Virtual Reality for Heart and Lung Assessment Training: Nursing Students' Motivation and Competency

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Abstract

Background: Virtual reality (VR) is proving to be an increasingly effective and immersive solution to the current challenges in nursing education, leading to its widespread integration into undergraduate curricula for developing skills and knowledge. This study aims to investigate the effects of virtual reality training on heart and lung assessment on nursing students' learning motivation and competency. **Methods:** A quasi-experimental research design was conducted involving 80 participants. Assessment data form and intrinsic motivation inventory tools were used to collect pertinent data. Results revealed that there was a statistically significant difference among the study participants' groups in terms of total scores of intrinsic motivation inventory: interest/enjoyment, perceived competence, effort, pressure/tension, perceived choice, and relatedness. Conclusions: This study found that using VR simulations can be an effective way to help nursing students build stronger heart and lung assessment skills. By practicing in a realistic, immersive environment, students are better prepared to provide high-quality care for patients with cardiac and respiratory conditions.

Keywords: Virtual Reality – heart-lung assessment – Nursing students' motivation and competency

Introduction:

In the past ten years, technology has become integral to higher education. A range of platforms and applications have been introduced to support online teaching and provide faculty with the tools to manage digital courses, training, and exams **(Albloushi et al., 2024).** Due to recent challenges in nursing education, virtual reality (VR) is increasingly used as an immersive and effective tool for skill and knowledge development in undergraduate nursing curricula **(Saab et al, 2021).** Over the last decade, more challenges to nursing education have resulted in increased use of novel technologies such as virtual reality (VR) **(Gamba & Hartery, 2024).** Virtual reality includes "a wide variety of computer-based applications commonly associated with immersive, highly visual, 3D characteristics that allow the participant to look about and navigate within a seemingly real or physical world" **(Zaman et al., 2024).**

Unlike traditional teaching methods, technology offers a more immersive approach to bridging theoretical and clinical learning in nursing education **(Waliu et al., 2025).** Nursing education involves the integration of cognitive, intellectual, affective, and psychomotor skills. Errors in real clinical settings can compromise patient safety, making it essential for nursing students to repeatedly practice core interventions in simulated environments. This repeated practice helps them develop fundamental psychomotor skills before entering clinical placements. Simulations emulate real-life situations in which nursing students can gain clinical experience without putting patients at risk **(da Silva Tiago & Mitchell, 2024).** In nursing education, various modes of simulators, such as high-fidelity (interactive patient simulators) and low-fidelity simulators (computer and video), may be operated **(Deng et al., 2024).**

Simulations offer effective learning environments where nursing students can improve their practice and advance critical thinking, communication, clinical decision-making, and problem-solving skills without hurting patients, and boost their confidence and readiness for real clinical practice **(Solmaz et al, 2024).** Virtual reality (VR), which is a type of simulation, consists of state-of-the-art reality

mediation. The more the simulation is same the real clinical setting, the more educated and skilled the students are at acquiring abilities. VR simulations offer nursing students the opportunity to execute high-risk and high-cost interventions on virtual patients and acquire experience without risking the safety of actual patients **(Nolasco-Rózsás & Schädler, 2024).**

Existing undergraduate education should prepare undergraduate student nurses for clinical practice and increase their professional skills using different methods as simulators. **(Cary et al, 2024).** A large range of methods have been used in the effort to teach these skills, including manikins, standardized patients, and simulations. In addition, digital methods, including simulations, have been employed. Alternative methods have been recommended to aid in the teaching of these core skills to nursing students **(Fauseweh, 2024).**

