

VIRTUAL NURSING DIAGNOSIS AS AN E-MOBILE LEARNING STRATEGY TO IMPROVE MEDICAL-SURGICAL NURSING COMPETENCY EXAMINATION OUTCOMES

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ABSTRACT

Medical-Surgical Nursing is a core competency in nursing education that is directly related to mastery of clinical reasoning, the nursing process, and case-based decision-making. Student competency test performance still faces challenges, particularly in clinical vignette-based questions that require accuracy in identifying data, establishing nursing diagnoses, and prioritizing interventions. The integration of Virtual Nursing Diagnosis based on e-mobile learning has the potential to be a learning innovation that supports strengthening students' understanding of nursing diagnoses and preparing them for the Medical-Surgical Nursing competency test. This study aimed to analyze the effect of Virtual Nursing Diagnosis as an Augmented Reality-based e-mobile learning strategy on Medical-Surgical Nursing competency examination outcomes among Diploma III nursing students. This quasi-experimental study involved 80 final-year Diploma III nursing students selected using purposive sampling, consisting of 40 students in the intervention group and 40 students in the control group. The intervention group received Virtual Nursing Diagnosis using Augmented Reality-based e-mobile learning via smartphone, while the control group received intensive conventional learning. The instrument used was a 20-question Medical-Surgical Nursing competency exam, then the data were analyzed using the Mann-Whitney test. The intervention group achieved higher post-test scores than the control group, with median scores of 85.00 and 60.00, respectively. The Mann-Whitney test showed a significant difference between the two groups with a p-value of 0.000 (<0.05) and an effect size of 0.84. Virtual Nursing Diagnosis as an Augmented Reality-based e-mobile learning strategy effectively improved students' Medical-Surgical Nursing competency examination outcomes.

Keywords: Augmented Reality; Competency Examination; E-Mobile Learning; Medical-Surgical Nursing; Virtual Nursing Diagnosis.

Introduction

Nursing competency is a key prerequisite for ensuring patient safety, quality of care, and accountability in nursing practice. Nurses are not only required to be able to perform technical procedures, but also must possess the skills of assessment, clinical reasoning, problem prioritization, decision-making, therapeutic communication, and the provision of evidence-based care. The WHO emphasizes that strengthening the education, employment, leadership, and capacity of nursing personnel is a crucial strategy for strengthening health systems and achieving universal health coverage. The latest WHO report also places nursing educational capacity as a key indicator in strengthening the global health workforce (WHO, 2025). Improving the competency of prospective nurses during their education is a strategic issue because nursing graduates will be directly exposed to complex patient conditions, requiring rapid, accurate, and safe clinical decisions. Medical-Surgical Nursing is one of the core competency areas in Diploma III Nursing education in Indonesia. The Diploma III Nursing curriculum developed by AIPViKI emphasizes the importance of curriculum

updates in accordance with developments in nursing science and technology, educational regulations, and the arrangement of Indonesian nursing competencies based on the Indonesian National Qualifications Framework level 5 (AIPViKI, 2018). The Medical-Surgical Nursing course requires students to understand nursing care for adult patients with various body system disorders, such as oxygenation disorders, fluid and electrolytes, nutrition, elimination, safety and comfort, mobilization, bed rest, perioperative conditions, terminal conditions, and emergencies. This area also requires students' abilities in conducting assessments, formulating nursing diagnoses, developing action plans, implementing interventions, evaluating outcomes, and documenting care systematically.

Student achievement in competency testing remains a challenge for a number of nursing educational institutions. The national competency test serves as a quality assurance instrument for graduates because its results are related to the fulfillment of competency standards and the graduates' readiness to enter professional practice. Kusuma's (2023) study showed that the change in the competency testing model to an exit exam system impacted the dynamics of the graduation achievements of Diploma III Nursing students in Indonesia. Huzaifah et al. (2023) study also showed that the briefing method can improve the competency test scores of Diploma III Nursing students, although the study design was still limited to a single pre-test and post-test group. The issue of competency test achievement is not simply understood as a matter of exam readiness, but also related to the quality of learning, conceptual understanding, case analysis skills, and students' accuracy in applying the nursing process.

Students' difficulty answering case-based questions is a significant issue in competency tests, particularly in Medical-Surgical Nursing. Competency test questions not only measure theoretical recall but also require students to read clinical vignettes, recognize critical data, interpret patient conditions, prioritize problems, select appropriate nursing diagnoses, and determine the most appropriate interventions. The NCSBN Clinical Judgment Measurement Model framework explains that modern nursing exams measure clinical judgment and decision-making through the process of recognizing clinical cues, analyzing data, prioritizing hypotheses, generating solutions, taking action, and evaluating outcomes (National Council of State Boards of Nursing, 2023). This principle is relevant to explaining nursing students' challenges in answering case-based competency questions, particularly when they must quickly connect clinical data, nursing diagnoses, and intervention decisions.

