E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.01.526

Research Article

Comparison of Simulation-Based Training and Bedside Teaching in Enhancing Clinical Skill Acquisition among Medical Students

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Received: 16.02.2026 Revised: 13.05.2026 Accepted: 24.05.2026

ABSTRACT

Background: Learning of clinical skills is an essential aspect of undergraduate medical training. Conventional bedside teaching has been the pillar of clinical training but simulation-based training is a novel training method that offers safe and controlled learning environment.

Objective: To compare the effectiveness of simulation-based training and bedside teaching in enhancing clinical skill acquisition among medical students.

Methods: This comparative analytical study was conducted at the Frontier Medical and Dental College, Abbottabad from March 2024 to March 2025. Eighty-two undergraduate medical students were recruited and separated into two groups, where they were trained via simulation (n = 41) and taught at the bedside (n = 41). Objective Structured Clinical Examination (OSCE) scores were used to measure clinical skills. Other outcomes were level of competency, level of error, advancement in knowledge, confidence and student satisfaction. The SPSS version 25 was used to analyze data with a p-value of 0.05 being statistically significant.

Results: Students in the simulation group demonstrated significantly higher mean OSCE scores (78.6 ± 8.4) compared to the bedside group (70.2 ± 9.1; p = 0.001). Competency levels were higher in the simulation group (78.0% vs. 58.5%; p = 0.03), with fewer major errors. Knowledge improvement, confidence levels, and satisfaction were also significantly better among students receiving simulation-based training.

Conclusion: Simulation-based training is more effective than bedside teaching in enhancing clinical skill acquisition, improving competency, and increasing student confidence and satisfaction. An integrated approach combining both methods is recommended for optimal medical education outcomes.

Keywords: Simulation-Based Training, Bedside Teaching, Clinical Skills, Medical Education, OSCE, Competency.

INTRODUCTION

Clinical skill acquisition is a core objective of undergraduate medical education, as it directly influences the competence and confidence of future healthcare professionals. Bedside teaching has traditionally been considered the standard of clinical training, which offers students first-hand patient exposure and a possibility of training in communication and diagnostic skills. Nevertheless, bedside instruction is frequently questioned by the lack of access to patients, the inconsistency of clinical conditions, time constraints, and patient safety and comfort issues (1-3).

Over the last few years, simulation-based training has become a leading method of education in the medical field as an innovation. Simulation offers a guided and regulated

learning space in which students are able to exercise clinical skills repeatedly with no harm to patients. It enables teaching in a standardized manner, immediate feedback and has a chance to learn through mistakes within a safe environment. Such a practice is consistent with competency-based medical education, which places an emphasis on the acquisition of skills and quantifiable learning outcomes (4-6).

Some studies have shown that training based on simulation boosts procedural skills, increases knowledge retention and confidence among the learners. It supports also active learning and critical thinking based on practice in scenarios. Even with these benefits, simulation will never be able to simulate the richness and diversity of interactions with real patients, which is needed to acquire holistic clinical competence (7, 8).

On the other hand, bedside instruction provides real clinical exposure and development of professional behavior, communication skills and clinical reasoning in real life contexts. It can however be ineffective due to lack of consistent teaching opportunities and the passive nature of learners in certain clinical settings. Thus, the comparative advantage of simulation-based training over bedside teaching is a significant research field (9).

In the context of evolving medical education strategies, there is a need to evaluate and compare these teaching modalities to identify the most effective approaches for clinical skill development. This study aims to compare simulation-based training and bedside teaching in enhancing clinical skill acquisition among medical students, thereby providing evidence to guide curriculum design and educational practices.

METHODOLOGY

This comparative analytical study was conducted at the Frontier Medical and Dental College, Abbottabad over a period of one year, from March 2024 to March 2025. The study aimed to compare the effectiveness of simulation-based training and bedside teaching in enhancing clinical skill acquisition among undergraduate medical students.

A total sample size of 82 medical students was included in the study. The sample size was determined based on feasibility and availability of participants during the study period. Students were divided into two equal groups using a non-probability convenience sampling technique. Group A (n = 41) received simulation-based training, while Group B (n = 41) underwent traditional bedside teaching. Both groups were exposed to the same clinical skills content to ensure comparability.

Inclusion criteria were undergraduate medical students in clinical years of study (3 rd year, 4 th year and final year) who agreed to take part in the study. Students that had formal training in simulation training previously or those who did not want to take part in the study were not included in the study.

