Society of Medical Education & Research

2022, Volume 2, Page No: 250-260
ISSN: 3108-4850

Annals of Pharmacy Education, Safety, and Public Health Advocacy

# Enhancing Pharmacy Student Competencies through Case-Based Integrated Education: A Controlled Trial on Respiratory Disease Management

**Luca Ferretti[1]*, Martina Gallo[1], Alessandro Ricci[1], Chiara Bassi[1]**

[1]Department of Social and Administrative Pharmacy, Faculty of Pharmacy, University of Bologna, Bologna, Italy.

***E-mail** ✉ luca.ferretti@gmail.com

## Abstract

Conventional pharmacy training is commonly based on isolated, discipline-specific courses, which may not sufficiently equip students to handle the complexities of modern healthcare practice. This research assesses the impact of an integrated educational model in pharmacy on strengthening core knowledge and applied competencies. A comprehensive, integrated course centered on respiratory disorders was designed and delivered to final-year pharmacy students at Tabriz University of Medical Sciences. The course applied case-based learning and combined content from multiple areas, including pharmacology, medicinal chemistry, and pharmaceutics. An educational controlled trial design was used, comparing students enrolled in the integrated course (intervention group) with those following a conventional curriculum (control group).

Questionnaire findings indicated that more than 60% of participants perceived marked improvement in their ability to handle respiratory-related clinical cases. Students in the intervention group achieved significantly superior clinical decision-making performance, with a mean examination score of 31.4 versus 15.75 in the control group ($p < 0.05$). Qualitative feedback from students emphasized the benefits of the integrated approach and supported its wider adoption, along with the inclusion of additional topics and varied case scenarios. Pharmacy education delivered through an integrated, case-based framework substantially improves student competence and hands-on skills, thereby enhancing readiness for real-life pharmacy practice. These findings endorse the broader implementation of integrated courses in pharmacy programs to strengthen curricula and educational effectiveness. Further recommendations involve sustained integration and the extension of subject areas to further advance pharmacy education.

**Keywords:** Pharmacy education, Pharmacy competencies, Integrated education, Case-based learning

## Introduction

Pharmacy education encompasses multiple scientific domains, requiring an inclusive and cohesive strategy to prepare future pharmacists. Traditional educational models, marked by compartmentalized subjects and discipline-focused curricula, frequently fail to meet the challenges posed by advanced healthcare systems. Historically, pharmacy programs concentrated on core sciences such as biology, chemistry, biochemistry, pharmacology, pharmaceutics, and medicinal chemistry, which were vital for drug formulation, preparation, and dispensing. Consequently, curricula were organized into distinct courses for each discipline.

As pharmacy practice gradually shifted toward a more clinically oriented role, educational strategies evolved from content-based instruction to outcome-oriented learning, mirroring developments in medical education [1, 2]. During the past decade, pharmacy faculties have undertaken numerous curriculum reforms. Nevertheless, a considerable disparity persists between students' academic performance and the professional skills required in practice settings [3]. Within current educational structures, learners progress through separate courses, accumulating fragmented knowledge and skills.

Access this article online https://smerpub.com/

**Received:** 14 September 2022; **Accepted:** 07 December 2022



**How to cite this article:** Ferretti L, Gallo M, Ricci A, Bassi C. Enhancing Pharmacy Student Competencies through Case-Based Integrated Education: A Controlled Trial on Respiratory Disease Management. Ann Pharm Educ Saf Public Health Advocacy. 2022;2:250-60. https://doi.org/10.51847/rojxaye4Au

This lack of cohesion limits their ability to grasp the full scope of professional roles and responsibilities [4].

Integrated education has emerged as an innovative and increasingly adopted model across professional disciplines worldwide. This approach simultaneously addresses multiple branches of a field to improve learning outcomes and student involvement [5]. It is especially suitable for pharmacy education [6], which inherently combines various scientific disciplines, and has been implemented in numerous universities in the United States [7]. In addition, accreditation standards for pharmacy education in the United States [8] and Canada [9] place strong emphasis on curricular integration. Two main forms of integration are recognized: vertical and horizontal. Vertical integration aligns foundational sciences with clinical application throughout the curriculum, whereas horizontal integration links related subjects within a given scientific domain [10]. Strategies to support integration include case-based learning, digital learning platforms, and engagement of specialized PhD-trained faculty members [11].

