



Original Research Article

Healthcare Students' Perceptions of Simulation-Based Learning for Clinical Skill Reinforcement: A Cross-Sectional Survey

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Citation: Priya S, Vijayalakshmi K, Mary HR, Kanchana G, Gnanarani JJ. Healthcare Students' Perceptions of Simulation-Based Learning for Clinical Skill Reinforcement: A Cross-Sectional Survey. *Bull Health Sphere*. 2026;1(2):60-70.

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Received: June 15, 2026;

Revised: July 22, 2026;

Accepted: August 26, 2026;

Published: September 30, 2026

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DOI: <https://doi.org/10.63150/bhs.2026.08>

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ABSTRACT

Background: Simulation-based learning (SBL) has become a core strategy in health-professions education for consolidating clinical skills in a safe, deliberate-practice environment. However, the way students across different healthcare disciplines perceive its value for reinforcing skills learned in the classroom remains incompletely characterised, particularly in multi-programme cohorts.

Objective: To evaluate healthcare students' perceptions of SBL for clinical skill reinforcement and to examine how those perceptions vary with discipline, academic year, and prior simulation exposure.

Methods: A cross-sectional survey was conducted among 380 healthcare students across six disciplines. Perceptions were measured with a 21-item questionnaire scored on a 5-point Likert scale spanning four domains: Skill Reinforcement, Confidence and Self-Efficacy, Satisfaction and Engagement, and Realism/Fidelity. Internal consistency was assessed with Cronbach's alpha.

Results: All four subscales demonstrated good internal consistency ($\alpha = 0.82-0.88$; overall scale $\alpha = 0.95$). Mean perception scores were positive and significantly above the neutral midpoint of 3.0 for every domain (all $p < 0.001$), highest for Satisfaction and Engagement (3.74 ± 0.73) and lowest for Confidence and Self-Efficacy (3.22 ± 0.78); the overall mean was 3.44 ± 0.67 , with 73.9% of students scoring above neutral. Students with prior simulation experience reported significantly higher perceptions across all domains (overall 3.55 vs 3.30; $p < 0.001$). Perceptions differed by discipline (overall ANOVA $F = 3.42$, $p = 0.005$) and rose steadily across academic years ($F = 4.95$, $p = 0.002$; linear trend $p < 0.001$). Subscales were strongly inter-correlated ($r = 0.69-0.73$, all $p < 0.001$).

Conclusion: Healthcare students perceived SBL favourably as a means of reinforcing clinical skills, with the strongest endorsement for engagement and satisfaction and comparatively more reserved views on independent competence. Prior exposure and later training stage were associated with more positive perceptions, supporting early, repeated, and curriculum-integrated simulation across disciplines.

Keywords: Simulation training, Clinical competence, Students, Health occupations, Educational measurement, Self-efficacy, Cross-sectional studies.

INTRODUCTION

Reliable transfer of knowledge learnt in classrooms and laboratories to the bedside is essential for clinical competence in the health professions [1]. However, opportunities for supervised hands-on experience in actual clinical practice are becoming increasingly limited due to concerns about patient safety, overcrowding at placements, lack of clinical instructors, and ethical boundaries of learning invasive skills on patients [2]. One of the major pedagogical solutions to these challenges is simulation-based learning (SBL), where students can repeat, practice and learn psychomotor and cognitive skills over and over again with structured feedback, and make and correct mistakes without compromising the safety of patients [3]. Evidence is emerging that supports the use of SBL to enhance knowledge and skill learning in nursing and other health-professions programmes, and that can last when scenarios are well designed and debriefed [4].

The affective and motivational aspects of simulation are recognized as important to its educational value, as well as measurable performance gains [5]. The experiences of undergraduate students, which are summarized through qualitative syntheses, highlight simulation as a psychologically safe environment where students can: synthesize theory, practice decision-making, build professional identity, and experience general issues related to artificiality, equipment fidelity and emotional experience [6]. The perception of these experiences is important as it is what has an impact on engagement, the desire to practice deliberately, and the extent to which simulated practice is internalised and transferred into practice in the real world of work [7].

