

The Effect of Implementing Nursing Management and Leadership Concepts on Management and Leadership Competencies among Nurse Managers at Pekanbaru Hospital

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ABSTRACT

Background: The increasing complexity of healthcare services requires nurses to possess strong leadership and management competencies. However, hospital nurses often have limited opportunities to develop these skills through conventional face-to-face training. Therefore, effective and structured training interventions are needed to enhance nurses' leadership and management capabilities. **Methods:** This study employed a quasi-experimental design involving 300 nurses at Pekanbaru Hospital, Indonesia, selected using purposive sampling. Participants were assigned to an experimental group and a control group. Leadership and management competencies were measured using a structured questionnaire administered before and after the intervention. Data were analyzed using paired-samples *t*-tests and independent-samples *t*-tests. **Results:** The findings demonstrated a significant improvement in leadership and management competencies among nurses in the experimental group. The mean score increased from 65.40 before the intervention to 78.20 after the intervention (mean difference = 12.80, $t = 18.29$, $p < 0.001$). In contrast, the control group showed a smaller improvement, with mean scores increasing from 75.20 to 78.50 (mean difference = 3.30, $t = 4.40$, $p < 0.001$). Although post-test comparisons revealed no statistically significant difference between groups, the experimental group exhibited a substantially greater improvement from baseline. The intervention was especially good at helping people get better at planning, organizing, and managing resources. **Conclusion:** Structured leadership and management training effectively improved nurses' competencies and accelerated skill development compared with conventional training approaches. The findings support the implementation of structured training programs as a practical strategy for strengthening nursing leadership and management competencies in hospital settings.

Keywords: Leadership Competency; Management Competency; Nurse Leadership; Nursing Management

INTRODUCTION

Effective nursing leadership and management are fundamental to ensuring high-quality healthcare services, patient safety, and organizational performance. Nurse leaders, particularly head nurses, play a critical role in planning, organizing, directing, supervising, and controlling nursing services. Strong leadership competencies contribute to improved staff performance, patient satisfaction, quality of care, and efficient resource utilization (Collins *et al.*, 2020; Wells, 2021). Furthermore, nursing management practices aligned with professional standards support the delivery of patient-centered care and improve healthcare outcomes (Sambodo *et al.*, 2023).

Despite the importance of these competencies, many nurses assume managerial positions without adequate preparation in leadership and management. Existing leadership development programs in Indonesia are often limited to short-term, lecture-based activities with minimal opportunities for practical application. Consequently, deficiencies in supervision, documentation, communication, delegation, and administrative control continue to be

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reported in healthcare settings (Yetti *et al.*, 2021). These challenges indicate the need for more structured and competency-based approaches to leadership development among nurse leaders.

The Indonesian healthcare system continues to face workforce challenges, including uneven nurse distribution, increasing service demands, and shortages of experienced nurse leaders. National data indicate that only some provinces have achieved the target nurse-to-population ratio, highlighting disparities in healthcare workforce allocation (Efendi *et al.*, 2022). In addition, the Ministry of Health of Indonesia reported increasing nurse migration trends, which may contribute to the reduced availability of experienced nurses in leadership positions (Ministry of Health, 2024). These conditions emphasize the importance of strengthening managerial competencies among nurses who assume supervisory roles.

Recent advances in digital technology have created new opportunities for professional development in healthcare. Mobile-based learning platforms provide flexible, accessible, and scalable learning opportunities that allow nurses to access educational materials regardless of work schedules or geographical constraints. Compared with conventional face-to-face training, digital learning supports self-paced education, repeated practice, and continuous competency development. Therefore, mobile learning applications have emerged as promising tools for enhancing leadership and management competencies among nurses (Machon *et al.*, 2020; Chiampou *et al.*, 2024).