Evidence suggests that although medical education reforms in Iran increasingly promote problem-based and student-centered learning [12–14], pharmacy education largely continues to rely on subject-oriented curricula [15]. Since 1983, the national pharmacy curriculum in Iran has undergone four revisions; however, none have substantially altered the underlying educational structure [16]. As a result, the current system does not sufficiently prepare graduates to address societal healthcare needs [17]. Recognizing that foundational science education is crucial for developing competencies required for patient-centered care, the present study seeks to design a horizontally integrated course that connects multiple pharmaceutical disciplines. It further examines the course's effectiveness in delivering essential basic science knowledge that supports student learning throughout the pharmacy program and contributes to the development of competent pharmacy graduates.

## Materials and Methods

*Design and implementation of the integrated component*

At the outset, seven faculty members from the School of Pharmacy and one academic from the School of Medicine were chosen, representing expertise in pharmacology, medicinal chemistry, pharmaceutics, pharmacognosy, and community medicine. Selection criteria for the educational team included subject-matter proficiency, motivation to engage in the research project, and previous involvement in educational system enhancement initiatives. After finalizing the integrated pharmacy education team, ten structured meetings, supplemented by informal discussions, were conducted to introduce principles of integrated education and to identify student learning needs.

The initiative commenced in late 2019 and consisted of weekly two-hour development sessions held over a ten-week period, bringing together core instructors and faculty specialists. Early discussions concentrated on creating new learning pathways with horizontal alignment across the pharmacy degree curriculum. It was stressed that curriculum reform should occur as a stepwise transition rather than through abrupt, large-scale changes, in order to minimize resistance or concern among faculty members. Furthermore, active support from senior administrators at both the faculty and university levels was considered essential to facilitate the change process.

*Development of an educational structure*

A structured lesson plan was prepared by faculty members and subsequently approved by the Educational Council of Tabriz University of Medical Sciences as an optional two-credit course entitled "Integrated Pharmacy Education." The course was specifically designed to address existing curricular gaps, with particular emphasis on the management of respiratory disorders. Content related to respiratory diseases was adapted from the book *Integrated Pharmacy Case Studies*, published by Pharmaceutical Press in 2015 [18]. The primary objective was to equip final-year pharmacy students with in-depth competence in managing respiratory clinical cases, focusing on recognizing and resolving pharmaceutical care issues.

The course aimed to promote an integrated understanding by combining concepts from previously completed pharmacy subjects, including pharmacology, pharmaceutics, medicinal chemistry, pharmacognosy, and physiopathology. Respiratory diseases were selected as the thematic focus due to the critical role pharmacists play in providing appropriate care for patients with asthma and cough-related conditions, which involve a broad range of medications and delivery devices. This includes addressing the complexity of drug use in respiratory illnesses, educating patients on inhaler techniques, and offering guidance on over-the-counter cough remedies. The interdisciplinary nature of the topic,

limited coverage in the existing curriculum, and the expertise of the participating faculty members further justified this choice.

*Evaluation and assessment*

An educational controlled trial design was applied, involving pharmacy students divided equally into an intervention group and a control group. Students in the intervention group enrolled in the two-credit elective course "Integrated Pharmacy Education," whereas those in the control group selected a "Psychology" elective from the optional pharmacy curriculum. To assess potential academic performance bias between the "Course group" and the "Control group," grade point averages (GPA) were compared. The mean GPA of the "Course group" was $16.9 \pm 1.19$, while that of the "Control group" was $16.72 \pm 0.87$ ($P > 0.05$). These findings demonstrate no statistically significant difference in baseline academic achievement between groups, indicating that study outcomes were not confounded by pre-existing academic disparities.

Following completion of final examinations, participants were invited to complete a survey. An online questionnaire was used to gather feedback from students enrolled in the integrated course. Items addressed students' perceptions of the value of integrated education, their preferred degree of integration, and the manner in which integration was applied throughout the course. Students also evaluated how effectively the course improved their ability to manage respiratory patients in pharmacy practice. In addition, to assess the influence of the course on clinical decision-making, a descriptive assessment was administered to both groups at the end of the semester. To maintain objectivity, both groups were presented with the same case study [19] involving a patient with hypertension, a subject not included in the "Integrated Pharmacy Education" course. Students were required to identify key considerations for each medication in the case.

*Statistical analysis*

Data analysis was performed using SPSS statistical software, version 26. Data normality was evaluated using the Kolmogorov–Smirnov test. A common examination was administered simultaneously to both groups using a modified answer key, with scores reported on a numerical scale ranging from 0 to 100. Comparisons between groups were conducted using the independent two-sample t-test. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful difference between group scores and supporting the confirmation design hypothesis.

