Vol. 5 No. 1 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Perceived Impact of Simulation-Based Learning on Knowledge and Skill Development among Undergraduate Nursing Students

Zafar Fiaz
Registered Nurse, University of Lahore Teaching Hospital, Lahore
Email: rn.zafarfiaz@gmail.com
Ishrat Asghar
Registered Nurse, College of Nursing, Allama Iqbal Medical College
Email: Khushikhan2697@gmail.com
Hafsa Babar Chaudhary
BSN , College of Nursing, DHQ Hospital, Muzzafargarh
Email: Hafsababar50@gmail.com
Tahira Bibi
Master of Science in Physics, University of Punjab, Lahore
Email:Tahiranazik91@gmial.com
Sheharyar Ahmed
Registered Nurse-II, Emergency Department PAF Hospital, Islamabad
Email: Sherrynurse.profession@gmail.com
Chaudhary Muhammad Zaid
MBBS, Nishtar Medical College Multan Email: chaudharyzaid43@gmail.com

Author Details

Keywords: Simulation-based learning, nursing education, knowledge acquisition, skill development, undergraduate nursing students, clinical simulation, Pakistan

Received on 18 Feb 2026
Accepted on 19 Mar 2026
Published on 28 Mar 2026

Corresponding E-mail & Author*:
Zafar Fiaz
Email: rn.zafarfiaz@gmail.com

Abstract

Background: Simulation-based learning has become an effective educational strategy in nursing education by providing a safe and realistic environment where students can develop clinical knowledge and practical skills without compromising patient safety. Despite its widespread adoption internationally, evidence regarding its effectiveness in Pakistan remains limited.

Objective: To assess undergraduate nursing students' perceptions of simulation-based knowledge acquisition and skill development and to compare these perceptions according to demographic characteristics (gender, age group, and year of study).

Methods: A descriptive quantitative cross-sectional study was conducted among 170 undergraduate BSN students at the Lahore School of Nursing, The University of Lahore. Participants were selected through purposive sampling. Data were collected using a structured questionnaire consisting of items assessing knowledge acquisition and skill development through simulation-based learning. Data were analyzed using SPSS version 25. Descriptive statistics, including frequencies and percentages, were used to summarize participant characteristics and outcome variables, while one-way ANOVA was used to examine associations between demographic variables and simulation-based learning outcomes.

Results: Of the 170 participants, 71.8% were male and 28.2% were female. Most participants (54.7%) were aged 21–25 years, while 52.4% were first-year students. Regarding knowledge acquisition, 41.8% of participants demonstrated high knowledge development and 24.7% demonstrated excellent knowledge development. For skill development, 39.4% achieved high skill development and 13.5% achieved excellent skill development. Higher knowledge and skill scores were observed among students aged 21–25 years and second-year students compared with younger and first-year students. Male participants also showed slightly higher proportions of high knowledge and skill scores than female participants.

Conclusion**:** Simulation-based learning was positively associated with improved knowledge acquisition and skill development among undergraduate nursing students. The findings support the integration of simulation into undergraduate nursing curricula to strengthen clinical competence, critical thinking, and decision-making skills. Expanding simulation-based education in nursing institutions may contribute to producing more competent graduates and improving the quality of patient care in Pakistan.

Introduction

Background

Simulation in nursing education has been adopted in the current society as an essential part of nursing training. The advancement of health care institutions requires grounded and analytical thinkers endowed with technical practicality and professional techniques. In this way, exactly these competencies are fostered through simulation, these are all taught to the nursing students within a controlled environment that induces real-life experiences through its clinical scenarios based practice (Recker & Scheele, 2024).

Internationally, Simulation training is recognised for achieving the concept of theory to practice interface, enabling nursing students to practice without risking the lives of patients. According to research, it plays a major part in the improvement of communication, self-promotion, and information acquisition (Guerrero et al., 2024). Previous studies confirmed the effectiveness of Simulation in nursing education in different countries, however, little information is available concerning its applicability to and results in developing countries such as Pakistan.