A structured and validated assessment method was used to collect the data. Objective Structured Clinical Examination (OSCE) scores were used as measurement of the clinical skill acquisition based on standardized checklists. The evaluation of knowledge was performed with the help of pre-test and post-test. Other variables, including the level of competency, frequency of errors in procedures, the level of confidence, and student satisfaction were measured through structured questionnaires and checklists during observation.

The process of data collection entailed the administration of a pre-test before the training to the two groups and their training procedures. Students were assessed after training session completion by the use of OSCE stations and post-test tests.

Questionnaires based on Likert scales were used to measure the level of confidence and satisfaction immediately after the intervention. To be valid and reliable, all the assessment tools were checked by the medical education experts, and pilot testing was carried out on a limited number of students before the study. OSCE made use of standardized checklists that minimized the influence of the observer and all evaluators received the training to ensure consistency in evaluation.

Statistical Package for Social Sciences (SPSS) version 25 was used to enter the data and analyze the data. The quantitative variables were provided in the form of the mean and the standard deviation like the scores in the OSCE and test scores whereas the qualitative variables were provided in the form of frequencies and percentages. Independent sample t-test was used to compare the mean scores of the two groups and Chi-square test was used to test the association between categorical variables. A p-value of less than 0.05 was taken to be statistically significant.

RESULTS

A total of 82 medical students were included in the study and were equally divided into two groups: Simulation-Based Training (n = 41) and

Bedside Teaching (n = 41). The comparative analysis demonstrated that students trained through simulation showed better clinical skill acquisition, higher confidence, and improved satisfaction levels compared to those trained via bedside teaching.
The demographic characteristics were comparable between both groups. The majority of participants were in the 22–24 years' age group, with a slight female predominance.

Table 1: Demographic Characteristics of Participants (N = 82)

Variable	Category	Frequency (%)
Age Group	20–22 years	28 (34.1%)
	23–25 years	38 (46.3%)
	>25 years	16 (19.5%)
Gender	Male	36 (43.9%)
	Female	46 (56.1%)
Year of Study	3rd Year	29 (35.4%)
	4th Year	31 (37.8%)
	Final Year	22 (26.8%)

The mean OSCE scores of the simulation group were higher than those of the bedside group, which implies that the students had better clinical skills.

Table 2: Comparison of Clinical Skill (OSCE) Scores

Group	Mean OSCE Score ± SD
Simulation-Based Training	78.6 ± 8.4
Bedside Teaching	70.2 ± 9.1

A larger percentage of the students in the simulation group were considered competent, and there were less significant errors as compared to the bedside teaching group.

Table 3: Competency Level and Error Rate

Variable	Category	Simulation n (%)	Bedside n (%)
Competency	Competent	32 (78.0%)	24 (58.5%)
	Not Competent	9 (22.0%)	17 (41.5%)
Error Rate	No Error	18 (43.9%)	10 (24.4%)
	Minor Errors	17 (41.5%)	19 (46.3%)
	Major Errors	6 (14.6%)	12 (29.3%)

Both groups showed improvement in knowledge scores; however, the simulation group demonstrated a greater increase from pre-test to post-test.

Table 4: Knowledge Assessment (Pre- and Post-Test Scores)

Group	Pre-Test Score ± SD	Post-Test Score ± SD
Simulation-Based Training	62.4 ± 7.5	81.2 ± 6.9
Bedside Teaching	63.1 ± 8.0	74.5 ± 7.8

Students who were trained using simulation reported they had increased confidence and a higher level of satisfaction than their counterparts in bedside teaching.

Table 5: Confidence Level and Satisfaction

Variable	Category	Simulation n (%)	Bedside n (%)
Confidence Level	Low	5 (12.2%)	12 (29.3%)
	Moderate	14 (34.1%)	18 (43.9%)
	High	22 (53.7%)	11 (26.8%)
Satisfaction	Poor	3 (7.3%)	9 (22.0%)
	Average	10 (24.4%)	17 (41.5%)
	Good	16 (39.0%)	10 (24.4%)
	Excellent	12 (29.3%)	5 (12.2%)

The differences in clinical skill scores, competency, confidence, and satisfaction were statistically significant with the simulation-based training being more advantageous.