## Results and Discussion

*Fulfillment of course learning goals*

Within the integrated pharmacy course, students were required to achieve predefined learning targets across three central clinical cases: asthma, acute and severe asthma exacerbation, and cough. These targets were mapped to the core learning outcomes of the pharmacy curriculum, with a focus on strengthening essential scientific knowledge required for professional practice. The principal competencies emphasized in the course included[1]: recognizing the underlying pathophysiological mechanisms and clinical signs associated with respiratory illnesses[2]; identifying and comparing therapeutic strategies for respiratory disorders[3]; describing the mechanisms of action of medications used in respiratory care[4]; analyzing the chemical and structural properties of respiratory drugs and their relevance to pharmacological and clinical performance [5]; distinguishing among dosage forms and delivery systems applied in respiratory therapy; and [6] identifying factors affecting patient adherence and recommending methods to improve treatment compliance. The specific objectives corresponding to each of the three case studies are presented in **Tables 1, 2, and 3**, forming a clear and systematic framework to support competency development.

**Table 1.** Learning objectives for the asthma case

| No. | |
|---|---|
| 1 | Describe the pathophysiology of asthma and its associated symptoms. |
| 2 | Outline the available treatment options for asthma, with particular emphasis on the principles of stepping up and stepping down therapy. |
| 3 | Discuss the chemical properties of glucocorticoids and β2-adrenoreceptor agonists employed in the management of asthma. |
| 4 | Explain the formulation and design of pressurised metered-dose inhalers. |

| | |
|---|---|
| 5 | Describe the correct technique for using spacers in conjunction with pressurized metered-dose inhalers. |
| 6 | Outline the formulation and characteristics of dry powder inhalers. |
| 7 | Identify key factors that influence adherence to asthma treatment and propose suitable recommendations to enhance compliance. |

**Table 2.** Learning objectives for the management of acute and severe asthma exacerbation

| **No.** | |
|---|---|
| 1 | Describe the underlying pathophysiology of asthma. |
| 2 | Outline the clinical signs, symptoms, and typical triggers associated with acute asthma exacerbations. |
| 3 | Discuss the various classifications of acute asthma severity. |
| 4 | Outline the available treatment approaches for managing asthma exacerbations. |
| 5 | Describe the main characteristics of different inhalation devices, including pressurised metered-dose inhalers, dry powder inhalers, and nebulisers. |
| 6 | Discuss the essential pharmaceutical monitoring needs for patients with asthma and provide appropriate recommendations regarding therapeutic management. |

**Table 3.** Learning objectives for the cough case

| **No.** | |
|---|---|
| 1 | Describe the pathophysiology, signs, symptoms, and diagnostic approaches for various types of cough. |
| 2 | Outline the treatment options available for different types of cough. |
| 3 | Discuss the chemistry and mechanism of action of expectorants. |
| 4 | Discuss the chemistry and mechanism of action of opiate antitussives. |
| 5 | Recognise situations in which a patient presenting with a cough should be referred to another healthcare professional. |
| 6 | Demonstrate effective patient questioning techniques to assist in reaching an appropriate diagnosis. |

This instructional framework enabled students to apply and combine knowledge drawn from different pharmaceutical disciplines—including pharmacology, medicinal chemistry, and pharmaceutics—within applied clinical contexts. The overarching purpose was to promote meaningful integration and real-world application of previously acquired content. Each case study opened with explicitly stated learning goals, offering students clear guidance regarding expected outcomes and skill development. Prior to case analysis, comprehensive patient information, such as medical history and current medication use, was provided. Throughout the course, students addressed a series of targeted questions designed to reflect authentic pharmacist decision-making scenarios and routine professional challenges **(Table 4)**.

**Table 4.** Questions developed for the asthma case

| **No.** | |
|---|---|
| 7 | Define the key characteristics of asthma. |
| 8 | Identify the most common signs and symptoms associated with asthma. |
| 9 | Describe the process and criteria used to diagnose asthma. |
| 10 | Outline the available non-pharmacological treatment options for asthma. |
| 11 | Identify the primary pharmacological treatment approach for asthma. |
| 12 | Explain the circumstances under which treatment with inhaled corticosteroids should be started. |
| 13 | Define what a pressurised metered-dose inhaler (pMDI) is and describe the advantages provided by using a spacer with it. |

| | |
|---|---|
| 14 | Classify the Turbohaler as a type of inhalation device and explain how it differs from a pressurised metered-dose inhaler (pMDI). |
| 15 | Draw the chemical structures of budesonide and formoterol, and discuss their structural relationships to other corticosteroids and β2-adrenergic receptor agonists used in asthma management. |
| 16 | Discuss the factors that can influence adherence to asthma treatments. |
| 17 | Describe the SMART regimen and indicate the situations in which it is recommended. |

