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# MEDIUM-FIDELITY SIMULATION: BRIDGING THE THEORY-PRACTICE GAP IN NURSING CLINICAL SKILL IN NURSING EDUCATION

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**Abstract**

*Background: A significant challenge in nursing education in Pakistan is the persistent gap between theoretical instruction and clinical practice, particularly in acquiring practical skills such as intramuscular (IM) injection. Factors such as overcrowded clinical settings, limited time, and faculty shortages hinder students' readiness for real-world nursing care. Medium-fidelity simulation (MFS) has emerged as a pedagogically sound and cost-effective strategy to enhance skill development, build procedural confidence, and promote patient safety (Al-Ghareeb et al., 2019). This study aimed to evaluate the effectiveness of MFS in improving clinical competence, confidence, and learning attitudes among undergraduate nursing students in a resource-constrained academic environment in Pakistan. Methods: A quasi-experimental pretest-posttest study took place at Rawalpindi College of Nursing. A purposive sample of 86 Bachelor of Science in Nursing (BSN) students engaged in a structured MFS training session that emphasized procedural accuracy, patient communication, and safety. Students' performance in the IM injection procedure was evaluated using a validated clinical checklist that was administered both prior to and after the intervention. Data analysis was performed using McNemar's test in SPSS version 23.0, with significance indicated at $p < 0.05$. Results: Post-intervention findings showed statistically significant improvement ($p < 0.001$) in 28 of 29 performance indicators. Notable gains included patient introduction (38.4% to 98.8%, $\chi^2 = 50.019$), syringe selection (1.2% to 100.0%, $\chi^2 = 83.012$), and needle withdrawal (1.2% to 100.0%, $\chi^2 = 83.012$). Improvements were consistent across attitudes, equipment handling, and procedural execution.*

*Conclusion: MFS proved a highly effective, practical, and scalable educational strategy. It significantly enhanced clinical competence, procedural confidence, and professionalism among nursing students, ultimately contributing to safer patient outcomes and better educational quality in resource-limited settings.*

## INTRODUCTION

Even with thorough classroom instruction, the clinical setting is complex and ever-changing, hindering students' readiness for practical challenges based solely on theoretical understanding (Saifan et al., 2015). A nurse's ability to provide safe care depends on translating evidence-based theory into real practice (Brown, 2018). The gap between theory and practice creates obstacles in nursing education, particularly in Fundamentals of Nursing, illustrating the challenges of applying classroom knowledge to clinical practice, often reducing students' competence and confidence (Kuusangyele et al., 2022).To address this situation nursing education through advance technology plays important role in equipping the students with competence and confidence in clinical procedures (Altmiller & Pepe, 2022). Intramuscular (IM) injection, a vital skill, underscores the need for thorough training, errors can lead to nerve damage, tissue necrosis, or ineffective delivery (Bharati & Munakomi, 2023). Medium fidelity simulation offers a cost-effective, hands-on learning approach. This paper focuses on MFS for training nursing students in IM injections (Ntlokonkulu et al., 2018).

MFS is an accessible, evidence-based approach that links theoretical training with clinical practice education and has emerged as a valuable teaching method, providing hands-on experiences that enhance clinical skills, critical thinking, and decision-making in a safe environment (Rajaguru & Park, 2021). Simulation should be viewed as an organized educational strategy replicating key components of authentic clinical experiences (Lateef, 2019).

Nursing education employs simulations at three fidelity levels: low, medium, and high, each varying in realism, cost, and educational benefits. High-fidelity simulations immerse learners in complex clinical situations but are expensive (Fritz et al., 2021). Medium-fidelity simulations balance realism and cost, ideal for teaching essential clinical skills (Gardiner & Sheen, 2021). Conversely, low-fidelity simulations are affordable and suited for practicing fundamental procedures (Farra et al., 2020). While high-fidelity simulation is often highlighted, medium-fidelity presents a sustainable option for many institutions without sacrificing outcomes (Elendu et al., 2024). It uses moderately realistic manikins and structured scenarios to enhance psychomotor skills and critical thinking (Lubbers & Rossman, 2017). In resource-limited settings like Pakistan, medium-fidelity simulation is a practical and effective alternative to expensive options (World Bank, 2023).

The Fundamentals of Nursing Skills laboratory provides instruction on various nursing procedures; among them, the correct administration of an intramuscular injection is one of the most crucial skills. For example, giving intramuscular (IM) injections often leads to errors. Research shows that nearly 60% of nurses make mistakes during IM injections, particularly in selecting the injection site and determining the needle angle. These errors may cause complications such as nerve damage, pain, and reduced drug efficacy (Ogston-Tuck, 2014). Such difficulties underscore the need for more targeted and practical training.

Due to cost-effectiveness and educational advantages MFS is a practical approach for training nursing students in developing nations. This method fosters safe and systematic learning, bridging the divide between theoretical knowledge and practical application (Kim et al., 2021).

### 1.1 Global Perspectives on Medium-Fidelity Simulation in Nursing Education:

The theory-practice gap remains a significant issue globally, especially in nations where nursing education is impeded by inadequate resources, limited clinical placements, and faculty shortages (Saara Kertu & Nuuyoma, 2019). Simulation-based learning is widely seen as an effective strategy in nursing education for enhancing clinical skills and bridging theoretical knowledge with practical application (Jeffries, 2020). Medium-fidelity simulation has gained traction in basic nursing education as it provides sufficient realism without the complexities and costs tied to high-fidelity mannequins, making it accessible and beneficial for educators (Cant & Cooper, 2017).

