

Evaluating Interprofessional Education Competencies in Nursing and Pharmacy Students During an Interprofessional Problem-Based Learning Activity: A Quasi-Experimental Study

Hailah Almoghira¹, Rana Aljadeed¹, Khulud Khalid Almutairi², Raeed Alanazi³, Asma Abdulrahman Alfarhan¹, Wael Mansy¹, Basma Y Kentab¹, Latifah Almater², Ghada A Bawazeer¹, Haya M Almalag¹

¹Department of Clinical Pharmacy, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia; ²Department of Medical Surgical Nursing, College of Nursing, King Saud University, Riyadh, Saudi Arabia; ³Department of Nursing Administration and Education, College of Nursing, King Saud University, Riyadh, Saudi Arabia

Correspondence: Hailah Almoghira, Department of Clinical Pharmacy, College of Pharmacy, King Saud University, Riyadh, Saudi Arabia, Email halmoghira@ksu.edu.sa

Background: Interprofessional education (IPE) is essential for preparing healthcare students to collaborate effectively in clinical practice. However, empirical evidence on IPE outcomes among nursing and pharmacy students in Saudi Arabia remains limited.

Objective: To evaluate the impact of a structured interprofessional problem-based learning (PBL) activity on nursing and pharmacy students' interprofessional attitudes, teamwork behaviors, and knowledge in addition to exploring students' reflections on the learning experience.

Methods: A quasi-experimental study was conducted with 201 intermediate-level students at King Saud University. Students participated in a one-hour interprofessional PBL session built around a shared clinical case, preceded by a recorded briefing and ice-breaker activity. The following assessment strategies were employed: The Interprofessional Attitudes Scale (IPAS), the Individual Teamwork Observation and Feedback Tool (iTOFT), knowledge and retention assessments, and students' reflective evaluations of the experience.

Results: IPAS scores indicated generally positive attitudes toward interprofessional collaboration, although lower scores in interprofessional bias suggested that some stereotypes persisted. iTOFT ratings showed high levels of effective teamwork. Thematic analysis of reflections revealed perceived gains in communication, understanding of roles and responsibilities, teamwork, and ethical practice. Students also identified challenges related to timing, group size, and logistical organization, and recommended clearer instructions, smaller groups, better scheduling, and inclusion of additional health professions. Knowledge scores were high immediately post-activity but showed a modest decline at three months, with one item related to understanding professional roles improving over time.

Conclusion: A single, structured interprofessional PBL activity may foster positive interprofessional attitudes, support observable teamwork behaviors, and enhance understanding of professional roles. Nonetheless, residual biases, partial knowledge decay, and logistical challenges highlight the need for longitudinal, well-integrated IPE activities involving multiple disciplines. These findings may support the ongoing attempts for integration and enhancement of IPE within health professions curricula that may prepare students to better collaborative, and patient-centered care.

Keywords: collaboration, interprofessional education, pharmacy, problem-based activity, nursing

Introduction

In recent years, the increasing complexity of healthcare has highlighted the need for collaboration among professionals from different disciplines to deliver safe, effective, and patient-centered care. Interprofessional education (IPE), where students from two or more health professions *learn with, from, and about one another*, has gained global recognition as an essential element in preparing a collaborative healthcare workforce.^{1,2} IPE improves core competencies such as teamwork, communication, and role



understanding, which are critical for effective interprofessional collaboration.³⁻⁶ Recent evidence suggests that IPE can enhance students' understanding of healthcare knowledge more effectively than traditional teaching approaches.^{7,8}

Problem-based learning (PBL) is used to support IPE; it places students in realistic, collaborative clinical scenarios that require shared problem-solving and the application of diverse professional perspectives. The integration of IPE with PBL has been recognized to increase student engagement, support self-learning, and enhance interprofessional collaboration.⁹ Studies have reported improvements in teamwork, communication, and attitudes toward interprofessional practice following IPE-PBL activities, although some findings suggest variability in how students develop role clarity across disciplines.³⁻⁵

In Saudi Arabia, the adoption of IPE aligns with the healthcare education reforms promoted under Saudi Vision 2030.¹⁰ While there is growing institutional interest, IPE is still emerging in many academic programs, and empirical data on its effectiveness remains limited, particularly among nursing and pharmacy students.¹¹⁻¹⁴ Local studies indicate a generally positive attitude toward IPE and a readiness to engage in interprofessional learning.^{11,12,15} However, they also highlight challenges such as insufficient coordination across programs and limited faculty experience with IPE methods.⁷

To address this gap, and due to the continuous needs for innovative methods in IPE healthcare curricula, the present study introduces a new method of interprofessional PBL activity that is easily applicable, characterized by its short duration, seamless integration into existing coursework, and multi assessment approach involving nursing and pharmacy students at King Saud University in Saudi Arabia.

This study aims to evaluate the effect of this PBL learning experience on key interprofessional competencies such as teamwork, communication, role clarity, and collaborative decision-making, guided by the Interprofessional Education Collaborative (IPEC, 2016) framework and documented evaluation of the 4 domains (values and ethics, roles and responsibilities, teams and team work, and communication). The findings might contribute to the growing body of evidence on IPE and support ongoing efforts to improve collaboration in health profession education by using a problem-based approach.

Methods

Study Design and Settings

This is a quasi-experimental study to assess students' interprofessional education competencies following a BPL-based activity. The activity is structured as part of an intermediate-level course in both pharmacy and nursing. The faculty members of the pharmacy and nursing programs collaborated to design an activity that includes information necessary for both specialties. The study utilized a single-group post-test design without a comparison group.

