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ORIGINAL

Evaluating Satisfaction and Self-Confidence in Critical Care Training: A Simulation-Based Learning Research in Medical Education

Evaluación de la satisfacción y la autoconfianza en la formación en cuidados críticos: Un aprendizaje basado en la simulación Investigación en educación médica

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ABSTRACT

Simulation-based learning (SBL) is recognized as an invaluable teaching medium in medical education, providing an opportunity for healthcare practitioners to acquire hands-on experience in managing emergencies within a controlled environment. Although the practice of critical care needs no emphasis in medical training, there is little empirical evidence regarding the effects of simulation-based learning on medical trainees. This research assesses how an SBL would increase satisfaction and self-confidence in medical trainees concerning critical care scenarios. A total of 170 participants included undergraduate medical trainees who took part in well-structured simulation exercises depicting live emergencies, such as cardiac arrest, respiratory failure, and sepsis. In evaluating the effect of SBL, participants had to complete pre- and post-simulation satisfaction and self-confidence surveys. A paired t-test was used to compare pre- and post-simulation self-confidence ratings. Finally, descriptive statistics were used to assess the satisfaction levels, and thematic analysis was conducted for the qualitative feedback from participants. A significant change in self-confidence was documented post-simulation ($p<0,05$). On the whole, participants were happy with the simulation practice, particularly the levels of realism and the opportunity for hands-on practice. Feedback indicated that training-specific debriefing sessions were greatly valued for reinforcing learning and skills acquisition. The research supports the incorporation of SBL into critical care curricula to promote the greater preparation of healthcare professionals for high-stakes clinical situations.

Keywords: Satisfaction; Self-Confidence; Critical Care Training; Medical Education; Simulation-Based Learning (SBL).

RESUMEN

El aprendizaje basado en la simulación (ABS) está reconocido como un medio de enseñanza inestimable en la formación médica, ya que ofrece a los profesionales sanitarios la oportunidad de adquirir experiencia práctica en la gestión de emergencias dentro de un entorno controlado. Aunque la práctica de los cuidados críticos no necesita énfasis en la formación médica, existen pocas pruebas empíricas sobre los efectos del aprendizaje basado en la simulación en los médicos en formación. Esta investigación evalúa cómo un SBL aumentaría la satisfacción y la autoconfianza de los médicos en formación en relación con los escenarios de cuidados críticos. Un total de 170 participantes eran estudiantes universitarios de medicina que participaron en ejercicios de simulación bien estructurados que representaban emergencias reales, como paradas cardiacas,

insuficiencia respiratoria y sepsis. Para evaluar el efecto del SBL, los participantes tuvieron que rellenar encuestas de satisfacción y autoconfianza antes y después de la simulación. Se utilizó una prueba t pareada para comparar las puntuaciones de autoconfianza antes y después de la simulación. Por último, se utilizaron estadísticas descriptivas para evaluar los niveles de satisfacción, y se realizó un análisis temático de los comentarios cualitativos de los participantes. Se documentó un cambio significativo en la autoconfianza tras la simulación ($p<0,05$). En general, los participantes se mostraron satisfechos con la práctica de la simulación, en particular con los niveles de realismo y la oportunidad de realizar prácticas. Los comentarios indicaron que las sesiones informativas específicas de la formación se valoraron mucho para reforzar el aprendizaje y la adquisición de habilidades. La investigación apoya la incorporación del SBL a los planes de estudio de cuidados críticos para promover una mayor preparación de los profesionales sanitarios ante situaciones clínicas de alto riesgo.

Palabras clave: Satisfacción; Autoconfianza; Formación en Cuidados Críticos; Educación Médica; Aprendizaje Basado en Simulación (SBL).