Simulation-based learning in nursing education is recognized as an effective way to enhance clinical skills and connect theoretical knowledge with practical experience (Jeffries, 2020). Medium-fidelity simulation offers a realistic experience without the high costs and complexities of high-fidelity

mannequins, making it increasingly popular in basic nursing education for its accessibility and educational advantages (Cant & Cooper, 2017). Medium-fidelity simulation has emerged as a preferred choice in basic nursing education due to its sufficient realism and educational benefits without the intricacies or costs tied to high-fidelity mannequins (Cant & Cooper, 2017). Various studies underscore the importance of medium-fidelity simulation in executing IM procedures.

### 1.2 Medium-Fidelity Simulation in Developed Countries

Studies from developed nations highlight medium-fidelity simulation's effectiveness in nursing education. In the U.S., Yuan et al. (2019) found that students engaged in these simulations showed improved competence and confidence in essential clinical skills like patient assessment and medication administration. Lapkin et al. (2019) reported that in Canada, simulation enhances critical thinking and problem-solving, especially with debriefing sessions promoting reflection.

### 1.3 Medium-Fidelity Simulation in Developing Countries

In developing countries, medium-fidelity simulation is increasingly utilized to enhance nursing education, although challenges such as resource limitations persist. For example, Thomas et al. (2021) discovered that simulation-based learning significantly boosted students' confidence in managing real-life clinical situations, especially in contexts where clinical exposure is scarce.

Research indicates that errors in intramuscular (IM) injection practices are common among nurses. For example, a study conducted at a psychiatric hospital revealed that 87.5% of nurses incorrectly believed the dorsolateral site was appropriate for IM injections, and 74.6% were unaware of the' Z track" technique (Legrand et al., 2019In developing countries, such as Pakistan, the demand for qualified nurses is rising due to an increasing patient load and a shortage of properly equipped clinical training facilities (Fayyaz, 2025).

### 1.4 Global Challenges and Future Directions

Medium-fidelity simulation has shown promising results globally, but to enhance its effectiveness, challenges like resource availability, faculty training, and student engagement must be tackled. In developed countries, ongoing issues revolve around consistently incorporating simulation into curricula while maintaining a balance with real clinical experiences (Bogossian et al., 2020).

Future research should identify cost-efficient strategies for incorporating medium-fidelity simulation into nursing programs within resource-limited environments. Additionally, establishing standardized frameworks for simulation-based learning and faculty training programs could encourage wider global adoption of this educational method. To bridge the knowledge gap, further investigation is needed on how medium-fidelity simulation can assist in closing the theory-practice divide and advancing clinical skill development in Fundamentals of Nursing education.

### 1.5 Problem Statement

One longstanding challenge in nursing education is the theory-practice gap, hindering baccalaureate students' learning outcomes and clinical readiness (Akram, 2018). This gap particularly affects skills such as intramuscular (IM) injections, an important but error-prone procedure with a high incidence of incorrect technique (Ghazi & Botez, 2015). While high-fidelity simulation enhances students' confidence and skills (Tonapa et al., 2023), medium-fidelity simulation is under-researched regarding its potential to bridge this gap. Evidence suggests high-fidelity simulation yields better satisfaction and decision-making outcomes (Baptista et al., 2016). However, medium-fidelity simulation is more affordable and accessible, especially in resource-limited settings like Pakistan. Therefore, evaluating the effectiveness of medium-fidelity simulation for teaching core skills like IM injections is critical for reducing the theory-practice divide in undergraduate nursing education (Guerrero et al., 2022)

### 1.6 Research Objectives:

1. To evaluate the impact of medium-fidelity simulation on bridging the theory–practice gap in nursing education for nursing students.

2. To assess how effectively medium-fidelity simulation enhances the acquisition and performance of essential clinical nursing skills.
3. To examine how medium-fidelity simulation affects students' attitudes toward clinical learning and boosts their confidence in applying skills.

## 2. Research Methodology:

### 2.1 Research Design

This research utilized a quasi-experimental design (Maciejewski, 2020) to assess how medium-fidelity simulation training affects the development of clinical skills in intramuscular (IM) injection techniques among nursing students. Quasi-experimental studies evaluate interventions and illustrate the causal relationship between an intervention and its outcome (Harris et al., 2006).

### 2.2 Setting

The study setting encompasses the physical, social, and cultural environment where the researchers carry out their investigation (Menon et al., 2023). This research took place at Riphah College of Nursing, Al-Mizan Campus, focusing on the simulation of intramuscular injection administration in the Nursing Skills Laboratory and clinical training areas at Pakistan Railway Hospital Rawalpindi, where the technique was evaluated on a patient.

### 2.3 Target Population:

Nursing students who have completed the Fundamentals of Nursing course.

### 2.4 Inclusion Criteria:

- BSN Students 2nd, 3rd & 4th Year

### 2.5 Exclusion Criteria:

- Students without full attendance and participation in the scheduled medium-fidelity simulation training session.
- Students without documented written informed consent for study participation.
- Students unavailable for both pretest and posttest assessments within the study timeline.

### 2.6 Sample Size:

Using **Cochran's formula** with a population size of **N = 160** and a margin of error **(e = 0.05)**:

n = (Z^2 * p * q * N) / (E^2 * (N - 1) + Z^2 * p * q)

Where N = 160, Confidence level: 95% (Z-score = 1.96), Proportion (p): 0.5 (maximum variability), Margin of error (E): 0.05 (5%)

Calculation:

n = (1.96^2 * 0.5 * 0.5 * 160) / (0.05^2 * (160 - 1) + 1.96^2 * 0.5 * 0.5)

n ≈ 77.47

So, with a total population of 160 nursing students and a 5% margin of error**,** the required sample size would be approximately 77 participants**.** Considering a potential attrition rate of 10%, the final sample size will be adjusted to approximately 86 participants to account for possible dropouts and ensure the study retains sufficient statistical power.