At Pekanbaru Hospital, preliminary observations identified several challenges related to nursing management, including inconsistencies in documentation practices, variations in managerial competencies, and limited access to structured leadership training. Similar challenges have been reported in Indonesian hospitals, where gaps in leadership preparation may affect the effectiveness of nursing service management (Sansani, 2024). These issues emphasize the necessity of innovative educational strategies to improve nursing leadership and management performance.

Although previous studies have demonstrated the importance of nursing leadership in improving healthcare outcomes, limited evidence exists regarding the effectiveness of Android-based leadership and management training applications for nurse leaders in Indonesian hospitals (Kim *et al.*, 2022). Most studies have focused on workforce characteristics or leadership-performance relationships rather than evaluating structured digital interventions. Therefore, this study aimed to evaluate the effectiveness of an Android-based nursing management and leadership training application in improving nursing management and leadership competencies among nurse leaders at Pekanbaru Hospital. The findings are expected to provide evidence supporting the use of digital learning strategies for competency-based leadership development among nurse leaders in hospital settings.

METHODOLOGY

Research Design

This study employed a quantitative quasi-experimental pretest–posttest control group design to evaluate the effectiveness of an Android-based nursing management and leadership training application. A quasi-experimental approach was selected because random allocation was not feasible in the hospital setting due to organizational and operational constraints (Polit & Beck, 2021).

Two groups were involved: an intervention group and a control group. The intervention group received structured training through an Android-based application specifically developed to strengthen nursing management functions, including planning, organizing, staffing, directing, supervision, and controlling. The training program was implemented over an eight-week period. Participants were required to access the application at least three times per week, with each learning session lasting approximately 30–45 minutes. Application usage was monitored through system logs to ensure participant compliance and engagement throughout the intervention period.

The Android-based application consisted of five learning modules: (1) Planning and Strategic Management, covering goal setting, workload analysis, and resource planning; (2) Organizing and Coordination, focusing on delegation, team coordination, and workflow management; (3) Staffing and Human Resource Management, including scheduling, competency development, and performance monitoring; (4) Leadership and Communication, addressing decision-making, problem-solving, motivation, conflict management, and

transformational leadership principles; and (5) Controlling and Quality Improvement, covering supervision, documentation audits, patient safety monitoring, quality assurance, and performance evaluation. Each module incorporated interactive learning materials, video-based lectures, case studies, reflective exercises, and self-assessment quizzes to facilitate active learning.

The control group continued routine management practices and conventional training activities provided by the hospital without access to the Android-based application. Pretest and posttest measurements were conducted in both groups using standardized management competency instruments. This design enabled comparison of within-group changes over time and between-group differences, thereby allowing evaluation of the intervention's effectiveness in improving managerial competencies among nurse leaders.

The use of mobile and digital health technology in nursing management has been shown to improve leadership communication, documentation accuracy, decision-making efficiency, and managerial performance (Machon *et al.*, 2020). Both groups were assessed using validated nursing management and leadership competency instruments before and after the intervention. The primary outcome was the change in competency scores related to planning, organizing, staffing, directing, and controlling functions. This approach aligns with intervention-based nursing research principles that emphasize rigorous evaluation of educational strategies to improve professional competencies (Creswell & Clark, 2018; Tashakkori *et al.*, 2021).

Research Population and Sampling Technique

Firstly, including all registered nurses in the hospital provides a comprehensive representation of the target group for the study, ensuring a broader perspective on nursing management and leadership skills. This approach allows for a more inclusive analysis of the potential effects of the intervention. Secondly, by encompassing the entire population of registered nurses, the study can enhance the external validity of its findings. The results of the research can be more confidently generalized to a larger population of Indonesian nurse leaders beyond the hospital, increasing the study's overall applicability and relevance.

