

EFFECTS OF SCENARIO COMPLEXITY AND COGNITIVE LOAD ON SIMULATION ACCURACY IN NURSING SKILLS: THE MEDIATING ROLE OF ANXIETY

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Abstract

Background: Simulation-based learning has become a standard method in nursing education for the development of clinical skills. However, increasing scenario complexity and higher cognitive load may elevate stress levels among nurses, potentially reducing the accuracy of their performance in simulations. Despite these concerns, empirical evidence on the interaction among scenario complexity, cognitive load, anxiety, and simulation accuracy remains limited. This study aimed to examine the impacts of scenario complexity and cognitive load on simulation accuracy and to assess the mediating role of anxiety in these relationships. Methodology: A quantitative cross-sectional research design was employed. The study included 360 nurses who completed structured questionnaires measuring scenario complexity, cognitive load, anxiety, and simulation accuracy. Data were analyzed using SPSS version 26, incorporating descriptive statistics, correlation analysis, regression analysis, and mediation analysis through the PROCESS Macro (Model 4). Results: The findings revealed that both scenario complexity and cognitive load had a significant negative impact on simulation accuracy, while cognitive load showed a positive association with anxiety. Furthermore, anxiety was found to partially mediate the effects of scenario complexity and cognitive load on simulation accuracy, indicating that heightened anxiety contributes to reduced performance precision during simulations. Conclusion: The study concludes that increased scenario complexity and excessive cognitive load can diminish simulation accuracy, partly through elevated anxiety levels. Gradual implementation of complex simulation scenarios is recommended to prevent excessive cognitive burden. Additionally, pre-briefing strategies and psychologically safe learning environments are suggested to reduce anxiety and enhance the overall quality and effectiveness of simulation-based training.

INTRODUCTION

Simulation-based learning (SBL) is recognized in present-day nursing education as an essential component which grants the learners a secure and managed environment to sharpen their clinical skills, grow their critical thinking, and be sure of themselves before facing real patients (Zhang et al., 2025). Simulated experiences that are structured give nursing

students a chance to undertake complex clinical procedure not risking patient safety, therefore creating a learning process that enhances professionally competent nurses. A study conducted at a private hospital in Lahore, Pakistan has shown that nursing interns who participated in structured simulations had significantly improved their clinical performance, decision-making, and procedural accuracy, in this way,

highlighting the importance of simulation in the bridging of the gap between theoretical knowledge and actual clinical practice (Russo, 2022; Farooq et al., 2023).

Systematic reviews and meta-analyses suggest that it is important to strike a balance between realism and simplicity in the selection of teaching methods, thus avoiding cognitive overload for learners while still providing them with the development of skills that are of great value (Khan, 2020; Lapierre et al., 2022).

In the context of nursing skills, the mediating role of anxiety between scenario complexity, cognitive load, and simulation accuracy is not well substantiated by the existing literature (Akbar & Hayat, 2020; Mauriz et al., 2021). The development of effective educational simulations which students can learn from requires the integration of anxiety as a key component according to the study's findings which focus on novice learners who face higher risks of cognitive overload (Quader, 2024; Zhang et al., 2025).

Simulation-based learning (SBL) is an essential component of present-day nursing education that is being increasingly recognized every day. Research conducted in Pakistan provided strong support for the method which showed that nursing interns who received structured simulation training demonstrated better clinical skills and decision-making ability and procedural performance. The study results present promising findings yet researchers must address existing limitations which impact their study outcomes (Ismail & Ali, 2020; Farooq et al., 2023).

The process of learning through simulation experiences is influenced by emotional aspects which include anxiety as a primary factor. The presence of high anxiety levels leads to cognitive overload which disables a person's decision-making skills, while effective emotional management helps a person to overcome their existing limitations (Roye, 2024; Yinusa & Ogoun, 2024).

Very few researches have considered the interplay of scenario complexity, cognitive load, and anxiety to place them as factors which affect the precision of nursing simulation skills assessment in Pakistan. The ongoing worldwide adoption of SBL in nursing education demands urgent research to establish the connections between these specific parameters. The understanding of these mechanisms will enable teachers to create simulations which provide authentic experiences that students can effectively manage to

achieve their learning objectives and practice clinical skills safely and effectively.

This research is of immense significance to the field of nursing education because it presents a complete picture of simulation accuracy through its research on the factors that control simulation accuracy. Previous research done in Pakistan already confirmed that simulation-based learning benefits nursing interns regarding clinical skills and decision-making, however, the underlying cognitive and emotional factors associated with these outcomes remain largely unexplored (Modupe, 2021; Farooq et al., 2023).

The findings will assist nurse educators who want to develop simulation programs that combine advanced technology with strong emotional support to better prepare their students for real-world work experience. The study will enhance local and international literature about teaching with simulations while offering research-derived recommendations to establish the optimal balance between realistic situations and managed cognitive load. This research will change nursing education in Pakistan while enhancing student academic performance and enabling safer, more advanced medical care delivery.

