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Original Article

Improving Indonesian nurse performance on nursing care documentation: A mixed-methods study of a culturally tailored hybrid roleplay intervention

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Abstract

Nursing documentation is critical for ensuring quality patient care and effective communication among healthcare professionals. However, in low- and middle-income countries (LMICs), documentation practices often fall short due to resource limitations and cultural barriers. This mixed-methods study evaluated a culturally adapted roleplay-based intervention to improve nursing documentation quality among Indonesian nurses. Guided by Kolb's Experiential Learning Theory, this intervention focused on experiential, reflective, and technology-enhanced components to enhance nursing documentation practices. Using a quasi-experimental design, 132 nurses from three public hospitals in Jakarta were assigned to either the treatment or control group. The intervention integrated conventional roleplay, digital simulation, and reflective practice. Quantitative data were collected at baseline, post-intervention, and at a 12-week follow-up, measuring documentation quality, self-efficacy, and cognitive load. Additionally, qualitative data were gathered through semi-structured interviews with 15 experimental group participants. Results showed significant improvements in documentation quality (Cohen's d=1.28 at T1; d=1.14 at T2), self-efficacy (d=0.99 at T1; d=0.85 at T2), and reductions in cognitive load (d=-0.84 at T1; d=-0.72 at T2), indicating significant and sustained improvements at the 12-week follow-up. Qualitative findings highlighted increased confidence, realism of the scenarios, integration of digital skills, and cultural considerations in documentation practices. Participants' hierarchical structure orientation moderated the effectiveness of the intervention. In conclusion, this study provides evidence that hybrid roleplay interventions can enhance nursing documentation practices in low- and middle-income countries, with a focus on culturally tailored healthcare education.

Keywords: Competence, documentation, education, nursing, roleplay

Introduction

Nursing documentation is a cornerstone of healthcare delivery, basically serving as a means of communication among health professionals. It supports clinical decision-making and ensures continuity of care [1-3]. Despite its recognized importance, many of these practices fall short of established standards in low- and middle-income countries (LMICs) and have major resource constraints on healthcare systems. These documentation gaps contribute to poor patient outcomes and a lack of efficiency within the health system in these settings.

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Indonesia provides a unique and important context for investigating nursing documentation practices as the world's fourth most populous country and largest archipelagic state. Furthermore, Indonesia is one of the rapidly developing LMICs, featuring diverse healthcare systems ranging from highly advanced urban facilities to resource-limited rural clinics [3,4]. This diversity and the ongoing digital transformation of health care make Indonesia an ideal setting to examine innovative approaches to improvement in nursing documentation [5].

Recent large-scale studies have identified that up to 65% of nursing records in Indonesia are documented with inaccuracies, omissions, or inconsistencies that might compromise patient care. The Indonesian National Nurses Association has set guidelines to standardize documentation practices, though compliance remains suboptimal. A comprehensive national survey conducted in 2023 showed that only 40% of nurses wholly adhered to these guidelines, a marginal improvement from 35% in 2021 [6]. These findings hence indicated the urgent need for effective intervention in enhancing the quality of documentation within the Indonesian healthcare context.

Various obstacles create conditions for poor accomplishment of documentation practices in Indonesia. Some studies identified high patient-to-nurse ratios, along with restricted professional development and minimal computerized systems [7,8]. Besides, cultural influences like hierarchical structure and communication patterns uniquely affect the same context of documentation practices. Whereas most traditional educational interventions focused on a didactic approach have been quite unsuccessful, it is believed that interactive pedagogical strategies, simulation-based learning, and roleplay are more apt to develop clinical competencies [6].

The established traditional educational interventions to improve nursing documentation usually use a didactic approach. However, Chernikova *et al*. performed a meta-analysis in which they found these approaches have variable success, with knowledge retention as low as 8% to as much as 67% at three months post-learning, depending on the subject matter and assessment methodology employed [9]. On the contrary, active pedagogical approaches, such as simulation-based learning and roleplay, are more effective in developing clinical competencies. Perry *et al*. reported that as many as 60% of gains in clinical performance were observed compared to traditional methods of instruction [4]. On the other hand, Saragih *et al*. recorded increases of 45% following simulation-based training in documentation precision [6].