Mastery of nursing diagnosis plays a crucial role in students' success in answering competency test case questions. A nursing diagnosis is the result of clinical reasoning based on assessment data and serves as the basis for determining appropriate nursing interventions. The nursing process consists of five main stages: assessment, diagnosis, planning, implementation, and evaluation. Therefore, errors in the diagnosis stage can impact the accuracy of intervention planning and implementation (Toney-Butler & Thayer, 2023). Research by Park (2022) shows that analyzing nursing diagnoses determined by students can illustrate their ability to understand patient problems and apply the nursing process. The ability to accurately establish nursing diagnoses is not only crucial for clinical practice but also serves as a key cognitive competency in answering case-based competency test questions.

Virtual Nursing Diagnosis can be positioned as a learning innovation that integrates mobile learning, clinical case studies, and strengthening nursing diagnostic reasoning through

Augmented Reality technology. This model differs from conventional learning, which generally focuses on lectures, class discussions, and limited practice exercises. Virtual Nursing Diagnosis is designed to help students learn the diagnostic process through virtual medical-surgical cases. Students can be guided to identify subjective and objective data, differentiate major and minor signs, select an appropriate nursing diagnosis, understand the relationship between the diagnosis and the patient's clinical condition, and determine intervention priorities. Development research by Bustami et al. (2023) has introduced Virtual Nursing Diagnosis (VND) as a mobile learning medium for Medical-Surgical Nursing courses. The medium was developed to provide an interactive, practical, and easily accessible learning resource for students. Evidence for the development of this medium still needs to be strengthened through intervention research that tests its effectiveness on competency test outcomes.

While various previous studies have demonstrated the significant contribution of mobile and virtual learning to improving the quality of nursing education, several aspects require further study. First, studies on mobile and virtual learning in nursing education have focused more on improving knowledge, skills, and satisfaction, while evidence specifically measuring their impact on mock competency examination results or competency test tryouts remains limited. Second, several Indonesian studies on competency test preparation and UKOM training applications still use a single-group pre-test and post-test design, thus not providing a strong comparison between the intervention and control groups. Third, research on Virtual Nursing Diagnosis is still predominantly at the media development stage, while testing its effectiveness as a learning strategy on Medical-Surgical Nursing competency test outcomes has not been conducted.

This study aims to analyze the effect of implementing Virtual Nursing Diagnosis as an E-Mobile Learning Strategy on the results of the Medical-Surgical Nursing competency test tryout in nursing students. The main focus of the study is directed at comparing the achievement of competency test results between the intervention group that received learning using Virtual Nursing Diagnosis and the control group that received conventional learning. This study is expected to provide an empirical contribution to the development of digital learning strategies based on nursing diagnosis, while strengthening the readiness of Diploma III Nursing students in facing case-based competency tests.

Research Method

This study is a quantitative study with a quasi-experimental design using a non-equivalent control group to assess the differences in the results of the Medical-Surgical Nursing competency test between the intervention group and the control group. The sampling technique used purposive sampling, namely final-year students in the Diploma III Nursing Study Program of Poltekkes Kemenkes Aceh who had been determined as research subjects. The research sample consisted of 80 students, consisting of 40 students from the Diploma III Nursing Study Program in Banda Aceh as the intervention group and 40 students from the Diploma III Nursing Study Program in Meulaboh as the control group.

The intervention group received technical guidance on Medical-Surgical Nursing in preparation for the competency test through Virtual Nursing Diagnosis based on Augmented Reality technology in the form of e-mobile learning accessed using a smartphone, while the

control group received intensive conventional learning. The research instrument consisted of 20 Medical-Surgical Nursing competency test questions with a 20-minute duration, and the research was conducted from February 9 to 12, 2026. The results of the normality test showed that the data were not normally distributed, so the analysis of differences in post-test scores between groups was carried out using the Mann-Whitney test.

Result

A. Univariate Analysis

Table 1. Demographic Characteristics of Respondents

Characteristics	Category	f	%
Study group	Control group	40	50
	Intervention group	40	50
Gender	Male	9	11,3
	Female	71	88,8
Age, years	19	2	2,5
	20	59	73,8
	21	14	17,5
	22	5	6,3
Total		80	100

Table 1 shows that this study involved 80 Diploma III nursing students from Poltekkes Kemenkes Aceh, primarily final year students, consisting of 40 students in the control group and 40 students in the intervention group. Most of the respondents were female, totaling 71 students (88.8%), while male respondents numbered 9 students (11.3%). The majority of respondents were 20 years old, with 59 students (73.8%), followed by 21 years old with 14 students (17.5%), 22 years old with 5 students (6.3%), and 19 years old with 2 students (2.5%).