Simulation is also designed to be implemented at the University of Lahore (UoL) in order to assess the BSN students' response. This work opted for knowledge attainment and skill enhancement as research strategies; thereby meeting an important research need of improving local nursing education in congruity with international norms of health trains for certification.

Simulation models that emulate human body physiological reactions; this way the learner can participate in various complex medical experiences. These simulations are useful in order to provide a risk-free environment for the participants where decision-making processes and distinct clinical interventions are difficult in actual clinical environments (Lee & Kim, 2024).

Globally, Simulation is a research proved educational intervention. This practice has become devoid among the curricula of nursing courses in the developed countries; it shows enhanced performance in matters concerning emergencies and critical care situations (Fotis, 2024). However, there are some challenges that have limited the growth of this model such as; high costs and no trained faculty deter the implementation of this model in developing nations.

The nursing education in Pakistan has developed over the period of time, but more emphasis is given to the conventional pedagogy. Simulation has been specified in modest organizations but there is a lack of research outcomes of its effects. That means the steps undertaken by the University of Lahore to adopt the Simulation training model should be viewed as the advancement of nursing education at the local level that must be continued in the future (Abdulmohdi & McVicar, 2024).

PROBLEM STATEMENT

A failure to provide simulation training can lead to ineffective skill development among nursing students which consequently affect patient care and quality outcomes in healthcare. It can therefore be argued that simulation training could be a revolutionary way of filling these gaps but it's implementation in the local setting has not been widely studied. (Guerrero et al. 2021)

SIGNIFICANCE

This paper assesses the contribution of Simulation education in improving nursing students training at the University of Lahore. The study will add on the database of empirical evidence for education reforms worldwide, will enhance clinical skills and patient care services in the context of Pakistan.

OBJECTIVES

To assess the perceptions of simulation based knowledge and skill development among undergraduate nursing students.

To compare the perceptions of simulation based knowledge and skill development with demographic characteristics (gender, age group, and study year)

LITERATURE REVIEW

Simulation approaches like low and high fidelity are being used in healthcare education. Simulation has now become the innovative tool in education especially in nursing practices, as it provides real fresco of learning. This review explores its impact on nursing students' knowledge acquisition and skill development, synthesizing insights from five pivotal studies: of these there are 3 international universities and 2 national universities.

Recker and Scheele (2024) studied the integration of simulation in obstetrics and gynecology training. As a result of the study they discovered that simulation techniques intended to model stressful working conditions markedly enhanced the decision making capability of nursing students. The study explained how though the environment at simulated real life, it was structured in such a manner that if the students are permitted to proceed with corrective measures, patient lives won't be at risk. In regard to the second and third domains, the iterative learning served to improve various cognitive competencies necessary in handling the challenging obstetric complications. Altogether, the study also underlined that such skills were preserved over the time, which proved the effectiveness of simulation training in enhancing the similar skills among educating nursing students and preparing them for the real life's excigencies.

Guerrero et al. (2021) as discussed the efficacy of between HFS and VS in nursing education. Their results revealed the fact that use of HFS is more effective compared to VS in enhancing independent confident and knowledge acquisition among students. The study identified that perceptions of 'preparedness' have indeed improved through the use of HFS – for example, when students are exposed to clinical simulations like acute cardiac care and respiratory emergencies. More importantly, therefore, simulation contributed to building a relationship between theoretical learning and the practical experience that cannot be easily developed in conventional learning models. Based on the results, the authors postulated that simulation training is essential for establishing fundamental standards of clinical nursing practice.

