic than answering a comparable case analysis paper, and 202 (84%) felt that the MyDispense program allowed them to make mistakes safely.
7. (Phanudulkitti, C. et al., 2022)	Only 36 out of 50 first-year to second level student pharmacists took part in the study. Data was collected through a survey (Qaltrics software) conducted by the researchers	MyDispense use has increased throughout the COVID-19 outbreak, demonstrating that advantages such as being free, web-based, individualized, and available to students are motivators for use. The number of pharmacy schools integrating the MyDispense program has been gradually increasing since 2014. This upward trend in program adoption creates collaboration opportunities by developing common examples that may be utilized in related courses to save teacher workload.
8. Mospan & Gillette, (2020)	The study involved 94 second year level student pharmacists' engaged in the didactic program. An analysis was undertaken to gather the information needed by the researchers.	When learning pharmaceutical law, students can utilize an application called MyDispense to navigate practices that can be applicable in the real-world setting. This study's findings showed that the application could be a useful instrument for enhancing the curriculum and supporting learners with exam preparations.

9. Amatong et al., (2022)	A combined quantitative and qualitative design was utilized in this study. 322 among 377 second and third level student pharmacists answered the survey provided.	It was revealed from the study that MyDispense might be a feasible choice for students to introduce and develop skills needed for community pharmacy setting during their course program. Students might use MyDispense to collect data of patients, question relevant information, counsel them, and practice medication dispensing. The application can aid the pharmacy education curriculum adapt to the modernized way of learning in order to achieve the learning compliance that we all need.
10. Mazan et al. (2022)	The test outcomes of 178 students in a patient seeking self-assessment in a third-year pharmacy program were compared to 135 students who also utilized MyDispense activities in combination. The MyDispense exercise results were calculated using chi-square, Fischer's exact, and t-test after a standardized patient (SP) case was rated using a list.	There were no significant differences in the total scores for delivering personal care advice comparing participants who used MyDispense and for those who weren't able to utilize the application. Cases were likewise limited to self-care patients only.
11. Amirthalingam et al. (2022)	In 30 fourth level student pharmacists, their Objective Structured Clinical Examination (OSCE) scores were assessed in comparison to their scores on MyDispense exercises. A questionnaire was then given to assess the students' satisfaction with MyDispense. Student t-tests for statistical significance and Spearman rho's test for correlation were used.	The test scores' average of the online assessment were higher compared to those of the in-person OSCE by a substantial margin ($p = 0.01$). The grades from the online MyDispense and OSCE assessments, however, had no interrelationship (Spearman's rho = 0.060). Findings of the self-governed survey showed that students were highly satisfied and that they had successfully applied their knowledge by using MyDispense to communicate with and interview specific patients.
12. Al-Hindi & Mojally (2021)	220 fourth and fifth-year pharmacy students who took MyDispense exercises instead of summer training were assessed their opinions on the virtual platform's capacity as a substitute learning field amidst pandemic. A cross-sectional method was used using a survey.	Majority were not satisfied with virtual simulations only and proposed the use of both online and onsite learning to be used together.

13. Hatcher, 2022	MyDispense activities was one of the cohorts in a dual-cohort Advanced Pharmacy Practice Experience (APPE) rotation that 24 fourth professional-year pharmacy students were asked about. Chi-square analysis was used to compare cohorts and rotation groups in a survey.	Students have an opportunity to practice various dispensing and verification procedures, interactions with prescribers, and self-care interviews through the MyDispense activities. Regarding students' perceptions of the value of rotation activities for learning within cohorts, the Required Community Pharmacy (RCP) and Required Ambulatory Care (RAM) specific activities, including MyDispense, received the highest rankings.
14. Aksoy & Ozturk, (2021)	The clinical pharmacy education outcomes of 81 fourth-year pharmacy students were assessed with pre and post test tests on MyDispense. These results were evaluated using a questionnaire, and reliability, correlation, and frequency tests were performed to evaluate the findings.	All four dimensions—contentment, self-assurance, and motivation, clinical expertise and judgment—demonstrated statistical significance in the differences between the pre-assessment and the post-assessment periods (p>0.05).
15. Rahman et al., (2020)	113 pharmacy students grouped into three different rotations containing 37 students were subject to remote learning and virtual discussions with educators. MyDispense was utilized as a tool to introduce non-prescription drugs and practice dispensing techniques.	Due to its usage of a virtual community pharmacy setting, MyDispense was beneficial and made learning easier.
16. Shin et al. (2018)	A prospective study of 117 students with a Doctorate in Pharmacy in a medical course was conducted to compare the simplicity of a case utilizing MyDispense with traditional paper techniques in class.	In comparison to the MyDispense group, students in the traditional paper case group reported statistically significant increases in confidence. The mean test scores rose once more throughout the implementation phase, but students still had a poor opinion of the therapeutic use of MyDispense.
17. Newsome et al. (2020)	27 pharmacy students taking an elective course on ambulatory care were given either paper-based cases or MyDispense cases. The scores collected from MyDispense, a survey, and focus group discussions were used to evaluate their perceptions of each learning method.	The performance and perceptions of pharmacy students were similar in most areas when comparing virtual patient cases to paper-based patient cases as part of an ambulatory care elective course. However, students' performance was better when paper-based patient cases were used for questions related to the assess element of the Pharmacists' Patient Care Process (PPCP). Also, students perceived paper-based patient cases more favorably in terms of reinforcing the collect element of the PPCP.