Study Participants and Study Recruitment

Students from two intermediate-level courses in pharmacy and nursing were invited to participate in this study because both courses in both programs share a curriculum on a specific health condition, including its pathophysiology, progression, and medication, providing an appropriate context for IPE. All enrolled students in these selected levels were eligible. Participants were recruited from both programs, and the activity was clearly explained to them, either in person or via email. College students from both disciplines met in a combined classroom under the supervision of instructors from both colleges. The students were asked to consent through an electronic link using Microsoft Forms and then complete information related to gender and grade point average (GPA).

Sample Size and Bias

A convenience sampling method was employed. The study targeted all students enrolled in the designated courses during the study period. Accordingly, all 201 eligible nursing and pharmacy students registered in these courses were invited to participate in this study; therefore, no formal sample size calculation was conducted. Prior to the study activities, invitations were disseminated, and 201 students granted consent. McConnell et al assert that a sample size of $N = 50$ (25 per group) is sufficient for educational interventions; our final cohort of 201 participants exceeds this criterion.¹⁶

Study Variables

The IPE Activity Design

The activity was structured to include a briefing and an ice-breaker activity, followed by an interprofessional PBL session based on a shared clinical case. Undergraduate students from nursing and pharmacy colleges were assigned to collaborate in a one-hour session to review a patient's case and address questions that aim at enhancing the management of the patient's condition and quality of care.

Case Scenario

A team of experts, who teach therapeutics courses and related courses in the College of Pharmacy and College of Nursing, was tasked with creating two patient scenarios to accommodate the activity being conducted across different sections on two separate days. The patients' cases underwent several rounds of review until the team reached agreement on the final version. ([Appendix 1](#)).

The cases created were two pages long and focused on the management of Epilepsy, a topic previously explored by both disciplines. Students were asked to integrate the knowledge learned into patient care by answering seven questions related to: vital signs assessment, medication recommendations, lab monitoring, medication adjustments, nondrug measures, patient education, and interprofessional approach to patient-centered care.

The assessment team consisted of four academic pharmacists, four academic nurses, and five intern students. The intern students were assigned to facilitate the activity by being available during the session to guide the students and provide the necessary support, in addition to participating in the assessment of students' improvement. Before the activity day, all assessment team members participated in a training session on the activity that involved discussions on how to use the assessment tools appropriately.

The IPE Activity

One week before the activity, a recorded educational presentation and videos about interprofessional education concepts were sent to students through Blackboard (LMS-1997-2025 Blackboard Inc).[©], an online learning management platform. The objective of these materials was to brief students on interprofessional education (IPE) definition, discuss core competencies of interprofessional education, identify the importance of interprofessional collaboration and its impact on quality and safety of patient care, discuss the importance of communication for effective collaboration, and identify the opportunities for using IPE to improve interprofessional collaboration ([Appendix 2](#)).

On the day of the activity, students from the nursing and pharmacy disciplines were distributed to interprofessional teams. Each team consisted of about two to four pharmacy students and two to four nursing students. The activity was conducted on two different days due to space limitations and scheduling arrangements. On the first day, students were distributed into a total of 15 interprofessional groups, while on the second day, the rest of the students were distributed into a total of 16 interprofessional groups. Each group comprised an average of three pharmacy students and three nursing students. Each interprofessional team worked for one-hour to provide management for a patient with Epilepsy. In the first 10 minutes, the facilitator explained the activity to the students and addressed any concerns they raised. After that, students completed the consent form to participate as research participants, followed by a 5-minute ice-breaker activity. During the icebreaker activity, each member introduced themselves to the group and thereafter stated their professional function. This icebreaker activity aimed to facilitate students' acquaintance and promote comfortable interaction among them. Then, each interprofessional team spent 45 minutes reading the case posted on the online learning platform and working collaboratively to understand it and answer the provided questions. Each group emphasized contributing meaningfully to the case workup. After completing the activity, students submitted the case file to the online learning platform. A 30-minute debriefing discussion was then conducted with all groups about the case and their experience. Finally, all students were invited to complete a set of assessments.

IPE Assessment

Multiple assessment strategies to capture students' learning and improvement were selected to use in this activity. These assessment strategies were a combination of objective and subjective assessments, as recommended in the literature for evaluating an interprofessional education activities.^{17,18} Reeves et al recommend the use of the Kirkpatrick Model as an evaluative model for assessing learning outcomes of any interprofessional educational activity.¹⁹ This model consists of four

levels: reaction, which assesses the satisfaction and engagement of the participant in the activity; learning, which assesses the acquisition of the desired knowledge, skills, or attitudes; behavioral change, which assesses the capability of participants to utilize their learning; and results, which assess the achievement of the intended outcomes. The following assessment strategies were used after aligning them with the first three levels of the Kirkpatrick evaluation model:

- The interprofessional attitude scale (IPAS) completed by students was used after the activity to assess students' learning.²⁰
- The individual Teamwork Observation and Feedback tool (iTOFT) completed by assessment teams during the activity was used to assess behavioral change.²¹
- Knowledge and retention tests directly after completing the activity and three months later were used to assess students' learning.
- Students' reflection about the experience completed by students after the activity was used to assess students' reactions.