National Patient Safety Foundation **(Scott & APSF Hemodynamic Instability Writing Group, 2024)** reported that patient safety has almost eliminated preventable medical errors that cause harm to patients. High-quality nursing education is a precondition of patient safety. Simulations, in general, and VR improve the quality of nursing education and allow students to put theory into practice and develop skills and positive attitudes **(Ogawa et al., 2024).** Those students are more likely to consider patient safety when implementing clinical interventions **(Valli et al, 2024).** Nursing students have problems hearing cardiac and pulmonary sounds in the clinic. Thus, they need to learn heart and lung sounds effectively and correctly before being placed in clinics. The use of high-fidelity simulators was found to be more effective in teaching heart and lung sounds to student nurses. Students' ability to listen to sounds effectively will reduce the risk of mistakes when they start working in the clinic **(Henrichs & O'Donnell, 2024).**

Significance of the Study

Nurses have difficulty in hearing patients' heart and lung sounds. For this reason, student nurses need to learn normal/abnormal heart and lung sounds safely and effectively with simulators before becoming professional nurses. Using simulators in practice can reduce risks to patients **(Patry, 2024; Torabi et al, 2024).** Lack of clinical practice, which trains students for the real clinical environment, can influence nursing procedure errors that compromise the safety of patients **(Soori, 2024).** Limiting the gap between theory and practice during the educational process is essential but poses several challenges to nursing educators **(Miller, M. A., & Stoeckel, 2024).** To ensure the quality and safety of nursing education, educators have assumed various teaching strategies, including simulation experience for students **(Dissanayake et al, 2024).**

The practice of VR in simulations allows repetitive, hands-on training to develop cognitive and skill mastery among nursing students, which are usually defined as the measure of participants' understanding of concepts and the ability of a participant to validate a procedure or technique, respectively (Chang et al., 2024). In a study, 98% of the participating students advised virtual simulation for future use in nursing education **(Cho & Kim, 2024**).

Aim of the Study

The general aim of the current study is to investigate the effects of virtual reality (VR) training on the nursing students' overall learning experience of heart and lung assessment. This can be achieved through the following:

- Evaluate the effect of virtual reality (VR) training on the learning motivation of nursing students in performing heart and lung assessment.
- Evaluate the effect of virtual reality (VR) training on the competency of nursing students in performing heart and lung assessment.

Hypotheses:

H_1: Virtual reality training on heart and lung assessment for nursing students will improve learning motivation than lecture-based learning methodology.

H_2: Virtual reality training on heart and lung assessment for nursing students will improve competency than lecture-based learning methodology.

Subjects and Methods

Research Design:

Quasi-experimental research with an after-only nonequivalent control group design was utilized to fulfill the aim of the study. The after-only nonequivalent control group design is a quasi-experimental design used to assess the

effect of an intervention or treatment. The effect of the intervention is inferred by comparing the post-intervention outcomes between the treatment and control groups (Polit and Beck 2004).

Setting:

The present research was carried out at the Faculty of Nursing, which is part of the Modern University for Technology and Information (MTI), a private university located in Cairo, Egypt. The Faculty of Nursing is an established academic unit that admitted its first class of students in October 2009 and is situated in the Al-Mokattam district, a central and readily accessible area of Cairo.

Sample:

A convenient sample of 80 adult nursing students was included in the present study. The total sample size was calculated according to G power 3.1 with 90% statistical power, 95% confidence interval, and 5% level of significance. The students enrolled in the study were representatives of medical-surgical students. The participants had no previous exposure to such a topic. The students were randomly assigned either to the study group, which received virtual reality training in heart and lung assessment, or the control group, which received a traditional lecture related to heart and lung assessment using random assignment. English was the major communication language, and all resources were created in English.