The ways in which simulation is brought to the learner have increased in a dizzying way [8]. There are several different types of manikins or standardized patients that provide different affordances for skill reinforcement, as well as task trainers, hybrid options, and immersive virtual-reality (VR) and screen-based platforms [8]. VR and virtual-patient simulation are reviewed as knowledge and clinical reasoning, communication and confidence enhancers, with high learners' satisfaction, though with varying results based on implementation quality and familiarity [9].

Debriefing is consistently cited as the pedagogical "brain" of simulation and students' ratings of the quality of debriefing are highly correlated with perceived learning [10].

Most of the current literature about perception, however, focuses on individual disciplines, usually nursing and individual institutions or modalities [11]. There is a general positive attitude found in studies carried out in physiotherapy, pharmacy, and medical education [12] and the medical education curricula are becoming interprofessional, while simulation resources are often shared across curricula [13]. Thus, it is important to learn what students from various disciplines at various stages of training and with various prior experiences think about simulation when it comes to strengthening clinical skills and if they form coherent and measurable dimensions [14].

To fill this void, the current cross-sectional survey explored the perceptions of healthcare students regarding the use of SBL to reinforce clinical skills in four conceptual areas: perceived skill reinforcement, clinical skill confidence and self-efficacy, satisfaction and engagement, and realism/fidelity [15]. The study was designed with three objectives: (i) quantify overall and domain-specific perceptions of simulation for skill reinforcement; (ii) test the internal consistency of the four-domain measurement structure; and (iii) determine if there is a difference between perceptions by discipline, academic year, prior simulation experience, and preferred modality, and if there are differences, what the relationship between the domains is [16].

MATERIALS AND METHODS

Study Design and Setting

A descriptive, analytical cross sectional survey design was employed to obtain the perceptions of students in health care related fields by utilizing simulation-based learning at a single time. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations were followed in the study of the cross-sectional design. Structured, self-administered questionnaires were used to gather data, which were administered to students enrolled in

health-professions programmes with a shared simulation-education facility.

Participants and Sampling

The students who attended were those who were currently studying in a healthcare programme and had two or more simulation sessions as part of the programme. Consent was declined students and students who hadn't been involved in any simulation activities were excluded. A purposive sampling method was used and all students who were eligible to participate and provided informed consent and completed the questionnaire were included. A final analytic sample consisted of 380 students who responded to all items.

Instrument

Perceptions were assessed using a 21-item questionnaire based on the literature of simulation-education and organized into four conceptual domains (Skill Reinforcement 6 items; Confidence and Self-Efficacy 6 items; Satisfaction and Engagement 5 items; Realism/Fidelity 4 items). The items were scored on a 5-point scale (1 = strongly disagree to 5 = strongly agree). There was one item that was negatively worded and reverse-scored (6 – raw score) prior to analyzing the data, thereby ensuring the consistently higher scores were more favorable perceptions. Domains of the instrument are those that have been repeatedly highlighted in validated simulation instruments such as satisfaction and self-confidence scales among health-professions students. Demographic and background information (age, gender, programme, year of study, previous simulation experience, number of simulation sessions attended, preferred modality) was captured in an eight-item section.

Scoring

Four subscale scores were derived by taking the average of each of the items on each of the subscales, and an overall perception score was computed as the average of each of the 21 items (the negatively worded realism item was reverse-scored). All subscale and total scores thus ranged from 1 to 5, with higher scores representing more positive perceptions. The zero (neutral) point on the scale (3.0) was used as a reference against which the mean perceptions were judged.

Data Collection

This questionnaire was completed using a self-report survey method. The purpose of the study was explained to the participants, and anonymous and voluntary participation was emphasized, along with the fact that participation would not have any impact on the academic standing of the participants. This took about 10-15 minutes to complete. Personally, identifying information was not gathered, but each record was given an anonymous identifier.