INTRODUCTION

Simulation-based learning (SBL) is indispensable in medical education in general, and critical care training in particular. SBL is used to create a controlled environment where students can practice clinical skills, giving them practical experience without putting live patients at risk. Overall, this strategy is considered very effective at reinforcing both procedural skill and decision-making, which is important in the critical care environment.[1] Critical care settings involve environments of high stress and the healthcare provider must make rapid, lifesaving decisions. Such environments present unique challenges for training, with the utility of simulation providing an out-of-the-box approach to address the lack of practical training. Simulations are venues where students can practice realistic scenarios that help them to learn and prepare emotionally for real-world situations.[2] Power and self-efficacy in the case of critical care shifting the approach remotely speculated beginning and early signs of professional health. This confidence can be augmented through simulation-based training, which provides repeated exposure to high stakes situations. This allows students to become familiar with emergency protocols, making them more confident decision-makers in real-life emergencies.[3] Metacognition is yet another simultaneous action comprising the examination and monitoring of learning that comes into a play during the learning experience. Those whose training excited satisfaction are more likely to have learned the information and will be motivated to apply it. Studies reveal SBL has been more acceptable because it allows participant's to engage actively and receive real-time feedback and fostering a more compelling and, undoubtedly, effective learning curve.[4] Simulated training in critical care is becoming ever-more popular, but it is important to assess its effectiveness. Knowledge gained from the efficacy of simulation-based training along with student satisfaction and self-confidence, can contribute to its advantages and its critics. The research attempts to measure the above possibilities to continuously improve medical education.[5]

Simulation training could improve confidence among healthcare when managing clinical situations within acute care hospitals.[6] SBL turned out that the training, featuring simulation exercises, was more successful than conventional teaching methods. According to the findings, staff confidence in handling psychological emergencies in acute paediatric healthcare settings could be increased through simulation training. Chua WL.[7] a survey of 709 Singaporean nurses had an average level of confidence and skill in detecting and handling sepsis cases. Knowledge of sepsis was affected by parameters like job level, grade point average, and specialist area. Expertise had a self-assurance yet little superior education and training were required. The confidence to handle difficult circumstances scale gauges how confident nursing students are in handling difficult circumstances in practical settings.[8] The clinical training could be used to gauge apprentice nurses' trust levels within a variety of clinical contexts and has strong internal consistency. To assess how infant care training [9] affected mothers of preterm infants' self-assurance the role of mother self-efficacy, and maternal bonding. The findings indicated a clear correlation between these factors, indicating that maternal bonding could improve self-confidence and maternal self-efficacy. 370 nursing undergraduates reported on their satisfaction and self-assurance in evaluating the efficiency of nursing education, using the NLN/Jeffries Nurse Education Simulations Framework. Aldhafeeri F et al.[10], self-confidence and approval were associated with training design and instructional methods. Creating simulations with the framework could give learners experiences that were educationally sound, interesting, and meaningful.

The research aims to assess how well simulation-based learning (SBL) can increase medical participants' self-confidence and satisfaction with managing critical care scenarios like sepsis, breathing difficulties, and cardiac arrest through scheduled exercises.

The organization of the research contains 4 sections. Phase 2 includes methodological framework; Phase 3 involves results and discussions. Phase 4 contains the conclusion.

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METHOD

The methodology framework includes the pre- and post-simulation for the participants for the enhancement of the satisfaction level and self-confidence level.

Data Collection

The data consisted of medical students and residents, and 170 participants were engaged with SBL. The participants comprised 60 % males and 40 % females. The age range of the participants was taken as approximately 20-40 years, with a mean of 26 years (SD = 4,5). Regarding the educational background, 65 % were UG students and 35 % PG students. The learning experience level of the participants was divided into three beginners (30 % of participants had limited exposure to simulation-based learning), intermediate (50 % of them), and advanced (20 % participants had experience with simulation-based training). Participants completed pre- and post-simulation surveys for satisfaction and confidence-self evaluations, and some demographic information was used to analyse any potential correlation with training outcomes as shown in figure 1.