The teaching method of simulation-based learning functions as an essential educational method for nursing training programs; however, its effective implementation relies on multiple different yet interconnected components. The scenario's complexity serves as the key element that determines how well students perform because advanced simulation scenarios require students to engage in intensive cognitive work. The resulting higher demand leads to a higher cognitive load, which might be more than the learners' capacity to process information. When nurses experience excessive cognitive load they struggle to manage their stress and anxiety during high-pressure simulation environments. The nurse's decision-making suffers because elevated anxiety levels disrupt their focus from the task and decrease their efficiency which ultimately leads to inaccurate simulation results. The two factors of scenario complexity and cognitive load function as primary elements that predict simulation accuracy because they create an indirect relationship through which anxiety affects simulation outcomes. Understanding how these variables interact with each other helps to reveal how simulation design affects nurses' ability to perform their duties and achieve their learning objectives. The educators can enhance

simulation scenarios and manage cognitive load and reduce anxiety levels by addressing these issues, which will result in improved simulation accuracy and educational outcomes. This study aimed at:

1. The study will examine the relationship between cognitive load and simulation accuracy and their influence on nursing skill performance.
2. The research will analyze how different levels of scenario complexity create cognitive load which produces anxiety within a simulation-based learning environment.
3. To explore the possibility that anxiety may play a role as a mediator of the relationship between scenario complexity, cognitive load, and simulation accuracy.

This study aims to explore the impact of scenario complexity and cognitive load on the accuracy of simulation and whether anxiety plays a mediator's role in this relationship among nursing students. A quantitative approach was used for data collection through structured questionnaires and SPSS analysis with descriptive statistics, correlations, regression, and mediation analysis. The demographic factors age, gender, education, and type of employment were also investigated. The thesis is divided into six chapters: introduction and theoretical framework, literature review, methodology, results, discussion, and conclusions with implications, recommendations, limitations, and future directions, thus providing a neat structure to the understanding of the cognitive and emotional factors that affect the outcomes of simulation-based learning.

LITERATURE REVIEW

The present study is based on the Simulation Theory of Jeffries, which is the most comprehensive and the best framework when it comes to learning through simulation in acquiring and mastering nursing skills, developing critical thinking, and increasing self-efficacy of nursing students. This theory offers vital and scientifically verified support for connecting education with clinical practice through the application of simulation-based learning environments. It recognizes simulation as a systematic, interactive, and student-centered educational process that creates a link between theory and real-world clinical practice by allowing students to engage in genuine but risk-free experiences. (Jeffries, 2016).

Moreover, the facilitator's role was still very significant in the simulation's success. Teaching staff performed the roles of guides, mentors, and evaluators in addition to creating believable situations, bringing about psychological safety, and facilitating the practice of self-reflection (Mehdi, 2019; Al-Ghareeb et al., 2023). Facilitators set up the learning environment to be both welcoming and secure, which in turn, the stimulating, involving, and empowering (Hameed, 2020; Karabacak & Çelik, 2025). The quality of facilitation demonstrated through debriefing sessions showed direct evidence of how learning outcomes and students' emotional reactions to academic content developed. This indicates that for one to have a proper simulation-based education, a mix of both pedagogical and emotional skills is a must for the instructors (Lee & Park, 2024; Carlo, 2025).

It is true that students can face too much difficulty in their cognitive notepads because of the simulation scenarios' elaborate designs or poor instructions. Thus, the working memory of the students will be overloaded, and their performance and the accuracy of the decisions made will fall off as a result. The degree of complexity in a scenario becomes a factor that can work both ways: it can boost the level of realism and stimulate the critical thinking process, but it can also work against the performance accuracy if it is not set to the learner's level (Hakami et al., 2024; Modibbo & Inuwa, 2020). Thus, higher scenario complexity overloads learners' working memory, leading to increased errors and reduced simulation accuracy.

H1: Higher scenario complexity is negatively associated with simulation accuracy.

According to Lee and Park (2023), students dealing with high-complexity scenarios make more procedural errors. Hence, this hypothesis is supported as past research establishes the negative link between complexity and accuracy. The higher the scenario complexity, the more information students have to process at once, which results in heavy use of their working memory. They get tired mentally, which carries the risk of losing attention to the main clinical signals and performing the tasks inaccurately (Ufaq, 2019; Reed et al., 2024). As a result, learners make more errors and the simulation accuracy is lower, which might be the reason why cognitive load is high during the learning process. **H2:** Higher cognitive load is negatively associated with simulation accuracy. Cognitive Load Theory asserts that the human brain

can only handle a limited number of processes at a time (Tabatabaee et al., 2024). This means that if a person's cognitive load is more than what working memory can handle, it will lead to a decrease in the quality of both learning and performance. Nursing students, who were undergoing high cognitive load during the simulations, were found to have less precision in decision making; hence, the support for the hypothesis is derived from both theory and empirical evidence showing that high cognitive load is related to lower performance (Marc & Roussel, 2024; Tabatabaee et al., 2024). In other words, mental effort needs to be increased to cope with high cognitive load, which comes with more information pieces. The mental effort required to deal with multiple pieces of information simultaneously can lead the learners to be less capable of processing the relevant data and performing the clinical tasks accurately. Therefore, the accuracy of the simulation is reduced with higher cognitive load since the attention and information integration are impaired (Raja & Iqbal, 2019; Tabatabaee et al., 2024). This situation can also make the learners more anxious in difficult situations. High scenario complexity is a common cause of uncertainty, performance pressure and anxiety among students, as evidenced by recent literature.

H3: Scenario complexity is positively associated with anxiety.

Cavaleri et al. (2023) stated that complicated simulations involving numerous decision points cause students to be more stressed and nervous. Likewise, Rogers et al., (2025) verified that very complicated cases lead to significantly increased anxiety levels. Thus, this hypothesis is backed by the consistent evidence connecting complex simulations with increased anxiety. Complex scenarios necessitate fast judgment and multitasking, which can stress students out. The Yerkes-Dodson law posits that increasing task difficulty beyond a certain optimal point results in a rise in stress and anxiety (Rogers et al., 2025). Hence, scenario complexity is driving emotional responses of learners to be stronger, thus resulting in greater anxiety which is mainly the cognitive load that their mental demands exert on them further influencing the mental demand that results in anxiety. Researchers have been revealing that learners suffering from very high cognitive load suffer from emotional and physical anxiety (Muhammad & Yan, 2019; Takhdad et al., 2024).