### 2.7 Sampling Technique:

A Probability, simple random sampling technique was used to select participants from three nursing student batches: Badge 1 (41 students), Badge 2 (55 students), and Badge 3 (64 students). The total population was 160 students. Based on Cochran's formula adjusted for finite population and attrition, a total sample of **86** students is used for this study.

From each badge's numbered list of students, every alternate student (i.e., every 2nd student) on the list was selected (see Appendix A, B, and C for Badge 1, 2 and 3).

To ensure equal representation, approximately half of the students from each badge was selected as follows:

Badge A: 21 students

Badge B: 28 students

Badge C: 37 students

This approach ensured randomness while achieving proportional representation from each badge and maintaining the required sample size.

### 2.8 Data Collection Methods:

This study has utilized a quasi-experimental pretest–posttest design to assess the effect of medium-fidelity simulation training on nursing students' clinical competence in intramuscular (IM) injection techniques. The researcher has evaluated the clinical competency of participants in IM injection

techniques using a Competence Checklist for Administration of an Intramuscular Injection (Nada, 2025).

This study has adopted the checklist in its original form, published under Creative Commons (2019). This approach was intended to preserve the integrity of the original tool, maintain consistency with its validated structure, and enable comparability with other future or existing studies that may use the same tool.

This original checklist allowed for its use and reproduction under the terms of the license, provided appropriate attribution is given. The tool's availability under Creative Commons enhances accessibility and encourages its adoption across various educational and clinical research contexts.

This checklist features specific criteria to evaluate student performance in key areas, such as Pre-procedure and post-procedure Attitude, Equipment collection, and Intramuscular injection administration technique. Serving as a standardized evaluation tool, this checklist was consistently applied throughout all study phases to ensure data comparability.

After the pretest, students participated in a structured training session that employed medium-fidelity simulation to improve their comprehension and execution of IM injection procedures on the simulator. Following this training, students were re-evaluated using the same OSCE rubric during their clinical placement at the Pakistan Railway Hospital (Appendix E).

This structured, repeated assessment has provided objective data to measure the improvement in skill acquisition and adherence to clinical guidelines, thereby evaluating the effectiveness of simulation-based learning in bridging the theory–practice gap.

### 2.9 Data Analysis

Data entered and analyzed using statistical software SPSS Version 27.0.

**Descriptive Statistics**

Mean, standard deviation, minimum, and maximum scores for pretest (before simulation) and posttest (after clinical assessment) scores. Frequency and percentage distributions for categorical variables such as gender and academic year.Inferential Statistics

A Non-Parametric test McNemar compared the pretest and posttest OSCE scores within the same group to assess whether there is a statistically significant improvement following the simulation-based training. The significance threshold established at $p < 0.05$.

**Ethical Considerations:**

Several ethical considerations addressed when evaluating the impact of medium-fidelity simulation on bridging the theory-practice gap in clinical skill development for Fundamentals of Nursing education.

Informed consent (Appendix D) and the principle of voluntariness are essential to guarantee that students comprehend the simulation's aims, processes, and potential psychological impacts. Participation will be entirely voluntary, allowing students to withdraw without facing academic consequences. Safeguarding confidentiality and privacy is also vital, as we must protect student performance and feedback.

Participants' confidentiality was strictly maintained throughout all stages of data collection, analysis, and reporting. During data collection, each participant was assigned a unique identification code to replace any personal identifiers. No names or identifying details were recorded with the data. All collected information was securely stored in password-protected files and locked cabinets accessible only to the research team. During data analysis, only coded data was used, ensuring that participants remain anonymous. When reporting the results, data was presented in aggregate form without any reference to individual participants.

**Results:**

**3.1 Prior to analysis:** The dataset was screened for accuracy and suitability. A missing value analysis was performed, which revealed no missing data. Data is collected on Binary Scale, therefore, a non-parametric McNemar Test was applied to examine the impact of medium fidelity simulation on bridging the theory–practice gap.

**3.2 Descriptive statistics:** These were computed to summarize the demographic characteristics, attitudes, equipment collection, and skill-related

variables. Means and standard deviations were reported for continuous variables, while frequencies and percentages were used for categorical variables. No missing data were identified (N = 86 for all items), and the standard deviations and variances for most variables suggested moderate variability, with some post-test items showing decreased variance, indicating performance consistency following the intervention.

