

Research

Fostering collaborative practice: a pilot study on interprofessional education through simulation-based team-oriented learning sessions among pharmacy and medical students

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Abstract

Background It is pivotal to implement effective collaboration among professionals from different disciplines in the health-care sector. As the complexity of patients' health needs grows, so does the importance of developing innovative and efficient models of patient care that rely on interprofessional collaborative teamwork. Interprofessional education (IPE) is a valuable approach that improves communication, collaboration, and ultimately safe patient outcomes in healthcare settings. Students studying medicine and pharmacy are among the healthcare professionals who could potentially benefit from IPE. Despite the existence of newly added undergraduate curricula for interprofessional communication and professionalism, active implementation to achieve the required competencies and skills is not yet widespread, particularly in developing countries. This article presents a successful implementation of simulation-based team-oriented learning sessions among pharmacy and medical students at Delta University for Science and Technology in Egypt. The purpose of the IPE activity was to train students to work collaboratively as members of an interprofessional healthcare team by simulating a real-life situation.

Results Student feedback was very positive with most pharmacy and medical students being satisfied with their IPE experience. Moreover, students' feedback emphasized the significance of IPE and a simulated team-based environment in improving communication skills and collaborative practice.

Conclusion The high level of student satisfaction with the IPE sessions, particularly regarding the clarity of training objectives and the interactive nature of the experience, suggests that simulation-based learning is an effective tool for developing key interprofessional collaboration skills among healthcare students. This highlights the potential of IPE to cultivate future healthcare professionals who excel in interprofessional collaboration, ultimately leading to improved patient care and outcomes. Overcoming barriers to implementing IPE in Egypt needs a multifaceted strategy and a comprehensive long-term follow-up plan is critical for evaluating the lasting effect of IPE on students' collaborative practices in real-life healthcare settings.

Keywords Interprofessional education · Collaboration · Simulation · Teamwork · Flipped classroom

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1 Background

Interprofessional education (IPE) is a recognized method of enhancing collaboration, communication, and patient outcomes in healthcare settings. It provides an opportunity for healthcare professionals from different disciplines to learn about and from each other, with the ultimate objective of preparing them to work collaboratively to provide patient-centered care, thereby improving patient outcomes and reducing medical errors [1].

Recently, there has been a growing interest in IPE among healthcare professionals, educators, and policymakers worldwide. Many curricula have been developed and integrated into healthcare education programs to cultivate interprofessional attitudes, behaviors, and learning competencies among students before licensure. These programs focus on exploring and recognizing the different roles and responsibilities of each member of the interdisciplinary healthcare team and enhance communication skills and effective teamwork to ensure patient safety and improve healthcare outcomes [2, 3].

The Interprofessional Education Collaborative (IPEC) competencies provide a well-established theoretical framework for IPE, emphasizing teamwork, communication, and roles and responsibilities. These competencies guide the design and evaluation of interprofessional learning activities to enhance collaboration and patient safety [4]. In this context, our simulation-based IPE sessions aimed to foster these core competencies by creating a structured environment where pharmacy and medical students could engage in collaborative problem-solving.

Delta University for Science and Technology has designed recent curricula in the past three years, namely interprofessional communication and early clinical exposure, communication skills and medical ethics, basic clinical skills and professionalism for medical students, in addition to professional practice and clinical skills and entrepreneurship for pharmacy students. Moreover, some courses, such as professional ethics and leadership, pharmaceutical legislation, and practice ethics, are offered to all university students. These courses aim to foster the concepts of interprofessionalism among undergraduate students in the healthcare sector. To explore the benefits of these courses, their practical implementation in a simulation-based environment is essential. This approach creates a realistic clinical learning environment to provide students with a culture of interprofessional teamwork where training will potentially promote future performance. It also allows the use of authentic clinical problems for practicing and acquisition of complex skills and competencies. In addition, it provides opportunities for enhanced collaboration and communication, fostering safe, patient-centered care [5, 6].