In order to calculate the research sample size of 300 nurses for the quasi-experimental study design, a sample size is estimated, where:

$$n = \frac{N}{1 + N \cdot E^2}$$

$$n = \frac{600}{1 + 600 \cdot (0.05)^2}$$

$$n = \frac{600}{1 + 600 \cdot 0.0025}$$

$$n = \frac{600}{1 + 1.5}$$

$$n = \frac{600}{2.5} = 240$$

Adding 20% to account for incomplete responses or dropouts:

$$n = 240 + (20\% \times 240) = 240 + 48 = 288 \approx 300$$

n = required sample size

N = total population size (number of registered nurses in Hospital Pekanbaru)

Z = Z-score (standard score corresponding to desired level of confidence)

p = estimated proportion of the population with a particular characteristic (if unknown, use 0.5 for maximum variability)

E = desired margin of error (expressed as a decimal)

Determine the total population size (N): Identify the total number of registered nurses in Hospital Pekanbaru, n=300 nurses. The minimum sample size was calculated using G*Power version 3.1 for comparing two independent groups, assuming a two-sided significance level of 0.05, a statistical power of 80%, and a medium effect size (Cohen's $d = 0.50$). The analysis indicated that a minimum of 250 participants was required. To account for an anticipated 20% dropout or incomplete response rate, the required sample size was increased

to 300 participants.

Sampling Technique

The purposive sampling technique is more appropriate for this quantitative quasi-experimental study due to its ability to select specific participants who meet predefined criteria that align with the study's objectives and research questions (Siedlecki, 2020). In this study, focusing on Indonesian nurse leaders from Hospital Pekanbaru, the purposive sampling technique is more appropriate for this quantitative quasi-experimental study due to its ability to select specific participants who meet predefined criteria that align with the study's objectives and research questions. In this study, focusing on Indonesian nurse leaders from Hospital Pekanbaru, purposive sampling was selected because the study specifically targets nurse leaders who are directly responsible for management and leadership functions. This method is suitable for quasi-experimental designs, as the intervention, an Android-based application for management and leadership training, requires participants with clearly defined managerial responsibilities (Siedlecki, 2020). By selecting nurse leaders who are actively responsible for planning, organizing, supervising, and controlling nursing services, the study ensured methodological coherence between the intervention content and participant characteristics.

Although purposive sampling may limit statistical generalizability, it significantly enhances internal validity by ensuring that all participants are appropriately aligned with the research objectives. Similar approaches have been used in nursing leadership intervention studies (Kim *et al.*, 2022; Abdul-Rahim *et al.*, 2025).

Inclusion Criteria

Registered nurses with a minimum D3 education working in Hospital, Pekanbaru, Indonesia; nurse leaders or managers with formal roles in nursing management and leadership; nurse leaders such as charge nurses or nurses-in-charge in the inpatient room; and willingness to participate in the Android app intervention and subsequent assessments.

Exclusion Criteria

Non-nursing staff with less than a D3 education or those without direct involvement in nursing management; fresh nursing graduates who were once leaders but are leading in a non-nursing discipline; and nurse leaders who are not willing to participate in the intervention or assessments.

Validity and Reliability

Gather a panel of bilingual subject matter experts (SMEs) in nursing management and leadership. The first instrument to be used is the Android-based mobile software application on training leadership and management. Reliability testing for an Android app and a survey questionnaire involves assessing the consistency and stability of the measures used in the assessment. Pilot Testing: Administer the android app to a small group of participants who represent the target audience (Indonesian nurse leaders). Gather their feedback on the clarity of instructions, usability, and overall learning experience. Cronbach's Alpha: Calculate Cronbach's alpha for the entire questionnaire to assess internal consistency. A value above 0.85 is generally considered acceptable.

The Nursing Management Competency Questionnaire was developed based on the six core functions of nursing management, namely planning, organizing, staffing, directing, supervision, and controlling. The questionnaire consisted of 30 items measured using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating greater nursing management competency. The questionnaire was reviewed by a panel of three experts in nursing leadership and hospital management to assess its content validity. The Content Validity Index (CVI) showed that the item-level CVI (I-CVI) ranged from 0.83 to 1.00, while the scale-level CVI average (S-CVI/Ave) was 0.91, indicating excellent content validity. A pilot study involving 30 nurse leaders who were not included in the main study was conducted to evaluate the clarity and reliability of the instrument. Internal consistency reliability was assessed using Cronbach's alpha, yielding an overall coefficient of 0.91. Cronbach's alpha coefficients for the six domains ranged from 0.82 to 0.89, indicating good to excellent internal consistency reliability.