IPAS

The interprofessional attitude scale (IPAS) is a 27-item scale developed in 2015 by Norris, et al²⁰ The scale captures core attitudes towards core competencies in IPE, such as teamwork, roles and responsibilities, patient-centeredness, inter-professional biases, diversity and ethics, and community-centeredness. These competencies are captured through answering twenty-seven 5-point Likert scale items after completing the activity.

iTOFT

iTOFT is an evidence-based tool, developed by Thistlethwaite et al in 2016, used to assess interprofessional teamwork behaviors.²⁰ The selection of this tool was guided by a published decision aid, ensuring it was appropriate for evaluating behavioral change in students after an IPE activity.²² Notably, iTOFT demonstrates good reliability and validity in individual performance assessment. There are two versions of this tool "basic and advanced" chosen based on students' clinical teamwork experience. In this study, as participants were third-year students, the basic version was deemed most suitable. The basic version consists of 11 observable behaviours within two sections: shared decision-making and working in a team. The scale for this tool consists of four choices: not applicable, inappropriate, appropriate, and responsive. Additionally, there is a designated area to write qualitative feedback and assess the overall global impression. The assessment teams completed this tool during the activity. They used the iTOFT tool to evaluate students' performance and provide qualitative feedback to students.

Student Reflection

A debriefing discussion was conducted with all groups about the case and the experience. Students were then invited to complete a reflection about their experience to assess their reaction. Students' responses to the following three questions were captured:

- (1) What did you like about this lab experience?
- (2) What did you dislike about this lab experience?
- (3) Suggest areas for improvement.

Knowledge Test

To assess students' acquisition of knowledge about the IPE, a knowledge test was conducted ([Appendix 3](#)). The test consisted of four multiple-choice questions (MCQs) about the concept of IPE and its benefits for the healthcare system. Each MCQ had only one correct answer, ensuring clarity and precision in assessment. Students were invited to answer these questions directly after completing the activity.

Knowledge Retention Test

The long-term skill retention was found to improve if the knowledge retention test was delayed until three months after training.²³ Based on that, a knowledge retention test was conducted three months after completing the IPE activity to

evaluate how well participants retained information. The same four MSQs about the concept of IPE and its benefit for healthcare systems were used. This knowledge retention *test* allowed for the assessment of long-term knowledge retention rather than short-term recall.

Data Collection

The results from all assessment strategies were collected for analysis. The iTOFT completed by the assessment team was collected during the activity. The IPAS, knowledge test, and reflection completed by students were collected immediately after the activity, while the knowledge retention test was collected at 3 months.

Ethical Considerations

This study was approved by the Institutional Review Board of King Saud University, Riyadh, Saudi Arabia (Approval no. KSU-HE-25806). The study was conducted under the supervision of the College of Pharmacy Education Unit, the College of Pharmacy Simulation Lab Committee, and the College of Nursing Academic Affairs. Although the activity was part of the course, students were asked to consent to participating in the assessment process, and no students' identifiers were collected.

Data Analysis

Data were exported from Microsoft Forms and Google Forms into Microsoft Excel. The data was then coded and entered into IBM SPSS Statistics (Version 30). Categorical data is presented as numbers and percentages. Continuous data is presented as mean (\pm standard deviation) or median (interquartile range), as appropriate. The students' reflections underwent a simple thematic analysis using a deductive approach. Two authors [HM, HM] independently conducted the data analysis. Discrepancies were resolved through discussion and consensus; however, formal inter-rater reliability was not statistically assessed. On in the IPAS scale and to ensure all items were oriented in the same direction, where higher scores consistently indicate more favourable attitudes toward IPE, negatively worded items were reverse-coded before calculating subscale and total scores. These included: "It is not necessary for health sciences students to learn together" (Teamwork) and "I have prejudices or make assumptions about health professionals/students from other disciplines" (Interprofessional Biases). For each reverse-coded item, responses were transformed using the formula: reversed score = 6 - original score. Following this, item scores were averaged within each subscale and then combined to determine the overall IPAS score.

Results

In total, 201 students participated in this activity: 109 pharmacy students and 92 nursing students. Of the total participants, males comprised a slightly higher proportion of the sample compared to females (N=110, 55%, Table 1). The activity was conducted on two different days. On the first day, students were distributed into a total of 15 interprofessional groups, while on the second day, the rest of the students were distributed into a total of 16 interprofessional groups. Each group comprised an average of 3 pharmacy students and 3 nursing students. Each interprofessional team worked in a one-hour session to provide management for a patient with Epilepsy. The assessment team completed 162 iTOFT tools during the activity time. After completion of the activity, 176 students completed the IPAS tool, 192 students completed the knowledge, and 130 students

Table 1 Demographics of Participating Students (N=201)

Age, Years (Mean (SD))	21 (1)
Gender (n, %)	
– Male	110 (55)
– Female	91 (45)
Profession (n, %)	
– Pharmacy	109 (54)
– Nursing	92 (46)

completed a reflection about their experience. Three months after completing the activity, all students were invited to take a knowledge retention test, but only 48 students participated.

iTOFT Results

Across all 11 items of the Individual Teamwork Observation and Feedback Tool (iTOFT), both pharmacy and nursing students demonstrated high levels of interprofessional teamwork, with the vast majority of ratings in the “Responsive” category with very few “Inappropriate” ratings. Pharmacy students were most frequently rated as responsive for key behaviors such as planning care with the team (77.4%), prioritizing actions (87.1%), reviewing goals when situations changed (89.2%), and advocating for patients or groups (88.2%). Nursing students showed a similar pattern, with high proportions of responsive ratings for planning care (66.7%), prioritizing actions (71.0%), reviewing goals (65.2%), and advocacy (71.0%). Respectful behavior was particularly strong, with no inappropriate ratings among pharmacy students and only 2.9% among nursing students. The overall global impression was highly favorable for both groups, with 88.2% of pharmacy and 79.7% of nursing students rated as responsive, suggesting that the interprofessional activity effectively promoted competent and collaborative teamwork behaviors (Table 2).