Healthcare professionals, including clinicians and pharmacists, must practice professionally, respect patients' rights, and acquire a thorough understanding and deep appreciation of the legal and ethical principles of the profession. IPE opportunities enable them to develop these attributes early, preparing future healthcare graduates for collaborative practice and improving patient outcomes [7].

Despite its potential, IPE activities are often challenging due to inadequate timing and deficits in planning schedules and funding. There are claims that medical schools often fail to integrate interprofessional behaviors and attitudes into curricula, resulting in graduates entering multidisciplinary teams without fully understanding their colleagues' roles [8]. Early exposure to IPE can address this gap by helping students from different disciplines understand the roles and capabilities of their peers' roles within the healthcare sector before actual practice and avoid egocentric attitudes that restrain patient care and safety [9].

Another significant challenge is the lack of proper integration of IPE into undergraduate medical curricula across different faculties in developing countries. Graduates start their professional careers as clinical pharmacists, clinicians, physiotherapists, etc. within a multi-disciplinary team without understanding the roles and responsibilities of their colleagues or experiencing collaboration and communication skills needed for effective teamwork, as most undergraduate educational activities and teaching courses are designed independently for every profession [10].

Although there is a growing body of research on IPE in developed countries, literature on the implementation of such programs in the Middle East remains scarce [11]. Our study addresses this gap by examining a simulation-based IPE initiative in Egypt, providing a novel contribution to the field. We present a successful implementation of a simulation-based, team-oriented IPE workshop among pharmacy and medical students at Delta University for Science and Technology in Egypt. This study provides comprehensive information on the trial's specifics and student satisfaction, identifies challenges, and proposes recommendations for improving the IPE experience. Furthermore, we discuss and analyze various barriers to implementing IPE in Egypt and suggest possible solutions. Finally, we propose a long-term follow-up plan to evaluate the impact of IPE on students' collaborative practices.

2 Development and implementation of IPE simulation-based learning sessions

Teaching principles of interprofessional communication and clinical exposure, as well as communication skills and professional ethics, Basic clinical skills, and professionalism, enable students to shed light on the concepts of teamwork, cooperation, ethical behavior, attitudes, etc. However, these principles are still not effectively implemented at the undergraduate level. The facilitators of these courses at Delta University of Science and Technology at the Faculties of Pharmacy and Medicine have a shared interest in promoting integration and providing early participation in IPE activities for undergraduate students. To achieve this, IPE simulation-based learning sessions were conducted during the fall semester, of the academic year 2022–2023. To overcome the challenge of scheduling and spacing, the learning session was incorporated into the “Clinical Pharmacokinetics” course for the fourth-year Pharm-D program students at the Faculty of Pharmacy as well as the “Clinical Toxicology and Pharmacology” course for the third-year students at the Faculty of Medicine. First, as course coordinators from both faculties, we met to plan and organize sessions according to the targeted learning outcomes for both disciplines. We discussed together the course contents and learning guides for pharmacy and medicine students. We chose acute digoxin toxicity as a suitable case to be the start of the implementation of IPE (time and schedule are appropriate for students of both faculties). Then, we cooperated to modify the case scenario and incorporate the final learning objectives that suited the concepts of IPE for both disciplines in one learning guide for all students. An agreement was reached to use the flipped classroom strategy and assign the roles of the students before the upcoming sessions, which encourages the students to engage in clinical reasoning and critical thinking about the given case scenario (role-playing for clinicians, nurses, and clinical pharmacists).

To ensure that the learning outcomes were met, we began by outlining separate objectives for pharmacy and medicine students that were relevant to their respective fields. The case study itself was comprehensive, consisting of detailed patient history and demographic information, including the patient’s chief complaint, medical history, medication history, allergies, social habits, marital status, education, family medical history, and past surgical history. Along with the patient information, we incorporated details of the physical examination which encompassed vital signs, heart, chest, lung, abdomen, neurologic, head, back, skin, and extremities. This helped to facilitate a better comprehension of the patient’s overall health status and allowed for early detection of any potential complications. The information related to pharmaceutical calculations and requirements for digoxin prescription was also added to both disciplines to explore how they will use it during the session.

