Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Self-confidence of nursing students in the performance of technical skills during clinical simulation: A pre-experimental study with peer tutoring

Valeria Infante-Villagrán
valeria.infante@uss.cl
San Sebastián University
Andrés Carrasco Hernández
San Sebastián University
Katerina Castillo Valderrama
San Sebastián University
Vanessa Andrea Pérez Ormeño
San Sebastián University
Claudio Orlando Bertiola Flores
San Sebastián University
Diego Andrés Díaz-Guio
San Sebastián University

Research Article

Keywords: Clinical simulation, Peer tutoring, Nursing education, Self-confidence, Technical skills, Peer-assisted learning

Posted Date: May 7th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9172416/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Evidence regarding the effect of peer tutoring integrated into clinical simulation on nursing students' self-confidence in performing specific technical procedures remains limited. This study aimed to explore the impact of a peer-tutored clinical simulation intervention on nursing students' self-confidence in performing technical skills and to examine students' perceptions of this educational approach.

A pre-experimental design with a descriptive qualitative component was conducted across four simulation centres affiliated with a Chilean university. Thirty-eight second-year nursing students completed self-confidence instruments before and after participating in three peer-tutored simulation sessions. Quantitative data were analysed using paired-samples t-tests and the Wilcoxon signed-rank test. A thematic analysis was undertaken of responses to two open-ended questions exploring perceived strengths and areas for improvement of peer tutoring.

Statistically significant increases in self-confidence were observed, with effect sizes ranging from moderate to large. Students highlighted improved understanding, collaborative learning, and the value of supportive and accessible tutors. Suggested improvements focused on increasing tutor availability and session frequency.

The findings support the formal incorporation of peer tutoring within simulation models that combine peer support and expert supervision. Further longitudinal and controlled studies are required to examine the sustainability and broader educational impact of this approach.

Introduction

Clinical simulation has demonstrated benefits in the development of both technical (procedural) and non-technical skills, as it enables learners to make errors within a safe environment, without risk to either the student or the patient [1, 2].

Peer tutoring is underpinned by the principles of social and cognitive congruence between tutors and tutees [3, 4, 5]. Peer tutors are students who, although not professional educators, have attained a more advanced academic level and support other students at earlier stages of their training [6].

Within peer-tutoring contexts, the relationship is symmetrical, with both tutors and tutees developing skills [7]. In Simulation-Based Education (SBE), tutees develop both technical and non-technical skills [8, 9, 10, 11], while tutors additionally cultivate pedagogical and leadership competencies [7, 12, 13]. Throughout this process, tutors act as mediators of learning and skills development by fostering a climate of trust, collaboration, communication, emotional support, active participation, and reflective practice [7, 9, 12, 14, 15].

Self-confidence is defined as an individual's perception of their own capability [16, 17]. The integration of peer tutoring and clinical simulation therefore represents a potential opportunity to strengthen this

construct. However, the existing intervention studies [8, 9, 10, 12, 14, 18] do not allow firm conclusions to be drawn as to whether the observed effects are consistent or merely contextual.

Methods

The objectives of the present study were to explore the effect of a three-session peer-tutoring intervention on nursing students' self-confidence during the performance of technical skills in clinical simulation, and to describe their perceptions regarding the strengths and areas for improvement of this educational approach.

The reporting of the methods follows the simulation-specific extension of the STROBE guidelines [19].

2.1. Study design

A pre-experimental one-group pre-test–post-test design was employed [20], incorporating a descriptive qualitative component aimed at exploring students' perceptions of the clinical simulation intervention supported by peer tutoring.

2.3. Participants

A total of 369 second-year nursing students participated in the simulation sessions, alongside 12 trained peer tutors from the fourth and fifth years and 25 nurse educators with expertise in simulation. Data were collected from 38 students who agreed to participate, provided written informed consent, and completed both the pre-test and post-test assessments.

The required sample size to detect an effect was calculated using G*Power, based on two measurements within a single-group pre-experimental design (pre- and post-intervention assessments). Assuming a statistical significance level of 0.05, a statistical power of 90%, and a moderate effect size (0.5), the estimated required sample was 36 participants.

The peer-tutor team comprised 12 individuals, 80% of whom identified as female. The educator team consisted of 25 individuals, 72% of whom identified as female.