Tools & Data collection

Data was collected from students directly through the two tools; the first one is the Assessment data form, and the second one is the Intrinsic Motivation Inventory. The first tool included three sections*:*

- *The first section* of the assessment data form included students' demographics as age, gender, and academic level.
- *The second section included a nursing Knowledge assessment test:*

  Participants completed post-assessment multiple-choice exams to evaluate their overall competency approximately 10 minutes after training due to the transitional period. participants were asked to answer one diagnostic accuracy question and one knowledge acquisition question, resulting in a total of ten questions. These questions were presented in an online form to reduce grading time and improve grading accuracy by removing the human component. The total score was calculated individually for each participant scale from 0 to 5. A score of 0 indicates that no questions were answered correctly, whereas a score of 5 indicates that all questions in the respective category were answered accurately. For example, answering all 5 diagnostic accuracy questions would yield a 5 out of 5 score, but getting one question incorrect would yield a score of 4 out of 5 **(Gibson et al, 2024).**

- The third section included the competency assessment:

  The assessment comprised the five different heart and lung sounds presented in a randomized order through wireless stethoscopes to better approximate real-world conditions. The wireless stethoscopes also allowed us to evaluate all participants at the same time to avoid variability in time assessed after training. Overall competency was divided into two distinct categories: the ability to correctly identify heart sounds, diagnostic accuracy, the ability to explain the underlying pathophysiology, and knowledge acquisition. The total score was calculated individually for each participant scale from 0 to 1. A score of 0 signified that no questions were answered correctly, whereas a score of 1 indicated that all questions in the respective category were answered accurately (Gibson et al., 2024).

To ensure the validity of the assessment test, the questions were developed based on published educational handbooks that provide detailed descriptions of each heart and lung assessment. Additionally, experienced clinicians and educators in the field were consulted to review the questions for content validity and ensure they accurately reflected the key aspects of cardiac and lung auscultation and pathophysiology.

Second tool: Intrinsic Motivation Inventory (IMI)

A multidimensional measurement device intended to assess participants' subjective experience related to target activity in laboratory experiments. It has been used in different experiments related to Intrinsic Motivation

Inventory and self-regulation. The IMI consists of varied numbers of items from these subscales, all of which are factors analytically coherent and stable across a variety of tasks, conditions, and settings **(Cardoso & Zaro, 2024).** The instrument assesses participants' interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity, thus yielding six subscale scores. The research was conducted using a pre-validated questionnaire. Intrinsic Motivation Inventory addresses two topics: learning motivation and learning competency. Both categories had four questions, and respondents used a scale from one to seven for feedback, where one to seven scale with one implying 'strongly disagree' and seven being strongly agreed'. Each participant spent four minutes on average for 10 minutes. In comparison, the mean values of VR learning motivation and competency with those of lecture-based learning.

Validity and Reliability

The reliability of the instrument is established by calculating Cronbach's Alpha, which is used to determine the consistency and stability of the instrument. A Cronbach's alpha coefficient exceeding 0.9 indicates a high level of internal consistency and a range of $0.7 \leq \alpha < 0.9$ is measured as acceptable. Convergent validity, denoting a high correlation among items within a construct was assessed by inspecting the factor loadings. To establish convergent validity, factor loadings should exceed 0.5 and be statistically significant. Convergent validity is established by high factor loads that are statistically significant **(Laubscher & Bosch. 2024).**

Pilot Study:

A pilot study was conducted on 8 students, who represented 10% of the sample. Data obtained from these patients was not included in the existing study. The pilot study was performed to test the clarity, and the applicability of the instruments estimate the time needed to collect data and test the feasibility of the research process.

Procedure

Methods

Lecture and VR learning approaches are chosen for testing. In certain cases, the same training material for heart and lung Auscultation is prepared. Methodologies of instruction. All participants were exposed to all the selected learning approaches in a random sequence to assess the influence of learning motivation and learning competency. The data were collected between October and December of 2023.

Participants took part in this study after receiving ethical permission. Each—volunteer student was recruited willingly through announcements for participation in the " lung and heart Auscultation Assessment workshop". Heart and Lung Realities RER MED online educational application and free-to-use version, either through Google, Apple, or Android Play Stores© 2023 was chosen for virtual reality and video-based learning experiences.