Statistical Analysis

IBM SPSS Statistics version 20 were used for data analysis. Categorical variables were summarized as frequencies and percentages while continuous variables were summarized as means and standard deviations (SD). Internal consistency was evaluated for each subscale and overall scale, using Cronbach's alpha, which ranged between 0.70 and 0.80, and One-sample t-tests were used to compare the mean score with each of the neutral scores of 3.0. Independent-samples t-tests (with Welch's correction) were used to compare scores based on prior simulation experience and gender, and Cohen's d was used to measure the effect size. A one-way analysis of variance (ANOVA) was used to compare differences between programme, year of study, and modality of study, and eta-squared (η^2) was used as an effect size measure. Pearson correlation coefficients were used to describe associations between subscales and the multiple linear regression model to identify independent predictors of the overall perception score. The statistical significance was accepted as a two-tailed p value < 0.05.

Ethical Considerations

The study was done in compliance with the Declaration of Helsinki. The study was approved by the Institutional Ethics of Apollo College of Nursing, (Approval no. Acon/IEC/2025/027). The participants were asked to complete a questionnaire and consent was obtained and their participation was anonymous and voluntary.

Use of Artificial Intelligence

In accordance with the journal's artificial-intelligence writing policy, the authors disclose that no Artificial

Intelligence tools were used during the preparation of the manuscript.

RESULTS

Participant Characteristics

There was a total of 380 healthcare students involved. The mean age was 21.7 years (SD 2.2; range 18–29). The majority of participants were females (269; 70.8%) with the highest proportion being nursing (153; 40.3%) and medicine (80; 21.1%). There were about equal numbers of participants distributed across the four academic years and 219 (57.6%) students said they had experience with simulations before taking this course. The participants averaged 5.8 (SD 2.6, range 1–14) simulation sessions. High fidelity manikins were the most chosen (123; 32.4%). All participant details are provided in Table 1.

Internal Consistency and Overall Perceptions

The internal consistency of all four subscales (Cronbach's $\alpha = 0.82$ – 0.88) and the scale as a whole (21 items, $\alpha = 0.95$) was satisfactory, indicating a good coherence of the four-domains structure. Positive mean scores for all domains were found and significantly higher than the neutral score of 3.0 (all $p < 0.001$ vs.

neutral). Satisfaction and Engagement was rated most favourably (3.74 ± 0.73), followed by Skill Reinforcement (3.47 ± 0.75) and Realism/Fidelity (3.35 ± 0.80) while Confidence and Self-Efficacy was rated as the lowest (3.22 ± 0.78). The general perception was 3.44 ± 0.67 with 73.9% above the neutral score. Subscale reliabilities and descriptive statistics are summarised in Table 2.

Item-level Perceptions

The most positive responses on the item level were in relation to satisfaction and engagement: students would recommend simulation-based learning to peers (3.81 ± 0.94) and were satisfied with the sessions (3.80 ± 0.94). There were a number of items with the lowest ratings that were within the confidence domain, including feeling competent to perform key skills independently (2.98 ± 0.95) and reduced anxiety about real patient care (3.17 ± 0.98). For the skill-reinforcement domain, majority of students agreed or strongly agreed that simulation reinforced skills learned in class (58.7%) and helped to link theory and practice (52.1%). Here are the items that were selected that yielded this result in Table 3.