Because of the COVID-19 pandemic and associated isolation policies, instructional sessions were delivered through pre-recorded video lectures presented by faculty members, accompanied by narrated motion graphics, and uploaded to the Learning Management System (LMS) of Tabriz University of Medical Sciences. All lectures were recorded in advance and supported by visual explanations. Lecture materials were distributed electronically at least 48 h prior to each session, and supplementary discussions were conducted via social media platforms. This integrated use of defined objectives, case-driven instruction, and virtual interaction ensured comprehensive exposure to the management of respiratory conditions.

Students' perception of integrated education

Following completion of the course, students were invited to complete an online survey to evaluate their awareness and understanding of integrated education. Prior to participating in this course, a notable proportion of students (36.4%) reported no previous exposure to or knowledge of integrated education. Slightly more than half of respondents (51.5%) indicated limited familiarity with the concept, noting that their experience differed from their initial expectations **(Table 5)**.

**Table 5.** Students' familiarity with integrated education (n = 33)

| No. | Response | Percentage |
|---|---|---|
| 1 | I was already familiar with integrated education. | 4 (12.1%) |
| 2 | I had a partial or moderate level of familiarity with integrated education. | 11 (33.3%) |
| 3 | I had heard of integrated education before, but the approach used in this plan was completely different from what I expected. | 6 (18.2%) |
| 4 | I had no previous knowledge of it. | 12 (36.4%) |

Students' perspectives on integrated exercises and competency development

Students' opinions regarding the role of integrated component exercises in enhancing professional competencies were collected through a questionnaire completed by all 33 participants, resulting in a 100% response rate. The findings revealed a high level of agreement, with more than 60% of students reporting a notable improvement in their ability to manage asthma and cough cases after completing the integrated exercises **(Figure 1)**.

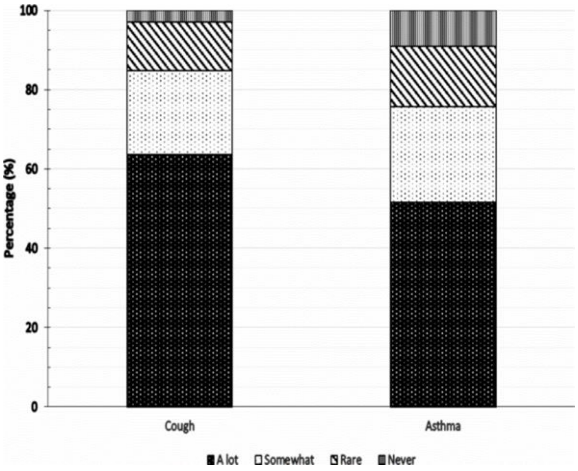


**Figure 1.** Students' perceptions of the impact of integrated education on managing asthma and cough cases

Suggestions for future application of the integrated component

In response to questions concerning the continuation of case-based integrated components within the pharmacy curriculum, 94% of respondents (n = 31) supported ongoing implementation **(Table 6)**. Despite this strong endorsement, students identified areas requiring refinement, particularly the need for sustained integration across a wider range of course modules. Analysis of open-ended feedback indicated that students believed the integrated approach facilitated connections between subjects and enhanced the relevance of their learning. They further recommended expanding future course content to include additional conditions commonly encountered in community pharmacy practice, as well as incorporating discussions related to the management of

common poisoning cases. Increasing the number of case studies was also suggested **(Table 7)**.

**Table 6.** Students' opinions regarding the presentation of the integrated pharmacy education course (n = 33)

| No. | Opinion | Percentage |
|---|---|---|
| 1 | I support continuing the course in this format. | 5 (15.1%) |
| 2 | It was satisfactory, but further expansion on the subject would have improved it. | 20 (60.6%) |
| 3 | All topics in the curriculum should be delivered in this manner. | 6 (18.2%) |
| 4 | Integrated education is not suitable for the pharmacy curriculum. | 2 (6.1%) |