The students were informed that they could access the survey with any electronic device through their email. The study began with a brief description of the study itself, followed by a detailed informed consent and the assessment taken by the investigators to ensure the privacy of the personal information. The study was accessed by students following their agreement to this informed consent.

Stage One: In this stage, the researcher provides instructions and a brief overview of utilizing VR. A thorough demonstration of the Medical Reality application was performed. Data was collected directly from students using an online questionnaire developed by the researchers. The questionnaire aimed to assess students' perceptions of the readiness, benefits, and obstacles of using virtual reality in learning, as well as their motivation and competency in heart and lung assessment.

Stage Two: In stage three, the first researcher briefed the audience about the lecture-based learning approach, its impacts, and outcomes. The responders were then asked to read a one-and-a-half-page printed text file. The text file contains the same information as the heart and lung assessment. Following completion of the text-based user experience, users were asked to answer a questionnaire concerning learning

motivation and learning competency using the text-based learning technique.

Interventions: In a conference room setting, the control group (n=40) received a 10-minute pre-recorded slide presentation comprising video and heart and lung sounds, which are traditionally PowerPoint lecture-used modalities for teaching cardiac and lung auscultation. The interventional group (n=40) received the same 10-minute pre-recorded slide presentation, supplemented with simulated cardiac cycles of 3D cross-sectioned hearts and haptic synchronization using VR. A virtual human anatomy simulator provided 3D cross-sectional cardiac cycles. Heart sounds recorded from Harvey, the cardiopulmonary simulator, were overlaid on each cardiac cycle clip, and the respective 3D phonocardiograms were presented in the control group's video. Haptic synchronization involved participants tapping along with the heart sounds played in the video when the notification appeared on the screen. Printed phonocardiograms were provided for each heart sound as a tapping guide. These components created a multisensory environment incorporating visual, auditory, and tactile learning in the educational material.

Stage Three: Outcome Measures: Participants completed a post-assessment multiple-choice exam and a competency test in the clinical medical-surgical Laboratory, with each lasting approximately 10 minutes after the training. Following this, participants' subjective experience related to target activity in the laboratory was assessed, along with their intrinsic motivation and self-regulation using the Intrinsic Motivation Inventory (IMI).

Ethical considerations

Before conducting the current study, official ethical permission was taken from the ethical committee of faculty of nursing, MTI University number (FAN/146/2024) to conduct the current study, as well as the preparation of the study tools. The researchers arranged a time to meet students and give a full description of the aim of the study, and written informed consent collected from students who agreed to participate in the study. Participants were informed that they could withdraw from the study at any time and that no compensation would be provided for their participation.

Data Analysis

Data was entered and analyzed using Statistical Package for Social Science software (SPSS version 22); Data-related descriptive statistics were summarized using mean as an average, and standard deviation as a measure of dispersion of results around the mean. For the inferential results, a correlation test was used. The alpha level of .05 was utilized for all tests of significance. The internal consistency of all tools was assessed by Cronbach's alpha.

Results:

Table (1) presents the demographic data of the study participants. Around 42.5% of the participants were around 22 years old for the VR group and the traditional group. More than half of them (65%) were female and around one-third of them (35%) were male. According to the academic level, all the study participants enrolled in the second study level. It was proved that the VR and traditional groups' participants were homogeneous groups, as there was no statistically significant difference between the groups in relation to demographic characteristics.

Table (2) revealed that there was a statistically significant difference among the study participants' groups as regards knowledge and competency scores between the VR group and traditional group, as $t = 6.898$, $p = 0.000$, and $t = 4.564$, $p = 0.000$, respectively.

Table (3) illustrates that there was a statistically significant difference among the study participants groups as regards total scores of the Intrinsic Motivation Inventory; interest/ enjoyment, perceived competence, effort, pressure/ tension, perceived choice and relatedness as $t = 19.558$, $p = 0.000$, $t = 15.476$, $p=0.000$, $t=22.152$, $p=0.000$, $t=37.546$, $p = 0.000$, $t = 43.159$, $p = 0.000$, $t=14.429$, $p=0.000$ respectively.