Table 1: Characteristics of the study participants (N = 380)

Characteristic	Category	n (%)
Age (years)	Mean $\pm$ SD	21.7 $\pm$ 2.2
	Range	18 – 29
Gender	Female	269 (70.8)
	Male	97 (25.5)
	Prefer not to say	14 (3.7)
Programme	Nursing	153 (40.3)
	Medicine	80 (21.1)
	Physiotherapy	54 (14.2)
	Pharmacy	42 (11.1)
	Dentistry	28 (7.4)
	Medical Lab Sciences	23 (6.1)
Year of study	Year 1	99 (26.1)
	Year 2	98 (25.8)
	Year 3	95 (25.0)
	Year 4	88 (23.2)
Prior simulation experience	Yes	219 (57.6)
	No	161 (42.4)
Sessions attended	Mean $\pm$ SD	5.8 $\pm$ 2.6

<i>Table 1 Continued...</i>		
Preferred modality	High-fidelity manikin	123 (32.4)
	Virtual / VR simulation	70 (18.4)
	Hybrid	69 (18.2)
	Standardized patient	67 (17.6)
	Task trainer	51 (13.4)

SD, standard deviation; VR, virtual reality. Percentages may not total 100 due to rounding.

Table 2: Internal consistency and descriptive statistics for perception subscales and overall score (N = 380)

Domain	Items (k)	Cronbach α	Mean $\pm$ SD	Median	Range
Skill Reinforcement	6	0.87	3.47 $\pm$ 0.75	3.50	1.50 – 5.00
Confidence & Self-Efficacy	6	0.88	3.22 $\pm$ 0.78	3.17	1.00 – 5.00
Satisfaction & Engagement	5	0.84	3.74 $\pm$ 0.73	3.80	1.40 – 5.00
Realism / Fidelity	4	0.82	3.35 $\pm$ 0.80	3.25	1.25 – 5.00
Overall perception	21	0.95	3.44 $\pm$ 0.67	3.43	1.33 – 4.95

All domain means differed significantly from the neutral midpoint of 3.0 (One-sample t-test, $p < 0.001$). SD, standard deviation.

Table 3: Selected item-level perceptions, ranked within domain (N = 380)

Domain	Item	Mean $\pm$ SD	Agree %*
SR	Reinforced clinical skills learned in class	3.65 $\pm$ 0.95	58.7
SR	Helped link theory to practice	3.53 $\pm$ 0.94	52.1
SR	Improved psychomotor / hands-on skills	3.47 $\pm$ 0.93	48.9
CF	Feel more confident performing clinical skills	3.40 $\pm$ 1.02	45.8
CF	Feel prepared to handle clinical situations	3.30 $\pm$ 0.94	43.4
CF	Feel competent to perform key skills independently	2.98 $\pm$ 0.95	29.7
SA	Would recommend SBL to peers	3.81 $\pm$ 0.94	63.4
SA	Satisfied with the simulation sessions	3.80 $\pm$ 0.94	64.5
SA	Simulation should be integrated more into curriculum	3.67 $\pm$ 0.93	58.7
RE	Scenarios were realistic	3.36 $\pm$ 1.01	44.2
RE	Environment resembled a real clinical setting	3.29 $\pm$ 0.97	41.3

*Agree % = proportion selecting 4 (agree) or 5 (strongly agree). SR, Skill Reinforcement; CF, Confidence & Self-Efficacy; SA, Satisfaction & Engagement; RE, Realism/Fidelity; SBL, simulation-based learning.

Table 4: Perception scores by prior simulation experience (independent-samples t-test)

Domain	Prior: Yes (n=219)	Prior: No (n=161)	t	p	Cohen d
Skill Reinforcement	3.59 $\pm$ 0.74	3.30 $\pm$ 0.72	3.90	<0.001	0.40
Confidence & Self-Efficacy	3.33 $\pm$ 0.79	3.07 $\pm$ 0.74	3.22	0.001	0.33
Satisfaction & Engagement	3.83 $\pm$ 0.72	3.62 $\pm$ 0.74	2.69	0.007	0.28
Realism / Fidelity	3.45 $\pm$ 0.78	3.22 $\pm$ 0.80	2.82	0.005	0.29
Overall perception	3.55 $\pm$ 0.67	3.30 $\pm$ 0.65	3.65	<0.001	0.38

Values are mean $\pm$ SD unless otherwise indicated. Welch's correction applied.