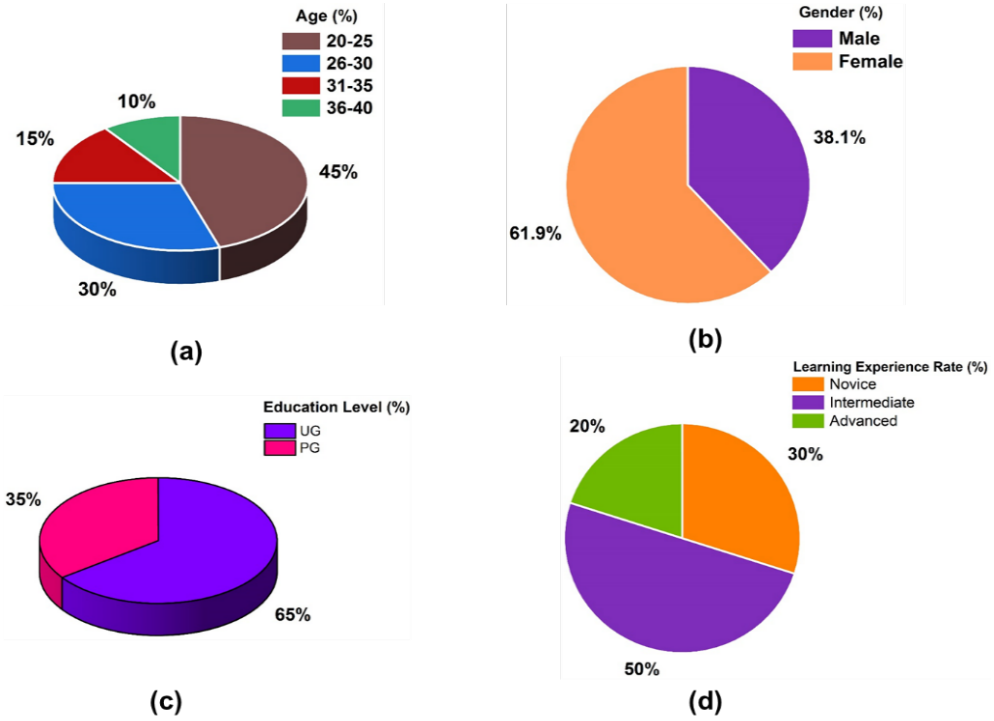

Figure 1. Presentation of (a) Age, (b) Gender, (c) Education level, (d) Learning experience rate

Research Instrument

The survey was analysed based on pre- and post-simulations formed on a combination of quantitative as well as qualitative evaluation techniques.

Quantitative Method

The quantitative method includes a questionnaire analysis of the participants based on SBL. The analysis was divided into 5 sections: active learning, collaboration, diverse ways of learning, problem-solving, and clinical skills confidence. Each variable has 2 questionnaires, total 10 questions. The response was collected from participants using a 5-point Likert scale, where 1 represents “strongly disagree” and 5 indicates “strongly agree”.

- Active Learning: 2 questions within this phase are intended to gauge how involved participants are in techniques for active learning, such as simulations and practical application. These methods encourage a more thorough comprehension and improved recall of abilities in clinical practical settings.
- Collaboration: this section involves two questions created to gauge how well participants work with each other in group environments. To improve collaboration in solving issues and skill utilization, healthcare modeling promotes collaboration and interaction.
- Diverse Ways of Learning: this section intends 2 questions to evaluate the efficacy of various learning styles, such as kinaesthetic, visual, as well as auditory methods. These approaches seek to improve overall student performance and support various ways of learning.

- Problem-Solving: 2 questions within this section have the objective of determining the ability of participants to analyse intricate situations and reach well-informed conclusions. Problem-Solving places a strong emphasis on applying acquired skills in emergency simulations and on logical thinking.
- Clinical Skills Confidence: 2 questions within this section aim to evaluate the participants' satisfaction with performing clinical duties, such as identifying and treating illnesses. It shows how prepared and at ease they are managing actual critical care situations.

The research used questionnaires to evaluate the satisfaction and confidence in the participants pre-and post-intervention research. The questionnaires were designed to evaluate SBL works in the critical care course, targeting their impact on readiness and self-confidence when handling crises.