Building on these developments, the present study describes a state-of-the-art hybrid roleplay intervention that seamlessly blends the best of face-to-face roleplay with state-of-the-art technologies. This integrated model incorporates virtual simulation, advanced digital documentation, and reflective practice elements in tackling the practical and interpersonal nuances of nursing documentation and better preparing nurses for the increasingly digitized health environment.

The present study is underpinned by the Experiential Learning Theory (ELT) developed by Kolb [10,11], which postulates that learning approaches turn experience into knowledge. The theory is focused on the four-stage learning cycle: concrete experience means hands-on engagement in real-life situations; reflective observation involves critical reflection and feedback; abstract conceptualization focuses on the integration of new insights into the already existing knowledge frameworks; and active experimentation puts to work newly acquired skills. The cycle works perfectly in nursing documentation training because it supports skill acquisition through iterative practice and reflection.

This hybrid roleplay intervention integrates multiple learning models to enhance nursing documentation skills. The intervention combines traditional in-person roleplay exercises, where nurses simulate realistic documentation tasks, with digital simulation tools that replicate complex and diverse documentation scenarios. It further incorporates reflective practices, where participants analyze their performance, identify areas for improvement, and develop strategies for refinement. These activities are complemented by opportunities to apply learned skills in clinical settings, bridging the gap between simulation and practice [1-4]. By incorporating Kolb's ELT, this multi-modal, hybrid approach fosters deeper learning and a sustained improvement in the documentation skills among nurses through iterative cycles of experience, reflection, and application [15].

As the literature on roleplay and technological interventions in nursing education continues to emerge [5-7], only a few studies have explored the combined effect of these modalities concerning documentation practices. Therefore, even fewer such projects have been contemplated in LMICs like Indonesia. This intervention was uniquely adapted to address specific cultural and resource challenges within the Indonesian healthcare context. For example, all training materials, scenarios, and discussions were conducted in the local Indonesian language to ensure accessibility and cultural relatability. Roleplay scenarios were designed to reflect the common hierarchical structure and communication styles prevalent in Indonesia, emphasizing respect for authority and collaborative problem-solving consistent with collectivist cultural values [8]. Furthermore, gender dynamics were carefully considered to align with cultural norms in nurse-patient interactions, enhancing the cultural relevance and acceptance of the training [9].

The hybrid roleplay intervention integrates these principles to foster deeper learning. It combines in-person roleplay exercises with digital simulations that replicate complex documentation scenarios, providing nurses with a multi-faceted learning experience. Reflective practices were incorporated to help participants analyze their performance, identify areas for improvement, and strategize for refinement. These components work synergistically to bridge the gap between theoretical learning and practical application [15].

To evaluate the effectiveness of this intervention, the study hypothesized that the hybrid roleplay intervention would result in significant improvements in documentation quality, increased self-efficacy, and reduced cognitive load among Indonesian nurses. Additionally, it hypothesized that cultural factors would moderate these outcomes, with the intervention being more effective in settings that align with the culturally tailored design. Ultimately, this research aspires to contribute significantly to nursing education and practice in Indonesia and other low- and middle-income countries. The findings are expected to inform the development of policies and curricula for nursing education and continuing professional development programs. Moreover, this approach offers a scalable, future-oriented solution for improving the quality of documentation, which is critical for enhancing patient outcomes and optimizing healthcare system efficiency in the digital era.