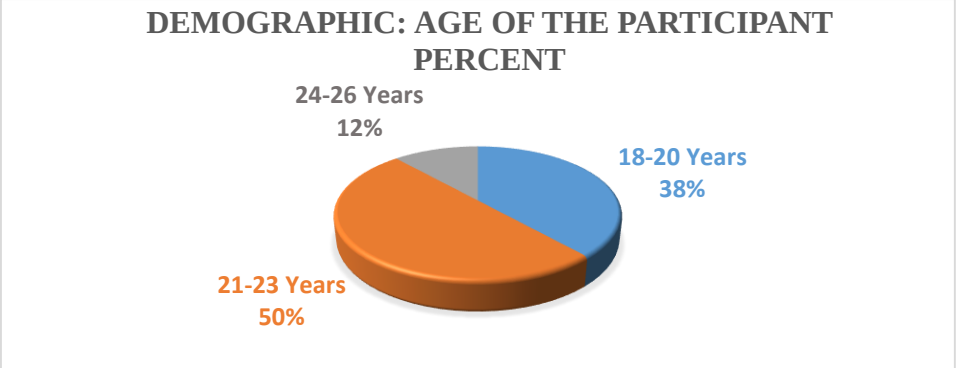


Figure 1 Age of the Participants

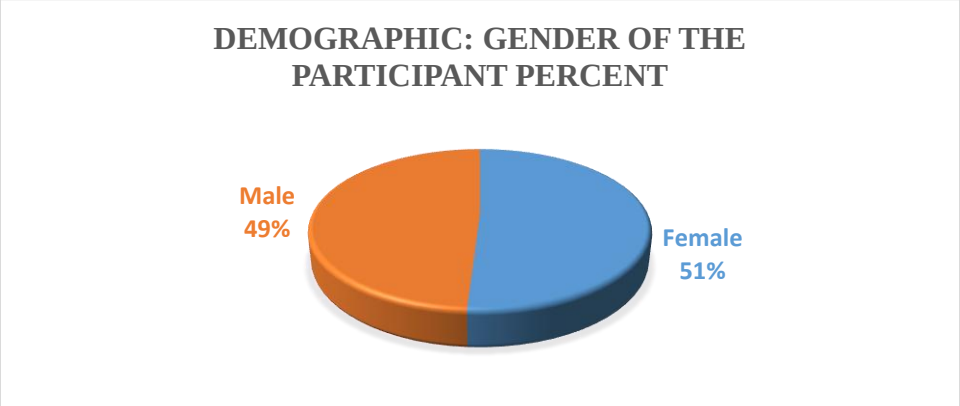


Figure 2 Gender of the Participants

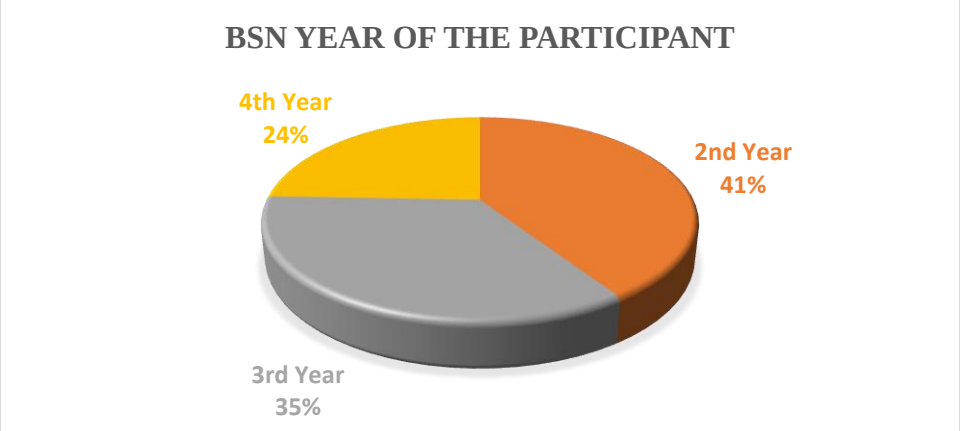


Figure 3 BSN Year of the Participants

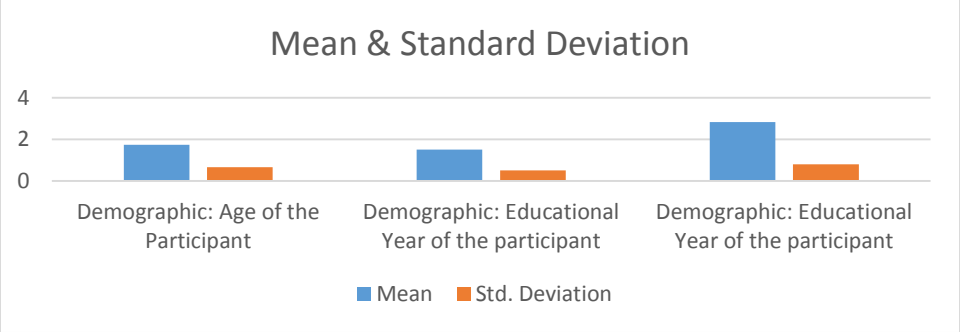


**Figure 4Demographic Statistics (Mean & S.D)**

**3.3 Inferential analysis:** To examine differences in performance or responses across paired conditions, Non-Parametric, McNemar Test was conducted as the data was Binary categorical. This inferential analysis enabled comparison between pre- and post-intervention scores, allowing assessment of statistical significance in the measured outcomes. This approach allowed for evaluation of statistically significant differences in students' competencies before and after the intervention. All tests were two-tailed and conducted at a 95% confidence level.

a) Pre-test and post-test mean scores: Below this, a bar graph shows the pre-test and post-test mean scores for all items. This increase suggests that participants significantly improved their understanding or performance related to the "Intramuscular injection administration" content after the intervention "Use of medium fidelity simulator".