Table 2 Results of the Objective Assessment of Students During the Activity Using the Individual Teamwork Observation and Feedback Tool (iTOFT)

Items	Pharmacy				Nursing			
	NA n (%)	A, n (%)	R, n (%)	I, n (%)	NA n (%)	A, n (%)	R, n (%)	I, n (%)
1. Plans patient care or group intervention with team members	0	18 (19.4)	72 (77.4)	3 (3.2)	0	19 (24.6)	46 (66.7)	4 (5.8)
2. Prioritises actions relevant to the management of the patient or the group intervention	0	9 (9.7)	81 (87.1)	3 (3.2)	0	17 (24.6)	49 (71.0)	3 (4.3)
3. Reviews patient or group goals when/if the situation has changed	0	7 (7.5)	83 (89.2)	3 (3.2)	0	22 (31.9)	45 (65.2)	2 (2.9)
4. Advocates for patient/family or group as partners in decision-making processes	0	8 (8.6)	82 (88.2)	3 (3.2)	0	18 (26.1)	49 (71.0)	2 (2.9)
5. Shares health care information with patients/families or groups	8 (8.6)	5 (5.4)	78 (83.9)	2 (2.2)	5 (7.2)	14 (20.3)	48 (69.6)	2 (2.9)
6. Integrates patient's/family's or group circumstances, beliefs, and values into care/intervention plans	0	10 (10.8)	79 (84.9)	4 (4.3)	0	16 (23.2)	51 (73.9)	2 (2.9)
7. Includes relevant health professionals in patient care management or group intervention as appropriate	8 (8.6)	10 (10.8)	74 (79.6)	1 (1.1)	5 (7.2)	16 (23.2)	46 (66.7)	2 (2.9)
8. Participates in interprofessional discussions about patient care or group intervention	0	18 (19.4)	69 (74.2)	6 (6.5)	0	24 (34.8)	42 (60.9)	3 (4.3)
9. Demonstrates respect for others in and outside the team	0	9 (9.7)	84 (90.3)	0	0	11 (15.9)	56 (81.2)	2 (2.9)
10. Invites the opinions of other team members	0	19 (20.4)	73 (78.5)	1 (1.1)	0	15 (21.7)	51 (73.9)	3 (4.3)
11. Participates in discussions about team performance	0	16 (17.2)	75 (80.6)	2 (2.2)	0	25 (36.2)	41 (59.4)	3 (4.3)
Overall global impression	0	10 (10.8)	82 (88.2)	0	0	13 (18.8)	55 (79.7)	1 (1.4)

Abbreviations: A, Appropriate; R, Responsive; I, Inappropriate; NA, Not Applicable.

IPAS Results

Among the participants (N=176), the mean overall IPAS score was 3.99 (SD=0.70), reflecting generally positive interprofessional attitudes. At the subscale level, the highest mean score was observed for Patient-Centeredness (mean=4.15, SD=0.80), followed by Diversity and Ethics (mean=4.05, SD=0.83), Teamwork, Roles, and Responsibilities (mean=3.98, SD=0.73), and Community-Centeredness (mean=3.97, SD=0.74). The lowest mean score was recorded for Interprofessional Biases (mean=3.76, SD=0.85). Overall, these findings suggest favorable attitudes toward interprofessional learning, collaboration, and patient-centered practice. Responses to teamwork-related items showed broad agreement on the value of shared learning for improving communication and professional role clarity. Furthermore, most students disagreed that interprofessional learning is unnecessary, reinforcing positive perceptions of the curriculum. While the Interprofessional Biases subscale yielded the lowest mean, it remained above the scale midpoint, indicating generally positive attitudes despite the possible persistence of some professional stereotypes. Welch's independent-sample t-tests confirmed no statistically significant differences between pharmacy and nursing students on the overall IPAS score or any individual subscale ($p > 0.05$) (Table 3 and Figure 1).

Students' Knowledge Test and Retention Knowledge Test

The knowledge test analysis evaluated students' understanding of the four IPE competencies: interprofessional communication (Q1), values and ethics (Q2), roles and responsibilities (Q3), and teams and teamwork (Q4). The assessments were conducted anonymously and responses could not be matched; therefore, only descriptive analyses are reported. Per-question analysis revealed a decline in correct responses over the 3-month period (Table 4). Q1 dropped from 98.96 to 87.5 (retention rate of 88.4 and absolute change -10.54), Q2 dropped from 88.02 to 75 (retention rate of 85.21 and absolute change -2.81), and Q4 dropped from 91.67 to 81.25 (retention rate of 88.64 and absolute change -3.03), suggesting a modest decline in retained knowledge over time. For question 3 about the role and responsibility domain, the knowledge retention was 86.84 and the absolute change was positive (7.68), which indicates improvement in understanding the role and responsibilities over time.

Students' Reflection

The analysis of student reflective feedback about the experience was divided into two parts. The first part was about the strengths of this experience, and the second part was about challenges and suggestions.