H4: Cognitive load is positively associated with anxiety.

Cognitive overload, according to Reed et al. (2024), causes the body to undergo stress reactions that make the learner lose self-confidence and, thus, worry that the learner's worries will be the main fight of the classroom. Thus, this hypothesis is supported by the existing evidence that shows a direct positive relationship between cognitive load and anxiety. Stressful cognitive load in most cases refers to both deep mental work and a situation where the learner's ability to handle information is outdone. The tension coupled with the 'not good enough' feeling inside the mind is the cause of anxiety (Tabatabaee et al., 2024). For that reason, as the cognitive load is getting more and more increasing the anxiety is probably growing to the same extent, which on the other hand negatively affects the success of the simulation. The findings of various studies widely confirm the view that anxiety negatively affects the various aspects of psychomotor skills (Rehman & Malik, 2020; Abbott et al., 2024)

H5: Anxiety is negatively associated with the simulation accuracy.

Spielberger (2017) suggested that anxiety in large amounts might cause one's performance to suffer since one's attention would be shifted from the task to one's insecurity. In another paper, Abbott et al., (2024) showed that nursing students under high anxiety conditions in simulations were less accurate in their performance. Therefore, this hypothesis gets its justification from strong empirical evidence which indicates that anxiety indeed reduces performance accuracy. The cognitive resources of anxious learners get occupied by their worries and fear of failure instead of executing the task. This emotional distraction cuts down their ability to process information accurately and thus leads to decreased accuracy (Abbott et al., 2024; Marc et al., 2025). Therefore, anxiety will be considered as a factor that is mediating between complexity and accuracy, and thus higher anxiety is anticipated to bring about poorer simulation results. Theories related to the regulation of emotions posit that anxiety functions as a mediating factor between environmental stressors (for example, scenario complexity) and performance (Reed et al., 2024).

H6: Anxiety mediates the relationship between scenario complexity and simulation accuracy.

Ahmed & Park (2023) reported that the participants who were placed in complex simulations not only

experienced higher levels of anxiety but also had their task accuracy reduced as a result of their anxiety. Thus, this hypothesis is valid as the literature indicates that anxiety has a mediating effect between complexity and performance. Complex scenarios make the learners perceive the difficulty level of the task as higher which results in the feeling of anxiety. In turn, anxiety will decrease the learners' ability to concentrate and their efficiency. Anxiety is the emotional channel through which scenario complexity affects the accuracy of simulation (Lee & Park, 2023). Therefore, it can be concluded that learners in complex situations may not perform well mainly because of the anxiety these situations cause, and a similar mediating effect is anticipated in the case of cognitive load as well. According to prior research, cognitive overload can indirectly reduce performance through its influence on anxiety (Ali & Senturk, 2019; Takhdad et al., 2024).

H7: Anxiety mediates the relationship between cognitive load and simulation accuracy.

The study of Reed et al. (2024) stated that the students who were subjected to a high mental workload were

put under anxiety, which, in turn, was the factor leading to the reduced accuracy of the simulation. Therefore, this hypothesis gets supported by the mediation of both theories and empirical evidence. Cognitive load raises the mental effort and the pressure of the situation, which causes anxiety and emotional exhaustion. The anxiety, which results from this situation, creates difficulties for both decision-making processes and psychomotor abilities. The relationship between anxiety and high cognitive load creates a direct link that leads to higher simulation errors according to Rodriguez and his colleagues in 2023. The current research shows that simulation accuracy depends on three interconnected factors which include scenario complexity, cognitive load, and learner anxiety. The combination of pre-briefing, debriefing, and guided reflection as systematic interventions, demonstrates that both cognitive and emotional aspects work together to improve nursing education results in simulation-based training, according to Bautista and his colleagues in 2024 and Kim and his colleagues in 2024.