Table (4) shows that there was a statistically significant difference among the study participants groups as regards total scores of task evaluation domains; interest/enjoyment, perceived competence, effort, and pressure/ tension, as $t = 19.743$, $p = 0.000$, $t = 27.590$, $p=0.000$, $t = 14.420$, $p = 0.000$, $t = 32.011$, $p=0.000$ respectively.

Table (5) reveals that there was a statistically significant difference among the study participants groups as regards total scores of task evaluation domains; interest/enjoyment,

perceived competence, effort, and pressure/tension, as t =21.375, p = 0.000, t = 25.449, p=0.000, t = 17.668, p = 0.000, respectively.

Table (6) illustrates that there was a statistically significant difference among the study participants groups as regards total scores of activity perception domains; interest/ enjoyment, value/usefulness, and perceived choice as t =31.430, p = 0.000, t = 14.743, p=0.000, t = 10.499, p = 0.000 respectively.

Table (7) shows that there was no statistically significant difference among the study participants groups as regards total scores of subject impression domains; relatedness, interest/enjoyment, perceived choice, and pressure/tension as t =1.163, p = 0.249, t = 1.689, p=0.097, t = 0.723, p = 0.473, t =1.450, p = 0.153 respectively.

Concerning table (8), it reveals that there was a negative correlation between lack of knowledge, low motivation, and age (p = 0.03) and (p = 0.04), respectively. Also, the same table shows a positive correlation between competency, motivation, and knowledge (p = 0.00) and (p= 0.00) respectively, as well as a positive correlation between competency and motivation (p = 0.00).

Table (1): Frequency distribution among the study participant groups according to their demographic data (n=80).

Characteristics	VR Group (n=40)		Traditional Group(n=40)		X^2	p
	No.	%	No.	%		
Gender					0.0	1.0
Female	26	65.0	26	65.0		
Male	14	35.0	14	35.0		
Age					9.1	0.05
20	0	0	1	2.5		
21	15	37.5	5	12.5		
22	17	42.5	17	42.5		
23	7	17.5	12	30		
24	1	2.5	5	12.5		
Mean ± SD	21.8±0.8		22.3±0.95			
Academic level					0.0	1.0
Second	40	100.0	40	100.0		

Table (2): Comparisons between Knowledge and Competency Mean Scores Among the Study Participant Groups (N=80).

Scores	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Knowledge	4.17	0.84	2.87	0.60	6.898	0.000*
Competency	0.85	0.36	0.35	0.48	4.564	0.000*

*Significant at p-value<0.05

Table (3): Comparisons between Mean Scores of Intrinsic Motivation Inventory among the Study Participant Groups (n=80).

Intrinsic motivation Inventory	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Interest/Enjoyment	31.35	2.39	20.13	2.04	19.558	0.000*
Perceived Competence	27.65	1.59	18.33	2.89	15.476	0.000*
Effort	12.78	1.23	19.40	1.08	22.152	0.000*
Pressure/Tension	7.55	1.32	20.25	1.30	37.546	0.000*
Perceived Choice	28.30	1.71	11.23	1.33	43.159	0.000*
Value/Usefulness	34.55	1.15	34.00	1.60	1.529	0.132
Relatedness	30.90	1.26	24.85	1.92	14.429	0.000*

*Significant at p-value<0.05

Table (4): Comparison between Task Evaluation mean scores among the study participant groups (n=80).

Task evaluation	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Interest/Enjoyment	32.70	1.64	22.78	2.21	19.743	0.000*
Perceived Competence	23.32	1.28	12.52	1.72	27.590	0.000*
Perceived Choice	16.23	1.82	10.28	1.34	14.420	0.000*
Pressure/Tension	7.08	1.49	20.03	1.64	32.011	0.000*

*Significant at p-value<0.05

Table (5): Comparison between Text material mean scores among the study participant groups (n=80).