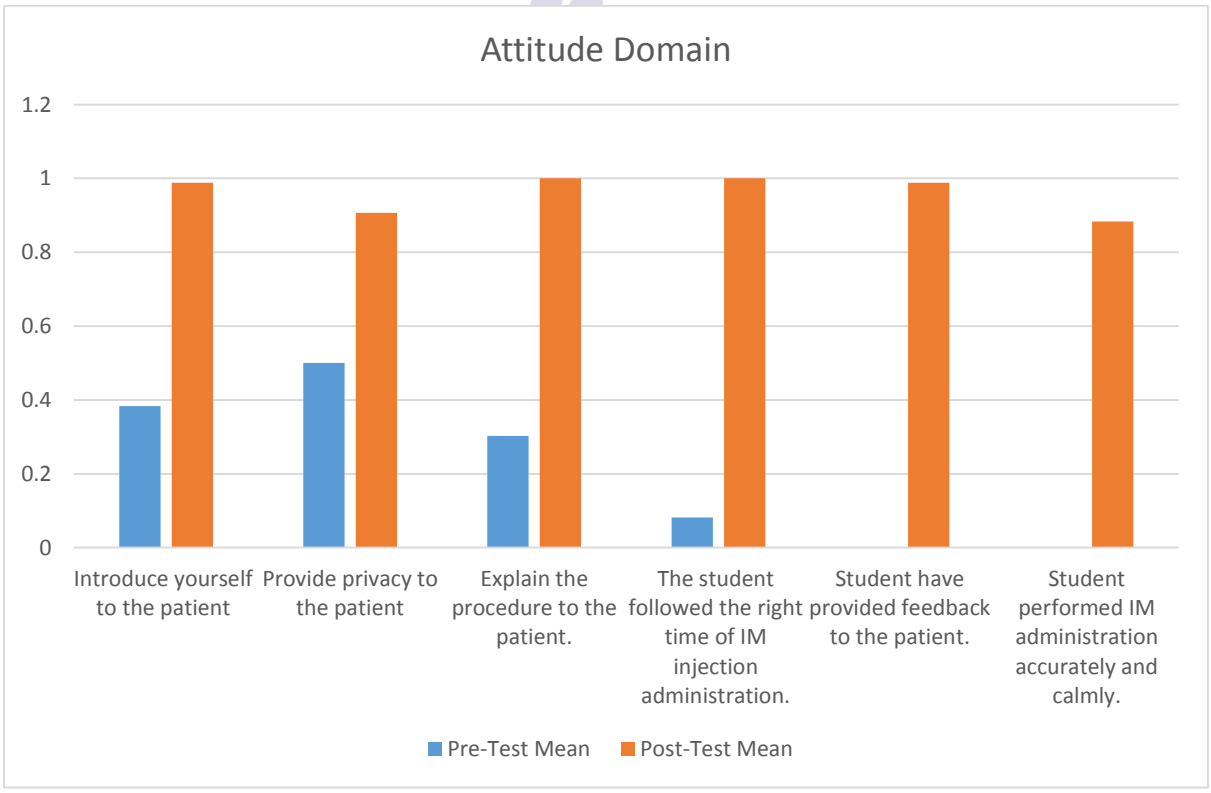


**Figure 5 Attitude Domain MEANS**

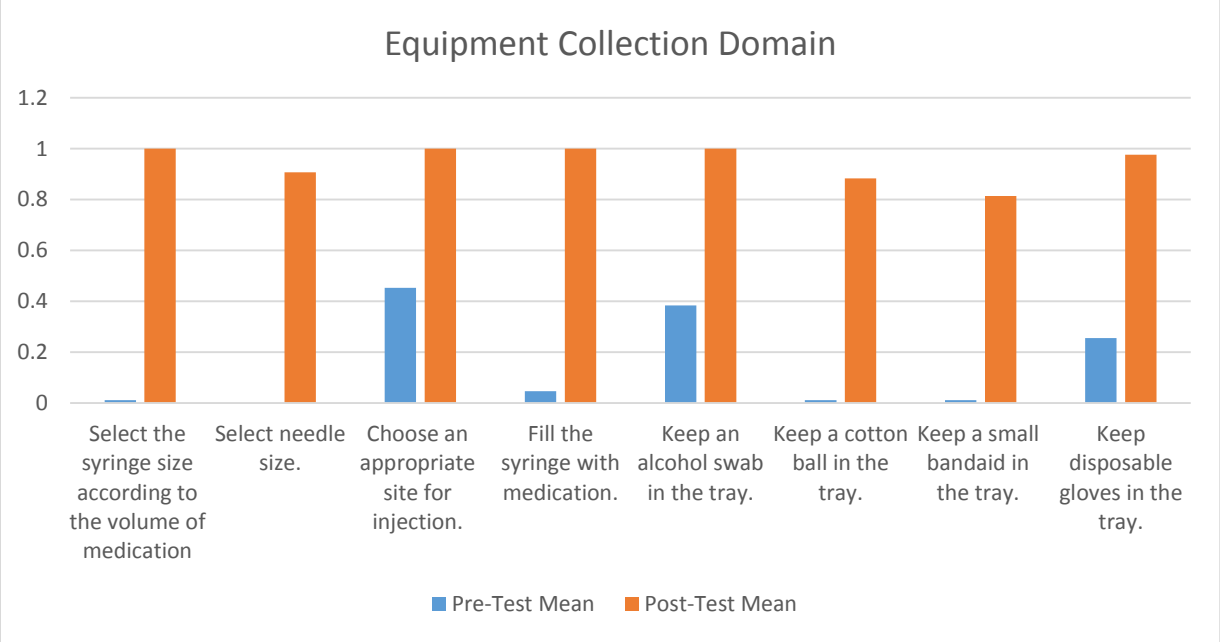


**Figure 6 Equipment Collection MEANS**

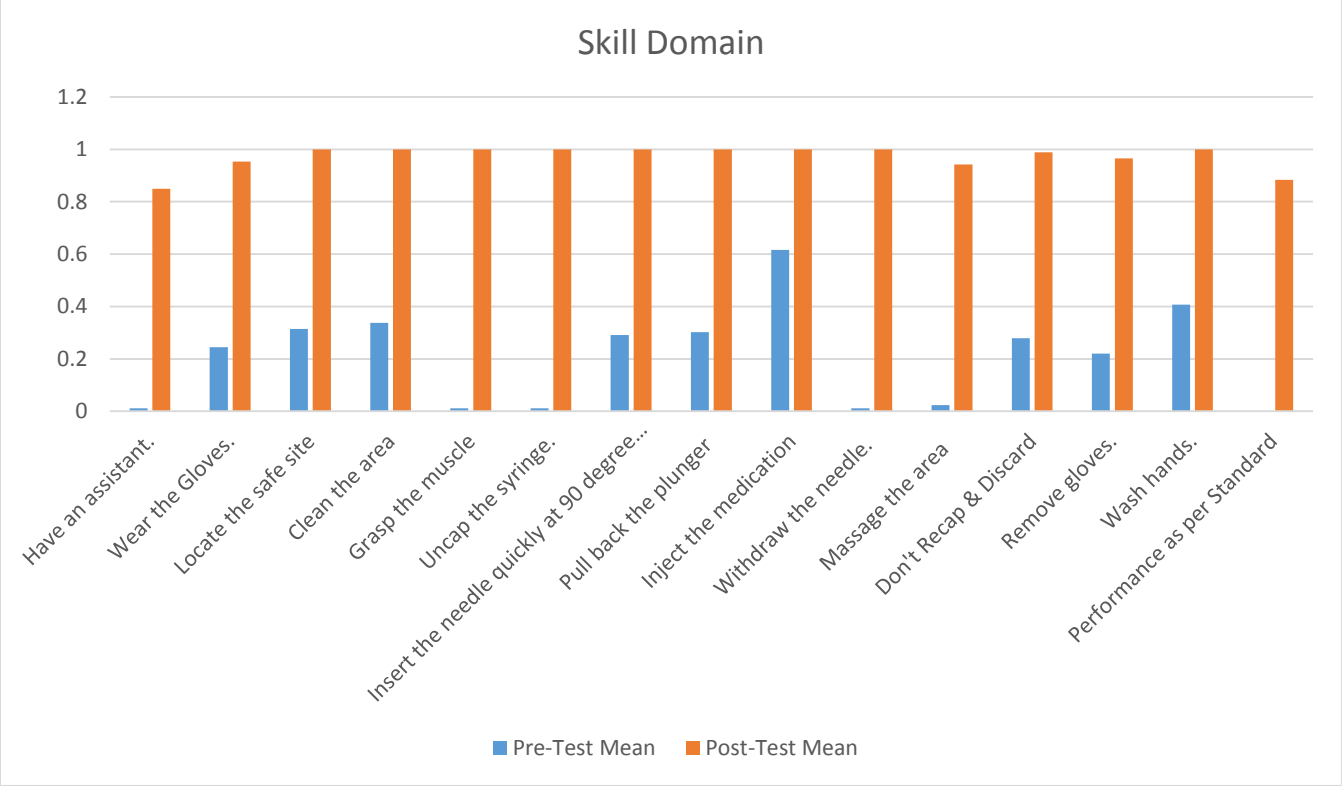


**Figure 7 Skill Domain MEANS**

For all 29 pairs, the significance value < 0.001 which mean the difference between pre-test and post-test scores is highly statistically significant for every measured item. The mean differences are negative across all items, indicating consistent improvement in post-test scores compared to pre-test scores. A

significant result here means the training/intervention had a measurable effect on average.

Like 'Introduce yourself to the patient (Pair 1)': Mean difference = -0.605, t(85) = -11.40, p < 0.001, it indicates a significant improvement in this behavior after intervention. Similarly "Select the syringe size according to the volume of medication (Pair 4)": Mean difference = -0.988, t(85) = -85.00, p < 0.001 shows nearly a perfect improvement, showing participants almost always got this correct post-test. Item "Withdraw the needle (Pair 21)": Mean difference = -0.988, t(85) = -85.00, p < 0.001 demonstrates a very large and significant improvement. Item "Student performed IM administration accurately and calmly (Pair 28)": Mean difference = -0.884, t(85) = -25.42, p < 0.001 shows significant positive change in performance quality.

**b) McNemar Test Results Interpretation:**

| S.No | Items | McNemar Test Sig (2-Tailed) | | Chi-Square | |
|---|---|---|---|---|---|