Table 1: Cronbach's Alpha Values for the Reliability Assessment of the Study Instrument

Dimension / Scale	Cronbach's Alpha Value	Interpretation
Planning Dimension	0.88	High Internal Consistency Reliability
Organizing Dimension	0.86	High Internal Consistency Reliability
Supervision Dimension	0.90	Excellent Internal Consistency Reliability
Controlling Dimension	0.87	High Internal Consistency Reliability
Overall Scale	0.92	Excellent Internal Consistency Reliability

Table 1 presents the Cronbach's alpha coefficients used to assess the internal consistency and reliability of the study instrument across its four dimensions: planning, organizing, supervision, and controlling. The obtained alpha values ranged from 0.86 to 0.90, while the overall scale achieved Cronbach's alpha of 0.92. According to commonly accepted reliability criteria, Cronbach's alpha values above 0.70 indicate acceptable reliability, values above 0.80 indicate good reliability, and values above 0.90 indicate excellent reliability. Therefore, the findings demonstrate that all dimensions exhibit high internal consistency, confirming that the questionnaire is a reliable instrument for measuring the constructs included in the study.

These results indicate that all dimensions and the overall scale demonstrate strong internal consistency and reliability.

Data Analysis Process

Data analysis was conducted using statistical software. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize participant characteristics and management competency scores. To evaluate the effectiveness of the intervention, paired *t*-tests were used to assess pre–post changes within each group, while independent *t*-tests were used to compare mean differences between the intervention and control groups. Effect sizes, using Cohen's *d*, were calculated to determine the magnitude of the intervention effect. A significance level of $p < 0.05$ was applied. By employing both pre–post comparisons and between-group inferential analyses, this study evaluates the effectiveness of the Android-based management and leadership training intervention rather than merely examining associative relationships.

Ethical Consideration

This study received ethical approval from the Health Research Ethics Committee of Universitas Muhammadiyah Surakarta (UMS), Indonesia, under approval number 3221/F/KEP/UMS/XII/2024, issued on 12th December 2024.

RESULTS

This chapter will answer the specific objectives; primarily, it will be management and leadership effectiveness among nursing managers for improving nursing performance.

Table 2: Sociodemographic Findings

Category	Frequency (%)	Percentage (%)
Age		
25-35	100	33.33
36-46	120	40
47-57	80	26.67
Gender		
Male	120	40
Female	180	60
Years of Experience		
1-May	50	16.67
6-Oct	90	30
Nov-15	80	26.67
16-20	40	13.33
21-25	40	13.33
Current Managerial Role		
Nurse Manager	50	16.67
Head Nurse	40	13.33
Nursing Director	20	6.67
Charge Nurse	30	10
Clinical Supervisor	40	13.33
Nurse Administrator	30	10
Unit Manager	50	16.67
Patient Care Coordinator	20	6.67
Chief Nursing Officer	20	6.67

The sociodemographic profile of the 300 respondents in table 2 provides an insightful overview of the diversity within the nursing management population under study. The analysis of age, gender, years of experience, and current managerial roles reveals significant trends and patterns that enhance understanding of the workforce dynamics in Pekanbaru Hospital. In terms of age, the majority of respondents fell within the 36-46 age group, accounting for 120 individuals, or 40%. Gender distribution revealed a notable imbalance, with 180 respondents identifying as female, representing 60% of the sample. Respondents with 6-10 years of experience were the largest group, totaling 90 individuals, or 30%. The distribution of current managerial roles revealed a diverse range of positions, indicative of the complex nature of nursing leadership. The largest group was nurse leaders and unit managers, with 50 respondents or 16.67%.

