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Original Article

The Impact of a Team-Based Learning Intervention on Healthcare Student's Readiness towards Interprofessional Education; A Quasi-Experimental Study

Sana Shah, Maryam Akram, Syed Muhammad Junaid, Sana Siddiqui***, Saadia Rehman****, Izza Umbrin******

Department of Medical Education, Islam Medical College, Sialkot Pakistan, *Medical Student, Islam Medical College, Sialkot Pakistan, **Department of Medical Education, Sardar Begum Dental College, Peshawar Pakistan, ***Department of Medical Education, Army Medical College/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, ****Department of Medical Education, Abbottabad International Medical Institute, Abbottabad Pakistan

ABSTRACT

Objective: This study assesses the impact of an innovative Interprofessional Education (IPE) intervention, involving team-based learning session, on healthcare students' readiness for IPE in Pakistan.

Study Design: Quasi-experimental Study.

Place and Duration of Study: Islam Medical & Dental College, Islam College of Nursing, Pharmacy & Physiotherapy, Sialkot Pakistan, from Apr to Sep 2023.

Methodology: A Team-Based Learning (TBL) intervention for Interprofessional Education (IPE) was conducted with various healthcare discipline students, employing convenience sampling. The TBL included forming multidisciplinary teams, Individual Readiness Assurance Tests (IRAT), Team Readiness Assurance Tests (TRAT), and problem-solving exercises. Inclusion criteria required both pre and post Readiness for Interprofessional Learning Scale (RIPLS) questionnaire completion, resulting in 104 responses for statistical analysis. Paired t-tests within each discipline & subscale determined statistical significance ($p \leq 0.05$) using SPSS Version 26. Learning gains were calculated per Barwood et al.'s method.

Results: Ceiling effects were evident, reflecting high pre-intervention performance. The overall mean score increased from 74.49±10.6 pre-intervention to 76.87±10.4 post-intervention, although the change was statistically insignificant (p-value= 0.518). A substantial 23% increase in learning gains was observed.

Conclusion: This research highlights the promising impact of IPE interventions and suggests their feasibility in enhancing Pakistan's healthcare education. The positive impact of the intervention calls for a structured and unified IPE curriculum in Pakistani health education institutions. This step will enhance readiness for IPE, improving healthcare outcomes in Pakistan.

Keywords: Health professions education, Interprofessional education, Team-based learning.

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INTRODUCTION

In today's dynamic healthcare landscape, Interprofessional Education (IPE) has gained prominence as an essential educational approach, fostering collaboration among diverse health disciplines, equipping future professionals for cohesive teamwork beyond specialized knowledge.[1] IPE plays a pivotal role in instilling the skills and readiness essential for effective interdisciplinary collaboration.[2] As the healthcare landscape undergoes continuous evolution, IPE assumes the role of a cornerstone in healthcare education, catalyzing a shift from a discipline-centric focus to one firmly rooted in patient-centered care.[3] Through IPE, students are not only prepared to excel in their disciplines but also thrive as integral members of unified healthcare teams, thus ensuring the delivery of comprehensive & patient-focused healthcare services.[4]

Correspondence: Dr Saadia Rehman, Dept of Medical Education, Abbottabad International Medical Institute, Abbottabad Pakistan

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The literature reinforces that interventions within the realm of Interprofessional Education (IPE) yield positive outcomes, fostering the development of healthcare professionals well-equipped for collaborative efforts aimed at enhancing patient outcomes.[5] Additionally, early exposure to IPE holds the potential to cultivate enhanced leadership, collaboration, and communication within healthcare teams, ultimately advancing patient safety.[1,3,6] There is also substantial evidence suggesting that structured formal experiences provide greater benefits for novice students, establishing a robust framework for their learning journey.[7] Furthermore, IPE activities have proven to be effective tools for enhancing readiness related to interdisciplinary teamwork, communication, shared problem-solving, & the acquisition of knowledge & skills crucial for collaboration within interdisciplinary teams.[8]

Among the various IPE interventions explored in the literature, Team-Based Learning (TBL) in the junior years stands out, with its capacity to captivate partici-

pants' focus on the learning process and its correlation with the improvement of teamwork skills and enhanced communication.[9] The nature of Team-based learning (TBL) lends itself well to interprofessional education, fostering a culture of collaboration among health professional students.[10,11]

In Pakistan, where the integration of Interprofessional Education (IPE) into the healthcare education curriculum is still a work in progress, there is a lack of research on the impact of IPE interventions on healthcare students' readiness. Existing studies primarily focus on individual healthcare disciplines, overlooking the broader context of interprofessional collaboration. This study aims to address this gap by assessing the influence of a novel Team Based Learning IPE intervention on diverse healthcare students' readiness within the Pakistani healthcare education landscape. This research will help provide insights into the effectiveness of TBL Interprofessional Education interventions in enhancing students' readiness for interprofessional collaboration, which is crucial in modern healthcare. The findings can inform the development of IPE climate in Pakistan and contribute to the preparation of healthcare professionals who can work effectively in interdisciplinary teams, ultimately improving patient care and healthcare outcomes.