Perceptions by Prior Simulation Experience

Students with prior simulation experience reported significantly more favourable perceptions than those without, across every domain and for the overall score (3.55 vs 3.30; $t = 3.65$, $p < 0.001$; Cohen's $d = 0.38$).

Differences were largest for Skill Reinforcement ($d = 0.40$) and smallest for Satisfaction and Engagement ($d = 0.28$) (Table 4). In contrast, no significant difference in overall perception was observed between female and male students (3.47 vs 3.36; $p = 0.17$).

Table 5: Overall perception score by discipline and academic year, with one-way ANOVA

Subgroup	n	Overall mean $\pm$ SD	ANOVA
Discipline			F = 3.42, p = 0.005
Dentistry	28	3.85 $\pm$ 0.51	
Medical Lab Sciences	23	3.61 $\pm$ 0.71	
Nursing	153	3.42 $\pm$ 0.64	
Medicine	80	3.41 $\pm$ 0.72	
Physiotherapy	54	3.40 $\pm$ 0.62	
Pharmacy	42	3.23 $\pm$ 0.74	
Year of study			F = 4.95, p = 0.002
Year 1	99	3.29 $\pm$ 0.69	
Year 2	98	3.39 $\pm$ 0.70	
Year 3	95	3.45 $\pm$ 0.67	
Year 4	88	3.65 $\pm$ 0.57	

$\eta^2 = 0.044$ (discipline). Positive linear trend across year of study, $p < 0.001$.

Table 6: Pearson correlations among perception subscales and the overall score

	SR	CF	SA	RE	Overall
Skill Reinforcement (SR)	1.00	—	—	—	—
Confidence (CF)	0.70	1.00	—	—	—
Satisfaction (SA)	0.71	0.69	1.00	—	—
Realism (RE)	0.70	0.69	0.73	1.00	—
Overall	0.89	0.89	0.88	0.87	1.00

All correlations significant at $p < 0.001$.

Perceptions by Discipline and Academic Year

Overall perceptions differed significantly across disciplines (ANOVA $F = 3.42$, $p = 0.005$, $\eta^2 = 0.044$). Dentistry students reported the most favourable overall perceptions (3.85 $\pm$ 0.51) and pharmacy students the least favourable (3.23 $\pm$ 0.74); the difference between these groups was statistically significant ($p < 0.001$). Domain-specific analyses showed significant disciplinary variation for Confidence, Satisfaction, and Realism (all $p < 0.01$) but not for Skill Reinforcement ($p = 0.14$), suggesting that the perceived reinforcement value of simulation was comparatively consistent across programmes (Table 5).

Perceptions also increased with academic progression. Overall scores rose from 3.29 $\pm$ 0.69 in first-year students to 3.65 $\pm$ 0.57 in final-year students (ANOVA $F = 4.95$, $p = 0.002$), with a significant positive linear trend across years ($r = 0.19$, $p < 0.001$). By contrast, overall perceptions did not differ significantly by preferred simulation modality ($F = 0.25$, $p = 0.91$),

indicating that favourable perceptions were not confined to any single delivery format.

Associations among Domains and Predictors of Overall Perception

The four perception domains were strongly and positively inter-correlated ($r = 0.69$ – 0.73 , all $p < 0.001$), and each correlated highly with the overall score ($r = 0.87$ – 0.89), consistent with a coherent underlying construct (Table 6). The number of simulation sessions attended showed a weak but significant positive association with overall perception ($r = 0.17$, $p < 0.001$). In a multiple linear regression model including prior experience, sessions attended, year of study, age, and gender, the model was statistically significant ($F = 5.46$, $p < 0.001$) but explained a modest share of variance ($R^2 = 0.07$). Prior simulation experience was the only independent predictor to reach significance ($B = 0.22$, $p = 0.001$), with year of study showing a positive but non-significant trend ($B = 0.07$, $p = 0.085$).