Lee and Kim (2024) assessed the relevance of simulation training in enhancing communication and knowledge translation as well as clinical judgment. Their work analyzed communication skills among nursing students to demonstrate their interpersonal collaboration and interaction as defined in role plays, which included teamwork during the multidisciplinary conferences. The authors said that implementation of the structured debriefing sessions after the simulation scenarios was useful for the identification of any gaps. Since the reflective discussions emphasised on performance or a certain task, these sessions enabled the students to evaluate their performance constructively. The lessons learned identified that simulation fostered the two abilities of communication and reasoning that can be applied in various context across clinical learning environment making it a most useful tool in education.

Socio-emotional advantages of simulation in nursing the education were examined by Contreras-Ramos et al. (2024) in a national sample. The study also emphasised that, in facilitating simulation, the aim should not be on converting patients into students, students into patients, but instead help them to foster empathy and emotional intelligence which are essential and relevant in care delivery processes, especially patient-centred care. The authors pointed out that more specifically, IT students who were put through higher fidelity scenarios showed a better appreciation of the patient's lifestyle and emotions. The research findings therefore pointed out that simulation has the potential of contributing to the formation of responsive and professional fashioned nursing staff.

In turn, Abdulmohdi and McVicar (2024) examined the effect of simulation training on decision-making and skills maintenance of nursing students. Their marked research focused on students' attitudes towards the methods of learning in simulation. Another advantage, as stated by participants, was in the ability to complete as many task-oriented exercises in realistic situations as possible, and to identify priorities and make sound decisions. Also, according to the study, satisfaction was high among students trained through the simulation than those trained using a standard mode. This the more reason why simulation training should be included in the curriculum for nurses to enhance their technical and non-technical skills.

The combined study presented here corroborates the positive assertion of simulation as the best training model for nursing training. International studies stress its capacity to develop the cognitive, technical, and sociopolitical and interpersonal competencies in learners, as well as national studies in terms of its capacity to address certain contextual issues like inadequate clinical experience and or traditional modes of teaching. One of the most important aspects of simulation identified in all studies regard the reflective part, which in debriefing sessions, simulation provided tools for students to examine the events.

Despite the good methodological quality of the reviewed studies, there are still some issues and limitations to the use of simulation. Recently, Guerrero et al. (2024) argued that there has been a lack of longitudinal research to assess skills bought from the simulation in the long run. Moreover, Lee and Kim (2024) insisted that, through faculty training, the capacity of simulation could be fully unlocked. At a national level, Contreras-Ramos et al., (2024) established that financing and lack of support from institutions are key challenges that hinder the use of simulation in Pakistan.

Simulation education in nursing has continually demonstrated improved knowledge, psychomotor skills and acquisition of social emotional characteristics through fidelity. That said, it can reproduce complicated clinical situation that offer students a no-risk approach to enhance competencies. The findings from both local and international literatures support the need for expanding coverage of its application in diverse geographical regions especially in such constrained environments as Pakistan..

MATERIALS AND METHODS

Study Design:

Descriptive Quantitative Cross-sectional study was the study design for this study as we are going to access the relation between Simulation training and Knowledge assessed by students.

Study Variables:

- Knowledge acquisition and skill development in relation to simulation

Operational Definitions

Knowledge Acquisition related to simulation

Knowledge acquisition in this context refers to the process by which students gain theoretical understanding, critical thinking, and the ability to connect academic knowledge with clinical practice through simulation experiences. This is assessed by evaluating aspects such as realism of scenarios, clarity of objectives, integration of theory into practice, and reflective learning.