Methods

Research design

The present study employed an explanatory sequential mixed-methods design within a quasi-experimental pretest-posttest control group design, including a 12-week follow-up. The explanatory sequential approach was chosen to prioritize the collection and analysis of quantitative data in the first phase, which informed the subsequent qualitative phase. The qualitative approach adopted was phenomenology, chosen for its strength in exploring and contextualizing participants' lived experiences and the mechanisms underlying quantitative findings. The Mixed Methods Appraisal Tool (MMAT) was utilized to ensure the methodological rigor of the mixed-methods approach. Specifically, MMAT guided the design, execution, and reporting of both the quantitative and qualitative components, ensuring transparency and integration of findings [10].

Quantitative data included hierarchical orientation scores, assessed using a culturally adapted 5-point Likert scale to examine preferences for professional hierarchical structures, which were later analyzed as a potential moderator of intervention effectiveness [11]. The qualitative approach used in the second phase was phenomenology, which allowed us to explore and contextualize the quantitative findings in greater depth, particularly the mechanisms behind the intervention's effects on nursing documentation quality, self-efficacy, and cognitive load.

The quasi-experimental design was adopted due to the practical and ethical impossibility of randomizing nurses working in the same hospital, a common problem described in many studies on nursing education in Indonesia [16]. Cluster randomization at the hospital level was not feasible due to resource constraints and the interdependence of healthcare staff. This aligns with recent methodological advancements in nursing education research in low- and middle-income countries, where individual randomization within clusters is often impractical. This also agrees with recent methodological developments in nursing education research in LMICs, whereby

cluster randomization at the hospital level is often not feasible [17]. To ensure the intervention's effectiveness, it was culturally tailored to align with Indonesian healthcare practices, incorporating local communication styles and healthcare scenarios. This cultural adaptation was essential to enhancing the relevance and engagement of the nurses, increasing the likelihood of successful outcomes. MMAT criteria were used to evaluate the alignment of study objectives, coherence between methods, and integration of quantitative and qualitative data.

Sample size

A priori power analysis was performed using G*Power 3.1. [18], based on earlier related studies on educational interventions in nursing documentation [12-14], which identified a medium effect size of Cohen's d=0.5. This effect size is conservative compared to the larger effects presented by some studies [15-17], d=0.7 to 0.9, but accounts for the likely moderation by cultural factors in the Indonesian context. Using α=0.05 and the desired power, 1-β=0.90, the sample size required was 128, which is 64 per group. Assuming a most likely attrition rate of 20% (26 participants), the adjusted sample size was calculated as 154 participants. However, to enhance the robustness of the study and allow for subgroup analyses, the sample size was further increased to 197 participants. This larger sample ensured adequate statistical power to detect meaningful effects, especially considering potential variability in the nested structure of the data (nurses within hospitals). Despite this plan, only 132 participants were ultimately recruited due to logistical constraints, including limited availability of eligible nurses within the selected hospitals and scheduling conflicts that impacted participation. These challenges highlighted the practical difficulties of achieving target sample sizes in real-world healthcare settings, particularly within low- and middle-income countries (LMICs) like Indonesia.

Participants and setting

This study was carried out in three public hospitals in Jakarta, Indonesia. The participants included registered nurses with at least one year of clinical experience in inpatient wards. The exclusion criteria included participation in documentation-specific training in the last six months and inability to use basic computer applications. A total of 197 nurses were available, of which 132 met the inclusion criteria and provided consent. The participants should not have attended documentation-related training in the previous six months.

Stratification by years of experience resulted in 132 participants being randomly assigned either into the experimental group, n=66, or into the control group, n=66, in this study, using a computer-generated random number sequence. The randomization was performed by an independent statistician not involved with intervention delivery or data collection. In the qualitative part of the study, a subgroup of the experimental group was selected to undergo in-depth interviews. For maximum variation sampling, 15 participants were chosen according to their age, years of work experience, and education. Accordingly, 15 participants were interviewed individually at three points: before, immediately after, and at the 12-week follow-up.