METHODOLOGY

The study was conducted at Islam Medical & Dental College, Islam College of Nursing, Physiotherapy, and Pharmacy, Sialkot Pakistan, over a six-month period from April to September 2022. The target population consisted of 375 healthcare students. All students were invited to participate in the study, with an initially intended sample size of 188 determined using the WHO sample size calculator. Convenient sampling was used for participant selection due to its practicality and accessibility. However, a total of 117 multidisciplinary students voluntarily participated in the study by attending the TBL session on IPE. This session was conducted outside their regular class schedule.

Inclusion Criteria: First-year students in the fields of Medicine, Dentistry, Nursing, Physiotherapy, and Pharmacy were included in the study. Participants were required to participate in the Team-Based Learning (TBL) session and complete both the pre-test and post-test questionnaires of the Readiness for Interprofessional Learning Scale (RIPLS).

Exclusion Criteria: Participants in years except first, or who did not attend the TBL session and those unable to complete both the pre-test and post-test questionnaires were excluded from the study.

Ethical approval for the study was obtained from the Institutional Ethics Review Board (IERB) Islam Medical College with the reference number 900/IMC/ERC/000102.

The data collection process involved two stages. Prior to the TBL session, participants completed the pre-survey RIPLS questionnaire. Following this, participants were provided with pre-reading materials and attended lectures on Interprofessional Education in Healthcare. On the day of the intervention, participants were grouped into multidisciplinary teams, including students from dentistry, nursing, medicine, pharmacy, and physiotherapy in an effort to promote diversity and encourage interprofessional collaboration. An initial Individual Readiness Assurance Test (IRAT) was conducted, where participants individually answered a set of 10 multiple-choice questions to assess their baseline knowledge of interprofessional learning. Subsequently, within their respective teams, participants collectively tackled the same set of questions in the Team Readiness Assurance Test (TRAT). Immediate feedback and facilitation followed the TRAT, with correct answers shared and explanations provided. Facilitators were available to address queries and support participants. The Team Application Exercise involved problem-solving activities within teams, fostering critical thinking & collaboration.

Post-survey data were collected immediately after the TBL session using the same RIPLS questionnaire to evaluate changes in participants' readiness for interprofessional collaboration.

The collected data were analyzed using IBM SPSS Statistics version 26. Mean and standard deviation were calculated for quantitative variables and frequency and percentages were calculated for qualitative variables. Subsequently, paired t-tests were employed to com-pare subscales pre-post intervention. This same statis-tical method was applied for discipline-specific com-parisons, calculating *p*-values for each to assess significance. Learning gains were calculated following the methodology recommended by Barwood *et al.* (Total post-test score-Total pre-test score)/(Maximum score-Total pre-score)x100, offering insights into the impact of the intervention on participants' readiness for interprofessional learning.

RESULTS

Among the 104 study participants, 29(27.88%) were from the dentistry, 25(24.04%) from Physio-

therapy, 27(25.96%) were from medical, 10(9.62%) nursing, and 13(12.50%) from the pharmacy discipline. In terms of gender distribution, 29(27.88%) were male, and 75(72.12%) were female. Overall, the mean score pre-Intervention (74.49±10.6) increased post intervention (76.87±10.4) with a *p*-value of (0.518). Readiness for Interprofessional Learning Scale (RIPLS) and its various subscales were evaluated before and after the intervention, as shown in Table-I.

Table-I: RIPLS and Subscales Scores Pre- and Post-Intervention

RIPLS Subscales	Item Numbers	Range of Possible Points	Pre-Intervention	Post Intervention	*p*-value
			Mean±SD	Mean±SD	
Teamwork & collaboration	1-9	5-45	39.1±6.38	39.9±6.36	0.75
Negative Professional ID	10-12	3-15	7.44±3.24	8.55±3.85	0.30
Positive Professional ID	13-16	4-20	16.94±3.17	17.46±2.91	0.56
Roles and Responsibility	17-19	3-15	11.27±10.9	10.88±2.42	0.58
RIPLS Total	1-19	19-95	74.49±10.6	76.87±10.4	0.51

An analysis of specific subscales from the Readiness for Interprofessional Learning Scale (RIPLS) revealed the following changes in mean scores with their corresponding standard deviations (SD):

Teamwork & Collaboration: The mean score increased from 39.1±6.38-39.9±6.36 after the intervention (*p*=0.750).