Scores for knowledge acquisition are calculated based on responses to 13 questions using a 5-point Likert scale. The total score ranges from 13 to 65. Frequency and percentages for each category are provided below:
Low Knowledge Development (13-26): 8.8%
Moderate Knowledge Development (27-39): 24.7%
High Knowledge Development (40-52): 41.8%
Excellent Knowledge Development (53-65): 24.7%

Skill Development related to simulation

Skill development refers to the enhancement of practical competencies, technical abilities, and interpersonal skills, including communication, teamwork, and self-confidence, as fostered by simulation sessions. This is assessed by evaluating aspects such as technical proficiency, decision-making, communication skills, and the ability to apply learning to clinical scenarios.
Scores for skill development are calculated based on responses to 20 questions using a 5-point Likert scale. The total score ranges from 18 to 90. Frequency and percentages for each category are provided below:

Low Skill Development (18-36): 14.1%
Moderate Skill Development (37-54): 32.9%
High Skill Development (55-72): 39.4%
Excellent Skill Development (73-90): 13.5%

Study Setting:

Lahore School Of Nursing, The University of Lahore was the study setting for this research.

Study Population:

BSN students of Lahore School of Nursing, The University of Lahore was the Population of this research project.

Sampling Technique:

Purposive sampling was used as sampling technique for this research project.

Sample Size:

The sample size is calculated using Cochran's formula:

$$n_{\text{adjusted}} = \frac{n}{1 + \frac{n-1}{N}}$$

- N= 300 (population)
- Z=1.96Z = 1.96Z=1.96 (for 95% confidence level).
- p=0.5p = 0.5p=0.5 (assumed prevalence of sufficient knowledge).
- e=0.05e = 0.05e=0.05 (margin of error).

170 participants (calculated using Cochran's formula with a 95% confidence level)

Study Duration:

This study took 4 months (Sep,2024 to Dec,2024).

Inclusion Criteria:

- First-year and Second-year BSN students
- Students willing to participate voluntarily

Exclusion Criteria:

- Students with prior LFS and HFS exposure outside The University of Lahore

Research Tools:

Structured questionnaire.

Data Collection Procedure:

The data collection process will rely on administering a structured questionnaire specifically designed to evaluate the impact of simulation on nursing students' knowledge and skill

development. This approach ensures a standardized and systematic way of collecting data while directly addressing the research objectives.

Data Analysis Plan:

Data will be analyzed using SPSS (v25.0). Descriptive statistics and ANOVA one way test is used to determine the Association between Dependent and Independent Variables.

Ethical Considerations:

The rules and regulations set by the ethical committee of university of Lahore will be followed while conducting the research and the rights of the research participants were respected.

- Written informed consent attached will be taken from all the participants.
- All information and data collection will be kept confidential.
- Participants will be remained anonymous throughout the study.
- The subjects will be informed that there are no disadvantages or risk on the procedure of the study.
- They will also be informed that they will be free to withdraw at any time during the process of the study.

RESULTS AND DISCUSSION

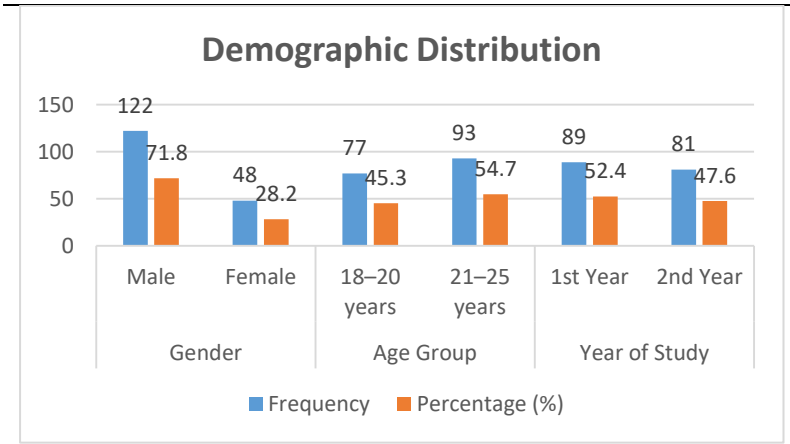
This chapter presents the results of the study on knowledge and skill development among participants using simulation-based learning. The analysis is based on the responses collected from 170 participants and includes frequency distributions, percentages, and demographic breakdowns. Key findings are presented in tabular and graphical formats to ensure clarity and comprehensiveness.