DISCUSSION

This is a present cross-sectional study that assessed students' perceptions of simulation-based learning (SBL) as a learning tool for reinforcing their clinical skills across six health-profession programmes, comprising 380 students. Overall, students' perceptions were favourable in all four of the areas measured, with about 75% of the students rating their overall simulation experience at or above the midpoint of the measurement scale. The four domains achieved an acceptable level of internal consistency (good-to-excellent) and showed evidence of the instrument being coherent as a measure of students' perceptions of simulation-based learning. These results indicate that there was a positive attitude towards simulation across the various health-profession disciplines, and that simulation can be used as a structured setting to consolidate clinical knowledge and skills. This is in line with the results of this study, which was echoed by Moloney et al. [17] who found that undergraduate nursing and midwifery students were generally positive about simulation-based education and believed it was important for reinforcing learning and for readiness to clinical practice.

The findings related to domain-level provide additional information about students' experiences of simulation. Satisfaction and Engagement represented the best scores; students were willing to appreciate interactive and experiential learning through simulation. This could be due to the opportunity to interact and be a part of clinical situations, to use theory, and to have feedback in a controlled learning environment. The same has been observed in studies on the high-fidelity simulation, in which the satisfaction and self-confidence of learners were positively linked with the design and educational aspects of the simulation. In simulation learning, instructional organization and learner engagement are considered important, as illustrated by Gaspar et al. [18] who found that well-structured high-fidelity simulation was linked to positive student satisfaction and self-confidence.

Confidence and Self-Efficacy (CSE) on the other hand was the comparatively weaker domain in the present study especially in the case of items related to

independent competence and reduced anxiety. This discovery suggests that students might value the use of simulation as a learning tool but are unsure about their capacity to transfer to clinical simulation to actual scenarios independently. This discovery is of educational significance since confidence is probably built incrementally over multiple exposures to the simulation rather than from one simulation exposure. This is supported by evidence from a standardized-patient intervention: Blaak et al. [19] found that self-efficacy, knowledge acquisition and knowledge retention were found to be improved after simulation-based learning. So, further practice, feedback, reflection, and debriefing could be crucial to making positive simulation experiences last in terms of sustained clinical confidence.

Only previous simulation experience predicted overall perception in the current regression model and was linked to more positive perceptions in the domains. One such finding was that knowledge of simulation appears to lessen the cognitive and emotional load of working with a new learning environment. Students who have previous experience can thus devote more effort to clinical reasoning, decision making, communication and psychomotor performance. The increased perceptions found in the present study from academic years could be due to increased clinical experiences and increased experience with simulation as well. To support this interpretation, Fung et al. [20] found that students gained confidence after taking part in a centrally led multisite undergraduate medical simulation programme provided in eight hospitals. Their results suggest that structured simulation can be used for developing confidence in various clinical settings.

The findings of a positive association between prior simulation experiences and overall perception have implications for curriculum planning. Simulation may be more effective as a longitudinal process instead of as a stand-alone teaching tool just prior to clinical placement. Repeatedly exposure enables students to get to know simulation processes and to gradually build up complexity in clinical tasks. However, the relatively poor correlation between session attendance and overall perception of the program, and the limited

regression model explanatory power suggests that session attendance alone is not enough to explain students' perceptions. Facilitator skill and expertise, scenario complexity, psychological safety, feedback, debriefing and the integration of the curriculum into the simulation experience can play a significant role in the simulation experience.

Most domains showed differences in discipline, with none of these differences being significant for Skill Reinforcement. The finding of no difference between the disciplines for Skill Reinforcement extends the implications of this; if it is the case, simulation could be used to reinforce clinical skills across the various professional programmes, although this is dependent on the professional programme and the curricular domains. However, differences in Satisfaction and Engagement, Confidence and Self-Efficacy, and Realism may be due to variations in clinical responsibilities, prior experience, scenario design, or level of fidelity and authenticity of simulation to actual clinical practice.