Table 3 Interprofessional Attitudes Scale (IPAS) Subscale and Overall Scores by Profession

Subscale	Pharmacy Students (N=99)		Nursing Students (N=77)		t	p	Cohen's d	95% CI for Mean Difference
	Mean	SD	Mean	SD				
Teamwork, Roles, and Responsibilities (9 items)*	3.996	0.719	3.949	0.746	0.416	0.678	0.063	-0.172 to 0.265
Patient-Centeredness (5 items)	4.147	0.788	4.161	0.810	-0.115	0.909	-0.018	-0.252 to 0.224
Interprofessional Biases (3 items)*	3.778	0.829	3.725	0.878	0.405	0.686	0.062	-0.202 to 0.308
Diversity and Ethics (4 items)	4.073	0.829	4.022	0.845	0.405	0.686	0.062	-0.198 to 0.301
Community-Centeredness (6 items)	4.008	0.724	3.918	0.769	0.796	0.427	0.121	-0.133 to 0.314
Overall IPAS Score	4.014	0.685	3.966	0.729	0.445	0.657	0.068	-0.163 to 0.259

Notes: Higher scores indicate more positive attitudes. t-tests are Welch-corrected independent-samples tests comparing nursing and pharmacy students.*indicates subscales that include a reverse-coded item.

Abbreviations: IPAS, Interprofessional Attitudes Scale; d, Cohen's d.

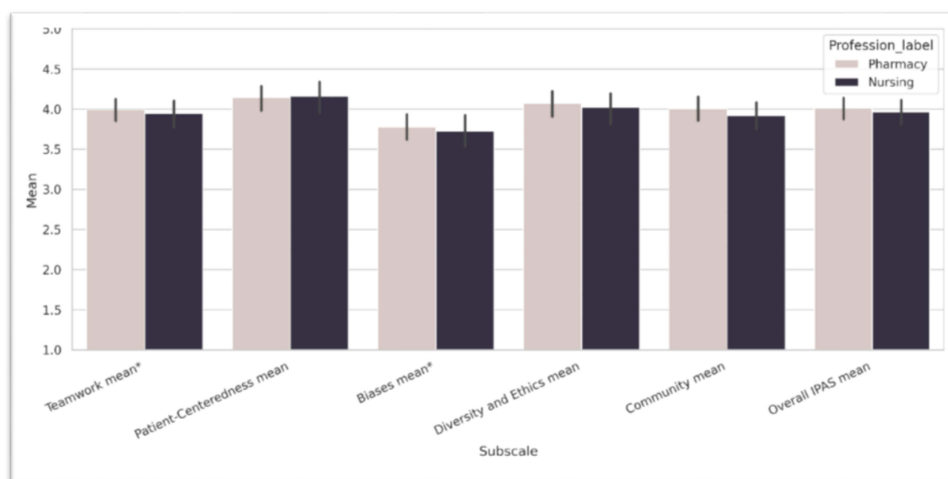


Figure 1 Interprofessional Attitudes Scale (IPAS) Subscale by Profession. *indicates subscales that include a reverse-coded item.

Strengths

The themes from the data representing the strengths were organised using the IPEC core competencies for IP collaborative practice. The themes are presented below with illustrative quotes. We indicate whether the quote originated from a pharmacy student or a nursing student by using P for pharmacy and N for nursing.

Table 4 Knowledge and Knowledge Retention Rate and Absolute Change

Question (IPEC Core Competency)	The Answer	Correct Answer n=192 (%)	Correct Answers Retest n=48 (%)	Knowledge Retention	Absolute Change
Effective interprofessional education between health care sectors is believed to improve the (Communication, value-ethics, teamwork, and roles and responsibilities)	All the above	190 (98.96)	42 (87.5)	88.42	-10.54
The famous report of the expert panel on “Interprofessional Core Competencies for IPE/C” published in 2011 includes which of the following four competency domains: (Communication, value-ethics, teamwork, and roles and responsibilities)	Communication, value-ethics, teamwork, and roles and responsibilities	169 (88.02)	36 (75)	85.21	-2.81
Use the knowledge of one’s own role and those of other professions to appropriately assess and address the health care needs of the patients and populations served is the definition of (Roles & Responsibilities)	Roles/Responsibilities	152 (79.17)	33 (68.75)	86.84	7.68
A 25-year-old obese lady presented with grade I obesity (BMI 32 kg/m ²) and she wants to do a sleeve gastrectomy. However, the multidisciplinary treating team decided to give her a chance for dieting (Teamwork)	It supports providers to work together to deliver better care	176 (91.67)	39 (81.25)	88.64	-3.03

Communication

Students were positive about their experience of communicating with other professionals and found it helpful for their education and future practice.

I learn how communicate with other in health field (P65)

I liked earning new information from nursing students, and communicating with them was fun (P16)

Communication and teamwork (N19)

I like sharing information with each other & it will help us in the future & improve quality of life of the patients (P128)

Roles and Responsibilities

Students indicated that the experience helped them learn more about the roles of other professions and that collaboration among different professions is important to provide safe and effective care for patients.

I have met new colleagues from the nursing side which made me understand them more and know their perspective when solving a case (P22)

Getting to know other professions, therapeutic approaches to treating the patient and care for them (P31)

Adding information about other specializations and exchanging ideas (N36)

I liked the opportunity to collaborate with pharmacy students, as it provided a better understanding of interdisciplinary teamwork. The hands-on practice and real-life case discussions were very beneficial in reinforcing my learning (N129)

Teams and Teamwork

Students felt positively about the opportunity to collaborate with other professionals and demonstrate teamwork skills, which are closely linked to their future practice.

This lab will improve health care in general and promote collaboration and education between health professionals (N7)

Group work and understanding my colleagues (P56)

The talking that produced a perfect teamwork (P50)

I appreciated the opportunity to work collaboratively with the team and learn from different perspectives (N15)

Values and Ethics

Students acknowledged this opportunity to work in an interprofessional team with students from other professions and demonstrate the skills needed to provide optimal patient care.