Delta University for Science and Technology is equipped with a big skill lab similar to a ward hospital as well as mannequins that enable the implementation of a simulation-learning session mimicking the real-life situation and foster the application of interprofessional healthcare team scenarios.

The proposal put forth by both coordinators involved the simulation of a genuine clinical problem, specifically, digoxin toxicity. The simulation encompassed the entire diagnostic and management process, utilizing the ABCD approach to adjust digoxin dosages in accordance with the patient’s work-up profile and current clinical condition. The ABCDE technique (Airway, Breathing, Circulation, Disability, and Exposure) is a systematic method utilized in critical care and emergency medicine to assess and manage patients who are critically ill. An announcement was disseminated to students in both faculties to prepare for this activity. Notably, students were invited to volunteer as patient role-players for the history-taking, physical examination, and active participation throughout the sessions, instead of relying solely on mannequins. Mannequins were reserved for use during the ABCDE approach or other invasive procedures.

The students were divided into groups and four joint sessions of 90 min each were conducted, with 60 students in each session, 30 from each faculty. The sessions were facilitated by two faculty members: one Pharmacy faculty member (PharmD, PhD) and one Medicine professor (MD). These faculty members provided guidance during the IPE sessions to ensure that students from both disciplines were engaged in effective interprofessional collaboration. In each session, students from the Faculty of Medicine took the patient history, made a diagnosis, and administered first aid to stabilize the patient according to the findings demonstrated in the learning guide. They also prioritized critical issues and discussed further management and follow-up with the pharmacy students. Each member of the team was assigned a specific role based on their specialty. On the other hand, the pharmacy students performed a complete case assessment of the patient, by correlating the patient’s demographics, symptoms, clinical condition, and laboratory data, as well as the digoxin serum concentration to confirm or rule out digoxin toxicity. According to these results, pharmacy students carried out the calculations required to adjust the dose of digoxin. Finally, pharmacy students engaged with medical students to discuss the new modified digoxin dose, required monitoring parameters, and other precautions that should be considered in this patient to maximize safety and therapeutic efficacy.

3 Methods

An online questionnaire consisting of multiple choice questions was utilized to evaluate student perceptions and satisfaction with the IPE activity. The survey included questions assessing the clarity of the training objectives, exposure to new knowledge, the interactive nature of the session, and overall satisfaction with the IPE session. The answers of the students were scored on a 5-point Likert scale, going from “strongly agree” to “strongly disagree,” and a 1–10 rating scale for overall satisfaction. In addition to quantitative responses, the questionnaire included an open-ended section where students provided written feedback. These comments were reviewed, and common themes were identified. The comments presented in the results section are representative examples of the general perspectives shared by students. The responses were categorized based on recurring themes.

The online questionnaire used in this study was validated through expert review before its implementation. Experts in pharmacy practice, medicine, and IPE evaluated the questionnaire for relevance, clarity, and comprehensiveness to ensure it aligned with established standards for validity and reliability [12–14]. Additionally, we reviewed existing validated instruments in IPE to inform our questionnaire design process [15–18].

While the questionnaire focused on student satisfaction, which provides valuable insights into the acceptability of the session, we acknowledge that it does not directly measure the acquisition of knowledge or skills. The study did not include objective assessments of student competency. Future research could incorporate tools such as Objective Structured Clinical Examinations (OSCE) to assess the effectiveness of IPE in developing communication and collaboration skills.

4 Results

The online questionnaire was completed by 101 students from both faculties, out of 235 students who attended the IPE session, for a response rate of 43%. As shown in Table 1, the respondents comprised 65 medical students and 36 pharmacy students. Figure 1 illustrates the findings and opinions expressed by these students regarding the session, offering a comprehensive overview of their perspectives.

Regarding the clarity of the training objectives, the results indicate that 30.7% of the students strongly agreed, 54.5% agreed, 13.9% were neutral, 0.9% disagreed, and no respondents strongly disagreed. This suggests a high level of agreement among the students that the training objectives were clear (Fig. 1A).