**Table 7.** Students' feedback regarding the integrated pharmacy education program

| No. | Student Feedback on Integrated Education | Details/Percentage |
|---|---|---|
| 1 | Enhancement of clinical decision-making abilities | The majority of students reported an improvement. |
| 2 | Relevance to professional practice in the future | The majority considered it highly relevant. |
| 3 | Endorsement for incorporating into the overall pharmacy curriculum | 94% considered it valuable. |
| 4 | Advocacy for extending the unit to include additional topics | 75% suggested expansion. |
| 5 | Call for ongoing integration across different modules | Recommended to achieve greater cohesion within the curriculum. |
| 6 | Suggestion for wider range of topics | Proposed adding areas such as over-the-counter medications and dermatological products. |
| 7 | Request for additional case studies | Highlighted the importance of practical scenarios and emphasis on real-world problems. |

Effect of the integrated teaching–learning approach on students' clinical decision-making ability

The subsequent phase of assessment involved comparing student performance on a clinical case that was not related to the integrated course content or instructors, in order to identify differences between the two groups in case comprehension and decision-making. Test adjustment and scoring followed the same criteria applied to the final examination **(Table 8)**. Each correct response received 4 points, and total scores were calculated on a 0–100 scale. Students who completed the integrated training achieved a mean score of $31.4 \pm 3.32$, whereas the control group attained an average score of $15.75 \pm 3.29$. Statistical analysis demonstrated a significant difference between the groups ($P < 0.05$), thereby supporting the study hypothesis. These findings indicate that engagement in the integrated course significantly improved students' clinical decision-making performance.

**Table 8.** Scoring rubric for the final examination

| Medication | Paraphrased Factors to Consider |
|---|---|
| Prednisolone | • Necessitates reassessment depending on the patient's requirements and the length of the prescription • Bisphosphonates are required to prevent osteoporosis • The importance of calcium and vitamin D supplementation in preventing osteoporosis caused by prednisolone |
| Fluticasone inhaler | • Identify the device type: Accuhaler or Diskhaler • The patient is not on a long-acting beta-2 agonist; clarify the rationale for prescribing an inhaled corticosteroid • Confirm whether the patient is using the device properly • Check if the patient rinses their mouth after use • Determine if the patient requires a spacer |
| Aspirin | • Guidelines recommend prescribing it following a myocardial infarction (MI) |
| Furosemide | • Explain the reason for prescribing a loop diuretic despite low blood pressure • Identify any evidence indicating heart failure • Consider the optimal timing for administering furosemide |
| Combivent (Ipratropium + Salbutamol) | • Assess the necessity for a short-acting beta-agonist • Consider switching to a long-acting beta-2 agonist |
| Enalapril | • Determine if the low dose is intended for managing heart failure or hypertension, given the patient's low blood pressure on admission |

| | |
|---|---|
| Theophylline | • Theophylline is typically prescribed only after trials of short- and long-acting bronchodilators • Risk of hypokalemia is heightened when used concurrently with prednisolone and furosemide |
| Senna | • Evaluate the patient's current use and ongoing need for laxatives • After two weeks, assess the risk of bowel inertia |
| Warfarin | • Monitor the patient's INR • Exercise caution regarding drug interactions; anticoagulants such as warfarin can be influenced by prednisolone and aspirin • Note that the patient's haemoglobin levels are at the lower limit of normal |
| Zolpidem | • This medication is recommended for short-term use only; establish the duration of the patient's current treatment |
| Diclofenac | • An alternative pain reliever should be considered • Diclofenac elevates the risk of bleeding when taken alongside warfarin and aspirin |

The findings of this study indicate that a case-based integrated pharmacy education model substantially improves both the learning experience and applied competencies of pharmacy students. Implemented among final-year pharmacy students enrolled at Tabriz University of Medical Sciences, the program effectively reduced the disconnect between theoretical instruction and practical application. It enabled learners to synthesize and apply foundational knowledge within authentic pharmacy practice contexts.

*Development of the integrated component*

Although the academic team possessed considerable experience in delivering undergraduate pharmacy education, the adoption of theme-driven integrative case studies represented a novel pedagogical approach that encouraged stronger interdisciplinary cooperation. Informal observations suggested that faculty members and educational administrators within the School of Pharmacy responded positively to efforts aimed at establishing an integrated educational framework. Comparable initiatives have been reported by other pharmacy institutions, highlighting the advantages of interdisciplinary collaboration and innovative instructional strategies [20, 21].

The respiratory disease module in *Integrated Pharmacy Case Studies* [18] closely corresponds with students' prior learning, making it particularly suitable for final-year instruction. This section addresses key respiratory conditions through structured case studies, each supported by defined learning outcomes and patient-oriented questions. Emphasis is placed on patient care, alongside comprehensive coverage of disease pathology, pharmacotherapy, mechanisms of action, chemical properties, dosage forms, stability, and drug interactions relevant to each case. The cases also explore scientific principles, pharmacokinetic considerations, interactions, and adverse effects, reinforced by targeted analytical questions.