4.2 Demographics of Participants

The demographic data of participants are summarized in Table 4.1.

Table 4.1: Demographic Distribution

Demographic	Category	Frequency	Percentage (%)
Gender	Male	122	71.8
	Female	48	28.2
Age Group	18–20 years	77	45.3
	21–25 years	93	54.7
Year of Study	1st Year	89	52.4
	2nd Year	81	47.6

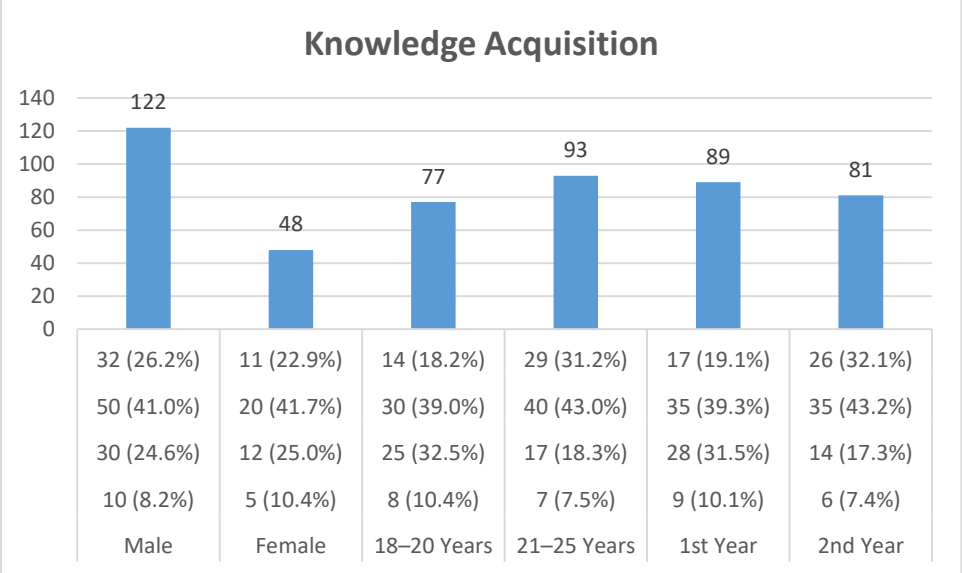


4.3 Knowledge Acquisition Scores

The knowledge Acquisition scores were categorized into four levels based on the operational definition. Table 4.2 provides the frequency and percentage of participants within each category.

Table 4.2: Knowledge Acquisition Scores by Demographics

Demographic	Low (13–26)	Moderate (27–39)	High (40–52)	Excellent (53–65)	Total Participants
Male	10 (8.2%)	30 (24.6%)	50 (41.0%)	32 (26.2%)	122
Female	5 (10.4%)	12 (25.0%)	20 (41.7%)	11 (22.9%)	48
18–20 Years	8 (10.4%)	25 (32.5%)	30 (39.0%)	14 (18.2%)	77
21–25 Years	7 (7.5%)	17 (18.3%)	40 (43.0%)	29 (31.2%)	93
1st Year	9 (10.1%)	28 (31.5%)	35 (39.3%)	17 (19.1%)	89
2nd Year	6 (7.4%)	14 (17.3%)	35 (43.2%)	26 (32.1%)	81