I have gained a lot of skills and how to deal with the patient properly and correctly with participation on nurses (P48)

I liked the opportunity to collaborate with pharmacy students, as it provided a better understanding of interdisciplinary teamwork. The hands-on practice and real-life case (N129)

Challenges and Suggestions

Challenges

Students expressed concerns regarding the knowledge level of the other students, scheduling, and logistical organization of the activity.

Our information were not always the same (P4)

Personally, the lab timing was an issue. Our midterm for another subject coincided with the lab, which made it hard to concentrate (P39)

Suggestions

To improve this activity, key recommendations included scheduling it at a more convenient time, clarifying the instructions, optimizing the seating plan, and using smaller groups. Involving students from various health specialties and incorporating a real-world scenario was also highlighted to further enhance the activity's relevance and interdisciplinary value.

A place that is more spacious and better group division (P11)

Hope to make it optional next time and adjust the timing (N32)

Nothing specifically but it would be interesting to solve cases with students from other health care professions such as med students and lab analysis students (P80)

Discussion

This study evaluated the impact of an interprofessional problem-based learning (PBL) initiative on the interprofessional competencies, attitudes, and knowledge of nursing and pharmacy students at King Saud University. Overall, the results indicate that even a brief, structured interprofessional learning experience can foster positive attitudes toward collaboration, enhance observable teamwork behaviors, and promote a deeper understanding of professional roles. However, there are still problems with scheduling, logistics, and keeping knowledge gains. This study was conducted within a single institution and a specific cultural and curricular context, which should be considered when interpreting the applicability of the findings to other settings.

The amalgamation of various assessment techniques, including the IPAS, iTOFT, knowledge evaluations, and reflective narratives, facilitated a thorough assessment of students' affective, cognitive, and behavioral learning outcomes. In IPE research, triangulating data sources is crucial, as no single instrument can completely encompass the intricacies of interprofessional competencies.²⁴ Combining objective (iTOFT, knowledge assessments) and subjective (IPAS, reflections) evaluations not only made our results more reliable, but it also gave us more detailed information about our strengths and weaknesses that we need to work on in the future.

The IPAS tool indicated strong positive attitudes toward teamwork and patient-centered care, while iTOFT revealed these attitudes in collaborative behaviors. The high levels of teamwork performance observed through the iTOFT ratings suggest that students were able to effectively engage in interprofessional collaboration during the activity. Most students were rated at the "Responsive" level, indicating that they were not only participating but also adapting to team needs, listening to others, and contributing meaningfully to shared decision-making. The near absence of "inappropriate" behaviors further supports that the learning environment was conducive to respectful, professional interaction and suggests that students strongly value learning with other professions. Similarly, the positive IPAS scores across domains such as teamwork, roles and responsibilities, patient-centeredness, and values and ethics reinforce these observations. These results align with a growing body of literature demonstrating that interprofessional education, especially when case-based and interactive, can enhance students' attitudes toward team-based care and improve self-reported or observed teamwork skills. Kim et al, showed that a brief 4-hour workshop targeting graduates from occupational therapy, physical therapy, and physician assistant programs focusing on IPE had significantly improved graduate students' interprofessional attitudes, their understanding of other professions, and their perceived readiness to collaborate across disciplines and care for older adults.²⁵ In addition, previous studies have reported that PBL and simulation-based IPE activities promote better understanding of professional roles, improve communication, and increase readiness for interprofessional collaboration in clinical practice.²⁶

On the other hand, the IPAS mean score was lowest in the interprofessional biases. This is comparable to the study from Oklahoma University that was conducted on students from several health sciences (allied health, dentistry, medicine, nursing, pharmacy, public health, and social work). The study showed that the lowest mean score was reported for interprofessional bias (4.8 ± 1.1 vs. 3.7 ± 0.8 in our study).²⁷ Several other studies also demonstrated lower scoring in

the interprofessional bias.^{28–30} These findings related to interprofessional bias suggest that stereotypes and preconceived notions between professions exist, and in our study, it may persist despite a single exposure. Shift in interprofessional bias requires repeated, longitudinal IPE experiences within curricula, intentional structured mixed profession activities, reflection on stereotypes, and explicit discussion of role expectations.

Our study showed that scores of the knowledge test were highest immediately after the activity, indicating successful short-term learning. However, knowledge retention faded over time (at 3 months). Interestingly, one item related to understanding professional roles showed improvement at three months, which may reflect that role clarity may be reinforced later through clinical placements or other coursework. Similarly, Gunaldo et al, reported a temporary gain in student perceptions of their confidence in interprofessional skills after engaging in a brief IPE experience.³¹ The single experience could have contributed to this pattern of knowledge retention; however, the improvement in understanding of roles over time may suggest that IPE can seed concepts that are then reinforced and deepened in later clinical or academic contexts.

The qualitative reflections further provided more support and context to the quantitative findings. Students frequently described the value of communication, teamwork, and understanding the perspectives of other professions. Many linked the experience directly to future practice and to improved patient care, which suggests that they perceived the activity as authentic and relevant rather than purely academic. At the same time, students highlighted challenges such as mismatched knowledge levels, time conflicts with other assessments, and less-than-ideal group sizes and room arrangements. These comments emphasize that the success of IPE is influenced not only by content and facilitation, but also by practical, organizational and logistic factors. Common themes are also reported in the IPE literature where students value opportunities to work with peers from other disciplines.³² This study has several strengths. It involved a relatively large sample of intermediate-level pharmacy and nursing students working in interprofessional PBL activity that is easily applicable, characterized by its short duration, seamless integration into existing coursework, and used multiple validated instruments (IPAS and iTOFT) alongside knowledge tests, and incorporated qualitative reflections to provide rich contextual understanding. However, certain limitations should be considered when interpreting the results. The quasi-experimental design without a comparison group and pre-test limits causal inference. Although all eligible students were included, no formal sample size or power calculation was conducted, which may affect the ability to detect meaningful differences. Selection bias may be present, as participants may have had more positive attitudes toward teamwork. The single-institution setting and specific cultural and curricular context may limit generalizability. Additionally, knowledge was assessed using only four multiple-choice questions, which may not fully capture the complexity of interprofessional learning and clinical reasoning. Participation in the retention test was substantially lower than in the initial assessment, potentially introducing response bias and limiting the accuracy of long-term conclusions. Finally, anonymous data collection prevented matching of individual responses, precluding paired analyses and limiting assessment of within-subject changes.