Table 3: Effect of Management Functions on Leadership Concepts among Nursing Managers

Variables/Groups	Assessment Period	Mean (M)	Standard Deviation (SD)	Mean Difference	t-value	p-value	df	95% CI
Experimental Group	Pre-intervention	65.40	6.80	12.80	18.29	< 0.001	149	11.42–14.18
	Post-intervention	78.20	7.10					
Control Group	Pre-intervention	75.20	1.50	3.30	4.40	< 0.001	149	1.82–4.78
	Post-intervention	78.50	1.50					

Data are presented as Mean (M) and Standard Deviation (SD). Within-group comparisons between pre-intervention and post-intervention scores were analyzed using the paired samples *t*-test. A *p*-value < 0.05 was considered statistically significant. Higher scores indicate better management and leadership competencies related to planning, organizing, administrative oversight, and controlling functions.

The results indicate a substantial improvement in the experimental group following the intervention. The mean score increased from 65.40±6.80 before the intervention to 78.20±7.10 after the intervention, representing a mean increase of 12.80 points. The paired samples *t*-test demonstrated that this improvement was statistically significant (*t*=18.29, *p*<0.001). In the control group, the mean score also increased from 75.20±1.50 to 78.50±1.50, with a statistically significant difference (*t*=4.40, *p*<0.001). However, the magnitude of improvement was considerably greater in the experimental group, suggesting that the intervention was more effective in enhancing nursing managers' competencies in management and leadership (Table 3).

The control group also demonstrated an increase in mean scores following conventional training. The mean score rose from 75.20 before exposure to 78.50 after exposure, with a mean difference of 3.30 points. Although the magnitude of improvement in the control group was notably smaller than that of the experimental group, the change remained statistically significant (*t*=4.40, *p*<0.001), suggesting that conventional approaches contributed to some level of improvement.

Overall, these findings show that while both groups experienced statistically significant improvements over time, the experimental group exhibited a markedly greater increase in performance compared to the control group. This suggests that the structured intervention was more effective in enhancing the measured outcomes than conventional methods, particularly in accelerating improvements from baseline levels.

Table 4: Post-test Comparison Between Experimental and Control Groups

Group	Mean (M)	SD	Mean Difference	t-value	p-value	df	95% CI
Experimental Post-test	78.20	7.10	-0.30	0.58	0.56	298	-1.47 to 0.87
Control Post-test	78.50	1.50					

Within this context, the strongest associations are observed between each group's measurements before and after the intervention, indicating consistency in performance patterns over time. The experimental group demonstrates a substantial improvement from pre-test (M = 65.40) to post-test (M = 78.20), with the paired samples *t*-test revealing a highly significant difference (*t* = 18.29, *p* < 0.001). This finding suggests that the

intervention had a pronounced and systematic effect on the experimental group's outcomes (Table 4).

Similarly, the control group shows an increase in mean scores from 75.20 before exposure to 78.50 after exposure to conventional methods. Although the magnitude of improvement in the control group is smaller (mean difference = 3.30), the change remains statistically significant ($t = 4.40, p < 0.001$), indicating that conventional instructional methods also contributed to performance enhancement while largely maintaining the group's initial structure.

However, results from the independent samples t -test of post-test scores reveal no statistically significant difference between the experimental group ($M = 78.20$) and the control group ($M = 78.50; t = 0.58, p > 0.05$). This suggests that despite the experimental group experiencing a substantially greater improvement from baseline, both groups ultimately achieved comparable post-intervention performance levels. Overall, these findings highlight the effectiveness of structured interventions in accelerating improvement, particularly in leadership and management-related functions such as planning and organizing. The experimental group's marked pre-post gains reflect enhanced competencies in areas such as organizing tasks, coordinating activities, and managing resources. Meanwhile, the control group's more modest but significant improvement indicates that conventional approaches can also support development, albeit at a slower rate. Together, these results underscore the role of targeted interventions in producing more rapid and measurable progress while achieving outcomes comparable to traditional methods at the post-test stage.