Negative Professional Identity: The mean score increased from 7.44±3.24-8.55±3.85 post-intervention (*p*=0.302).

Positive Professional Identity: There was an increase in the mean score from 16.94±3.17-17.46±2.91 (*p*=0.569).

Roles and Responsibility: The mean score changed from 11.27±10.93-10.88±2.42 post-intervention (*p*=0.586).

Overall, the RIPLS total score increased from 74.49±10.63-76.87±10.42 (*p*=0.518). Discipline-wise analysis against the subscales for readiness is listed in Table II.

In the Dental discipline, the mean scores for specific subscales changed as follows: Teamwork & Collaboration decreased from 42.24±3.79-40.37±8.22 (*p*=0.651), Negative Professional Identity changed from 7.89±4.33-7.41±4.33 (*p*=0.411), Positive Professional Identity increased from 17.89±2.43-18.17±2.08 (*p*=0.220), and Roles and Responsibility decreased from 11.37± 2.16-10.89±2.48 (*p*=0.143). The total RIPLS mean score for Dental students changed from 79.41±9.01-76.86± 10.63 (*p*=0.400).

In the context of the Physiotherapy discipline, the Teamwork & Collaboration subscale showed a mean score increase from 38.04±5.96-39.92±3.90 (*p*=0.63), while Negative Professional Identity increased from 7.24±2.57-8.28±3.34 (*p*=0.86). Positive Professional Identity increased from 16.76±2.97-17.16±2.40 (*p*=0.69), and Roles and Responsibility increased from 10.36± 1.80-10.80±2.27 (*p*=0.67). The overall RIPLS mean score for students in this discipline changed from 72.40±8.63-76.16±7.02 (*p*=0.39).

In the Medical discipline, Teamwork & Collaboration showed no significant change with a mean score of 41.66±3.19 (pre) and 41.37±3.59 (post), *p*=0.91. Negative Professional Identity increased from 5.88± 2.45 (pre) to 7.74±3.56 (post), *p*=0.58. Positive Professional Identity remained stable with a mean score of 17.92±1.87 (pre) and 17.81±2.85 (post), *p*=0.49. Roles and Responsibility decreased from 11.44±2.10 (pre) to 10.40±1.71 (post), *p*=0.15. The total RIPLS mean score for students in this discipline changed from 76.92±5.83 (pre) to 73.33±7.03 (post), *p*=0.93.

For the Nursing discipline, changes were observed as follows: Teamwork & Collaboration increased from 29.10±7.72-32.90±8.92 (*p*=0.09), Negative Professional Identity showed no significant change with a mean score of 8.80±2.78 (pre) and 10.70±2.45 (post), *p*=0.77. Positive Professional Identity increased from 12.30±4.66 (pre) to 13.80±4.39 (post), *p*=0.06, and Roles and Responsibility remained stable with a mean score of 9.60±2.95 (pre) and 10.00±3.80 (post), *p*=0.91. The total RIPLS mean score for students in this discipline changed from 58.80±14.50 (pre) to 67.40±17.76 (post), *p*=0.09.

In the Pharmacy discipline, changes were observed as follows: Teamwork & Collaboration increased from 37.84±5.85 (pre) to 41.69±4.69 (post). Negative Professional Identity increased from 9.00±3.10 (pre) to 11.69±3.14 (post), Positive Professional Identity increased from 16.69±2.89 (pre) to 18.53±2.18, and Roles and Responsibility increased from 11.00±2.27 (pre) to 12.69 ±1.93. The Total RIPLS score increased from 74.53± 10.69 (pre) to 84.61±9.18. However, these changes were not statistically significant.

This analysis demonstrates positive shifts in readiness for interprofessional learning in the Pharmacy, Physiotherapy and Nursing disciplines, although statistical significance was not reached in the sample A learning gain of 23.53%, calculated using the tool recommended by Barwood *et al.* was observed.