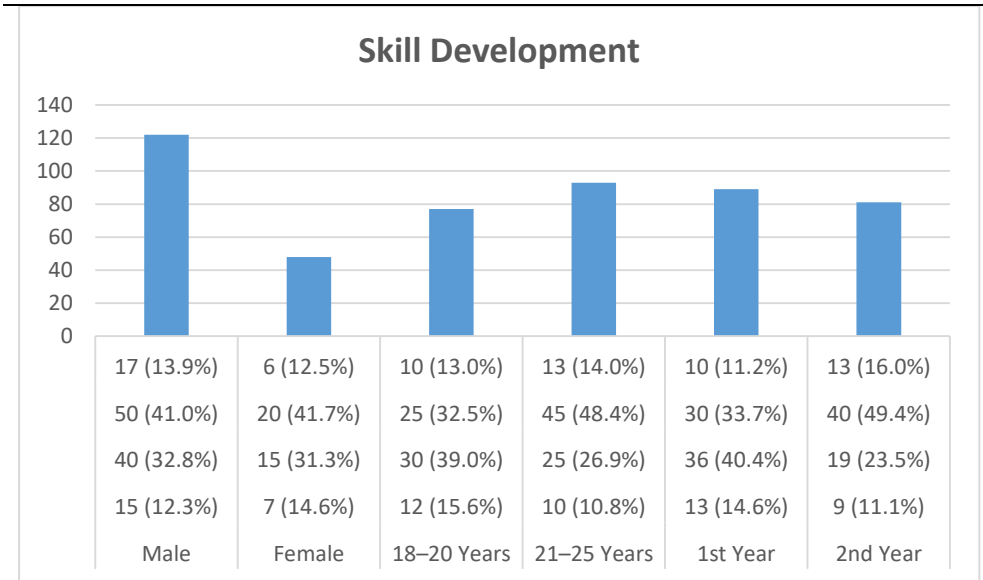
4.4 Skill Development Scores

The skill development scores were categorized into four levels based on the operational definition. Table 4.3 provides a detailed breakdown of skill development scores by demographics.

Table 4.3: Skill Development Scores by Demographics

Demographic	Low (18–36)	Moderate (37–54)	High (55–72)	Excellent (73–90)	Total Participants
Male	15 (12.3%)	40 (32.8%)	50 (41.0%)	17 (13.9%)	122
Female	7 (14.6%)	15 (31.3%)	20 (41.7%)	6 (12.5%)	48

18–20 Years	12 (15.6%)	30 (39.0%)	25 (32.5%)	10 (13.0%)	77
21–25 Years	10 (10.8%)	25 (26.9%)	45 (48.4%)	13 (14.0%)	93
1st Year	13 (14.6%)	36 (40.4%)	30 (33.7%)	10 (11.2%)	89
2nd Year	9 (11.1%)	19 (23.5%)	40 (49.4%)	13 (16.0%)	81



4.5 Interpretation of Results

Knowledge Acquisition

- The majority of male participants (41%) scored within the "High" category, whereas female participants predominantly scored within the "Moderate" and "High" categories.
- Participants aged 21–25 years had a higher percentage (43%) in the "High" category compared to those aged 18–20 years (39%).
- Second-year students displayed a stronger performance in the "High" and "Excellent" categories compared to first-year students.

Skill Development

- Male participants showed a higher distribution in the "High" category (41%), while female participants predominantly scored in the "Moderate" category.
- Older participants (21–25 years) performed better in the "High" and "Excellent" categories compared to their younger counterparts.
- Second-year students outperformed first-year students in skill development, with a greater percentage scoring "High" and "Excellent."

DISCUSSION

This chapter presents the conclusions of the given study on the use of simulation as the means of learning and knowledge/skill enhancement. They are analyzed in terms of prior published papers and discussed based on the observed changes across population groups and latent consequences for future educational approaches.

5.1 Main Conclusion and Implications

Knowledge Development

In terms of results, the study shows that simulation-based learning is a very effective approach to knowledge transition; 41.8% classified as “High”, and 24.7% “Excellent”. These observations conform with previous research done in this line that emphasize on emphasizing on realism in improving on theoretical knowledge and thinking.

Gender Differences:
Male participants reported more “High” and “Excellent” scores than low scores slightly than female participants. This could have been because of differing practical experience in terms of practice based scenarios or; differing learning approaches. Nevertheless, both male and female participants reported a significant increase in their knowledge scores thus vindicating the simulation based teaching methodology.