In terms of exposure to new knowledge and practice, the majority of students expressed positive views. Specifically, 38.6% of the students strongly agreed, 49.5% agreed, 9.9% were neutral, and no respondents disagreed, while 2% strongly disagreed (Fig. 1B).

Regarding the interactive nature of the training session and the use of examples, the results demonstrated that 33.7% of the students strongly agreed, 44.6% agreed, 16.8% were neutral, 4.1% disagreed, and 0.8% strongly disagreed. These findings suggest that the majority of students found the session to be interactive and well-illustrated with examples (Fig. 1C).

To evaluate the students’ overall satisfaction with the IPE session, students used a scale from 1 to 10 to rate their experience. The responses were as follows: 1 (0%), 2 (0%), 3 (0%), 4 (5.9%), 5 (4%), 6 (8.9%), 7 (17.8%), 8 (27.7%), 9 (16.8%), and 10 (18.8%). The distribution of responses indicates that a significant percentage of students rated the session positively, with the highest frequency of responses being in the 8–10 range (Fig. 1D).

Table 1 Overview of student participation in interprofessional education (IPE) sessions and feedback questionnaire

| Faculty | Year of study | Course | Number of participants in IPE sessions | Number of participants in feedback questionnaire |
|----------|---------------|--------------------------------------|--|--|
| Pharmacy | Fourth-year | Clinical Pharmacokinetics | 118 | 36 |
| Medicine | Third-year | Clinical Toxicology and Pharmacology | 117 | 65 |
| Total | | | 235 | 101 |