Qualitative Method

In the qualitative phase of the research, participant interviews were done face-to-face, with a 30-minute duration for each session. These sessions generated reflections providing detailed experiences of the learners regarding SBL in critical care training. Medical students shared their views on items affecting their satisfaction and self-confidence as well as areas in which they feel the training could be improved. In this way, the qualitative approach provided an in-depth understanding of the SBL's outcome on clinical skill and readiness. The qualitative data provided richer insights into the mixed-methods design and improved interpretation of the real-life medical practice measures of the training effectiveness.

Evaluation Variables

- Active Learning: participants engage in active learning through practical training sessions where students are integrated in real critical care scenarios to demonstrate decision-making, and practice skill in a management capacity and enhance their understanding. Some of these interactive sessions help participants to connect with the topic and improve the learning outcomes.
- Collaboration: this approach focuses on how participants interact in simulated scenarios where cooperation and clear communication are essential. The research gauges the amount of cooperation exhibited by participants under stress. The competencies observed are one of the critical aspects required in intensive care activities, such as teamwork, collaboration, group problem-solving, and decision-making.
- Diverse ways of learning: through combining several teaching strategies, such as visual simulations, auditory cues, and practical experience, numerous approaches learning are formed. This approach helps cement and ingrain key skills for critical care in the memory of participants because students engage with topics that satisfy their style of learning.
- Problem-Solving: the scenarios that are termed as complex, high-pressure scenarios require participants to assess the situation, decide upon a course of action, and then make decisions under pressure-such as heart attack or breathing failure that leverage one's problem-solving skills. The exercise tests how well participants translate their understanding into action while propagating these situations in simulations.
- Clinical Skill Confidence: the participants will be surveyed on their medical assurance before and after the simulation training to check their willingness to execute critical processes of care. The research is useful in determining whether learning through simulation has resulted in increasing the skills and confidence of the participants managing vital medical emergencies, which raises their overall security against practical medical concerns.

Simulation-based learning (SBL)

The SBL is an educative process that sets learners in modern interactive environments to train skills and clinical competencies in a risk-free context relative to disposition cases. SBL has proven invaluable in medical education for training healthcare professionals in emergency critical care and provides hands-on experience while dealing with complex cases, such as cardiac arrest, respiratory failure, and sepsis. SBL enables learners to practice decision-making, problem-solving, and teamwork, which enhance their mastery of clinical competencies. SBL allows faculty to provide urgent feedback, whereas summary sessions provide amended feedback on strengths and weaknesses. By enhancing both technical and non-technical skills, SBL is a solid building block in the training of medical professionals for emergencies that sharpen their minds, mostly benefiting the safety of the patients.

Statistical Analysis

The research assesses the efficiency of SBL in enhancing satisfaction and self-confidence during training. To assess the impact of SBL on the clinical skills of the medical trainees by statistical analyses. Data processing and interpretation are made in the Statistical Package for the Social Sciences (SPSS). These analyses concern

self-confidence and satisfaction levels before and after simulation. The paired t-test is used to compare the pre-and post-intervention scores. Descriptive statistics are used in analysing satisfaction, while some thematic analysis is done for qualitative feedback, which comprehensively assesses the training's effectiveness in critical care training.

Paired T-test

The analysis was used in this research to examine the change in the level of self-confidence of participant's pre- and post-simulation-based learning (SBL) in critical care training. It compares the means of two correlated groups (pre- and post-simulation) to perceive whether the variation among them is statistically important. The formula for the test is shown in equation (1).

$$t = \frac{\bar{d}}{s_d/\sqrt{n}} \qquad (1)$$

Where n the total number on pairs, s_d was the standard deviance from the variations, and d was the median variance of paired observations.

$$d_i = X_{post} - X_{pre} \qquad (2)$$

Where d_i the difference between each pair is pre- and post-simulation scores. The X_{post} and X_{pre} are the pre- and post-simulation self-confidence scores respectively, as shown in equation (2). This test significantly improves self-confidence scores.

Descriptive Statistics

The descriptive statistics provide insight into the participants' satisfaction with the SBL in the field of critical care training. An overview of the central tendency, variation, and distribution of the responses provided by participants is presented. Key measures refer to the mean, standard deviation, and frequency distribution. The formula for the mean is given by equation (3).

$$\mu = \frac{\sum_{i=1}^{n} X_i}{n} \qquad (3)$$

Where μ is the mean, X_i is the individual data points and n is the total number of data points. The formula for the standard deviation was given by equation (4).