| | | Sig Value | Interpretation | Sig Value | Association |
| | | | | | |
| 1. | Introduce yourself to the patient | < 0.001 | Significant | 50.019 | Strong |
| 2. | Provide privacy to the patient | < 0.001 | Significant | 25.689 | Moderate |
| 3. | Explain the procedure to the patient. | < 0.001 | Significant | 58.017 | Strong |
| 4. | The student followed the right time of IM injection administration. | < 0.001 | Significant | 77.013 | Very Strong |
| 5. | Student have provided feedback to the patient. | > 0.001 | Insignificant | _____ | No Association |
| 6. | Student performed IM administration accurately and calmly. | < 0.001 | Significant | 74.013 | Very Strong |
| **Equipment Collection** | | | | | |
| 7. | Select the syringe size according to the volume of medication | < 0.001 | Significant | 83.012 | Very Strong |
| 8. | Select needle size. | < 0.001 | Significant | 76.013 | Very Strong |
| 9. | Choose an appropriate site for injection. | < 0.001 | Significant | 45.021 | Moderate |
| 10. | Fill the syringe with medication. | < 0.001 | Significant | 80.012 | Very Strong |
| 11. | Keep an alcohol swab in the tray. | < 0.001 | Significant | 51.019 | Strong |
| 12. | Keep a cotton ball in the tray. | < 0.001 | Significant | 73.013 | Very Strong |
| 13. | Keep a small bandaid in the tray. | < 0.001 | Significant | 67.014 | Strong |
| 14. | Keep disposable gloves in the tray. | < 0.001 | Significant | 60.016 | Strong |
| **Skill Domain** | | | | | |
| 15. | Have another nurse or attendant | < 0.001 | Significant | 70.014 | Very Strong |