IPE Interprofessional education

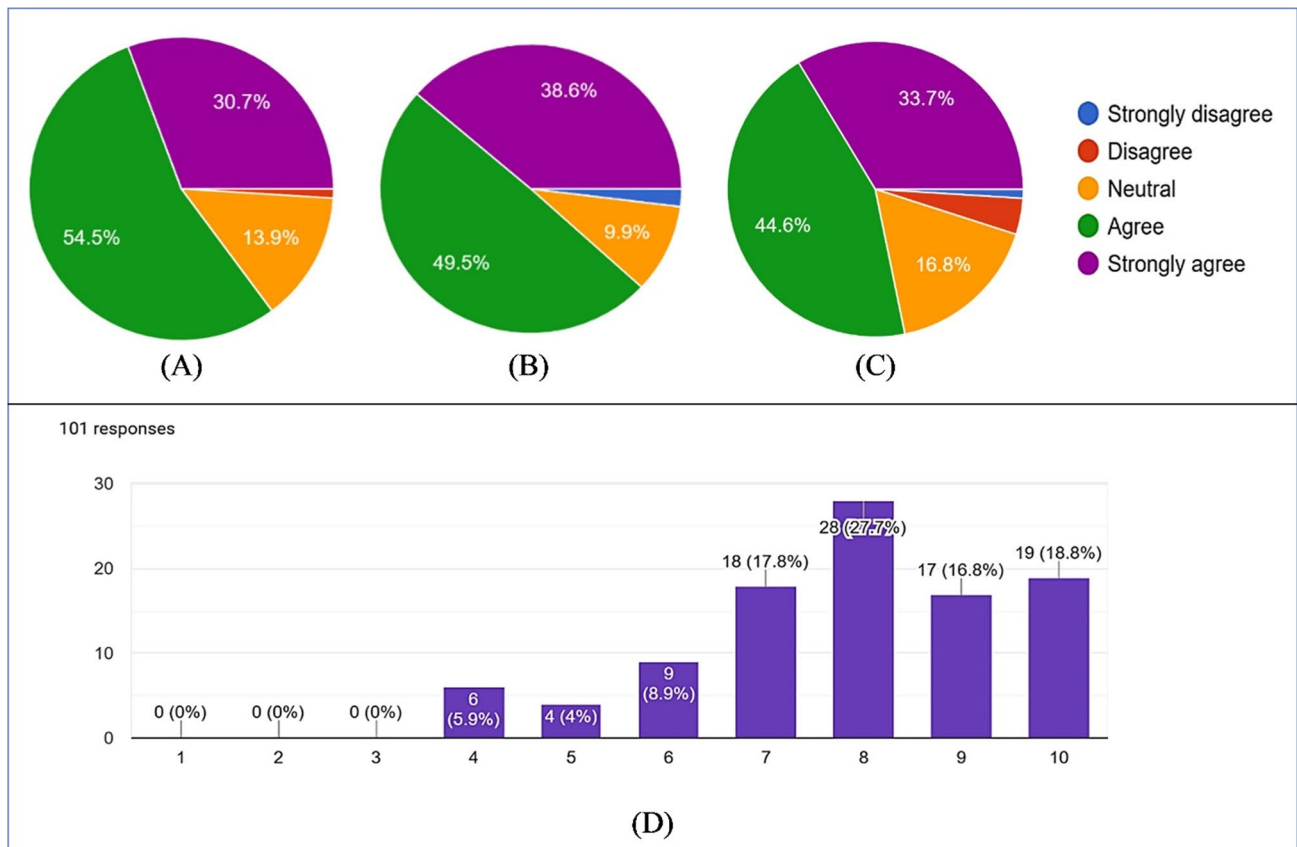


Fig. 1 Student responses and opinions about interprofessional education sessions (N=101). **A** Training objectives clarity, **B** exposure to new knowledge and practice, **C** interactive nature and use of examples, **D** overall satisfaction and meeting expectations (Scale: 1–10)

These results suggest that the majority of pharmacy and medicine students were satisfied with the simulation-based IPE session on digoxin toxicity. The clarity of the training objectives, the exposure to new knowledge and practice, and the interactive nature of the session were generally well-received. However, there is a room for improvement, as some students expressed neutral or negative views on certain aspects. These findings provide valuable insights for further enhancing the effectiveness and quality of future IPE sessions.

Moreover, the students demonstrate the points of strengths in their own words which are summarized as follows: "cooperation between colleagues is very important," "role play is good," "choosing the skill lab for simulation is perfect," "excellent interactive experience," "the session is so exciting and raises confidence among students," "engagement in an experience that mimics a real-life situation helps to avoid the first shock when dealing with it in hospitals," "there is a need for much more practice as it is hard to achieve all the required outcomes the first time," "it was a great idea and experience to apply what we studied independently most of the time and respect the roles and responsibilities of other members of the healthcare team," "there was a great collaboration between instructors and students (it wasn't a lecture and was not simply a role play it was a great mix of both)," "It gave the students the chance to cooperate and benefit from their colleagues in other fields linking the scientific and practical content together and simulation to what happens in reality." "This experience gives new knowledge, improves teamwork skills and information exchange, and highlights the importance of each specialty and how this preserves the patient's health," "this helps to gain more information from Pharmacy students and to know the perspectives of other professions," "perfect training on interprofessional communication and teamwork," "clinical pharmacists have a necessary role in patient management as they help clinicians to calculate doses and readjust prescriptions and check for drug interactions."

On the other hand, students mention some points that need improvement, such as "implementation of more sessions in the future," "more case scenarios," "scheduling and choosing appropriate time away from exams," "holding the sessions in hospitals with real patients," "smaller groups will be better and give opportunity for all to participate and more time for the session."

While some students noted areas for improvement, the overall feedback remained positive. Additionally, faculty facilitators also observed strong interprofessional interactions among students, with active engagement in communication and teamwork across both pharmacy and medicine.

5 Discussion

5.1 Discussion of findings

In the present experience, the implementation of IPE is being carried out at Delta University for Science and Technology, specifically within the Faculties of Pharmacy and Medicine. Student feedback suggests that the medical and pharmacy students found the pilot sessions beneficial, particularly in gaining exposure to interprofessional collaboration and communication skills. Based on student feedback, medical students expressed an appreciation for the critical role of pharmacists in providing expert opinions and advice during consultations, following up on prescriptions, checking treatment tickets, and helping them adjust drug doses based on the patient's workup profile and clinical findings. Pharmacy students, in turn, recognized the crucial role of their clinician peers in examination, diagnosis, and life-saving interventions to stabilize patients with digoxin toxicity. It was reported that clarifying roles and responsibilities and promoting teamwork and collaboration are core competencies of IPE and are crucial in preparing students for professional practice [3, 11].