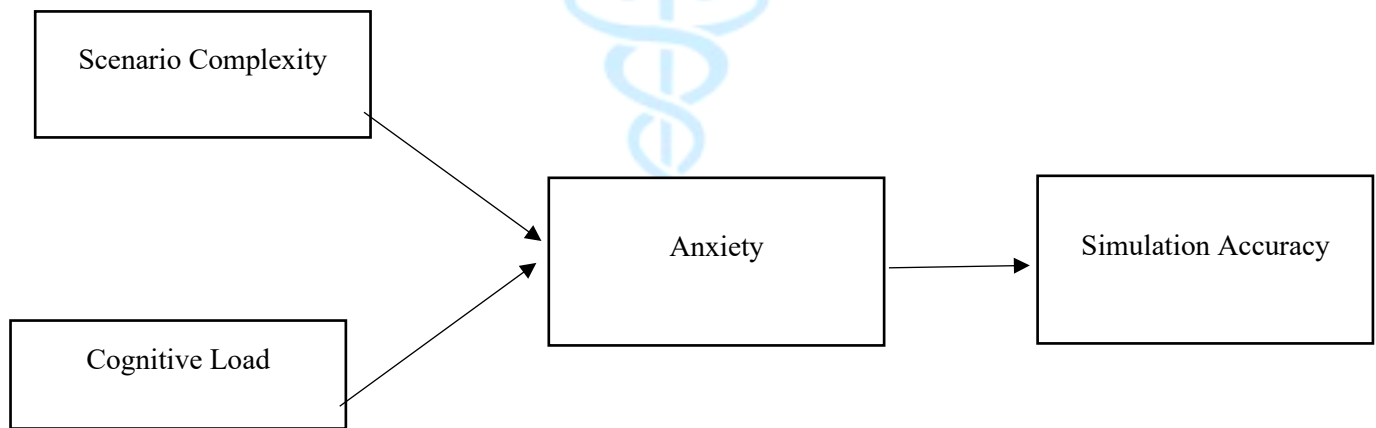


Fig. 1: Theoretical Framework

METHODOLOGY

The research chose to use realist ontology together with objectivist epistemology which resulted in establishing a positivist research framework. The main variables—scenario complexity, cognitive load, anxiety, and simulation accuracy—are clear, measurable, and appropriate for objective appraisal. The study used a deductive method that enabled researchers to test their hypotheses through empirical research based on simulation-based learning studies from existing literature. The study used a quantitative cross-sectional design together with a mono-method approach because researchers collected numerical data through

structured questionnaires that provided standardized assessment tools which minimized researcher bias while supporting statistical analysis. The study duration depended on available academic resources but it also enabled testing of research hypotheses. The sample for the research was made up of nursing students from four institutions: Lahore Institute of Science and Technology, Jinnah Hospital, Fatima Jinnah Medical University, and Children’s Hospital Lahore, which were chosen because the students had already been trained in simulation-based learning. The sample size was computed through G*Power (version 3.1) for multiple linear regression with four predictors

($f^2 = 0.05$, $\alpha = 0.05$, power = 0.95) and resulted in a minimum required sample of 377 participants. A non-probability convenience sampling method was applied for the recruitment of participants, as it was the most suitable way to recruit the students. The sampling unit included nursing students who completed one questionnaire to measure their cognitive load and anxiety levels and the complexity of the scenarios and the accuracy of the simulation.

Measures and Instruments

The research data for this study was collected through a structured questionnaire which used validated instruments that included the Scenario Complexity Checklist and the Cognitive Load Scale and GAD-7 and Simulation Accuracy Scale. The researchers used a 5-point Likert scale to achieve standardization while this scale also facilitated their statistical analysis.

Data Collection Methods

Self-administrated Google Forms were used as the means of data collection which resulted in an efficient, error-free, and confidential data collection process. Informed consent was taken prior to participation, and electronic distribution which was in line with the study design supported rapid data acquisition.

Data Analysis

To meet the research goals, SPSS Version 26 was used to perform the analysis of data collected from the 360 nursing students.

For the demographic variables like age, sex, education, and employment type, continuous and categorical variables were created and descriptive statistics (means, standard deviations, frequencies, and percentages)

were computed for each of them. Cronbach's alpha was the reliability measure of the scales.

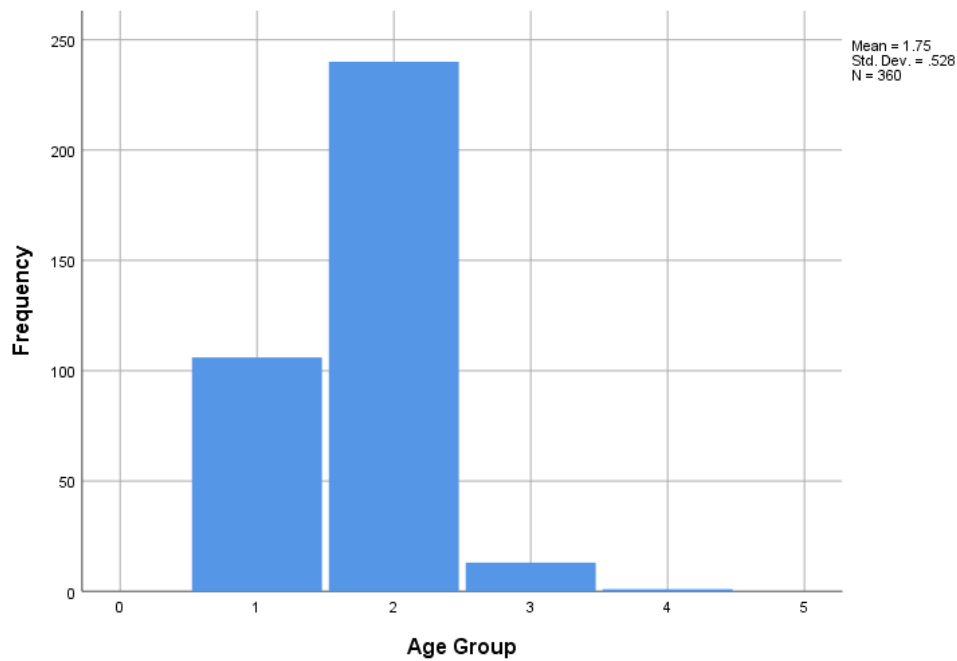
Pearson's correlation was applied to find out the relationships among scenario complexity, cognitive load, anxiety, and simulation accuracy. Both simple and multiple regression analysis were carried out to find the direct effects of scenario complexity and cognitive load on simulation accuracy while controlling for demographic variables.

Mediation analysis was done through PROCESS Macro (Model 4) which determined if anxiety was a mediator in the relationship between cognitive load, scenario complexity, and simulation accuracy based on bootstrapped confidence intervals (5,000 samples).