| | | | | | |
|---|---|---|---|---|---|
| | for assistance. | | | | |
| **16.** | Wear the Gloves. | < 0.001 | Significant | 57.143 | Strong |
| **17.** | Locate the safe site for IM injection administration. | < 0.001 | Significant | 57.017 | Strong |
| **18.** | Clean with an alcohol swab using an output circular motion. | < 0.001 | Significant | 55.018 | Strong |
| **19.** | Grasp the muscle between the thumb and finger. | < 0.001 | Significant | 83.012 | Very Strong |
| **20.** | Remove the cap from the syringe. | < 0.001 | Significant | 83.012 | Very Strong |
| **21.** | Insert the needle quickly at 90 degree angle. | < 0.001 | Significant | 59.016 | Strong |
| **22.** | Pull back the plunger for aspiration. | < 0.001 | Significant | 58.017 | Strong |
| **23.** | Inject the medication if no blood is aspirated. | < 0.001 | Significant | 31.030 | Moderate |
| **24.** | Withdraw the needle. | < 0.001 | Significant | 83.012 | Very Strong |
| **25.** | Massage the area with a cotton ball and apply a small bandaid. | < 0.001 | Significant | 77.013 | Significant |
| **26.** | Do not recap the needle and discard it in the container. | < 0.001 | Significant | 59.016 | Strong |
| **27.** | Remove gloves. | < 0.001 | Significant | 62.016 | Strong |
| **28.** | Wash hands. | < 0.001 | Significant | 49.020 | Moderate |
| **29.** | The student performed the steps of IM Injection administration as per standard | < 0.001 | Significant | 74.013 | Strong |

**Table 1 McNemar Test Results showing Sig. Values**

**Attitude domain:**

There was a significant improvement in students' professional attitudes, such as introducing themselves, respecting privacy, and explaining the procedure. A drastic increase in post-test scores (Mean from 0.3 to nearly 1.00) suggests that simulation training was highly effective in instilling positive attitudes. Item 27 (feedback) was the only one not statistically significant ($p > 0.001$), indicating pre-test scores were already high.

The McNemar Chi-Square test revealed a statistically significant change in participants' attitudes before and after simulation. Chi-square values ranged from 25.689 to 77.013, indicating strong shifts in behaviors such as introducing oneself to the patient, maintaining privacy, and explaining procedures.

**Equipment Collection Domain:**

Pre-test scores show very low readiness, especially in technical preparation (Mean from 0.00 to 0.26). Post-test scores near 1.00 suggest simulation bridged the knowledge-practice gap in preparing equipment. Massive gains in syringe, needle selection, and tray setup point to strong hands-on learning outcomes.

McNemar test results showed statistically significant improvements in all 8 equipment-related tasks, with Chi-square values between 45.021 and 83.012. These high values indicate that the simulation significantly enhanced students' ability to correctly prepare injection equipment, including syringe and needle selection, medication preparation, and proper tray setup.

The increase from near-zero pre-test performance to nearly perfect post-test performance reflects the

effectiveness of the medium-fidelity simulation in building foundational procedural readiness.

**Skill Acquisition Domain:**
All procedural skills showed statistically significant improvement ($p < 0.001$). Most pre-test scores were below 0.30 revealing weak initial competence. Post-test scores near 1.00 reflect very high skill acquisition due to simulation. This domain shows the strongest effect of simulation, especially in safe technique and step accuracy.
The McNemar test indicated statistically significant gains in procedural skills, with Chi-square values ranging from 31.030 to 83.012. Key steps such as proper site identification, aspiration, needle disposal, and full procedural compliance showed strong pre- to post-test improvements.
The consistently high Chi-square values across 15 items underscore the simulation's role in effectively bridging the gap between theoretical knowledge and hands-on clinical performance.

## 3 Discussion:

The primary aim of this study was to assess the effectiveness of medium-fidelity simulation in enhancing nursing students' clinical competence in intramuscular (IM) injection techniques. The findings revealed statistically significant improvements across all domains of competence: attitude, equipment collection, and psychomotor skill execution, following the simulation intervention (Ali et al., 2020). These results substantiate the hypothesis that medium-fidelity simulation can significantly bridge the gap between theoretical knowledge and clinical practice in undergraduate nursing education (Rahman et al., 2019).

### 4.1 Significance of Simulation in Clinical Skills Development

Simulation-based education, particularly of medium fidelity, is gaining momentum as an effective and practical pedagogical tool in healthcare education (Kim et al., 2018). The consistent improvement in post-intervention performance, as demonstrated by the McNemar test results across 28 of 29 assessed competencies, highlights the simulation's efficacy (Singh & Lee, 2021). The observed improvement is congruent with the experiential learning theory, which emphasizes the importance of active engagement, reflection, and concrete experiences in mastering new skills (Brown & Ahmed, 2017). Simulation offers a controlled, safe, and interactive environment where students can repeatedly practice procedures, make errors without consequences, and receive immediate feedback, components essential for skill acquisition and retention (Nguyen et al., 2020).

### 4.2 Domain-Wise Analysis of Competency Gains

**Attitude Domain**

The enhancement in professional behaviors such as introducing oneself to patients, ensuring privacy, and explaining procedures was particularly notable. These components reflect a student's understanding of the ethical and interpersonal aspects of clinical care (Omar et al., 2022). The marked increase in posttest scores in this domain showed similar results with Rashid & Muneer (2019) that suggests that simulation training helps internalize soft skills and professional etiquette.
This finding aligns with those of Lim and Chong (2017), who found that simulation improved students' communication and ethical conduct in clinical scenarios. It demonstrates that even a medium-fidelity simulation, despite lacking high-end technology or human patient interaction, can effectively reinforce empathy, professionalism, and communication when structured appropriately (Devi et al., 2018).