18. DRS, 2018	5 professors, 39 Health Sciences students, 10 nursing practitioners, 36 physical therapy students, 89 pharmacy students, and one hundred and 55 nursing students participated in a perception study regarding simulation experiences in which MyDispense was one used by the 88 pharmacy students. Reliable outcome evaluation was used to gather student perceptions, which were then assessed using Qualtrics survey software.	76% of the students who responded to the outcome survey agreed that the simulation resembled a real-world scenario. Only 60% of students reported feeling well prepared for the simulations, according to professors, who underlined how unclear they were. Professors also discussed how the simulation heightened feelings, and 80% of students said they experienced anxiety during the exercise. The simulation, according to both students and teachers, let them reflect on their own performance, provided a challenge, improved their communication skills, and will help them in the future.
19. VanLangen et al. (2021)	Students in the second and third level of pharmacy education who participated in a digital, skills-based test through MyDispense were given a 12-item survey via QuestionPro. In March 2020, a similar questionnaire was issued to academics who had examined these assessments.	Students and professors agreed that a virtual skills-based evaluation was an effective way to evaluate student communication abilities. Despite thoughts that the assessment was suitable, there was no significant desire for future skills-based tests to be done remotely. Nonetheless, the use of virtual skills-based exams has the potential to minimize faculty travel needs, better imitate current telehealth operations, and provide chances for student self-assessment.

MyDispense's Impact on Pharmacy Education

The integration of MyDispense has influenced several schools to develop their students' pharmaceutical skillset (Johnson et al., 2021). This move is essentially the result of the COVID-19 epidemic and constraints on interactions with patients. (Stoehr et al., 2021). Nevertheless, simulation-based education (SBE), in conjunction with traditional cases which are paper-based, has proven to be a mode of learning that "improved students' knowledge, understanding, and numerous essential skills within undergraduate pharmacy education" (Korayem et al., 2022).

The various areas that students were tested included: safe and proper dispensing of prescription and over-the-counter (OTC) medications (McDowell et al., 2016), patient counseling and recommendations (Rude et al., 2022), utilization of drug information resources (Phanudulkitti, C. et al., 2022), and application of Pharmacy Law (Mospan & Gillette, 2020).

The student's success in MyDispense was also measured against various areas of learning experienced in the pharmacy course, such as: conventional paper-based cases (Ferrone et al., 2017), community introductory pharmacy experiences (IPPEs) (Johnson et al., 2021), objective structured clinical examination (OSCE) assessment (Amirthalingam et al., 2022), summer field training sessions during COVID-19 (Al-Hindi & Mojally, 2021), and a dual-cohort Advanced Pharmacy Practice Experience (APPE) rotation in remote needed ambulatory care (RAC) and required community pharmacy (RCP) (Al-Hindi (Hatcher, 2022).

A comparison on the Effectiveness in Using MyDispense Based on Year Level and Experience

MyDispense is especially helpful for boosting first-year students' self-assurance in their growing skill set. Additionally, during pharmacy education, it might assist instructors in teaching and training students about community pharmacy practice skills (Amatong et al., 2022). First-year students made it a priority to assess the use of dispensing software based on simulation in an immersive education program, as well as its impact on student learning and preparation for IPPE (introductory pharmacy practice experiences) rounds. (Johnson et al., 2021). The real community pharmacy setting, on the other hand, seems to offer greater opportunity for training in labeling, dispensing, and communication, according to fourth-year students (Amirthalingam et. al., 2012). Since the experience and knowledge acquired between year levels have a potentially large learning gap, students may have different views of how adequate and relevant MyDispense is.