Histograms were created for the purpose of demonstrating the distribution of demographic and study variables. Such a method enabled the direct, indirect, and interaction effects of cognitive and emotional factors on the performance of nursing students in simulation-based learning to be systematically investigated.

RESULTS

This chapter contains the main findings from the study which considered scenario complexity and cognitive load as factors affecting the accuracy of nurse simulation, while at the same time pointing out the mediating role of anxiety in simulation-based learning. Results are structured in the form of participant characteristics, reliability analysis, descriptive statistics, correlation analysis, regression analyses, and mediation analysis.



The participants achieved a mean age group score of 1.75 which had a standard deviation of 0.528 and this result was based on 360 respondents who participated in the study. The study sample showed an age range distribution pattern which proved the participants shared similar ages. The age distribution serves as a suitable demographic basis to study simulation-based learning outcomes in nursing.

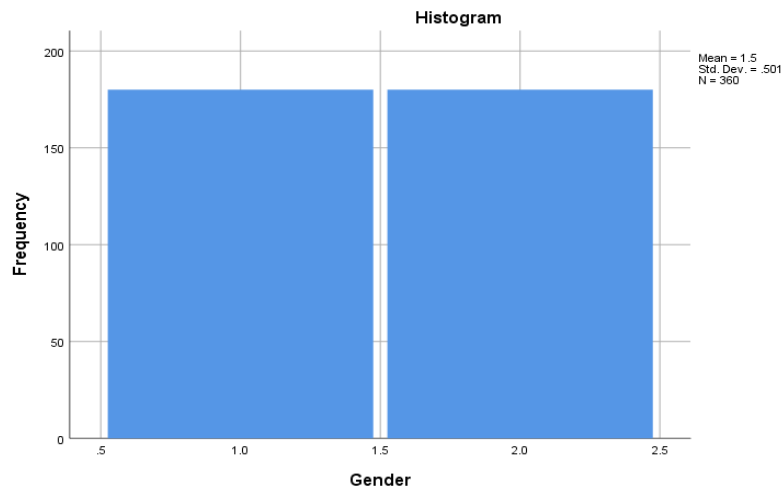
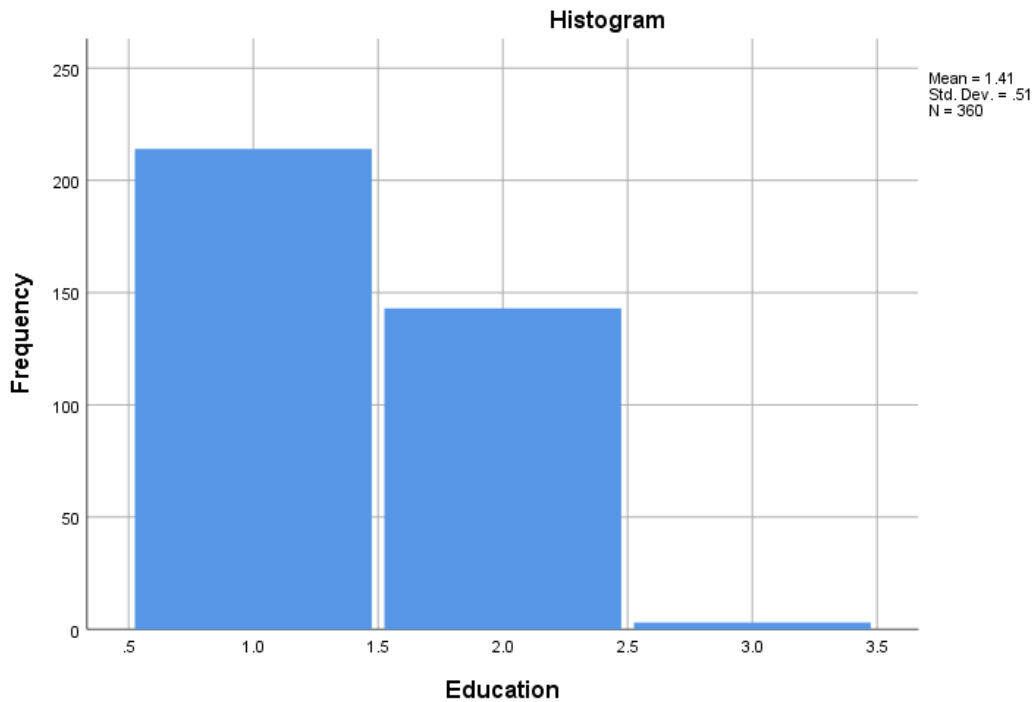


Figure 2 demonstrated that the number of male and female participants were in equal proportions, ensuring gender balance.



Most participants held a bachelor's degree (59.4%) while master's degree holders made up 39.7% of participants and only a small proportion possessed a PhD qualification.