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(X_i-\mu)^2}{n}} \qquad (4)$$

Where σ is the standard deviation and μ is the mean of the data that helps to assess the overall participant›s satisfaction levels.

RESULTS

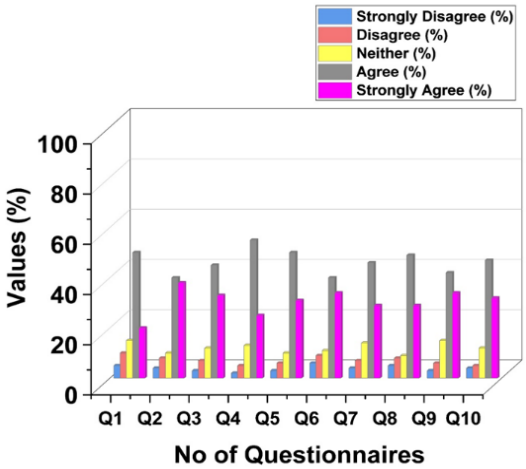

Figure 2. Outcome of Responses

This section involves the outcome of the statistical analysis to evaluate the satisfaction levels and self-confidence levels of the participants in the critical care unit of the medical field.

The survey employed a 5-point Likert scale to collect participants' perceptions of SBL within critical care training. The responses were meant to assess the perceived effectiveness, timeliness, and helpfulness of feedback that was given during training, particularly concerning clinical confidence and skill development. These results indicated that 50 % of all participants agreed and 20 % strongly agreed on the promptness of feedback, with 38 % strongly agreeing with its accuracy. When the feedback was considered in terms of learning needs, 45 % agreed and 33 % strongly agreed. Regarding the success of feedback, 55 % agreed and 25 % strongly agreed, with another 50 % and 31 % responding that feedback was motivating in figure 2.

Table 1 shows a thematic analysis of the evaluation variables pre- and post-SBL. Pre-simulation themes include limited engagement, individual learning, and lack of critical thinking, with no skills demonstrated in clinical practice by the participants. Post-simulation, the themes changed to enhanced engagement, teamwork, and critical thinking with the report of more confidence being felt by the participants towards management of emergency cases. The result from the usage of various methods of learning from different perspectives, which include hands-on practice and visual cues, significantly created improvements in the confidence of the participants to undertake clinical skills in critical care.

Table 1. Thematic Analysis of the Evaluation Variables

Variable	Themes (Pre)	Themes (Post)	Example Quotes (Pre)	Example Quotes (Post)
Active Learning	Limited engagement Traditional learning methods	Increased engagement in Hands-on learning	"I feel passive during lectures." "I don't get much practice."	"I felt involved and engaged." "The hands-on approach was very helpful."
Collaboration	Individual learning Lack of peer interaction	Enhanced teamwork Improved communication skills	"I work alone most of the time." "I struggle with group work."	"I worked well with my peers." "Collaboration boosted my learning."
Diverse Ways of Learning	One-dimensional learning style Limited methods	Variety of learning methods Use of visual, and kinaesthetic techniques	"I mostly listen to lectures." "The teaching is very textbook-based."	"The simulation helped me understand better." "The visual cues were great!"
Problem-Solving	Difficulty in critical thinking Limited practice in real-life scenarios	Improved critical thinking Ability to handle emergencies	"I find it hard to think quickly in emergencies." "I don't know what to do in a crisis."	"I feel confident in problem-solving now." "I know how to handle a crisis."
Clinical Skills Confidence	Uncertainty in clinical skills Lack of practical experience	Increased confidence Improved technical skills	"I'm not sure I could handle a real-life emergency." "I lack hands-on experience."	"I feel more prepared for critical care." "I now know how to respond in emergencies."