2.2. Setting

The study was conducted between 1 August and 30 November 2025 in four simulation centres affiliated with a Chilean university.

2.3. Intervention

The study was conducted over a five-week period. During the first week, the informed consent form was distributed via email and an informational session outlining the study was delivered. In the second week, participants completed a pre-test consisting of self-confidence instruments related to three psychomotor skills, together with a sociodemographic questionnaire.

Subsequently, three structured clinical simulation sessions incorporating peer tutoring were delivered over the following three weeks, one session per procedure. In the fifth week, a post-test was administered, comprising the three self-confidence instruments and an open-ended questionnaire.

A detailed description of the intervention is provided in Table 1 (pp.19–20).

Table 1
Elements of simulation-based clinical intervention

Element	Description
Orientation	Educators responsible for each section of the Care Management in the Individual course introduced the peer tutor who would support three of the sixteen procedures, clarified their role, outlined the learning objectives, specified the scheduled duration of the activity, and provided time for questions and clarification.
Type of simulator	For the simulation of venepuncture for blood sampling: multipurpose adult venepuncture arm. For the simulation of intravenous (IV) bolus medication preparation and administration: multipurpose adult venepuncture arm with an inserted IV cannula, three-way stopcock, and fluid reservoir. For the simulation of simple wound dressing: surgical wound model/simulator.
Simulation setting	All simulations were conducted face-to-face across four simulation centres affiliated with a Chilean university.
Scenario	Participants practised the following technical skills: (1) venepuncture for blood sampling; (2) preparation and intravenous bolus administration of medication; and (3) simple wound dressing. All three simulation scenarios were classified as Zone 1 according to Roussin et al. (2017). The objectives of the activities were for students to: 1. Identify the required materials and perform venepuncture in the context of blood sampling; 2. Prepare morphine 10 mg/1 ml and ketorolac 30 mg/ml (IV presentation) and administer them as an intravenous bolus via a peripheral venous line; 3. Recognise and apply aseptic technique in the context of simple wound dressing. All students assumed the role of primary operator. Twelve students participated per room, with six workstations available. Each student practised each procedure at least once. Immediate individual feedback was provided during the activity, followed by group feedback at the end of each session.
Instructional design	A structured sequence of orientation, simulation, and feedback was implemented. Each practice session lasted 120 minutes, followed by 20 minutes of directive feedback. In addition to administering the pre-test and post-test, during each session educators used structured observational checklists to assess the peer tutors' observable performance during the execution of technical skills.
Role of the peer tutor	The peer tutor had four main functions: (1) to encourage peers' active participation in the activities; (2) to stimulate reflection on learning; (3) to promote self-directed study; and (4) to provide directive feedback under the supervision of the educator.
Role of the educator	The educator was responsible for supervising the simulation sessions, applying assessment checklists, and providing feedback.

Element	Description
This table summarises the key components of the simulation-based clinical intervention supported by peer tutoring. It includes information on orientation, simulation resources, setting, scenarios, instructional design, and the roles of peer tutors and educators.	

2.4. Variables

Self-confidence in performing three technical skills constituted the primary outcome variable. Students' perceptions of peer tutoring were examined as a qualitative component, organised into two predefined analytical categories: perceived strengths and areas for improvement.

2.5. Instruments and data collection procedures

This study is part of a broader project, Project 2024-030: Peer Tutoring in Clinical Simulation for Strengthening Technical, Non-Technical, and Metacognitive Skills in Nursing, funded by the USS 2024–2025 Competitive Fund for Innovation and Research in University Teaching from the Center for Research in Higher Education of the Academic Vice-Rectorate at Universidad San Sebastián.

In its first phase, this project involved the development and evaluation of instruments, which are currently being prepared for submission to a scientific journal. In this context, three procedure-specific instruments were developed to assess students' perceived self-confidence in performing the three technical skills described above.

The instruments show evidence of validity and reliability in a population of Chilean university students (Table 2, pp. 6–7). The manuscript describing these findings is currently in preparation.

The development and psychometric evaluation of these instruments were undertaken because no tools with established validity were identified that specifically assessed these procedures within the educational context of the present study.