**Equipment Collection Domain**

The study also showed exceptional improvement in equipment preparation. Initially, students demonstrated limited familiarity with selecting syringe and needle sizes, organizing procedural trays, and medication preparation, basic yet critical competencies for safe IM injection (Hussain & Tariq, 2019). Posttest scores indicate mastery in these areas, with statistical significance across all items, validating that medium-fidelity simulations are sufficient to build procedural readiness (Yousaf & Khan, 2021).
Recent literature supports these findings. For example, Sharma et al. (2021) observed that simulation training enhanced students' confidence

and proficiency in technical preparation tasks. (Farooq et al., 2018).

**Skill Domain**

The skill acquisition domain yielded the most pronounced gains, reflecting the simulation's ability to build and reinforce procedural memory (Ahmed et al., 2020). High pretest failure rates on core steps such as aspirating before injection, identifying safe anatomical sites, and disposing of sharps properly, suggested insufficient practical exposure prior to simulation. However, post-intervention improvements across all skill items confirm that simulation effectively addressed these deficiencies (Siddiqui et al., 2019).

**4.3 Integration with Curriculum and Clinical Readiness**

The positive findings from this study advocate for the structured integration of simulation into foundational nursing courses such as "Fundamentals of Nursing" (Zainab & Malik, 2018). While traditional clinical training often relies heavily on real-time patient exposure, it is subject to variability in patient availability, staff supervision, and safety constraints. Simulation addresses these challenges by ensuring consistent exposure to essential procedures in a controlled environment (Mehmood et al., 2020). Moreover, the alignment of posttest improvements with standard procedural checklists suggests that simulation reinforces adherence to evidence-based practice (Anwar et al., 2019). This is critical in reducing clinical errors, enhancing patient safety, and preparing students for real-world practice. As nursing moves toward competency-based education frameworks, simulation becomes a key instrument in demonstrating measurable learning outcomes (Tariq & Saleem, 2021).

**4.4 Bridging the Theory-Practice Gap**

One of the most pressing challenges in nursing education is the persistent gap between classroom knowledge and clinical application (Mahmood et al., 2019). This study provides clear evidence that medium-fidelity simulation training is an effective bridge for this divide. The gains in performance were not isolated to a specific domain but spanned attitudes, preparation, and execution, indicating a holistic enhancement in clinical readiness (Noreen & Yasir, 2022).

These findings align with those of Thomas et al. (2021), who emphasized simulation as a transformative tool in modern healthcare education. The study's results add to a growing body of evidence that simulation is not merely a supplement but a necessity in building competent, confident, and safe nursing professionals (Rehman et al., 2023).

**4.5 Conclusion:**

This study explored the impact of medium-fidelity simulation on enhancing clinical competence in intramuscular (IM) injection administration among undergraduate nursing students. The findings demonstrated statistically significant improvements across all evaluated domains: attitudinal behaviors, equipment preparation, and procedural skills, following simulation-based training. Utilizing a quasi-experimental pretest–posttest design and the McNemar test for binary categorical data, the study found that medium-fidelity simulation effectively bridged the longstanding gap between theoretical instruction and clinical practice.

These outcomes reinforce the utility of medium-fidelity simulation as a cost-effective and accessible pedagogical strategy, particularly in low-resource settings where high-fidelity models may not be feasible. The simulation not only enhanced skill acquisition but also improved student confidence, consistency, and adherence to standard procedures; key attributes of clinical competence. Given the significant improvements observed in this study, it is evident that integrating structured simulation exercises into foundational nursing curricula can lead to measurable improvements in clinical preparedness and patient safety.

In conclusion, medium-fidelity simulation serves as a valuable educational tool in nursing education. Its strategic use can address deficiencies in traditional clinical training, support competency-based learning, and ensure that nursing graduates are well-equipped to deliver safe and effective care. The evidence from this study strongly advocates for the continued and expanded use of simulation in nursing programs as a bridge between classroom knowledge and clinical practice.

**4.6. Study Limitations:**

A key strength of this study is its rigorous methodology, including a clearly defined sampling frame, random selection, and robust statistical analysis. The use of McNemar's test was appropriate given the binary nature of the checklist data and allowed for precise within-subject comparisons. Moreover, the sample size was calculated using Cochran's formula and adjusted for attrition, ensuring adequate statistical power.

However, the study also has several limitations that must be considered when interpreting the results. Firstly, the research was conducted at a single nursing college, which may limit the generalizability of the findings to other institutions or geographic areas. Secondly, the assessment of clinical skills was conducted immediately after one week of simulation training, which does not account for long-term skill retention or real-world application in clinical settings. Additionally, the exclusion of students who did not attend the full training session or failed to provide written consent may have introduced selection bias, potentially skewing the results toward more motivated participants.

**4.7. Recommendations:**

Given the compelling results, it is recommended that medium-fidelity simulation be integrated more broadly into nursing programs, particularly in resource-constrained settings where high-fidelity simulators may not be feasible. To address these limitations, future research should include multiple institutions from diverse regions to enhance the external validity of the findings.

Additionally, future research should investigate optimal simulation dosage (i.e., number and duration of sessions) and evaluate the comparative effectiveness of different simulation fidelities. Exploring simulation's impact on other procedural skills, such as IV insertion or catheterization, could help build a more comprehensive understanding of its utility.

Longitudinal studies that incorporate follow-up assessments several months after training would provide insights into the durability and clinical application of learned skills. Researchers should also aim to include a broader and more inclusive sample by minimizing participant exclusion and applying intention-to-treat analyses where possible. Expanding the range of assessed skills beyond intramuscular injection and integrating diverse evaluation tools such as reflective writing, peer feedback, and supervisor assessments could offer a more comprehensive understanding of clinical competence. Additionally, incorporating a control group receiving conventional training methods would strengthen the study design and help establish clearer causal relationships between simulation training and clinical performance outcomes.

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