Text material	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Interest/Enjoyment	23.83	0.98	12.95	2.61	21.375	0.000*
Perceived Competence	9.35	0.89	4.33	0.62	25.349	0.000*
Pressure/Tension	2.60	0.87	6.90	1.01	17.668	0.000*

*Significant at p-value<0.05

Table (6): Comparison between Activity perception mean scores among the study participant groups (n=80).

Activity perception	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Interest/Enjoyment	38.60	1.03	21.48	2.80	31.430	0.000*
Value/Usefulness	41.30	2.03	32.40	2.61	14.743	0.000*
Perceived Choice	27.50	1.66	23.35	1.39	10.499	0.000*

*Significant at p-value<0.05

Table (7): Comparison between Subject impressions mean scores among the study participant groups (n=80).

Subject impressions	VR Group		Traditional Group		t	p
	Mean	SD	Mean	SD		
Relatedness	38.25	1.64	37.65	2.30	1.163	0.249
Interest/Enjoyment	33.18	2.18	32.10	2.74	1.689	0.097
Perceived Choice	17.55	1.13	17.75	1.01	0.723	0.473
Pressure/Tension	5.88	0.99	6.30	1.24	1.450	0.153
Effort	7.08	1.49	20.03	1.64	32.011	0.000*

*Significant at p-value<0.05

Table (8): Correlation between Selected Variables scores among the study participant groups (n=80).

Variables	Age		Knowledge		Competency		Motivation	
	r	p	r	p	r	p	r	p
Age	1							
Knowledge	-0.23	0.03*	1					
Competency	-0.09	0.39	0.41	0.00*	1			
Motivation	-0.22	0.04*	0.61	0.00*	0.49	0.00*	1	

***Significant a**t p-value<0.05

Discussion

This study aimed to investigate the effects of virtual reality training on heart and lung assessment for nursing students' learning motivation and competency. The findings revealed a statistically significant difference in average students' knowledge scores and practice scores between the VR group and the traditional group after applying the two interventions. First, the knowledge of heart-lung nursing assessment in the experimental group, to whom the heart-lung nursing assessment VR simulation program was applied, and the control group was significantly different based on the time point.

This suggests that the heart-lung nursing assessment VR simulation program has effectively enhanced learning outcomes in students. This may relate to participants' experienced simulation training, with most having received it through an in-person format. They reported being satisfied with the simulation training as it allowed them to experience nursing indirectly and reflect on how they would cope in certain situations. This result was consistent with that of a previous study, which reported that Brown et al. provided a VR program to advanced practice nurse students, who reported that the VR learning experience satisfied their educational needs, which is consistent with the results of our study. In the same stream, a study by **Chan et, al (2021)** entitled Virtual Reality Teaching in Chemotherapy Administration: Randomized Controlled Trial; reported that the knowledge of the experimental group was higher than that of the control group after educational materials using VR related to chemotherapy administration was provided to nursing students in Taiwan.

This finding was also inconsistent with **Stepan et al (2017)** who studied Immersive virtual reality as a teaching tool for neuroanatomy, in San Diego, which reported that there was no significant difference in knowledge scores between the intervention group, who received VR simulation, and the control group who studied with textbook data in neuroanatomy education for medical students. Nevertheless, considering earlier study findings that VR instruction was successful in imparting procedural information to students when repeated self-directed learning and an intermediate degree of learning immersion were offered, more learning sessions are required to confirm the program's effectiveness in further studies.