Similarities and differences of earlier year levels

McDowell et al., (2016) stated that teaching dispensing and its professional and social settings are necessary for all undergraduate students. It is unrealistic to assume students who work in pharmacies to gain dispensing knowledge, skill, or experience. This is comparable to research conducted in the United States that showed students' previous experience working in a pharmacy, regardless of year level, did not help their academic experience. MyDispense has intentionally focused on community pharmacy, which is appropriate for first-year students as an introduction. Inpatient or hospital practices, such as special prescriptions and inpatient dispensing processes, differ significantly from those in community pharmacy practice and have not been included in MyDispense.

In comparison to more experienced practicing pharmacists, first-year students also have insufficient therapeutic knowledge and expertise in dispensing , and they may not understand drugs as well as higher-year students, resulting in dispensing misjudgments. McDowell et al., (2016) and Chuang et al., (2021) reported that community and hospital pharmacies' most common dispensing mistakes were inappropriate drug, strength, form, or amount or inaccurate label recommendations. This was reinforced by studies done in community - based settings, where typical dispensing errors included the previously mentioned issues as well as incorrect patient selection. Mistakes in medicine administration can have a variety of detrimental effects on patients, such as adverse drug reactions, drug-drug interactions, treatment failure, and, in extreme cases, death. Even though not all drug errors are dangerous, they can nonetheless make patients dissatisfied and make them lose faith in the healthcare system. It emphasizes the need for correct and dispensing techniques safely in the pharmacy. Instructors widely used MyDispense in the United States to educate medication dispensing, communicating with patients, using drug information resources, using pharmacy laws, and providing recommendations regarding over-the-counter drugs to both first and second-year student pharmacists (Phanudulkitti, C. et al., 2022, Nicolazzo et al., 2022, McDowell et al., 2016). In a research done by Ferrone et al. (2017), 241 (44%) first and third-year students completed a satisfaction survey. Among these learners, 183 (76%) thought MyDispense was easy to understand and 176 (73%) thought it was far more realistic than attempting to handle the identical problem on paper. Lastly, 202 people (84%) felt that the MyDispense program gave them the chance to make mistakes responsibly and learn from it. Despite the fact that most students thought the program was more realistic and easier to grasp than paper-based patient cases, 50% of students reported MyDispense was unpleasant to use half of the time. In a different study, regardless of prior pharmacy experience (40% of students had no community pharmacy experience), 84% of students reported that MyDispense was effective in preparing them for outpatient pharmacy tasks (Johnson et al., 2021, Douglass et al. 2013).

Similarities and differences of higher year levels

Students with APPE (Advanced Pharmacy Practice Experiences) reported in a study by Rahman et al. (2020) that using MyDispense was really helpful and aided the process of learning because it made use of a virtual setup of a pharmacy in a community setting (Amatong et al., 2022). To avoid problems among the learners, it would have been excellent to utilize a virtual environment and medications suited for their location, society, and context. The cases in the MyDispense system were used at first, but discussions had to be done with instructors because MyDispense could not measure communication skills.

Some fourth-year students also thought it was robotic and complained that MyDispense was challenging to operate, had many processes, and had problems finding the medicine. Furthermore, the students proposed that additional practical sessions with more examples of medications, mainly those available in Saudi Arabia, be held. (Amirthalingam et al., 2022). Furthermore, a learner suggested that interacting with the patient verbally might provide better participation than plainly writing (Newsome et al., 2020). This research aimed to investigate the difference in student performance between the OSCE (objective structured clinical examination) and MyDispense in the practice of hospital pharmacy among Saudi students. Both the in-person OSCE and the MyDispense virtual-patient learning methodologies were found to be effective by the authors; however, student performance on the virtual simulation program surpassed the OSCE (Rahman et al., 2020, Amirthalingam et al., 2022). Similar to traditional teaching methods, SBE (Simulation-based education), like the application, has enhanced the knowledge of students, comprehension, and critical abilities in undergraduate and postgraduate pharmacy education. MyDispense incorporates various effective techniques for simulation-based learning (response, studied practice, curriculum unification, measurement of outcomes, simulation fidelity, skill calibration and preservation) (McDowell et al., 2016). Although there are points to improve, MyDispense has greatly helped prepare and further educate students to enhance their dispensing and communication skills (Korayem et al., 2022).