Table 6: Comparison of Outcomes with P-Values

Variable	Simulation	Bedside	p-value
Mean OSCE Score	78.6 ± 8.4	70.2 ± 9.1	0.001*
Competency (%)	78.0%	58.5%	0.03*
High Confidence (%)	53.7%	26.8%	0.01*
Satisfaction (Good/Excellent)	68.3%	36.6%	0.002*

*Statistically significant at $p \leq 0.05$

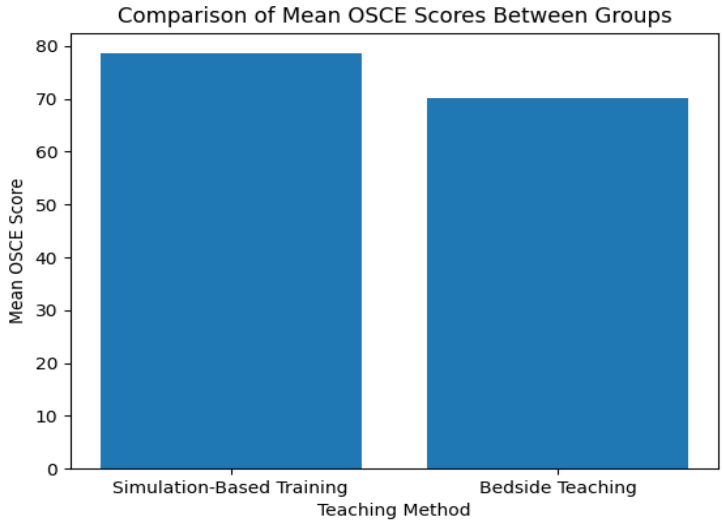

Figure 1: Comparison of Mean OSCE Scores between Simulation-Based Training and Bedside Teaching Groups. Students Trained Through Simulation Demonstrated Higher Clinical Skill Performance Compared To Bedside Teaching

DISCUSSION

The present study compared the effectiveness of simulation-based training and bedside teaching in enhancing clinical skill acquisition among medical students. The findings demonstrated that students trained through simulation achieved significantly higher OSCE scores, better competency levels, fewer procedural errors, and greater confidence and satisfaction compared to those undergoing traditional bedside teaching.

This high performance that was evident in the simulation group can be explained by the fact that simulation offers a structured, repetitive and controlled learning environment. In contrast to bedside instruction, simulation enables the students to learn clinical skills without the risk of injuring patients, which facilitates intentional practice and acquisition of skills. This agrees with the results reported, who highlighted that simulation-based learning improves the skill acquisition process with repetitive practices and immediate feedback. On the same note, research indicated that, high-fidelity simulation enhances clinical competence with feedback and structured debriefing (10-12).

The error rate was also lower among the simulation group in comparison to the bedside teaching group in this study. The significance of this observation is especially crucial in the scenario of patient safety because simulation-based trainings allow the learners to make errors in a safe environment and learn through these errors before they can work in a real clinical environment. Simulation training has been demonstrated to reduce procedure errors and improve patient outcomes in terms of safety, an addition to current investigations that demonstrates the value of including simulation training in undergraduate medical programs (13-15).

Both groups recorded higher gains in knowledge scores, but the simulation group had more gains on post-test. This indicates that simulation is not only better at improving psychomotor skills, but also strengthening cognitive learning. Combining theory and practice in simulation-based situations is likely to lead to better knowledge retention and practice. Conversely, bedside teaching,

although useful in practical exposure, could be constrained by the inconsistency in the availability of patients and consistency of teaching (16, 17).

Another important finding of this study was the significantly higher confidence and satisfaction levels among students in the simulation group. Confidence is a critical component of clinical competence, and increased confidence may translate into improved performance in real clinical settings. Students exposed to simulation-based training often report a more engaging and less stressful learning experience, which enhances motivation and learning outcomes. This aligns with contemporary medical education trends that emphasize learner-centered and competency-based approaches (18, 19).

Even though simulation-based training has the beneficence, bedside training should be a part and parcel of medical training. It offers actual contact with patients, building of communication skills and experience of clinical variability that cannot be complete in simulated settings. Thus, the results of this research indicate that although simulation is an excellent tool to acquire skills, it is better to use it as a supplement to bedside teaching and not as an alternative to it (20).

This study has certain limitations. The sample was quite small and only carried out in one institution and this could limit the generalization of the results. Also, skills retention in the long-term was not evaluated, and future research should investigate how simulation-based learning results in the long-term.

CONCLUSION

Simulation-based training is more effective than bedside teaching in enhancing clinical skill acquisition, improving competency, reducing errors, and increasing confidence and satisfaction among medical students. However, an integrated approach combining both simulation and bedside teaching is recommended to achieve comprehensive clinical competence in medical education.

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