Table 2. Numerical Outcomes of Paired T-test

Variable	Mean		Standard Deviation		Paired Difference Mean		Paired Difference Std Error		t-statistic	p-value
	(Pre)	(Post)	(Pre)	(Post)	(Pre)	(Post)	(Pre)	(Post)		
Active Learning	3,45	4,15	0,72	0,65	3,45	4,15	0,72	0,65	5,83	0,0001
Collaboration	3,50	4,00	0,80	0,70	3,50	4,00	0,80	0,70	3,57	0,0012
Diverse Ways of Learning	3,60	4,20	0,75	0,60	3,60	4,20	0,75	0,60	5,45	0,0003
Problem-Solving	3,40	4,05	0,70	0,65	3,40	4,05	0,70	0,65	5,00	0,0005
Clinical Skills Confidence	3,30	4,10	0,78	0,68	3,30	4,10	0,78	0,68	5,33	0,0002

Table 2 evaluates the impact of SBL on medical training and compares scores pre- and post-simulation. There were significant advances for all variables identified, including Active Learning ($t = 5,83$, $p = 0,0001$), Collaboration ($t = 3,57$, $p = 0,0012$), Diverse Ways of Learning ($t = 5,45$, $p = 0,0003$), Problem-Solving ($t = 5,00$, $p = 0,0005$), and Clinical Skills Confidence ($t = 5,33$, $p = 0,0002$). The results highlight the eminent potential of SBL for improving clinical competence but also for simultaneously promoting collaboration and active and diverse learning by greatly fostering the participants' confidence and problem-solving abilities in critical care scenarios.

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Figure 3 (a and b) describes the paired differences in mean scores for major evaluation variables pre- and post-SBL. The scores of active learning rose from a mean of 3,45 to 4,15. The scores for collaboration and diverse ways of learning improved as well, increasing from 3,50 to 4,00 and from 3,60 to 4,20, respectively. Problem-solving and clinical skill self-confidence followed the same trend, with rising means from 3,40 to 4,05 and from 3,30 to 4,10, respectively. These results show enhanced learning outcomes and increased levels of self-confidence after the simulation training.

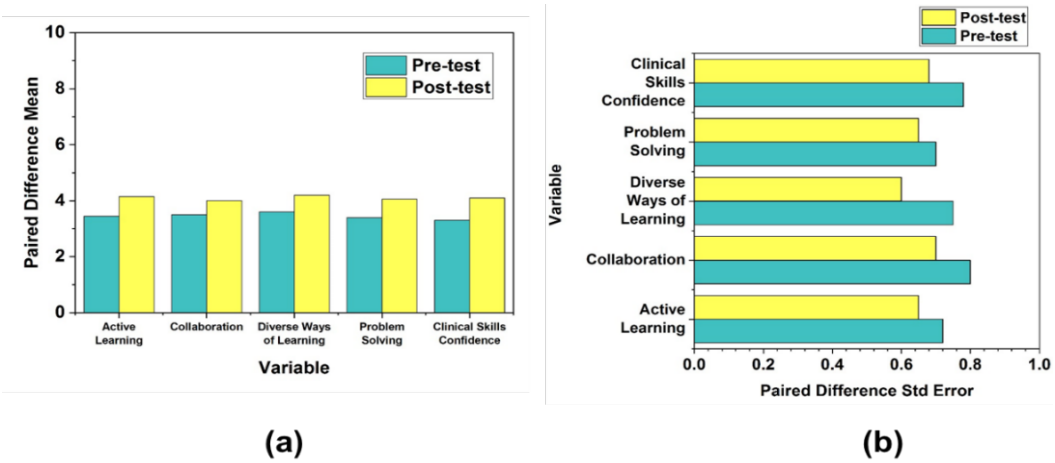

Figure 3. Representation of (a) Paired Difference Mean (b) Paired Difference Standard Error

Table 3 summarizes the descriptive statistics for selected outcome variables pre- and post-SBL. The data show improvements across the board in all variables, with a marked mean score increase from the pre- to the post-simulation active learning, collaboration, and various ways of learning increases in mean scores, which indicate increases in engagement and learning diversity. Problem-solving and clinical skills confidence also showed significant improvements, which signifies improvement in critical thinking and real-life emergency preparedness. The standard deviations indicated that improvement post-simulation remained fairly constant among participants. These results provide further evidence of the effectiveness of SBL in improving critical care training outcomes.