The results for the present study are also inconclusive for overall perception differences due to simulation modality. The results indicate that students might see different simulation methods as useful if these are matched to the learning goal. High-fidelity manikins, standardized patients, task trainers, virtual patients, and screen-based environments can all be incorporated into the simulation experience, and each have unique educational benefits. With the advent of randomized evidence, it has been shown that clinical communication skills are enhanced when students use virtual patient simulations, which highlights the education-promoting potential of technology-mediated simulation. Recently, randomized evidence has supported the enhancing potential of clinical communication skills for nursing students through the use of virtual patient simulations. In a virtual patient simulation study by Sörman et al., [21] the authors demonstrated that a virtual patient simulation enhanced students' confidence in clinical conversations in comparison with students' normal training. Therefore, what is required for the learning, the student's readiness, the available resources, and the curricular goals should be taken into account instead of

technological sophistication when deciding on the modality.

Inter-correlation between the four domain subscales shows that students' perceptions of simulation are multidimensional, but interrelated. It would seem that there is a holistic simulation experience that is influenced by skill reinforcement, satisfaction, confidence and realism. The moderate scores on the reverse-scored artificiality item indicate that perceived authenticity could still be a problem for some students. When students are asked to apply their simulated performances in real-life clinical situations, perceived realism can impact on immersion and engagement. But real subject matter should be considered in terms of the learning goal and not in an unlimited way. The fidelity required for psychomotor skills might be adequate using a task trainer; for communication or clinical reasoning and decision making, a standardized patient or a virtual environment might be a better choice [22].

The results therefore suggest that the educational effectiveness of simulation may be more related to the combined use of several instructional elements than to the use of simulation modality [23]. Constructing appropriate scenarios, preparing facilitators, structuring pre-briefing, creating psychologically safe learning environments, providing relevant feedback and debriefing effectively can all help to create positive learning experiences for learners [24]. The relatively high degree of correlation between the domains in the current study also lend further support to the notion that enhancements in one part of the simulation experience could be correlated with enhancements in other parts of the simulation experience.

CONCLUSION

Overall, healthcare students from various professions had a positive attitude towards simulation as a way to consolidate clinical skills and felt most enthusiastic about engagement and satisfaction, while more marginally favorable appraisals were made with regards to independent competence. The prior simulation exposure and later stages of training had a greater impact on more favourable perceptions, and modality did not have a significant effect on overall

perceptions. These results combined lend support to early, multiple and curriculum-integrated simulations, combined with structured debriefing and progressive autonomy to sustain positive experiences into long-lasting clinical self-assurance. Longitudinal and multi-institutional studies examining the relationship of perceptions to objective performance outcomes are warranted to further substantiate and build upon these findings.

Ethical Approval: Institutional Ethics Committee of Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India (Approval No. Acon/IEC/2025/027) and was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants.

Consent for Publication: Not applicable.

Availability of Data and Materials: The dataset is available from the corresponding author on reasonable request.

Financial Support and Sponsorship: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflicts of Interest: The authors declare that they have no competing interests.

Use of Artificial Intelligence (AI) - Assisted Technology for Manuscript Preparation: The authors confirm that no artificial intelligence (AI) - assisted technology was used to assist in the writing or editing of the manuscript, and no images were manipulated using AI tools.

Acknowledgements: The authors thank the participating students and the simulation-education staff of Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India, for their valuable support and cooperation during the study.

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S. Priya: Conceptualization, methodology, data collection, data analysis, and manuscript drafting.

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All authors contributed to the study, critically reviewed the manuscript, approved the final version, and agreed to be accountable for all aspects of the work.

ABBREVIATIONS USED IN THE STUDY

ANOVA: Analysis of Variance;

CF: Confidence and Self-Efficacy;

RE: Realism/Fidelity;

SA: Satisfaction and Engagement;

SBL: Simulation-Based Learning;

SD: Standard Deviation;

SR: Skill Reinforcement;

STROBE: Strengthening the Reporting of Observational Studies in Epidemiology;

VR: Virtual Reality.

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