The present study adds to existing evidence that VR-based heart-lung simulation training has positive, useful effects on nursing students' practical education. Considering the various advantages of simulation education using VR, it is necessary to make efforts to implement a realistic teaching and learning environment when designing education. This result was consistent with **Salameh et al (2021),** study on "Knowledge, Perceptions, and Prevention Practices among Palestinian University Students during the COVID-19 Pandemic: A Questionnaire-Based Survey" from different Palestinian universities; that of a previous study wherein it was discovered that students' clinical decision-making significantly improved, coupled with their critical thinking, observing, the ability to interpret, reflect, and reply

The findings favored the Intrinsic Motivation Inventory of VR and traditional groups, over reverse learning, highlighting its efficacy in enhancing students' intrinsic motivation Inventory, including interest and enjoyment, perceived competency, Effort, pressure, and tension; perceived choices; value and usefulness; and finally, relatedness. the present study. Consistent with this finding When **Zaragoza-García et al. (2021),** who done a study a quasi-experimental study "Virtual Simulation for Last-Year Nursing Graduate Students in Times of Covid-19", at the University Complutense of Madrid, used VR with nursing students in their senior year, they noticed an increase in self-confidence and satisfaction among those participants. **Moreover, Son (2020),** who studied the Effects of S-PBL in maternity nursing clinical practicum on learning attitudes, in College Students' Mental Health in the United States; metacognition, and critical thinking in nursing students, the researcher reported that learning using AR has positive effects on learning immersion, interest, and attitudes.

In line with these outcomes, **Salem and Cabaldo (2021)** explored the impact of using a moderate-fidelity mannequin versus a peer-simulated patient on nursing students' experiences and competency levels in lung and cardiovascular assessments at the Faculty of Nursing, Cairo University. Their study revealed no significant difference in competency levels between the two simulation approaches, suggesting that both methods are equally effective in supporting skill acquisition in health assessment. further supporting the notion that different learning environments can yield similar positive outcomes in nursing education.

Regarding Task evaluation of VR and traditional groups, the present study finds that there was a high statistically significant difference in interest and enjoyment, perceived competency, pressure, and tension. This was in line with the findings of an earlier study by **Lange et al. (2020)** on learning with virtual reality in nursing education, which found that using VR boosted students' motivation to learn;

on Germany, to provide education more effectively, we advise using learning resources and techniques that, when used with medical-surgical nursing simulation instruction, can improve learning immersion. Additionally, this finding was consistent with a study done by **Turrise et al (2020),** a study titled "Virtual Simulation: Comparing Critical Thinking and Satisfaction in RN-BSN Students", conducted on 27 RN-BSN nursing students in the United States, where the satisfaction of the experimental group was higher than that of the control group.

Furthermore, it aligned with a different study, by **Chan et al (2021)** that used a VR chemotherapy-integrated nursing education curriculum based utilizing a mobile head-mounted display that was done in China and found that the intervention and control groups' levels of practice satisfaction differed significantly. This might be the case because the educational program created for this study considered the participants' learning requirements and attempted to optimize the educational components by implementing clinical scenarios and scenarios with both clinical and educational validity in a realistic manner.

Concerning text material of VR and traditional groups, the present study finds that there was a high statistically significant difference in interest and enjoyment, perceived competency, pressure, and tension. This finding may be due to all participants reporting the need for VR-based simulation programs relating to respiratory and cardiac system assessment. In terms of essential educational content, the participants mentioned the need for detailed content regarding the respiratory and cardiac systems. According to Kolb's experiential learning theory (2022), Learning is accomplished through active exploration, comprehension of abstract ideas, reflecting observations, and particular concrete experiences. Simulation training is a great teaching tool that can enhance nursing students' learning experiences and is a good illustration of Kolb's theory. **Additionally, Lim et al (2021)** study "The Effect of Virtual Reality Simulation Education on Nursing Process Competency" in China; stated that students must receive frequent, comprehensive practice using VR-based simulation training to improve their performance on nursing duties. virtual reality (VR) simulation training before actual clinical practice. As a result, creating programs with thorough instructional content and a thoughtful design that takes student safety and learning objectives into account is crucial.