*Integration and student competency*

Combining disciplines such as pharmacology, medicinal chemistry, and pharmaceutics within a unified course framework markedly improved students' competence in managing respiratory conditions, particularly asthma and cough. This integrative model reflects the ongoing transition in pharmacy education toward outcome-focused curricula that address the increasing complexity of modern healthcare practice.

Survey findings demonstrated that approximately 60% of students experienced a notable enhancement in their ability to manage respiratory diseases, reinforcing the effectiveness of this instructional approach. These results align with the work of Kullgren *et al*., who reported that student and practitioner feedback from an integrated pain management course indicated improved learning outcomes and knowledge retention when integrated teaching methods were employed [22].

In addition, a 2016 investigation involving 94 pharmacy schools in the United States reported similar benefits, with nearly 65% of students acknowledging that integrated education improved their understanding, clinical application of knowledge, and practical skills [23].

Moreover, Brown *et al*. documented successful attainment of educational objectives through the use of an integrated curricular model at the American Winkle School of Pharmacy [24].

*Strengthening clinical decision-making through integrated instructional approaches*

The growing complexity of pharmacy practice demands rapid access to information and prompt, accurate clinical decisions in patient care. Although pharmacy students invest substantial effort during their academic training,

many graduate without key practical competencies, largely due to inadequate opportunities for content revision and consolidation. Extended study programs combined with limited review time can reduce graduates' confidence and effectiveness when delivering professional services [25, 26]. Moreover, teaching content in a disconnected manner has been shown to be less suitable for solving practical, real-life problems [27]. In contrast, integrated teaching frameworks allow instructors to evaluate students' abilities in patient assessment and pharmaceutical care more comprehensively, thereby strengthening clinical judgment and decision-making capacity.

The influence of the integrated teaching–learning strategy on students' clinical decision-making ability was clearly evidenced through assessment using a standardized case study. Student outcomes were compared independently of the integrated course content and instructors, enabling evaluation between two groups: those exposed to integrated learning and those following a conventional approach. Based on the final examination grading system—awarding 4 points per correct response and calculating scores out of 100—the integrated learning group achieved a mean score of 31.4, whereas the control group attained only 15.75. This statistically significant difference ($P < 0.05$) supports the study hypothesis and demonstrates that engagement in the integrated program substantially improved students' clinical decision-making performance.

When contrasted with conventional teaching models, traditional subject-based curricula, while essential for foundational knowledge, often result in fragmented learning that does not readily translate into clinical competence. The integrated model applied in this study offered a unified educational experience, enabling students to recognize relationships among different pharmaceutical disciplines. The notable superiority of the intervention group over the control group in the final assessment highlights the effectiveness of this approach. Beyond improving conceptual understanding, integrated learning significantly enhanced students' ability to apply knowledge in clinical contexts. The observed advancement in clinical decision-making suggests that students are better equipped to face real-world pharmacy practice, with increased confidence and professional readiness.

*Student feedback and future implications*

Survey findings indicated that prior to enrolling in this course, 36% of students had no prior exposure to integrated education systems, 12% reported full familiarity, and 52% indicated partial awareness. These data suggest that most students had a limited understanding of integrated educational models before participation. Incorporating this unit into the pharmacy curriculum increased student familiarity with integrated learning strategies and encouraged application of these methods beyond the course content.

Overall, student feedback was highly favorable, with most participants reporting improvements in clinical decision-making abilities and recognizing the relevance of integrated education to future professional practice. This confirms that the integrated approach effectively narrows the divide between theoretical instruction and practical application, a critical objective in pharmacy education.

Nevertheless, students also identified opportunities for enhancement. They emphasized the importance of sustained integration across multiple modules, suggesting that while integration is beneficial, it should be implemented more consistently throughout the curriculum. Strong support was expressed for incorporating this unit into the core pharmacy program, with 94% of students considering it valuable. Additionally, 75% of respondents believed the unit should be expanded to address a broader range of topics. This strong endorsement reflects the perceived contribution of integrated education to curriculum relevance and educational quality.

Students further recommended including additional subject areas and a greater number of case studies to enrich applied learning. They stressed the need to focus more extensively on issues frequently encountered in pharmacy practice, such as over-the-counter medications for common ailments and dermatological products. These comments suggest that the existing scope may not fully represent the diversity of challenges pharmacists face in professional settings. Such feedback provides important guidance for curriculum refinement and responsiveness to evolving educational needs.