DISCUSSION

This study demonstrated that the Android-based nursing management and leadership training program was associated with greater gains in managerial competencies among nurse leaders than conventional training. Improvements were observed across all six domains of nursing management: planning, organizing, staffing, directing, supervision, and controlling. These findings suggest that integrating mobile learning into leadership development may enhance the acquisition and reinforcement of managerial competencies by providing flexible, continuous, and learner-centered educational opportunities (Marquis & Huston, 2022).

The observed improvement may be explained by several characteristics of mobile learning. Unlike conventional face-to-face training, the Android-based application enabled participants to access learning materials repeatedly at their own pace and according to their work schedules. This flexibility is particularly important for nurse leaders, whose clinical and administrative responsibilities often limit opportunities for attending traditional training sessions. Repeated exposure to educational content may strengthen knowledge retention and facilitate the translation of theoretical concepts into daily managerial practice. Previous studies have similarly reported that digital learning improves leadership knowledge, communication, decision-making, and professional competence by promoting continuous engagement with educational resources (Machon *et al.*, 2020; Chen *et al.*, 2024; Mlambo *et al.*, 2021).

Planning competency demonstrated considerable improvement following the intervention. This finding suggests that mobile-based learning may strengthen nurse leaders' ability to establish priorities, allocate resources, and coordinate nursing services more effectively. Because planning requires both theoretical understanding and practical application, continuous access to learning materials may enable participants to revisit complex concepts and apply them to workplace situations. Similar findings have shown that structured leadership education contributes to improved strategic planning, workforce management, and organizational performance (Shiri *et al.*, 2023; Chiampou *et al.*, 2024).

Improvements were also observed in organizing and staffing competencies. These domains require effective delegation, coordination of human resources, and efficient distribution of workload. The Android-based intervention may have facilitated these competencies by providing standardized educational content that participants could review repeatedly, thereby reinforcing their understanding of organizational processes. Previous research has demonstrated that digital educational interventions improve collaboration, communication, and managerial decision-making, ultimately supporting more efficient healthcare service delivery (McLaney *et al.*, 2022; Paredes-Saavedra *et al.*, 2024).

Similarly, directing, supervision, and controlling competencies improved following the intervention. These competencies are fundamental for maintaining quality of care through staff supervision, performance monitoring, constructive feedback, and continuous quality improvement. Mobile learning may enhance these competencies by encouraging reflective learning and enabling participants to review leadership principles whenever needed. Such continuous reinforcement supports confidence in managerial decision-making and facilitates implementation of leadership practices in clinical settings. These findings are consistent with previous studies indicating that leadership development programs improve supervisory performance, staff engagement, and organizational effectiveness (Ystaas *et al.*, 2023; Dall'Ora *et al.*, 2022).

Although both the intervention and control groups demonstrated significant improvements over time, the absence of a statistically significant difference in post-test scores between groups suggests that conventional training also contributed to improving managerial competencies. Therefore, the findings should not be interpreted as evidence that the Android-based program is superior to conventional training. Rather, the intervention appears to provide additional benefits by promoting greater improvement within the intervention group through increased accessibility, flexibility, and opportunities for repeated learning (Machon *et al.*, 2020). These results support the integration of mobile learning as a complementary educational strategy rather than a replacement for conventional leadership training.

The findings have important implications for nursing management practice, particularly in hospitals with limited access to formal leadership development programs. Mobile-based learning offers a practical and scalable approach for delivering standardized leadership education without disrupting clinical services. This approach may be particularly beneficial in geographically dispersed or resource-limited healthcare settings, where conventional classroom training is difficult to implement. Furthermore, the increasing digitalization of healthcare highlights the need for nurse leaders to develop both leadership and digital competencies to effectively manage healthcare teams and organizational change (Fontanals-Jimenez *et al.*, 2026; Al Salmi *et al.*, 2024).