Conclusion

This study demonstrates that a brief structured interprofessional PBL activity may foster positive attitudes, observable teamwork skills, and understanding of professional roles among nursing and pharmacy students. While challenges remain regarding bias, sustainability of knowledge, and logistical implementation, the findings suggest that such activities have the potential to be integrated into health professions education. However, these findings should be interpreted with caution due to the study's design limitations, including the absence of a control group, lack of pre–post matching, and the single-institution context. Future initiatives should focus on mitigating constraints and expanding the scope of IPE projects to encompass a variety of healthcare professions. This can be achieved by incorporating repeated, progressively more complex IPE exercises into the curriculum, complemented by qualitative research to better understand students' evolving perceptions of professional roles and interprofessional dynamics while also incorporating control groups when available in future studies to strengthen causal inference.

Data Sharing Statement

All data supporting the conclusion are included.

Ethical Approval

This study was approved by the Institutional Review Board of King Saud University, Riyadh, Saudi Arabia (Approval no. KSU-HE-25806). The study was conducted under the supervision of the College of Pharmacy Education Unit, the College of Pharmacy Simulation Lab Committee, and the College of Nursing Academic Affairs. Although the activity was part of the course, students were asked to provide informed consent to participate in the assessment process, which included permission for the use and publication of anonymized data, including anonymized responses and direct quotes. No personally identifiable information was collected.

Informed Consent

The study complies with the ethical standards of the Declaration of Helsinki, and all participants provided informed written consent.

Acknowledgments

We acknowledge all the participating students from the 2025 PHRM 326 pharmacy course and NURS 314 course and pharmacy intern students who helped with the assessment.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agreed to be accountable for all aspects of the work.

Funding

Ongoing Research Funding Program, (ORF-2026-1281), King Saud University, Riyadh, Saudi Arabia.

Disclosure

The authors declare that they have no conflicts of interest in this work.

References

1. World Health Organization. Framework for action on interprofessional education and collaborative practice. Geneva: World Health Organization; 2010.
2. Interprofessional Education Collaborative. Core competencies for interprofessional collaborative practice: version 3. Washington, DC: IPEC; 2023. Available from: https://www.ipecollaborative.org/assets/core-competencies/IPEC_Core_Competencies_Version_3_2023.pdf. Accessed May 07, 2026.
3. Chu M, Xu L, Liu Y, et al. Interprofessional education in problem-based learning: a frontier form of PBL in medical education. *J Educ Health Promot.* 2023;12(1). doi:10.4103/jehp.jehp_62_23
4. Guraya SY, Barr H. The effectiveness of interprofessional education in healthcare: a systematic review and meta-analysis. *Kaohsiung J Med Sci.* 2018;34(3):160–165. doi:10.1016/j.kjms.2017.12.009
5. Thompson S, Metcalfe K, Boncey K, et al. Interprofessional education in geriatric medicine: towards best practice. A controlled before–after study of medical and nursing students. *BMJ Open.* 2020;10(1):e018041. doi:10.1136/bmjopen-2017-018041
6. Wang Z, Feng F, Gao S, Yang J. A systematic meta-analysis of the effect of interprofessional education on health professions students. *Attitudes J Dent Educ.* 2019;83(12):1361–1369. doi:10.21815/JDE.019.147
7. Banu N, Aslam N, Ghosn SA, Amin YHA, Ameer LA. Chronological evolution of interprofessional education (IPE) in Saudi Arabia: a systematic review. *Pharm Educ.* 2025;25(1):311–321. doi:10.46542/pe.2025.251.311321
8. Saragih ID, Arna Uly Tarihoran DET, Sharma S, Chou FH. A systematic review and meta-analysis of outcomes of interprofessional education for healthcare students from seven countries. *Nurse Educ Pract.* 2023;71:103683. doi:10.1016/j.nepr.2023.103683
9. Azzahrani M. Problem-based learning for interprofessional education: a review of the concept and its application in a geriatric team. *Cureus.* 2024. doi:10.7759/cureus.63055
10. Vision 2030- Kingdom of Saudi Arabia. Riyadh: Government of Saudi Arabia; 2022. Available from: <https://www.vision2030.gov.sa/>. Accessed May 07, 2026.
11. Abusabeib ZA, Baghdadi NA, Almadni NA, Ibrahim HK. Exploring perception and attitude of nursing students towards interprofessional education in Saudi Arabia. *PLoS One.* 2024;19(10):e0311570. doi:10.1371/journal.pone.0311570
12. Alaradi M, Abdulsalam M, Albenjasim K, Alwahoush OA, Abdulmalek S, Alsherooqi W. Nursing and medical students' perceptions of interprofessional education and social interactions: a qualitative study. *Clin Nurs Stud.* 2021;9(2):12. doi:10.5430/cns.v9n2p12