Addressing these recommendations would support the development of a more cohesive and comprehensive learning experience, better aligned with the multifaceted demands of pharmacy practice. Continuous integration across courses can facilitate conceptual connections and promote holistic understanding, while expanding course content can broaden students' clinical skill sets.

Delivering this unit prior to the urban internship may further enhance student preparedness for patient management in community pharmacy settings.

Collectively, these insights offer a strategic framework for strengthening the integrated education unit so that it more effectively meets student expectations and professional requirements. Implementing these improvements has the potential to create a more engaging, relevant, and robust educational experience, ultimately enhancing pharmacy graduates' competence and readiness for real-world practice.

*Challenges and considerations*

A major difficulty encountered during the rollout of this program was the COVID-19 pandemic, which required an abrupt transition from face-to-face instruction to online delivery. Despite these constraints, the integration of recorded lectures and virtual discussion forums preserved the quality and continuity of the learning process. Insights gained from this experience suggest that future implementations could adopt a blended instructional model, combining in-person sessions with online components to improve flexibility and learner access.

The favorable findings of this investigation indicate that integrated pharmacy education has the potential to function as a transferable framework for institutions seeking curriculum reform. Based on the positive outcomes of this pilot initiative, it is advisable to design and evaluate comparable integrated courses across multiple pharmacy schools to further assess and optimize this educational strategy. Moreover, conducting longitudinal research to examine the sustained effects of integrated learning on professional performance would offer a more comprehensive evaluation of its long-term effectiveness.

## Conclusion

The adoption of an integrated pharmacy education model, particularly one grounded in case-based learning, has demonstrated considerable effectiveness in improving both instructional quality and applied competencies among pharmacy students. By closing the divide between academic theory and practical application, this approach responds directly to the complexities of contemporary healthcare practice. Findings from the program implemented at Tabriz University of Medical Sciences showed that a respiratory disease–focused integrated curriculum substantially enhanced students' ability to manage clinical scenarios. The educational framework encouraged interdisciplinary interaction, leading to deeper comprehension and improved knowledge retention. This was evident in the notable advancement of clinical decision-making skills, with students in the intervention group achieving higher assessment scores than those in the control group.

Student evaluations further emphasized the importance of integrated education, with strong support for its expanded use within the pharmacy curriculum. The broad endorsement of continuous integration and the recommendation to include a wider range of topics reflect students' recognition of the practical advantages offered by this method. Although the transition to online instruction during the COVID-19 pandemic presented challenges, it also yielded important insights into the feasibility and benefits of hybrid educational models.

Future plans for this initiative include extending integrated instruction to additional subject areas and ensuring sustained integration throughout the pharmacy curriculum. It is strongly recommended that other pharmacy schools implement and adapt similar integrated courses to further test and refine this model. Long-term follow-up studies would be valuable in clarifying the enduring impact of integrated education on professional practice. Overall, integrated pharmacy education provides a strong and adaptable framework for preparing graduates to meet the multifaceted demands of modern pharmacy practice, supporting a cohesive, practice-oriented learning environment that enhances both competence and professional confidence.

**Acknowledgments:** None

**Conflict of Interest:** None

**Financial Support:** None

**Ethics Statement:** None

## References

1. Brown DL. It is time to rethink the all-Pharm. D. educational system: multiple tiered degrees would better serve the diverse nature of pharmacy practice. J Am Coll Clin Pharm. 2020;3(6):1147–54.