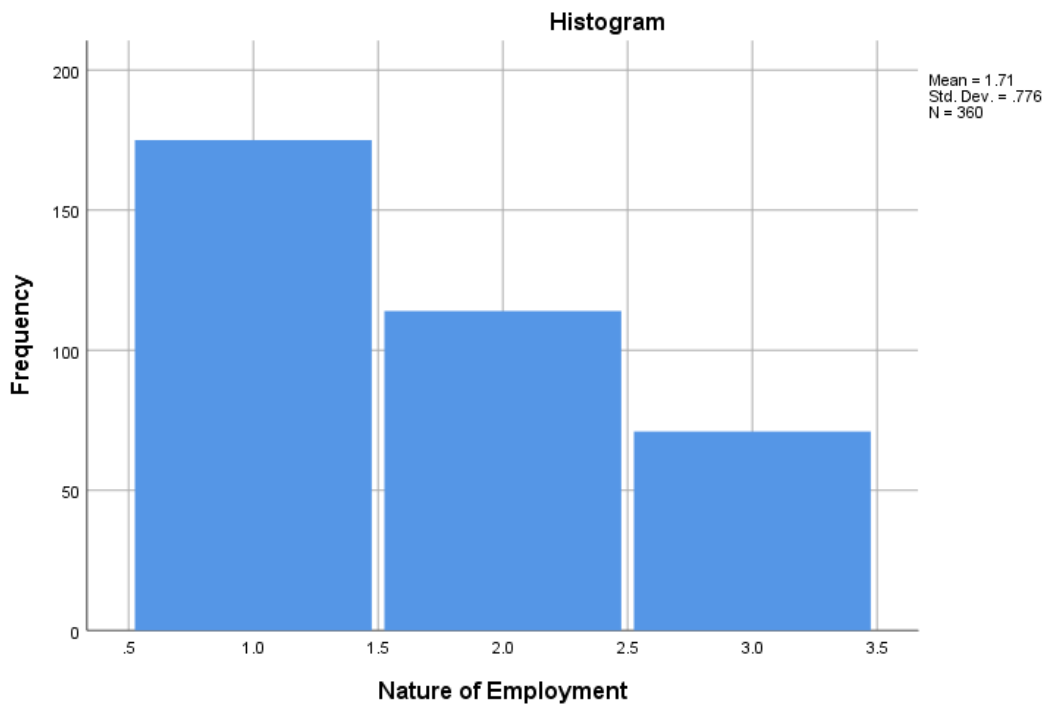


Figure 4 shows Nearly half of the participants were employed on a contractual basis, while approximately one-third held permanent positions.

The Cronbach's alpha method was utilized to evaluate the internal consistency of the study instruments. The scales for anxiety ($\alpha = 0.800$) and simulation accuracy ($\alpha = 0.819$) showed a good level of reliability. The

scenario complexity ($\alpha = 0.470$) and cognitive load ($\alpha = 0.503$) scales were also less reliable but were retained because of their theoretical relevance and previous use

in simulation-based learning research. Reliability coefficients are presented below in Table 1:

Table 1

Scale	Number of Items	Cronbach's Alpha
Scenario Complexity	5	0.470
Cognitive Load	5	0.503
Anxiety	5	0.800
Simulation Accuracy	5	0.819

Participants indicated moderate to high scenario complexity ($M = 3.92$, $SD = 0.45$) and cognitive load ($M = 3.98$, $SD = 0.47$) along with high anxiety ($M = 4.30$, $SD = 0.51$). The accuracy of the simulation was

relatively low ($M = 2.12$, $SD = 0.68$). Skewness and kurtosis values did not exceed ± 2 , and histograms showed nearly normal distributions, thus justifying the use of parametric analyses.

Table 2: Descriptive Statistics of Main Study Variables (N = 360)

Variable	Minimum	Maximum	Mean	Standard Deviation	Skewness	Kurtosis
Scenario Complexity	1.80	4.80	3.92	0.45	-0.48	0.36
Cognitive Load	1.80	4.80	3.98	0.47	-0.52	0.41
Anxiety	2.00	5.00	4.30	0.51	-0.61	0.58
Simulation Accuracy	1.20	4.60	2.12	0.68	0.64	-0.27

To investigate the interrelations among the study variables, Pearson correlation analysis was performed. Scenario complexity, on one hand, showed positive correlations with cognitive load and anxiety while on the other hand, it showed a negative correlation with simulation accuracy.

Cognitive load, in turn, was positively related to anxiety and negatively related to simulation accuracy. Moreover, the correlation between anxiety and simulation accuracy was very strong in the negative direction. The correlation matrix can be seen in Table 3.

Table 3: Pearson Correlation Matrix of Study Variables (N = 360)

Variable	1	2	3	4
1. Scenario Complexity	1			
2. Cognitive Load	0.458**	1		
3. Anxiety	0.335**	0.454**	1	
4. Simulation Accuracy	-0.299**	-0.316**	-0.440**	1

The results of the simple linear regression analysis have shown that the complexity of the scenario was a significant predictor of the accuracy of the simulation, and it accounted for 8.9% of the variance ($R^2 = 0.089$, $F(1, 358) = 35.17$, $p < .001$). The regression coefficients are listed in Table 6.

Table 4: Simple Linear Regression: Scenario Complexity Predicting Simulation Accuracy

Predictor	B	SE	β	t	p
Constant	3.896	0.302	—	12.91	< .001
Scenario Complexity	-0.454	0.077	-0.299	-5.93	< .001

Cognitive load was a substantial predictor of simulation accuracy, contributing an explanation for 10.0% of the variance ($R^2 = 0.100$,

$F(1, 358) = 39.67, p < .001$). The results of the regression analysis can be found in Table 7.

Table 5: Simple Linear Regression: Cognitive Load Predicting Simulation Accuracy

Predictor	B	SE	β	t	p
Constant	3.936	0.291	–	13.54	< .001
Cognitive Load	–0.458	0.073	–0.316	–6.30	< .001

The multiple regression model taking both predictors into consideration explained 13.0% of the variance in simulation accuracy ($R^2=0.130, F(2, 357)=26.66, p<0.001$). Each of the two variables individually predicted simulation accuracy (Table 6).