Students should participate in various interprofessional activities before graduation in order to promote effective communication and collaborative teamwork among colleagues from different healthcare professions. Rigorous design and planning facilitate the implementation of IPE activities, and applying a flipped classroom approach ensures an optimal learning environment suitable for students from various disciplines. This approach also enables better time management and increased interactions and discussions in the class [3]. It is worth noting that simulation-based learning is a highly effective method of learning and provides diverse practice opportunities. It can be introduced early in different undergraduate study programs and is particularly effective for beginners [1, 19]. Based on student reflections, the simulation sessions were perceived to provide valuable opportunities for developing skills such as teamwork, communication, building trust, and ethical collaboration with peers and other healthcare colleagues in the pharmacy and medical fields who are involved in patient care. However, further research is needed to assess the actual acquisition of these skills.

This pilot session experience enlightens both pharmacists and clinicians at an earlier stage of their education about the essential role of clinical pharmacists in reviewing and dispensing drug prescriptions, collaborating with clinicians during consultations, and effectively communicating with each other to provide high-quality healthcare services and enhance patient safety. This aligns with the findings of Gum and Salfi, who stated that IPE builds trust between healthcare professionals through discussions, questioning, and consulting specialists, with a focus on the patient [20].

5.2 Facilitators, limitations, and barriers

5.2.1 Facilitators of the IPE experience

Several facilitators contributed to the successful implementation of this IPE experience. Delta University for Science and Technology has introduced new curricula that promote the concepts of IPE in both the Faculties of Pharmacy and Medicine. Motivated and well-trained staff members are available, fully convinced of the significance of implementation and integration between different professions. The presence of a well-equipped skills lab and sufficient resources partially addresses the problem. The next step is to implement interprofessional activities to train the students and cultivate the core concepts and skills of IPE at earlier stages of the study programs in both disciplines.

Through rigorous and diligent discussions between the course coordinators in this study, there has been a recognized need to transition from uniprofessional education to interprofessional implementation between the two faculties. After considering the challenges of time constraints and crowded curricula and schedules, the flipped classroom and simulation-based sessions were identified as beneficial and the most effective tools for conducting the sessions. Chen et al. endorse the use of flipped classrooms as an effective way to motivate students, increase learner engagement, and facilitate learning about interprofessional collaboration, teamwork, and task-oriented values [21]. Furthermore, Labrague et al. argue that simulation-based learning is a preferable approach to IPE, particularly for undergraduate students [22]. It enhances the practice of realistic communication skills and interprofessional teamwork through standardized designs,

role-playing scenarios, and authentic clinical case simulations carefully designed by facilitators to promote interprofessional collaborative practice. Simulation-based learning also increases students' self-efficacy and fosters positive behaviors and attitudes toward IPE [23].

One of the strengths of this IPE activity is the role modeling of interprofessional leadership demonstrated by the course coordinators. van Diggele et al. emphasize that facilitators play a significant role in allowing students to observe collaborative attitudes and behaviors of joint leadership. This helps build trust and facilitates the acquisition of interprofessional skills, ultimately achieving the core competencies and objectives of IPE [3].

5.2.2 Limitations of the IPE experience

Limitations such as time constraints and scheduling posed a challenge in this experience in terms of repeating the sessions. Additionally, the large number of students made it difficult for all students to actively participate. Furthermore, no assessment methods were used for this IPE session, so assignments or other activities could be a simple solution used to evaluate the students. Moreover, Objective Structured Clinical Examination (OSCE) stations could be constructed to adequately evaluate the students' interprofessional competencies [1].

While this study focused primarily on student satisfaction and perceptions of the IPE experience, it did not directly assess skill acquisition or the effectiveness of interprofessional collaboration. However, the feedback gathered offers valuable insights into the acceptability and feasibility of IPE activities in a simulation-based environment.