Table 3. Descriptive Statistics of Evaluation Variables

Variable	Pre-Simulation				Post-simulation			
	Mean	Standard Deviation	Min	Max	Mean	Standard Deviation	Min	Max
Active Learning	3,45	0,72	2,00	4,80	4,15	0,65	2,80	5,00
Collaboration	3,50	0,80	2,50	4,90	4,00	0,70	2,60	5,00
Diverse Ways of Learning	3,60	0,75	2,80	4,70	4,20	0,60	3,00	5,00
Problem-Solving	3,40	0,70	2,40	4,60	4,05	0,65	3,10	5,00
Clinical Skills Confidence	3,30	0,78	2,20	4,50	4,10	0,68	3,00	5,00

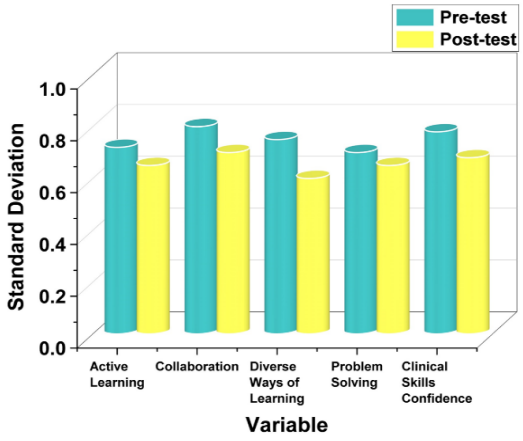

Figure 4. The outcome of Standard Deviations

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Figure 4 represents the standard deviations of the variables considered in the evaluation pre- and post- test of SBL. The standard deviations for active learning, collaboration, and diverse learning method decreased from pre-simulation to post-simulation, indicating that responses were became more consistent with each other and that development was more uniform. For Active Learning, the standard deviation dropped from 0,72 to 0,65, for collaboration from 0,80 to 0,70, and for diverse ways of learning from 0,75 to 0,60, while problem-solving (0,70 to 0,65) and clinical skills confidence (0,78 to 0,68) reflected a very slight decrease in their standard deviations.

DISCUSSION

This research highlights the beneficial effect of SBL in the training of critical care. The pre-and post-simulation assessment gathered substantial improvements in all assessed variables, including active learning, collaboration, and chances for diverse learning, problem solving, and clinical skills confidence. The improvement in mean scores, particularly in active learning and clinical skills confidence, is indicative evidence of SBL's ability to engage learners and increase their preparedness for real-life emergencies. Additionally, the mean change in SD of SBL learning experience shows a more consistent and even learning experience amongst participants post-simulation. The outcomes of the paired t-test strengthen the statistical significance of these changes. On the whole, SBL proves to improve clinical competence in teamwork, critical thinking, and self-confidence believed to be fundamental in effective critical decision-making situations. With such strong evidence, SBL is dignified for its widespread integration into medical education.

CONCLUSIONS

This research suggests the great impact of SBL on self-confidence and satisfaction among medical students in critical care training. After simulation, there was a significant enhancement in self-confidence denoting that SBL significantly prepares healthcare practitioners with skills and confidence to operate under high-pressure clinical situations. Participants did report high satisfaction levels, in recognition of the significance of the realistic and hands-on nature of simulations, with debriefing being acknowledged as a key element in permanent learning. Qualitative feedback indicates that the SBL processes develop critical thinking, teamwork, and problem-solving skills essential for handling emergencies. The findings provide support for the incorporation of SBL into medical curricula, as a safe, effective, and engaging way to develop clinical competence and confidence. The research supports the further use and expansion of SBL as an invaluable part of medical education. The potential for self-reported data bias and a single-institution focus limits the generalizability of this research. In the present work, short-term impact from simulation-based learning was assessed, without examining long-term outcomes. Future studies would address the long-term impact of SBL on clinical practice and include a diverse participant population, as well as consider its application in various medical specialties to broaden the insights.

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CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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