Age Group Trends:
The youngest group of participants who were 21 to 25 years had the highest “High” scores at 43%. This implies that as the students are older, and have more academic and practical experiences, the get more value for money from simulations. These results vindicate the approach that complexity of simulation has to be chosen based on the previous experience of the learner.

Year of Study:
Second year students had better knowledge improvement in comparison as only first year students; 32.1% of the second year students got ‘Excellent.’ This trend may be attributed to enhanced understanding of the theoretical constructs and usable translation of knowledge in classrooms into clinical area. The findings we therefore corroborate prior research critiques about the need to structure educational content assuming the students’ academic journey.

Skill Development
Performance enhancement results were also encouraging with the beneficiaries scoring high levels of skills’ attainment at 39.4% followed by excellent levels of skills at 13.5%. These outcomes have implications for supporting the application of simulation as a tool for training, to enhance proficiencies, decision-making, and communications and information transfer.

Gender Differences:
More male participants had better skills and ratings in the ‘High’ group: 41% of them as opposed to 31.3% females. This might be because of a variation in levels of confidence or previous IT experience with the new technology. It should therefore be made a point to promote inclusiveness in all possible skill enhancement so that there will not be any discrimination in the ability of different learners.

Age Group Trends:
In the 21–25 years age group the results were even better with 48, 4% respondents reaching “High” level of results. This implies that older participants and those with previous simulation exposure work more effectively through translating simulation tasks into real-life uses.

Year of Study:
A better-seeming performance was identified in second-year students, of which as high as 49.4% of the students possessed “High” skill development. This study accentuates compounded learning and shows that the higher learning students stand to benefit in a more complex manner since progression within program levels is often experienced.

5.2 CONSIDERATION FOR EDUCATION APPROACHES
Improve the generation of Knowledge.

The findings indicate that the features that enhance knowledge increase should include clarity of objectives as well as realism of simulation. Mainly, it is necessary to propose close match with the learner's background to scenarios used within the training. For instance, first and second-year students can participate in simple and differential simulation, respectively.
Thus, building the skill development is one of the important steps in the given approach.
If, for example, there are now disparities in terms of the skills developed by male and female participants, then confidence-building training sessions or further practical experience may be helpful. These results also suggest that extending the feedback structure and debriefing sessions should improve learning effectiveness.

Standing up for Learning Diverse Groups
These positive effects are well documented spanning all demographics and highlight the versatility of simulation-based learning. However, some factors like learning styles and prior exposure should come into play when designing simulation programs. Doing so can enhance the kinds of skills: Offering the level of difficulty that will be required; and, incorporating interdisciplinary teamwork into the course.

5.3 Some Constraints and Future Development

Limitations
Sample Size: The amount of participants that the study enlisted though manageable may not have captured all the variations in learners' experiences.
Self-Reported Data: There is always social-desirability bias when responses are based on self- administrations.
Context-Specific Findings: The results of the study are teaching related and may not apply to all educational environments.

Future Directions
Longitudinal Studies: Longitudinal research can help in giving more qualitative information with regard to the application of simulation based learning as it will be done in the following:
Interdisciplinary Approaches: This article outlines ideas about how the application of simulation genrefied across disciplines can improve communication and sharing abilities.
Technological Integration: This information contributes to the developments of the educational processes connecting the use of emerging technologies in the frameworks of simulation-based learning, for example, through investigating the impact of virtual reality.

5.4 Conclusion
This research has also revealed the importance of using simulation based learning to improve the knowledge and skills of the participants. To some extent some c onversion was observed in accordance to the various demographic data, however, playing the emphasis on the findings obtained, it is possible to ascertain that FlexSim succesful demonstrates a rather imperative potential for integrating simulation features for different types of learners. To this extent, by pinpointing the areas of weakness of this approach and building on its potential, educators can design meaningful and effective learning processes for learners.

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