Another limitation is that while equal numbers of pharmacy and medical students were enrolled in the IPE sessions, the feedback response rate was higher among medical students. While this discrepancy in feedback may slightly limit the generalizability of the survey results, the overall findings remain valuable, offering meaningful insights into the reception and potential impact of IPE activities across both disciplines.

5.2.3 Barriers to implementing IPE in Egypt and possible solutions

Several barriers hinder the effective implementation of IPE in Egypt, including the complex design of curricula, overcrowding, shortage of time, distinct professional identities among different disciplines, belonging to specific groups, inadequate resources, especially well-trained and motivated staff members, and resistance to change due to old attitudes [24–26]. Table 2 outlines and thoroughly analyzes three major barriers to implementing IPE in Egypt: overcrowding, time constraints, and resistance to change. In addition, possible solutions and strategies to overcome these barriers are presented.

5.3 Recommendations and follow-up plans

More IPE activities should be conducted during the semester for smaller groups of students, in different specialized courses, such as respiratory, nephrology, endocrinology, oncology, and other specialized areas. This would help in a more

Table 2 Barriers to implementing IPE in Egypt and possible solutions

| Barriers to implementing IPE in Egypt | Possible solutions |
|---------------------------------------|---|
| Overcrowding [27] | <p>Curriculum Redesign: Identify repetitions and non-core topics in existing curricula to create space for IPE activities without compromising core content [28–30]</p> <p>Prioritize IPE: Build support for IPE integration by showing its value in enhancing healthcare outcomes, despite overcrowding concerns [26]</p> |
| Time constraints [25, 26] | <p>Integrated Learning: Incorporate IPE into existing coursework and clinical classes. Use collaborative case discussions or joint assessments of patients during regular clinical rounds [25]</p> <p>Flipped Classroom Approach: Use the flipped classroom approach, in which students study topics independently outside of class and then come together to perform interactive IPE activities during contact hours [7, 21]</p> |
| Resistance to change [31] | <p>Faculty Development: Provide extensive training and professional development for faculty members to enhance their competence and confidence in promoting IPE [32]</p> <p>Student Advocacy: Encourage student involvement and advocacy for IPE. Involve students in planning and decision-making to foster ownership and inspiration for favorable change [10, 33]</p> <p>Leadership Support: Establish clear expectations and offer support from corporate leadership to advocate for IPE across all levels of the organization, encouraging a culture of collaboration [33]</p> |

in-depth and targeted understanding as well as better practice of skills in that specific field. Furthermore, this smaller number of students will allow for a more interesting and interactive learning experience. Additionally, conflict resolution skills should be practiced during IPE activities. This important skill is required to train students on how to effectively deal with conflicts that may be encountered among other members of the health care team. More different faculties should be involved in broader IPE activities to allow students to practice patient care from a more comprehensive perspective.

A complete IPE program with well-designed courses should be organized during internships to prepare students more practically for real-life cases and situations. Future IPE programs should ensure that their curricula are designed in alignment with the IPEC competencies that can serve as a practical guide for designing and evaluating IPE programs and activities to enhance communication, teamwork, and collaborative practice across disciplines.

To understand the continuing impact of IPE on students' collaborative practices, it is essential to develop a comprehensive long-term follow-up plan. However immediate feedback can give valuable insights, monitoring students' behavior and attitudes in real-life healthcare settings over an extended period will provide a more accurate image of IPE's effectiveness in qualifying future healthcare professionals. This follow-up plan aims to track the progress and development of students' interprofessional skills, teamwork, and attitudes after the IPE session, ensuring that positive changes in their collaborative practice are sustained [3, 34, 35]. This follow-up plan is outlined as follows:

5.3.1 Data collection and tracking

To start a long-term follow-up plan, a structured approach to data collection and tracking must be put in place. This will include collaborating with relevant faculties and healthcare organizations to access relevant student records and patient care data. The following approaches can be used: (a) Conduct periodic surveys and questionnaires after the IPE session at scheduled intervals to measure students' collaborative behaviors, attitudes, and perceived impact on patient care [36]; (b) Schedule on-site observations of students' interactions and group work in real-life healthcare settings, capturing their participation in interprofessional collaborations [37]; (c) Obtain feedback from patients and their families regarding their experiences with interprofessional care and the effect of students' collaborative practices on patient outcomes [35].