Intervention

Experimental group

The experimental group participated in a culturally tailored hybrid roleplay intervention designed to enhance clinical documentation skills through a combination of traditional roleplay, digital simulation, and reflective practice. The intervention was conducted sequentially to ensure a structured learning process. Traditional roleplay sessions were conducted with six 90-minute sessions across three weeks. During these sessions, participants engaged in scenario-based roleplays that simulated real-world clinical documentation challenges. The scenarios were developed based on an audit of common documentation errors identified in the initial patient record audit and validated by a panel of expert nurses. Scenarios were specifically adapted to Indonesian healthcare settings, incorporating cultural nuances such as hierarchical communication styles and family-centered care. Sessions were delivered in Bahasa Indonesia to ensure comprehension and engagement. The example of the scenarios can be found in **Appendix 1**. Importantly, these scenarios were adapted to reflect cultural nuances in Indonesian healthcare, such as hierarchical communication patterns and family-centered care, ensuring the content was

relevant and practical for participants. The sessions were delivered entirely in Bahasa Indonesia, the native language of all participants, to minimize barriers to comprehension and participation.

Following the roleplay sessions, digital simulation exercises were conducted in four 2-hour sessions. A simplified electronic health record system adapted to Indonesian healthcare was utilized in these sessions. In these sessions, participants were put into practice digital documentation focused on accuracy, completeness, and efficiency. After each session, the participants engaged in 30-minute structured peer feedback discussions and reflective exercises individually based on the Gibbs reflective cycle framework [18]. Participants also engaged in individual reflective exercises to consolidate their learning and apply feedback effectively. These reflective exercises, based on Gibbs' reflective cycle, are detailed in **Appendix 2**.

To ensure consistency and reliability, facilitators underwent a standardized 40-hour training curriculum before delivering the intervention. Intervention fidelity was maintained through random audits of 20% of the sessions, conducted by independent observers using a predefined fidelity checklist, which is included in **Appendix 3**. A comprehensive intervention module detailing the session plans, scenarios, digital simulation exercises, and reflective prompts is included in **Appendix 4** to support reproducibility. Additionally, the study design adhered to the Mixed Methods Appraisal Tool (MMAT) criteria to ensure methodological rigor.

Control group

The control group received training delivered in a conventional lecture format, representing the standard approach to continuing education in Indonesian healthcare settings. Training that attempted to match the experimental group's contact hours as closely as possible, including didactic lectures, case study discussions, paper documentation assignments, and open Q&A sessions (**Appendix 4** and **Appendix 5**). The participants attended six 1.5-hour lectures on the Indonesian National Nurses Association (INNA) documentation guidelines in separate modules on legal issues, Subjective Objective Assessment Plan (SOAP) note writing and common pitfalls in the documentation. Additionally, participants engaged in four 2-hour sessions analyzing pre-prepared case studies and completing paper-based exercises based on clinical scenarios. Three 1-hour Q&A clear-up sessions were made available to ask about documentation procedures. All resources were provided to clarify any questions regarding documentation procedures.

All training materials and sessions were conducted in Bahasa Indonesia to align with participants' linguistic needs, ensuring clarity and accessibility. The training scenarios and case studies were adapted to reflect typical healthcare challenges and documentation practices within the Indonesian healthcare system, making the content culturally relevant. Facilitators were experienced Indonesian nurses, ensuring a shared cultural and professional background with participants to foster better engagement and understanding. Gender considerations were also accounted for by ensuring gender diversity among facilitators to align with participant comfort and cultural norms in healthcare interactions. To maintain intervention fidelity, 20% of the sessions in the control group were randomly audited using the same predefined fidelity checklist applied to the experimental group. These audits were performed by independent observers. This standardized lecture-based approach mirrors the conventional method of documentation training in Indonesia, making it a suitable control condition for comparison with the hybrid roleplay intervention (**Appendix 3**).