As regards activity perception of VR and traditional groups, there was a high statistically significant difference in interest and enjoyment, value, and usefulness, and perceived choices. This is consistent with the study by **Park and Lee (2020)** study titled "Domestic Trends in Research on Education Using Augmented Reality" in China, which stated that VR-based learning materials can be divided into four categories: communicational, cooperative, experiential, and practical. Cooperative forms, in which multiple students collaborate to complete an assignment, could be used. In nursing education, hands-on training. In addition, **Brown et al (2023)** Curricular integration of virtual reality in nursing education at Johns Hopkins University, reported that virtual reality-based learning experiences, which allow for complete immersion of the student, may be a novel approach to delivering interesting nursing education and be a successful learning approach for students who are accustomed to digital settings.

Subject impressions of VR and traditional groups, the study findings were high statistically significant difference in relatedness, interest/enjoyment, perceived choice, pressure/tension, and effort. This may be related to academic motivation and self-efficacy are essential components in solidifying learning outcomes and enhancing the quality of education. In line with the study findings of **Haghgou et al. (2013)** study on "Comparison of the effect of WebQuest and lecture on students' learning of electrocardiogram interpretation" done at Shiraz University, which contrasts the lecture approach with the online Q&A method on the consolidation and motivation, of revealed that the web-based question-and-answer strategy improves learning motivation and consolidation in nursing students learning ECG interpretation, which is consistent with the results of the current study. Their study assessed knowledge consolidation levels as weak, moderate, and outstanding and highlighted motivation as an effective factor in doing so. The observation of

the intervention's beneficial impact on improving learning and associated elements like medical students' motivation and self-efficacy unites the two investigations.

Finally, the present study suggests the necessity of hybrid education utilizing partial models in the case of medical-surgical nursing skills that necessitate a VR-based simulation training program. When creating essential nursing abilities for simulation programs, the usage of partial models will be even more beneficial.

Limitations the study

The data were collected from a small sample of medical-surgical students, which may limit the generalizability of the results. To strengthen the findings, the study should be repeated with a larger group of participants. Additionally, future research should include both quantitative and qualitative data from clinical instructors, who are responsible for teaching nursing students in clinical settings.

Implications for the future:

Implications for how VR-based simulation training for nursing students in the treatment of adult respiratory patients will evolve in the future. To begin, educational programs must be carefully planned. Diversifying educational subjects and learners is necessary, according to earlier educational research employing VR. It was suggested that programs be thoughtfully and comprehensively constructed to satisfy the demands of students. Programs that incorporate specifics, correct methodologies, settings, and content will be required, as numerous studies have noted the constraints of precise, integrated design and implementation.

Conclusion

This study offers information to help create VR-based simulation training for nursing students about heart and lung assessment and provides students with skills to improve cardiac-respiratory patient care. It will be significant given the participants' educational backgrounds and requirements to create thorough and adaptable simulation systems that offer a learning environment that closely mimics actual clinical scenarios. Incorporating a realistic clinical setting and carefully considering learner safety is essential when creating a virtual reality simulation education program for nursing students.

Recommendations:

This research, focusing on the impact of virtual reality (VR) training on nursing students' motivation and competency in heart and lung assessment, presents an appreciated contribution to the field of nursing education. Given the increasing challenges in providing effective clinical training, particularly in specialized areas like cardiopulmonary assessment, the use of innovative technologies such as VR has considerable promise.

Based on the findings of this research, it is strongly recommended that the following be implemented:

- Integration of VR into Nursing Curricula**:** Nursing education programs would consider integrating VR-based simulation training into their curricula for heart and lung assessment. The immersive and interactive nature of VR can enhance student engagement and improve skill acquisition.
- Further Development of VR Training Modules**:** Developers and educators would collaborate to design VR training modules that are tailored to specific learning objectives and competency standards.
- Investigate Diverse VR Applications: This study focused on heart and lung assessment, but VR has the potential to enhance training in a wide range of nursing skills. Further research should explore the application of VR in other areas, such as medication administration, wound care, and emergency response.

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