Each instrument consisted of a series of behaviourally anchored statements. Responses were recorded using a five-point ordinal scale (Appendices 1, 2, and 3), representing a progressive continuum.

Table 2
Psychometric properties of the instruments

Instrument	Items	Validity	Reliability
Self-Confidence Scale for Performing Venepuncture	16 items (Appendix 1)	$\chi^2 = 1637$, gl = 120, $p < .001$; KMO = 0.915	ω = 0.963; α = 0.962
Self-Confidence Scale for Intravenous Bolus Medication Administration	17 items (Appendix 2)	$\chi^2 = 2143$, gl = 136, $p < .001$; KMO = 0.917	Factor I: ω = 0.968, α = 0.968 Factor II: ω = 0.912, α = 0.896.
Self-Confidence Scale for Performing Simple Wound Dressing	7 items (Appendix 3)	$\chi^2 = 550$, gl = 21, $p < .001$; KMO = 0.867	ω = 0.921; α = 0.915

This table presents the psychometric properties of the three self-confidence instruments developed for this study. Each instrument corresponds to a specific technical skill: venepuncture, intravenous bolus medication administration, and simple wound dressing.

2.5.4. Open-ended questionnaire on perceptions of peer tutoring in clinical simulation

A brief questionnaire comprising two open-ended questions was developed to explore perceived strengths and areas for improvement of peer tutoring. The questions were: “What do you value most about peer tutoring in clinical simulation?” and “What would you improve in future peer-tutoring sessions in clinical simulation?”

2.6. Data and information analysis

2.6.1. Quantitative data analysis

Statistical analyses were conducted using Jamovi version 2.6.44. Given that the assumptions for parametric testing were satisfied, paired-samples t-tests were performed to compare mean scores across all analysed variables. The dimension “self-confidence in implementing biosafety measures” was analysed using the Wilcoxon signed-rank test.

2.6.2. Qualitative data analysis

A thematic analysis was undertaken [21] to examine responses to the two open-ended questions outlined in the Instruments section. The process began with repeated reading to ensure familiarisation with the data, followed by the generation of initial codes. Emerging subthemes were then identified, reviewed, and organised into broader categories.

2.7. Ethical considerations

This study received ethical approval on 21 April 2025 from the Scientific Ethics Committee of Universidad San Sebastián (approval code: 19–25). The research was conducted in accordance with the Singapore Statement on Research Integrity, the Code of Ethics of the Chilean Medical Association, and the Code of Ethics of the Chilean Psychological Association.

The grammar and spelling of this text were reviewed by ChatGPT.

Results

4.1. Sample

Participaron 38 estudiantes, de los cuales un 81.58% se identifican con el género femenino. La edad promedio fue de 21.9 años (DE = 2.10).

4.2. Times

Three peer-tutored clinical simulation sessions were delivered, one per procedure, each with a total duration of 120 minutes.

4.2. Self-confidence in the performance of procedures

4.2.1. Venepuncture

An increase in scores was observed, with the mean rising from pre-test (M = 60.0, SD = 16.07) to post-test (M = 69.1, SD = 9.63). This difference was statistically significant, $t(37) = -3.37$, $p < .001$, $d = 0.55$.

4.2.2. Intravenous bolus medication administration

A difference was observed in the “biosafety” factor, with median scores increasing from pre-test (Mdn = 21, IQR = 7.00) to post-test (Mdn = 24, IQR = 3.00). This difference was statistically significant (W = 57.5, $p = .003$), with a large effect size estimated using the rank-biserial correlation ($r = -0.67$).

A statistically significant difference was also identified in “technical execution”, $t(37) = -4.84$, $p < .001$, $d = -0.785$, with mean scores increasing from pre-test (M = 39.7, SD = 14.54) to post-test (M = 51.6, SD = 8.10).

4.2.3. Simple wound dressing

A statistically significant difference in scores was observed between pre-test (M = 24.5, SD = 7.11) and post-test (M = 30.3, SD = 4.25), $t(37) = -4.52$, $p < .001$, $d = 0.73$.

4.4. Perceptions of peer tutoring in clinical simulation

Five subthemes were identified: optimisation of the learning process; tutors’ approachability and engagement; adequacy of the number of tutors; adequacy of the number of tutoring sessions allocated; and support provided during the performance of technical skills (Table 3, pp. 9–10).