2. Crass RL, Romanelli F. Curricular reform in pharmacy education through the lens of the Flexner report of 1910. Am J Pharm Educ. 2018;82(7):6804.
3. Ali SM, Ishaq W, Shabbir R, Nasrullah R, Safdar M, Liaquat A, et al. Systematic review and Meta-analysis on the gaps in Pharmacy Education System: a Prisma Compliant Study. Educational Administration: Theory Pract. 2024;30(8):573–7.
4. Sun D, Kinney J, Hintz A, Beck M, Chen AM. Advancing pharmacy education by moving from sequenced integration to true curricular integration. Am J Pharm Educ. 2023;87(6):100056.
5. Hubball* H, Burt H. An integrated approach to developing and implementing learning-centred curricula. Int J Acad Dev. 2004;9(1):51–65.
6. Husband AK, Todd A, Fulton J. Integrating science and practice in pharmacy curricula. Am J Pharm Educ. 2014;78(3):63.
7. Zakeri M, Fatima B, Yazdanfard S, Sansgiry SS. Integrated curriculum in the United States pharmacy programs. Currents Pharm Teach Learn. 2024;16(7):102094.
8. Accredation Council for Pharmacy Education. PharmD Program Accreditation 2024 https://www.acpe-accredit.org/pharmd-program-accreditation/.Accessed 21 Sep 2024.
9. The Canadian Council for Accreditation of Pharmacy Programs. Accreditation standards for Canadian Educational programs leading to the doctor of pharmacy (PHARM.D.) Degree 2023 https://ccapp.ca/wp-content/uploads/2023/09/2023-Pharmacy-Stds.pdf. Accessed 21 Sep 2024.
10. Ratka A. Integration as a paramount educational strategy in academic pharmacy. Am J Pharm Educ. 2012;76(2).
11. Dirks-Naylor AJ, Wright NJ, Alston GL. Development and Assessment of a Horizontally Integrated Biological Sciences Course Sequence for Pharmacy Education. Am J Pharm Educ. 2015;79(6):89.
12. Lankarani KB, Honarvar B, Faghihi SA, Haghighi MRR, Sadati AK, Rafiei F, et al. Demanded interdisciplinary subjects for integration in medical education program from the point of view of graduated medical physicians and senior medical students: a nationwide mixed qualitative-quantitative study from Iran. BMC Med Educ. 2024;24(1):125.
13. Ayati MH, Pourabbasi A, Namazi N, Zargaran A, Kheiry Z, Kazemi AH, et al. The necessity for integrating traditional, complementary, and alternative medicine into medical education curricula in Iran. J Integr Med. 2019;17(4):296–301.
14. Azizi F, Entezari A, Momtazmanesh N, Pezeshkian M, Tabrizchi N. Impact of Integration of Medical Education in the Health System of Islamic Republic of Iran. Strides Dev Med Educ. 2024;21(Supplement):1–10.
15. Nikanmehr M, Kouti L, Eslami K. A review of integrated courses in pharmacy education and impact of integration in Pharm D curricula. J Pharm Care. 2015;3(3-4):67–72.
16. Moezzi SMI, Nadimi Parashkouhi S, Abbasi H, Azadi A, Mohagheghzadeh A, Hamidi M. The necessity of revision and reform in Iran pharmacy education: finding a way for evolution. Trends Pharm Sci. 2021;7(4):227–32.
17. Tavakol M, Murphy R, Torabi S. Medical Education in Iran: An Exploration of some Curriculum issues. Med Educ Online. 2006;11(1):4585
18. Francis S-A, Smith F, Malkinson J. Integrated Pharmacy Case Studies: Pharmaceutical; 2015.
19. PharmDia. Clinical case studies with answers https://web.archive.org/web/20240419152244/https://pharmdia.com/clinical-case-studies-with-answers/.Accessed 19 Apr 2024.
20. De Matteis CI, Randall MD, Harvey EJ, Morris A, Winkler GS, Boardman HF. An integrated dyspepsia module for first-year pharmacy students. Am J Pharm Educ. 2019;83(1):6508.
21. Ryan TJ, Ryder SA, D'Arcy DM, Quigley JM, Ng NN, Ong WQ, et al. Development of Professional attributes through Integration of Science and Practice at First-Year Pharmacy Level. Pharmacy. 2020;9(1):4.
22. Kullgren J, Radhakrishnan R, Unni E, Hanson E. An integrated course in pain management and palliative care bridging the basic sciences and pharmacy practice. Am J Pharm Educ. 2013;77(6):121.
23. Poirier TI, Fan J, Nieto MJ. Survey of Pharmacy Schools' approaches and attitudes toward Curricular Integration. Am J Pharm Educ. 2016;80(6):96.
24. Brown B, Skau K, Wall A. Learning across the curriculum: connecting the pharmaceutical sciences to practice in the first professional year. Am J Pharm Educ. 2009;73(2):36.

25. Bero L, Mays N, Barjesteh K, Bond C. Expanding the roles of outpatient pharmacists: effects on health services utilisation, costs, and patient outcomes. The Cochrane Database of Systematic Reviews, 01 Jan 2000, (2):CD000336.
26. Harden RM. The integration ladder: a tool for curriculum planning and evaluation. Med Educ. 2000;34(7).
27. Slattery P. Curriculum Development in the postmodern era. Garland Reference Library of Social Science, volume 929. Critical education practice. Volume 1. ERIC; 1995.