DISCUSSION

In our study, we investigated the impact of a single-session Interprofessional Education Team-Based

Table II: Discipline-wise analysis against the subscales for readiness

Discipline Wise										
Your Discipline	Teamwork & Collaboration		Negative Professional ID		Positive Professional ID		Roles & Responsibility		Total	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Dental										
Mean±SD	42.24±3.79	40.37±8.22	7.89±4.33	7.41±4.33	17.89±2.43	18.17±2.08	11.37±2.16	10.89±2.48	79.41±9.01	76.86±10.63
N	29		29		29		29		29	
p-value	0.65		0.41		0.22		0.14		0.40	
Physiotherapy										
Mean±SD	38.04±5.96	39.92±3.90	7.24±2.57	8.28±3.34	16.76±2.97	17.16±2.40	10.36±1.80	10.80±2.27	72.40±8.63	76.16±7.02
N	25		25		25		25		25	
p-value	0.63		0.86		0.69		0.67		0.39	
Medical										
Mean±SD	41.66±3.19	41.37±3.59	5.88±2.45	7.74±3.56	17.92±1.87	17.81±2.85	11.44±2.10	10.40±1.71	76.92±5.83	73.33±7.03
N	27		27		27		27		27	
p-value	0.91		0.58		0.49		0.15		0.93	
Nursing										
Mean±SD	29.10±7.72	32.90±8.92	8.80±2.78	10.70±2.45	12.30±4.66	13.80±4.39	9.60±2.95	10.00±3.80	58.80±14.50	67.40±17.76
N	10		10		10		10		10	
p-value	0.09		0.77		0.06		0.91		0.09	
Pharmacy										
Mean±SD	37.84±5.85	41.69±4.69	9.00±3.10	11.69±3.14	16.69±2.89	18.53±2.18	11.00±2.27	12.69±1.93	74.53±10.69	84.61±9.18
N	13		13		13		13		13	
p-value	0.59		0.95		0.96		0.17		0.90	
Total										
Mean±SD	39.17±6.38	39.97±6.36	7.44±3.24	8.55±3.85	16.94±3.17	17.46±2.91	10.93±2.20	10.88±2.42	74.49±10.63	76.87±10.42
N	104		104		104		104		104	
p-value	0.75		0.30		0.56		0.58		0.51	

Learning (IPE TBL) intervention on healthcare students' readiness for interprofessional collaboration. While the statistical significance of pre-post comparisons was not achieved, there was notable learning gain. High pre-test scores in various RIPLS domains suggested participants already had a significant readiness for interprofessional learning, potentially limiting room for improvement. This aligns with the concept of a "ceiling effect."

Qualitative feedback and openended responses indicated that the workshop significantly improved students' teamwork and communication skills, resulting in a 23% positive learning gain post-intervention. These practical outcomes are essential to consider alongside statistical results when evaluating educational interventions, especially in timeconstrained healthcare education settings.

Our findings align with existing literature, demonstrating that IPE interventions positively influence healthcare students' readiness for interprofessional collaboration, with early exposure enhancing this readiness.[12,13] The consistency of our results with prior research underlines the effectiveness of IPE in promoting interprofessional readiness among healthcare students.[14,15]

Subscale analysis revealed potential enhancements in "Teamwork & Collaboration," a reduction in "Negative Professional Identity," a potential increase in "Positive Professional Identity," and the need for further exploration in "Roles and Responsibilities."

Variability in responses highlights the multifaceted nature of IPE, influenced by individual student characteristics and the need for tailored approaches to meet the specific needs of different healthcare disciplines.[16-18] Discipline specific variations emphasize the importance of recognizing differences in program design due to distinct healthcare cultures, values, and communication patterns.[19,20]

Dental students, with high baseline readiness, displayed limited room for improvement but showed an increase in positive professional identity. This highlights the need for more interprofessional exposure in dental education.[21] In contrast, Physiotherapy students demonstrated increased readiness, aligning with their collaborative field.[22]

Medical students exhibited a non-statistically significant decrease in readiness, emphasizing the need for targeted interventions in medical curricula. On the

other hand, Nursing students showed increased readiness, aligning with their emphasis on interprofessional care.[23]

Pharmacy students displayed a positive trend in readiness, emphasizing the need for continued investment in IPE initiatives to better prepare future pharmacists for interprofessional healthcare teams.

LIMITATIONS OF STUDY

Like many studies in the field, our research acknowledges certain limitations, including sample size constraints and potential self-report bias inherent in the RIPLS questionnaire. These limitations are common in IPE research and reflect the challenges of conducting comprehensive assessments within diverse healthcare education settings.

CONCLUSION

In conclusion, our study contributes to the growing body of evidence highlighting the positive impact of IPE on healthcare students' readiness. The consistency of our findings with prior research reinforces the value of IPE as a tool for shaping readiness conducive to interprofessional collaboration. However, it also underscores the need for customized IPE approaches that account for the diversity of healthcare disciplines and individual student characteristics, ensuring that the benefits of IPE are maximized across the spectrum of healthcare education. Further research in this direction holds promise for refining IPE practices and ultimately improving interprofessional collaboration in healthcare.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SS: & MA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

SMJ: & SS: Data acquisition, data analysis, approval of the final version to be published.

SR: & IU: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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