Table 3
Themes and subthemes: Perceptions of peer tutoring in clinical simulation

Themes	Subthemes	Codes	Frequency
Strengths of peer tutoring	Optimisation of the learning process	1. Improved understanding 2. Perceived usefulness 3. Collaborative learning	15
	Tutors' approachability and engagement	4. Patience 5. Kindness 6. Availability to answer questions 7. Creation of a positive learning environment	20
Areas for improvement in peer tutoring	Adequacy of the number of tutors	8. Limited number of tutors	9
	Adequacy of the number of tutoring sessions allocated	9. Limited number of simulation sessions supported by tutors	16
	Direct support during procedures	10. Need for closer supervision during procedures	10

This table presents the results of the thematic analysis of students' responses to open-ended questions exploring their perceptions of peer tutoring in clinical simulation.

Of the 38 participants, 35 responded to both open-ended questions, two did not respond, and one responded to only one question.

4.4.1. Subtheme 1: Optimisation of the learning process

Participants highlighted the contribution of peer tutoring to improved understanding and perceived usefulness. As illustrated in their accounts, peer tutors "made it easier to understand the simulation scenarios" (P5), "understand students and provide clear and easily comprehensible explanations" (P9), and "help improve students' technique" (P41).

The feedback provided during tutoring sessions was also positively valued. Participants noted that these interactions fostered collaborative learning, allowing those experiencing greater difficulties to receive support both from the tutor and from their peers, thereby contributing to more homogeneous group progress. As one participant explained: "It is an opportunity where the tutor helps us a great deal to correct our technique, provides feedback, and we also support each other as students—especially those who find it more challenging—so that we can all reach the same level" (P16).

4.4.2. Subtheme 2: Tutors' approachability and engagement

Particular emphasis was placed on tutors' patience, kindness, and willingness to address questions. Participants acknowledged tutors' capacity to explain procedures repeatedly and to draw upon their own experience, which facilitated understanding of practical content. As reflected in their accounts: "They are a great support for those of us who are learning to perform procedures; whenever we have doubts, they are willing to help" (P33); "They are prepared to explain and demonstrate as many times as necessary in order for us to learn properly" (P40).

Finally, participants positively highlighted the learning environment fostered by the tutors: "It makes learning more enjoyable" (P35); "Having more than one person able to explain makes learning more personalised" (P37).

4.4.3. Subtheme 3: Adequacy of the number of tutors

As an area for improvement, students suggested increasing the number of tutors available, given the large number of students per group. As reflected in their comments: "More attention for students—I feel there are too many of us" (P30); "There should be more than one [tutor]" (P34).

4.4.4. Subtheme 4: Adequacy of the number of tutoring sessions allocated

Participants expressed the need to increase the frequency of peer-tutoring sessions, both within the course and across the wider programme. Their responses included: "Perhaps tutoring sessions could take place more often" (P5); "It could be more continuous" (P9); "It should take place in all simulations, or at least most of them" (P23); "It should be implemented in more modules" (P24); and "More hours with tutors" (P27).

4.4.5. Subtheme 5: Direct support in technical skills

Participants suggested that tutors should take a more active role in demonstrating technical skills step by step. For example: "Perhaps having a tutor present during the demonstration of all technical skills" (P25); "If we have doubts about a procedure, the tutor could demonstrate how to perform it step by step" (P33); "The tutor should attend in person to resolve doubts or correct techniques as they arise" (P20).

Discussion

Consistent with previous research indicating that clinical simulation incorporating peer tutoring enhances self-confidence by enabling repeated practice within a safe and controlled environment [7, 12, 14], the present study demonstrated a statistically significant increase in self-confidence across all three evaluated procedures. The effect sizes, ranging from moderate to large, suggest that the intervention may have produced meaningful changes in participants' perceived self-confidence.

Students reported that peer tutoring optimised their learning process, facilitating comprehension of simulation scenarios and promoting collaborative learning, in line with previous studies [8, 9, 10, 11]. These perceptions help contextualise the quantitative findings, as the observed improvements in self-confidence are supported by subjective experiences of guidance, clarity of feedback, and increased opportunities to address uncertainties.