5.3.2 Collaboration with healthcare institutions

Interaction with the healthcare institutions where students undertake their clinical placement or internship is vital to the success of the long-term follow-up plan. Create partnerships with these organizations to access relevant data, ensure ethical compliance, and foster data sharing [3, 34].

5.3.3 Ethical considerations

Strict ethical considerations should be adhered to throughout the long-term follow-up plan. Informed consent is to be obtained from participating students, faculty members, and healthcare organizations. Ensure confidentiality and non-disclosure of participants' identities during data collection and analysis [35].

5.3.4 Data analysis

Perform a comprehensive analysis of the data gathered to determine changes, patterns, and trends in students' collaborative practices over time. Analyze qualitative data from surveys, questionnaires, and observations to acquire insight into the small differences in their interprofessional attitudes and interactions [35].

5.3.5 Evaluation of behavioral changes

Evaluate how students' collaborative practices have evolved over time through live observation and analysis of patient care data. Look for proof of improved teamwork, communication, and shared decision-making between students from different healthcare specialties [34].

5.3.6 Impact on patient outcomes

Analyze patient care data, including satisfaction, patient outcomes, and safety indicators, to pinpoint any associations with students' collaborative practices. Assess whether the IPE session contributed to measurable progress in patient care and health outcomes [35].

5.3.7 Feedback from healthcare professionals

Ask for feedback from healthcare professionals who have worked with the students over the long term. Interviews or focus groups may be performed to assemble insights into students' collaborative skills and the impact of IPE on interprofessional teamwork within the healthcare setting [3].

5.3.8 Comparison with control groups

To enhance the plan, consider creating control groups of students who did not participate in the IPE session. Compare the collaborative practices and patient outcomes of these groups with those of the IPE participants to determine the effect of IPE on students' attitudes and behaviors [3].

6 Conclusion

This study highlights the positive feedback from pharmacy and medical students regarding simulation-based team-oriented IPE sessions. Students reported high satisfaction with the clarity of learning objectives and the interactive nature of the sessions. These findings demonstrate that simulation-based IPE can help cultivate team-based skills and leadership qualities and foster collaboration and communication skills.

Undergraduate students in healthcare facilities must receive adequate training and opportunities to practice interprofessional skills before obtaining licensure and graduating. Waiting until clerkships, internships, and residencies to develop these core skills is not ideal and urgent action is needed in this regard.

Barriers to implementing IPE in Egypt, such as overcrowded curricula, time constraints, and resistance to change, were acknowledged during this study. Overcoming these barriers will require a multifaceted strategy, including integrating IPE into existing courses and fostering faculty and institutional support.

A comprehensive long-term follow-up plan is recommended to evaluate the sustained impact of IPE on students' collaborative practices in real-life. This plan should include objective competency assessments and broader inclusion of healthcare disciplines to maximize the impact of IPE sessions. These findings and recommendations contribute to the ongoing efforts to improve interprofessional collaboration and ultimately patient safety.

Author contributions SKM conceived the idea, designed the study, supervised its implementation, coordinated the students, analyzed the data, and was responsible for manuscript writing, editing, and revision. RHA also designed the study, supervised the implementation, coordinated the students, analyzed the data, and contributed to writing the manuscript. AKM and MAE reviewed the manuscript. All authors read and approved the final manuscript.

Data availability The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate This study involved a questionnaire-based survey of pharmacy and medical students. The study protocol was assessed and approved by Delta University Scientific Research Ethics Committee. The study was performed in accordance with the ethical standards. Participants provided their informed consent for their involvement in the survey. The survey included a statement: "By participating and submitting my response in this questionnaire, I consequently give my informed consent for sharing in this research. I declare that I understand the purpose of the study and its objectives as well as I have the right to withdraw at any time."

Informed consent Consent to participate and consent to publish were obtained from all participants.

Competing interests The authors declare no competing interests.

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