Table 6: Multiple Regression: Scenario Complexity and Cognitive Load Predicting Simulation Accuracy

Predictor	B	SE	β	t	p
Constant	4.583	0.340	–	13.48	< .001
Scenario Complexity	–0.297	0.084	–0.195	–3.52	< .001
Cognitive Load	–0.328	0.080	–0.226	–4.08	< .001

The results of multiple regression analysis indicated that the combination of scenario complexity and cognitive load was responsible for 22.7% of the variance in anxiety ($R^2 = 0.227, F(2, 357) = 52.42, p < .001$). Table 7 contains the regression coefficients.

Table 7: Multiple Regression: Scenario Complexity and Cognitive Load Predicting Anxiety

Predictor	B	SE	β	t	p
Constant	1.935	0.240	–	8.06	< .001
Scenario Complexity	0.183	0.060	0.161	3.08	.002
Cognitive Load	0.413	0.057	0.381	7.27	< .001

Mediation analysis was carried out with the aid of the PROCESS Macro (Model 4) at 5,000 bootstrap samples and 95% confidence intervals. Anxiety was considered as a mediator in the connections between cognitive load and simulation accuracy, and between

scenario complexity and simulation accuracy. The outcomes showed that anxiety was a partial mediator for both connections. The indirect effects for cognitive load and scenario complexity were significant and they have been displayed in Table 8.

Table 8: Indirect Effects of Cognitive Load and Scenario Complexity on Simulation Accuracy via Anxiety

Indirect Path	Effect	Boot SE	Boot LLCI	Boot ULCI
Cognitive Load → Anxiety → Simulation Accuracy	–0.246	0.073	–0.401	–0.117
Scenario Complexity → Anxiety → Simulation Accuracy	–0.195	0.063	–0.332	–0.089

Note. Bootstrap samples = 5,000; confidence intervals at 95%.

The results show that scenario complexity and cognitive load have a negative relation with the accuracy of nurses' simulations. The two variables also proved to be significant predictors of anxiety, which in turn, partly, the mediating effect of the latter on simulation performance. The findings point out the importance of anxiety as a dominant psychological factor that affects the results in simulation-based learning.

DISCUSSION

The current research investigated how different scenario difficulties and cognitive load testing requirements affected nurses' ability to accurately assess simulations. The research investigated how nurses' anxiety levels impacted their ability to learn through simulation-based training. Simulation has become a cornerstone of contemporary nursing education because it provides a safe environment which enables students to develop their clinical skills and decision making abilities and professional

confidence. The research findings show that students who undergo cognitive and emotional challenges which exceed their ability to cope with them will experience reduced educational advantages from simulation-based learning. The research findings show that simulation experiences need to find an equal distribution between actual elements and the cognitive and emotional preparedness of students.

The study results provide strong evidence which supports Hypothesis 1 (H1) because the research showed that increased scenario complexity leads to decreased simulation accuracy. Nurses demonstrated reduced accuracy in their simulation tests as they faced increasingly complex testing conditions. The evidence shows that complex scenarios exceed learners' capabilities because they block effective information processing and proper response development. Complex scenarios require doctors to handle multiple patient conditions while coping with quick patient status changes and solving advanced medical problems within short time limits. The requirements of learning material create obstacles which prevent learners from selecting essential information, causing them to respond with incorrect information and excessive delays.

Cognitive Load Theory explains that human working memory has a limited capacity which results in performance decline whenever task requirements surpass this memory limit according to Sweller et al. 2019. Nurses in simulation environments need to perform multiple tasks which include assessing patient signs and symptoms and understanding monitoring results and obeying medical protocols and demonstrating technical abilities. When tasks become too intricate, the brain needs extra power to handle them, which leads to a decline in performance because it exceeds the limits of working memory capacity. Previous studies have similarly reported that high scenario complexity negatively impacts clinical performance, decision making, and error rates among nursing students and healthcare professionals (LeBlanc, 2009; Fraser et al., 2014).

The researchers confirmed their second hypothesis which stated that increased cognitive load would decrease the accuracy of simulation results. The results showed that nurses were less accurate in their simulation performance when their cognitive load increased. Cognitive load requires mental effort which includes intrinsic load for task complexity and

extraneous load for instructional design. The simulation-based learning process shows that excessive cognitive load leads to attention impairment and diminished information retention and restricted decision-making abilities.

The research results demonstrate that properly created simulation systems will fail to deliver their intended value when they require users to engage in excessive cognitive work. Nurses who work under high cognitive demands face difficulties when they need to connect their theoretical knowledge to their practical skills which results in errors during patient care. The previous research shows that high cognitive load limits learning results and clinical skills development in healthcare simulation environments (Sweller et al., 2019). The educators need to design simulation exercises through which students can learn material while requiring them to think as little as possible.

The results supported Hypothesis 3 (H3), which suggested that scenario complexity is positively associated with anxiety. Participants displayed increased anxiety symptoms when they encountered more difficult simulation scenarios. Complex scenarios often include unpredictable patient outcomes and dangerous clinical situations together with student assessments by instructors and peers. The factors mentioned above increase learners' fear of making errors and their anxiety about their performance, which results in higher anxiety levels.

Research studies have established that anxiety exists in environments which simulate real-world situations. The study results indicate that moderate stress levels can boost alertness and focus, but high anxiety levels will damage both learning abilities and performance standards. According to research studies, nursing students experience heightened anxiety during high fidelity simulations because they must perform their tasks while facing potential negative assessments of their work (Al Ghareeb et al., 2017). The current results demonstrate that scenario complexity serves as the primary element which leads to this particular emotional reaction.