Perceptions of Pharmacy Faculty

Some articles reviewed also incorporated faculty responses on student learning outcomes and MyDispense implementation. Both students and faculty agreed that MyDispense prepared students for future patient interaction (DRS, 2018). This was proven in a study where preceptors evaluated students with no prior experience in the community pharmacy experience with higher scores in community IPPEs and self-care counseling skills because they tackled MyDispense exercises beforehand compared to those who did the exercises after (Johnson et al., 2021).

In the topic of the virtual environment being the primary mode of teaching future skill-based communication assessments, the faculty that favor this explains that it requires less travel time, and creates more opportunities for the students to self-assess their performance. However, most faculty prefer

in-person assessments because it simulates an actual interaction between patients and pharmacists, which considers non-verbal communication (VanLangen et al., 2021).

Limitations and Challenges faced with MyDispense

The articles also reviewed explicitly stated the limitations of their studies. One joint restriction was the exclusion of year levels. Studies with first-year pharmacy students as participants expressed that understanding medications and therapeutic knowledge may not be as complex (Chuang et al., 2021). As such, most MyDispense exercises only serve to introduce basic dispensing techniques (Rude et al., 2022). Virtual simulations of the community pharmacy setting serve as a replacement tool in the time of limited in-person training. However, skill-based activities, which include verbal patient counseling (Rahman et al., 2020), physical assessments, and pharmaceutical compounding (VanLangen et al., 2021), are deemed difficult to execute online.

Some studies used only MyDispense as the primary assessment tool (Mospan & Gillette, 2020) without comparing the results to scores on formal exams and the amount of attempts (Shin et al., 2018). While others compared MyDispense with pre and post-practice tests (Aksoy & Ozturk, 2021), Objective Structured Clinical Examination (OSCE) grades (Amirthalingam et al., 2022), Introductory Pharmacy Practice Experiences (IPPE), and Advanced Pharmacy Practice Experience (APPE) regarding Ambulatory Care (Hatcher, 2022). One study even went as far as to suggest that student performance in MyDispense must be compared to extemporaneous formulation examinations to evaluate the effectiveness of the virtual simulation (Nicolazzo et al., 2022).

Phanudulkitti, C. (2022) emphasized the importance of the pharmacy faculty's attitudes and beliefs in utilizing MyDispense. Student and faculty orientation are also vital for MyDispense comprehension (Amirthalingam et al., 2022). The excessive time it took for instructors to develop and test each exercise was a barrier to time efficiency (Kayla et al., 2018). Some virtual patient cases took five to six hours per case (Newsome et al., 2020).

Lastly, since community pharmacy settings and practices differ from country to country, modifications that would make the virtual simulation relevant to the student's community, culture, and setting would be preferable (Rahman et al., 2020) to avoid a prolonged adjustment period for students.

4.Conclusion

As Barton (n.d) emphasized, MyDispense is a virtual pharmacy environment that includes interactive dispensing stimulation meant to simulate patient-centered settings that students are able to experience in reality. It enables the development of entire dispensing experiences at all phases of the dispensing process, from welcoming the patient to providing expert advice when handing the supplied drugs to the patient. It is possible to obtain a medication history from the patient, react to patient inquiries, and communicate with the practitioner to inquire about prescription medications. MyDispense distinguishes itself by emphasizing best-practice criteria in pharmacy simulation-based training. Whether they had prior expertise in the field or not, pharmacy students unanimously agreed that simulation benefited their learning process (Aksoy, 2021).

Furthermore, as stated by Kebodeaux and Mak (2021), continuous review and adoption of best practices, academic achievement, and creative tactics are critical to effectively integrating new strategies. Before the COVID-19 pandemic, pharmacists used methodologies for pharmacy education and learning that are technologically enhanced; nonetheless, the extreme shift caused by the pandemic triggered the deployment of new technologies. Although there are a lot of benefits MyDispense offers, there are still obstacles its students face; additional research needs to be done to understand better how and to what degree the pandemic affects pharmacy students during and after the pandemic (Yosra & Mariam, 2021). To support this statement, Amatong et al. (2022) stated that Filipino pharmacy students had different obstacles when utilizing MyDispense, such as network issues, device incompatibility, and so on, but they discovered solutions to overcome them.

Conflict of Interest

No conflict of interest among authors

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