Data collection

Quantitative data

Data were collected at three time points: before the intervention, at the end of the intervention, and 12 weeks after the intervention. The main variable of the outcome, the quality of nursing documentation (primary outcome), was measured by using the Documentation Quality Assessment Tool (DQAT), adapted from Zeng *et al*., [19] and empirically validated for application to the Indonesian context, showing the reliability of α=89. Validation included both content and construct validation, using expert panel reviews and confirmatory factor analysis to ensure the tool's suitability for Indonesian healthcare settings (**Appendix 6**). The secondary outcomes of this study included self-efficacy in nursing documentation, cognitive load, and perceived barriers to high-quality documentation. Self-efficacy in nursing documentation was measured using the

Nursing Documentation Self-Efficacy Scale (NDSES) [19]. This tool comprises 12 items rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), with total scores ranging from 12 to 60. Higher scores reflect greater confidence in nursing documentation abilities. Cognitive load was assessed using the NASA Task Load Index (NASA-TLX) [20], which evaluates six dimensions: mental demand, physical demand, temporal demand, performance, effort, and frustration. Each dimension is rated on a 21-point scale (0 to 20), and a composite score is calculated using weighted averages, with higher scores indicating greater perceived cognitive load. Perceived barriers to high-quality documentation were measured using a custom-developed questionnaire comprising 15 items that explore organizational, technological, and individual factors. Responses were rated on a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating more significant perceived barriers. This questionnaire was content-validated by five nursing experts and achieved a reliability score of Cronbach's α=0.83 during pilot testing with 30 nurses in Surakarta (**Appendix 6** and **Appendix 7**).

Qualitative data

Semi-structured interviews were carried out with the selected 15 experimental group participants. The interviews took approximately 45–60 minutes each and were audio-recorded with participants' consent. The guide for the interview focused on participants' experiences in the hybrid roleplay intervention, perceived changes in their documentation practices, and any barriers or facilitators to taking up the learned skills in their daily work. The interviews were conducted in Indonesian by trained researchers and later transcribed and translated into English for analysis. The probing interview guide can be found in **Appendix 7**.

Data analysis

Quantitative data analysis was performed in R version 4.1.0. Due to the nested structure of the data (nurses within hospitals) and repeated measures, linear mixed-effects models were estimated using the lme4 package. The models contained fixed effects of the group (intervention vs control), time as a categorical variable with three levels (T0, T1, T2), and their interaction, while random intercepts were fitted for participants and hospitals. Inverse probability of treatment weighting was applied based on propensity scores calculated from baseline characteristics using a previously described technique to account for potential confounding. This helps balance the groups and minimizes the bias inherent in this quasi-experimental design.

Effect sizes are expressed as Cohen's d for between-group differences and as Glass's Delta (Δ) for within-group changes over time. Multiple imputations with chained equations were performed, assuming data were Missing at Random (MAR) and conditional on observed variables. Several moderation analyses were conducted to examine the potential moderating role of cultural factors, in which interaction terms between the intervention and scores on cultural orientation were added to the mixed-effects models.

For qualitative data, thematic analysis was done reflexively for the qualitative data based on Braun and Clarke [20], using the NVivo 12 software for coding. Two researchers independently executed coding, ensuring that reliability was observed, while disagreements were settled through discussion with the third researcher. The quantitative and qualitative findings have been integrated using a convergent parallel mixed-methods design by Creswell and Plano Clark [21], with joint displays used in visualizing integration.

Results

Participants Characteristics

The respondent characteristics in **Table 1** indicate that the majority of participants across both groups were aged 31–39 years (52.2%) and predominantly female (83.3%). Most participants had nursing academy education (80.3%), with over 46.9% having more than 10 years of work experience. Monthly incomes varied, with the largest proportion earning IDR 2,000,000–2,900,000 (33.3%), followed by IDR 3,000,000–3,900,000 (32.5%).