The results verified Hypothesis 4 (H4) because they showed that cognitive load creates an active connection to anxiety. Nurses experienced rising anxiety levels as their cognitive load increased. The high cognitive requirements of tasks create mental overload, which decreases learners' ability to manage their circumstances. The inability to control their work

tasks will lead to people experiencing heightened emotional stress and anxiety.

The connection between cognitive processes and emotional processes in learning establishes a close relationship between these two types of processes. Cognitive overload causes two negative effects because it disrupts information processing while simultaneously decreasing user confidence and raising their emotional distress levels. Previous research has shown that when clinical simulations create higher mental workload demands for participants their stress and anxiety levels result in elevated responses (LeBlanc, 2009). The study results show that learners need cognitive load management to improve their performance while protecting their mental health status.

The results supported Hypothesis 5 (H5), showing that anxiety negatively impacts simulation accuracy. The study found that higher anxiety levels resulted in lower performance accuracy because excessive emotional arousal disrupted proper task execution. The Yerkes-Dodson Law states that moderate anxiety levels improve performance through increased alertness while excessive anxiety hinders cognitive abilities and decision-making and motor skills (Diamond et al., 2007).

The study found that high scenario complexity together with excessive cognitive load anxiety beyond suitable limits resulted in decreased accuracy of simulation results. Anxious learners experience difficulties with concentration and memory recall and they struggle to perform clinical skills. The finding supports previous research which shows that high anxiety levels decrease both clinical reasoning abilities and performance in simulation-based learning environments.

The mediation analysis supported both Hypotheses 6 and 7 because their hypotheses proved that anxiety functions as a mediating factor between scenario complexity and simulation accuracy and between cognitive load and simulation accuracy. The results showed that both scenario complexity and cognitive load affected simulation accuracy through direct effects and indirect effects which resulted in higher anxiety levels. The results demonstrate that anxiety operates as a fundamental psychological mechanism which connects cognitive demands to performance outcomes. The research demonstrates that both cognitive factors and emotional factors function as learning elements in

simulation-based educational methods. The research shows that complex scenarios which require high mental effort lead to worse results because they overload working memory and create higher anxiety levels. The study shows that emotional responses function as key elements which need the same level of attention as cognitive demands when developing simulation-based educational environments.

The study results create important effects for nursing educational programs that use simulation as their primary teaching method. Educators should establish simulation scenarios by assessing both the cognitive capacity and emotional readiness of their learners. The Cant and Cooper study from 2017 shows that learners can increase their confidence and competence through gradual progression from low complexity to high complexity learning scenarios.

The study found that students achieved better learning results when they were given explicit instructions and organized guidelines and pre-simulation briefings. The debriefing methods that create a supportive atmosphere through their emphasis on reflective learning instead of assessment help to decrease anxiety while increasing psychological safety. Previous research showed that learning environments which allow students to reflect without facing judgmental assessments lead to better educational results and decreased emotional distress and improved simulation results (Rudolph et al. 2014).

The study demonstrates that simulation accuracy for nurses depends on two main factors which are scenario complexity and cognitive load. Excessively complex and cognitively demanding simulation scenarios create an overwhelming burden on learners which leads to heightened anxiety and results in decreased performance accuracy. The findings demonstrate that nursing education using simulation as a training method needs to establish a balance between realistic elements and the cognitive and emotional needs of students. When educators create simulations which control cognitive demands while providing emotional support to students they achieve two outcomes. The study increases educational value from simulations which leads to safe nursing skills development.

CONCLUSION

The present study aimed to determine the effects of nursing scenario complexity and cognitive load on the

accuracy of simulation, with anxiety as a mediator during the process of simulation-based learning. Results corroborate that difficult medical situations and high cognitive load significantly decrease the accuracy of simulation. Furthermore, anxiety turned out to be a crucial psychological barrier that impedes performance by means of these factors. One of the main outcomes of the research is that both the cognitive and emotional domains should be contemplated in the planning and implementation of nursing education through simulation techniques.

The research revealed that not only scenario complexity and cognitive load negatively impacted the accuracy of the simulation to a large extent but also signaled that there was a performance drop in such conditions which were difficult and required mental effort. The two factors were found to correlate with anxiety and this relationship was partly responsible for the negative impact on simulation outcomes. The impact of demographic variables was very small when cognitive and psychological factors were taken into account. Therefore, the study suggests that nursing educators should gradually create simulation scenarios that are more complex, it is also necessary to improve the pre-briefing sessions so that the objectives are clarified and uncertainty is reduced, and finally, the psychological safety of the students' learning environment should be ensured where mistakes are regarded as opportunities for learning. Furthermore, integrating strategies for managing stress and reflective debriefing can be helpful in reducing anxiety, raising the correctness of the simulation, and facilitating the acquisition of skills by nursing students effectively.

This study has a number of limitations despite its strengths. The cross-sectional design hinders the establishment of causal relations between the variables. Self-reported questionnaires were used for data collection, which may lead to biased answers. The research was limited to a few simulation settings, which could limit the applicability of the results. In addition, certain measurement scales showed moderate reliability, which may have affected the accuracy of the findings.

It is recommended that future studies use longitudinal or experimental designs to determine causal connections among cognitive load, scenario complexity, anxiety, and performance outcomes. It is advised to carry out studies in various healthcare settings with bigger samples for the purpose of

increasing generalizability. Besides, future research might look at intervention-based strategies designed to reduce anxiety and to optimize cognitive load during simulations. The simulation performance of nursing education can be better understood through the examination of additional psychological factors which include self-efficacy, resilience and coping strategies.

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