13. Bashatah AS. Assessment of nursing undergraduate's perceptions of Interprofessional learning: a cross-sectional study. *Front Public Health.* 2023;10. doi:10.3389/fpubh.2022.1030863
14. Makeen HA, Meraya AM, Alqahtani SS, et al. Exploring the awareness, attitude, and inclination of healthcare students towards interprofessional education: a cross-sectional study in Saudi Arabia. *Saudi Pharm J.* 2023;31(10):101784. doi:10.1016/j.jsps.2023.101784
15. AlRuthia Y, Alwhaibi M, Almalag H, et al. Assessing the pharmacy students' knowledge of common medical terms after a curricular change in Saudi Arabia. *Saudi Pharm J.* 2020;28(6):763–770. doi:10.1016/j.jsps.2020.05.002
16. McConnell MM, Monteiro S, Bryson GL. Sample size calculations for educational interventions: principles and methods. *Can J Anaesth.* 2019;66(8):864–873. doi:10.1007/s12630-019-01405-9
17. Barr H, Gray R, Helme M, Low H, Reeves S. Steering the development of interprofessional education. *J Interprof Care.* 2016;30(5):549–552. doi:10.1080/13561820.2016.1217686
18. Almoghira H, Illing J, Nazar H. A qualitative study to explore student learning and development of interprofessional collaboration during an online interprofessional education intervention. *BMC Med Educ.* 2023;23(1):957. doi:10.1186/s12909-023-04885-y
19. Reeves S, Boet S, Zierler B, Kitto S. Interprofessional education and practice guide no. 3: evaluating interprofessional education. *J Interprof Care.* 2015;29(5):305–312. doi:10.3109/13561820.2014.1003637
20. Norris J, Carpenter JG, Eaton J, et al. The development and validation of the interprofessional attitudes scale. *Acad Med.* 2015;90(10):1394–1400. doi:10.1097/ACM.0000000000000764
21. Thistlethwaite J, Dallest K, Moran M, Dunston R, Roberts C. Introducing the individual teamwork observation and feedback tool (iTFT): development and description of a new interprofessional teamwork measure. *J Interprof Care.* 2016;30(4):526–528. doi:10.3109/13561820.2016.1169262
22. Almoghira H, Nazar H, Illing J. Assessment tools in pre-licensure interprofessional education: a systematic review, quality appraisal and narrative synthesis. *Med Educ.* 2021;55(7):795–807. doi:10.1111/medu.14453
23. Kovács E, Jenei ZM, Csordás K, et al. The timing of testing influences skill retention after basic life support training: a prospective quasi-experimental study. *BMC Med Educ.* 2019;19(1):452. doi:10.1186/s12909-019-1881-7
24. Reeves S, Fletcher S, Barr H, et al. A BEME systematic review of the effects of interprofessional education: BEME Guide No. 39. *Med Teach.* 2016;38(7):656–668. doi:10.3109/0142159X.2016.1173663
25. Kim YJ, Radloff JC, Stokes CK, Lysaght CR. Interprofessional education for health science students' attitudes and readiness to work interprofessionally: a prospective cohort study. *Braz J Phys Ther.* 2019;23(4):337–345. doi:10.1016/j.bjpt.2018.09.003
26. Cruz EB, Sweetko J, Singh MK. Teaching interprofessional collaborative skills in primary care using team-based learning with simulation: a pilot study. *J Interprof Educ Pract.* 2025;39:100750.
27. Dennis V, Craft M, Bratzler D, et al. Evaluation of student perceptions with 2 interprofessional assessment tools-the collaborative healthcare interdisciplinary relationship planning instrument and the interprofessional attitudes scale-following didactic and clinical learning experiences in the United States. *J Educ Eval Health Prof.* 2019;16:35. doi:10.3352/jeehp.2019.16.35
28. Sakr CJ, Fakhri L, Dejong J, et al. Can interprofessional education change students' attitudes? A case study from Lebanon. *BMC Med Educ.* 2022;22(1):570. doi:10.1186/s12909-022-03608-z
29. Gillette C, Dinkins MM, Bliss R, et al. Health professions students' attitudes and perceptions of interprofessional biases. *Int J Pharm Pract.* 2019;27(4):396–398. doi:10.1111/ijpp.12536
30. Kusumawati W, Lestari ND, Suhartiningtyas D, Setyawati I, Orbayinah S. A mixed-method study of health care workers' attitudes about interprofessional collaboration. *Health Professions Educ.* 2025;11(4):Article5. doi:10.55890/2452-3011.1361
31. Gunaldo T, Rosenbaum C, Davis A. Long-term impact of a single interprofessional education high-fidelity simulation experience: a pilot study. *BMJ Simul Technol Enhanc Learn.* 2021;7(6):620–623. doi:10.1136/bmjstel-2021-000863
32. Teuwen C, van der Burt S, Kusurkar R, Schreurs H, Daelmans H, Peerdeman S. How does interprofessional education influence students' perceptions of collaboration in the clinical setting? A qualitative study. *BMC Med Educ.* 2022;22(1):325. doi:10.1186/s12909-022-03372-0

Advances in Medical Education and Practice

Publish your work in this journal

Advances in Medical Education and Practice is an international, peer-reviewed, open access journal that aims to present and publish research on Medical Education covering medical, dental, nursing and allied health care professional education. The journal covers undergraduate education, postgraduate training and continuing medical education including emerging trends and innovative models linking education, research, and health care services. The manuscript management system is completely online and includes a very quick and fair peer-review system. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <http://www.dovepress.com/advances-in-medical-education-and-practice-journal>

Dovepress
Taylor & Francis Group