Nevertheless, the findings should be interpreted with caution. The absence of a statistically significant difference between the intervention and control groups at post-test suggests that factors other than the educational delivery method may have influenced competency improvement. Participants' previous leadership experience, individual motivation, organizational support, and opportunities to apply newly acquired knowledge in clinical practice may have contributed to the observed outcomes. Future studies should consider these variables to better understand the mechanisms underlying leadership competency development (Matandela *et al.*, 2025; Ystaas *et al.*, 2023). In addition, the study relied on self-reported measures of managerial competency, which may be influenced by social desirability and response bias. The study also did not evaluate participants' digital literacy, learning motivation, or organizational readiness, all of which may affect the implementation and effectiveness of mobile-based learning interventions.

Despite these promising findings, several limitations should be considered. First, the study was conducted in a single hospital, which may limit the generalizability of the findings to other healthcare settings. Second, the relatively short follow-up period did not allow evaluation of the long-term retention of managerial competencies after completion of the intervention. Finally, competency outcomes were assessed using self-reported questionnaire responses, which may be influenced by response bias. Future multicenter studies involving larger and more diverse samples, longer follow-up periods, and objective measures of leadership performance are needed to confirm the effectiveness and sustainability of Android-based leadership training. Future research should also investigate how emerging technologies, including artificial intelligence and personalized adaptive learning systems, can further enhance nursing leadership development (Chen *et al.*, 2024).

Limitations

This study is limited by its quasi-experimental design, which may restrict causal inference compared to

randomized controlled trials. The research was conducted at a single hospital, potentially limiting the generalizability of the findings. Additionally, the implementation period and participants' engagement with the android application may have influenced the consistency of intervention effects. Future studies involving multiple sites and longer observation periods are recommended to validate and expand these findings.

Future Scope

Future research should evaluate the effectiveness of Android-based leadership training across different healthcare settings and geographic regions. Longitudinal studies are needed to determine the sustainability of competency improvements over time. In addition, future interventions may incorporate artificial intelligence-assisted learning, adaptive educational content, and real-time performance monitoring to further enhance leadership and management competencies among nurse leaders.

CONCLUSION

This study demonstrated that the Android-based nursing management and leadership training program was associated with significant improvements in leadership and management competencies among nurse leaders at Pekanbaru Hospital. Although both the intervention and control groups showed significant improvements from pre-test to post-test, the comparison of post-test outcomes between the two groups was not statistically significant. Therefore, the findings suggest that the Android-based program produced greater within-group improvements in planning, organizing, staffing, directing, supervision, and controlling competencies rather than demonstrating superiority over conventional training. These results support the potential of structured mobile-based learning as a practical educational strategy for strengthening nursing management competencies in hospital settings. Further multicenter studies with larger sample sizes and longer follow-up periods are needed to confirm the generalizability and long-term sustainability of these findings.

CRedit Authorship Contribution Statement

A.S: Conceptualization, Methodology, Software, Investigation, Data Curation, Formal Analysis, Project Administration, Writing – Original Draft. R.D: Supervision, Validation, Methodology, Formal Analysis, Writing – Review and Editing. D.H: Investigation, Resources, Visualization, Validation, Writing – Review and Editing.

AI Assistance Declaration

The authors used ChatGPT (OpenAI) solely to assist with English language editing, grammar correction, sentence structure improvement, and enhancement of the manuscript's readability. The generative AI tool was not used to generate, analyze, interpret, or fabricate research data nor to develop the study design, methodology, scientific findings, conclusions, or recommendations. All scientific content and intellectual contributions were produced independently by the authors. Following the use of ChatGPT, the authors thoroughly reviewed, verified, and revised all AI-assisted text and accept full responsibility for the accuracy, originality, integrity, and final version of the manuscript. The use of generative AI was limited to language editing and writing support in accordance with the journal's publication ethics and AI disclosure requirements.

Conflict of Interest

The authors declare that they have no competing interests.

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