From the perspective of cognitive congruence [3, 4], peer tutors—by sharing similar academic trajectories—may have been better positioned to adapt language and explanations to students' actual needs, thereby reducing cognitive distance and facilitating knowledge construction. This alignment fosters a deeper understanding of the simulated procedures and contributes to the strengthening of self-confidence. In this regard, the findings reinforce the role of the peer tutor as a mediator of learning [7, 9, 12, 14, 15].

Tutors' approachability and engagement were valued as contributing to a more positive and personalised learning environment. From the perspective of social congruence [3], the relatively symmetrical relationship between tutor and student may enhance trust, active participation, and the expression of doubts without fear of negative evaluation. These findings align with literature suggesting that peer tutoring promotes engagement and learning, particularly in emotionally demanding contexts such as clinical simulation [7].

The reduction in standard deviation at post-test suggests increased homogeneity in participants' levels of self-confidence. This finding is consistent with the qualitative results, in which students reported that the educational experience enabled them to progress more equitably and reach a level comparable to that of their peers.

Limitations

The pre-experimental design of this study limits the generalizability of the results; however, the standardization of the simulations, prior training of the peer tutors, prior orientation of the faculty, and the qualitative component provide greater control over the implementation of the intervention.

Conclusions

Peer tutoring within the context of clinical simulation promotes the development of nursing students' self-confidence in performing technical skills. The findings suggest that this may be related to tutors' proximity, approachability, kindness, and willingness to help.

We recommend the formal integration of peer tutoring into clinical simulation for the development of procedural skills, ensuring an adequate number of trained tutors within a blended model that combines peer support with direct guidance from educators.

Future research should explore the effects of this methodology on both tutees and peer tutors, using controlled designs, larger samples, and longitudinal follow-up to examine the sustainability of the observed effects.

Abbreviations

Simulation
Based Education (SBE)
Peer
Assisted Learning (PAL)

Declarations

Ethics approval and consent to participate: This study is part of the research project entitled “Peer Tutoring in Clinical Simulation for the Strengthening of Technical, Non-Technical, and Metacognitive Skills in Nursing,” approved on April 21, 2025, under code 19-25 by the Scientific Ethics Committee of Universidad San Sebastián (CEC-USS). All procedures were conducted in accordance with the relevant ethical guidelines and regulations, including the Declaration of Helsinki. Informed consent was obtained from all participants.

Consent for publication: Not Applicable.

Data availability and materials: All data generated or analyzed during this study are included in this published article and its supplementary materials. Additional information is available from the corresponding author upon request.

Competing interests: None.

Funding: Project 2024-030: Peer Tutoring in Clinical Simulation for strengthening technical, non-technical, and metacognitive skills in nursing, funded by: Fondo concursable para Proyectos de Innovación e Investigación en Docencia Universitaria USS 2024-2025 del Centro de investigación para la Educación Superior de la Vicerrectoría Académica de la Universidad San Sebastián.

Authors’ contributions: All authors made substantial contributions to the conception and design of the study, literature search and selection, data analysis, and drafting and critical revision of the manuscript. All authors read and approved the final version of the manuscript.

Acknowledgements: The authors thank Universidad San Sebastián for the development of this study.

References

1. Dieckmann P, Gaba D, Rall M. Deepening the theoretical foundations of patient simulation as social practice. Simul Healthc. 2007;2(3):183–93. 10.1097/SIH.0b013e3180f637f5.