Table 2. Comparison of Medical-Surgical Nursing Competency Examination Scores between Groups

Variable	Control Group (n=40)	Intervention Group (n=40)
Pre-test score		
Median (Min-Max)	60 (20–75)	70 (50–85)
Post-test score		
Median (Min-Max)	60 (30–75)	85 (65–100)
Mean $\pm$ SD pre-test	55,88 $\pm$ 14,93	68,63 $\pm$ 9,74
Mean $\pm$ SD post-test	60,50 $\pm$ 9,92	82,88 $\pm$ 5,98

Table 2 explains that the post-test score in the intervention group was higher than in the control group. The intervention group showed a median post-test score of 85.00, with scores ranging from 65 to 100, while the control group showed a median post- test score of 60.00, with scores ranging from 30 to 75. Descriptively, the mean score in the intervention group increased from

68.63 ± 9.74 in the pre-test to 82.88 ± 5.98 in the post-test, while in the control group it increased from 55.88 ± 14.93 to 60.50 ± 9.92.

B. Bivariate Analysis

Table 3. Bivariate Analysis of Post-Test Medical-Surgical Nursing Competency Examination Scores (n=80)

Group	Median (mean- max)	Mean rank	p- value	Effect Size (r)
Control	60 (30-75)	21,09	0,00	0,84
Intervention	85 (65-100)	59,91		

Table 3 explains that the results of the Mann-Whitney U Test showed a significant difference in the post-test Medical-Surgical Nursing competency exam scores between the control and intervention groups. The intervention group had a higher median score than the control group, with median scores of 85.00 and 60.00, respectively. The mean rating was also higher in the intervention group than the control group, indicating better post-test performance among students who received Virtual Nursing Diagnosis-based e-mobile learning. The difference was statistically significant, with a p-value <0.05, and a large effect size (r = 0.84), indicating a strong practical effect of the Virtual Nursing Diagnosis-based e-mobile learning intervention on students' competency examination outcomes.

Discussion

Bivariate analysis results showed that the post-test scores for the Medical-Surgical Nursing UKOM in the intervention group were higher than those in the control group, with a p-value <0.05 and an effect size of r = 0.84. This value indicates that the difference between groups is not only statistically significant but also has a significant practical impact. This finding indicates that the use of Virtual Nursing Diagnosis based on e-mobile learning and Augmented Reality can strengthen students' readiness to answer case-based UKOM questions. This is important because nursing competency questions not only assess conceptual mastery but also require students' abilities to analyze clinical data, understand disease pathophysiology, establish nursing diagnoses, and prioritize interventions. The advantage of Virtual Nursing Diagnosis in this study lies in its ability to help students learn the relationships between disease pathophysiology, the underlying causes of signs and symptoms, and potential nursing problems. Augmented Reality technology allows students to gain a more visual and contextual learning experience, enabling abstract clinical concepts to be understood through more concrete representations. The learning feature, which provides live disease material, also makes it easier for students to access clinical information when studying Medical-Surgical Nursing cases. Furthermore, the availability of a collection of nursing diagnoses and their explanations, which refer to the Indonesian Nursing Diagnosis Standards, supports students in recognizing the characteristics, causal factors, and diagnostic indicators more systematically (PPNI, 2017).

The findings of this study align with the NCSBN Clinical Judgment Measurement Model, which emphasizes that clinical skills in nursing exams include recognizing clinical cues, analyzing data, prioritizing problems, taking action, and evaluating outcomes (NCSBN, 2023). Virtual Nursing

Diagnosis supports this process because students are trained to connect subjective and objective data with appropriate nursing diagnoses, thus enhancing the diagnostic thinking process. These results are also consistent with meta-analyses by Kim and Park (2019) and Chen et al. (2021), which showed that mobile learning effectively improves nursing students' knowledge, skills, confidence, and clinical learning outcomes. This study expands on the previous study by Bustami et al. (2023), who developed Virtual Nursing Diagnosis media for Medical-Surgical Nursing courses, by examining its impact on UKOM outcomes through a two-group design and bivariate analysis.

Conclusion and Suggestion

The implementation of Virtual Nursing Diagnosis as an Augmented Reality-based e-mobile learning strategy significantly improved students' Medical-Surgical Nursing competency exam results, as demonstrated by higher post-test scores in the intervention group compared to the control group and a large effect size. These findings suggest that integrating disease pathophysiology visualization, direct access to disease-related learning materials, and standard nursing diagnosis content based on SDKI PPNI can strengthen students' diagnostic reasoning and readiness to answer case-based competency exam questions. Future studies are recommended to involve a broader sample from institutions across Indonesia, a longer intervention period, and additional outcome measures such as learning motivation and user satisfaction levels.

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