2. Díaz-Guio DA, Vasco M, Ferrero F, Ricardo-Zapata A. Educación basada en simulación, una metodología activa de aprendizaje a través de experiencia y reflexión. Simulación. 2024;6(3):119–26. 10.35366/118838.
3. Loda T, Erschens E, Loenneker H, Keifenheim KE, Nikendei C, Junne F, et al. Cognitive and social congruence in peer-assisted learning: a scoping review. PLoS ONE. 2019;14(9):e0222224. 10.1371/journal.pone.0222224.
4. Tamachi S, Giles JA, Dornan T, Hill EJR. You understand that whole big situation they're in: interpretative phenomenological analysis of peer-assisted learning. BMC Med Educ. 2018;18(1):1–8. 10.1186/s12909-018-1291-2.
5. Ten O, Durning S. Dimensions and psychology of peer teaching in medical education. Med Teach. 2007;29(6):546–52. 10.1080/01421590701583816.
6. Topping KJ. The effectiveness of peer tutoring in further and higher education: a typology and review of the literature. High Educ. 1996;32(3):321–45. 10.1007/BF00138870.
7. Dennis D, Furness A, Brosky J, Owens J, Mackintosh S. Can student-peers teach using simulation-based learning as well as faculty: a non-equivalent posttest-only study. Nurse Educ Today. 2020;91:104470. 10.1016/j.nedt.2020.104470.
8. Schaffer S, O'Neill P, Hassan S, Pearson M, Subramaniam M. Validating the use of peer-assisted learning laparoscopic simulation training for medical students. Med Sci Educ. 2021;31(1):359–63. 10.1007/s40670-020-01199-2.
9. Roehr M, Wu T, Maykowski P, Munter B, Hoebee S, Daas E, et al. The feasibility of virtual reality and student-led simulation training as methods of lumbar puncture instruction. Med Sci Educ. 2021;31(1):117–24. 10.1007/s40670-020-01141-6.
10. Kronschnabl DM, Baerwald C, Rotzoll DE. Evaluating the effectiveness of a structured, simulator-assisted, peer-led training on cardiovascular physical examination in third-year medical students: a prospective, randomized, controlled trial. GMS J Med Educ. 2021;38(6):Doc108. 10.3205/zma001043.
11. Koo HY, Lee BR. Effects of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students: a mixed-methods study. Heliyon. 2024;10(16):e36014. 10.1016/j.heliyon.2024.e36014.
12. He X, Rong X, Shi L, Qin F, Fang Y, Zhang P, et al. Peer-led versus instructor-led structured debriefing in high-fidelity simulation: a mixed-methods study on teaching effectiveness. BMC Med Educ. 2024;24:1290. 10.1186/s12909-024-06262-9.
13. Kamat SN, Patel RA, Patel R. Implementing and evaluating face-to-face near-peer teaching in response to the absence of objective structured clinical examinations (OSCEs) for junior medical students following the COVID-19 pandemic. Cureus. 2024;16(11):e74540. 10.7759/cureus.74540.
14. Nuutinen H, Lavikainen M, Nykopp TK, Sirola J. Virtual reality learning in suprapubic catheter insertion: the role of peer-tutor guidance versus teacher. Clin Teach. 2025;22(4):e70107. 10.1111/tct.70107.

15. Yoong SQ, Wang W, Chao FFT, Dong Y, Goh SH, Chan YS, et al. Using peer feedback to enhance nursing students' reflective abilities, clinical competencies, and sense of empowerment: a mixed-methods study. Nurse Educ Pract. 2023;69:103623. 10.1016/j.nepr.2023.103623.
16. Haro MM. Autoconfianza versus autoeficacia del traductor: propuesta terminológica y estado de la cuestión. Cadernos de Tradução. 2019;39(2):204–. https://doi.org/10.5007/2175-7968.2019v39n2p204. 26.
17. White KA. Self-confidence: a concept analysis. Nurs Forum. 2009;44(2):103–. https://doi.org/10.1111/j.1744-6198.2009.00133.x. 14.
18. Morrisby C, Bogle J, Dillon R, Reen C, Tanner G. Peer-led virtual learning: impact of dementia-specific communication training for occupational therapy students. Phys Occup Ther Geriatr. 2023;41(1):10–30. 10.1080/02703181.2022.2065403.
19. Cheng A, Kessler D, Mackinnon R, et al. Reporting guidelines for health care simulation research: extensions to the CONSORT and STROBE statements. Adv Simul (Lond). 2016;1:25. 10.1186/s41077-016-0025-y.
20. Ato M, López JJ, Benavente A. Un sistema de clasificación de los diseños de investigación en psicología. Psicol. 2013;29(3):1038–59. 10.6018/analesps.29.3.178511.
21. Braun V, Clarke V. Thematic analysis: a practical guide. London: SAGE; 2021.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- PRETESTYPOSTESTDEPURADOEXCEL.xlsx
- Appendix.docx