Table 1. Distribution of respondents' characteristics (n=132)

Respondents' Characteristics	Control group (n=66) (%)	Experimental group (n=66) (%)	Total (%)
Age			
20–30 years	13 (19.7)	13 (19.7)	26 (19.7)
31–39 years	37 (56.1)	32 (48.5)	69 (52.3)
40–49 years	15 (22.7)	16 (24.2)	31 (23.5)
>50 years	1 (1.5)	5 (7.6)	6 (4.5)
Sex			
Male	9 (13.6)	13 (19.7)	22 (16.7)
Female	57 (86.4)	53 (80.3)	110 (83.3)
Education			
Nursing academy	54 (81.8)	52 (78.8)	106 (80.3)
Bachelor's degree in nursing	12 (18.2)	14 (21.2)	26 (19.7)
Work experience			
1–1 year 11 months	5 (7.6)	5 (7.6)	10 (7.6)
2–3 years 11 months	12 (18.2)	10 (15.2)	22 (16.7)
4–9 years 11 months	22 (33.3)	16 (24.2)	38 (28.7)
>10 years	27 (40.9)	35 (53.0)	62 (47.0)
Monthly income			
IDR 1,000,000–1,900,000	0 (0.0)	3 (4.5)	3 (2.3)
IDR 2,000,000–2,900,000	30 (45.5)	14 (21.2)	44 (33.3)
IDR 3,000,000–3,900,000	21 (31.8)	22 (33.3)	43 (32.6)
IDR 4,000,000–4,900,000	7 (10.6)	18 (27.3)	25 (18.9)
IDR >5,000,000	8 (12.1)	9 (13.6)	17 (12.9)

IDR: Indonesian Rupiah

Quantitative findings

Impact on documentation quality

The detailed results of the impact on the documentation quality of the nurse students are presented in **Table 2.** Linear mixed-effects models were employed to assess the intervention effect on documentation quality over time. Specifically, models included fixed effects for group and time and their interaction, with random intercepts for participants and hospitals to account for the nested structure of the data. There was a significant interaction of group and time (β=5.06; SE=0.49; p<0.001) for T1 and (β=4.50; SE=0.49; p<0.001) for T2, indicating that the experimental group demonstrated greater improvement in documentation quality than the control group at both immediate post-intervention (T1) and 12-week follow-up (T2) time points. There was a large effect size at both T1 and T2. Immediately after the intervention at T1, the between-group effect size Cohen's d was 1.28 (95%CI: 0.91 to 1.65), indicating strong practical significance. The effect remained stable at 12-week follow-up, T2, with an effect size of 1.14 (95%CI: 0.78 to 1.50).

The analysis of the secondary outcomes using similar mixed-effects models showed that the experimental group significantly improved self-efficacy and cognitive load. Regarding self-efficacy, there was a significant interaction of group and time at T1 and T2, pointing to large increases in participants' confidence to perform the documentation tasks, which were maintained over time. The cognitive load measured with the NASA Task Load Index was significantly lower for the experimental group than the control group, which means that the intervention reduced the cognitive demand of the documentation tasks. The results of these secondary outcomes in detail are shown in **Table 3**.

The effect size (Cohen's d) in **Table 3** represents the magnitude of the difference between each group (experimental and control) at different time points. For example, the effect size of 0.13 in the control group at Time Point 1 (T1) reflects the change in self-efficacy for the control group alone, comparing the immediate post-intervention measurement to their baseline. Similarly, for cognitive load, the effect size in the control group represents the difference between the baseline and T1 scores in the control group. In contrast, the effect size for the experimental group at T1 compares the immediate post-intervention scores of the experimental group to their baseline, demonstrating the intervention's impact on self-efficacy and cognitive load for that group. These effect sizes help to highlight the magnitude of change within each group over time, as well as the differences between the experimental and control groups.

Table 2. Impact of the hybrid roleplay intervention on documentation quality over time using Documentation Quality Assessment Tool (DQAT)

Time Point	Group	Estimate (β)	Standard Error (SE)	*p*-value	Effect size (Cohen's d)	95% confidence interval (CI) for d
Immediate post-intervention (T1)	Experimental vs control	5.06	0.49	<0.001	1.28	0.91 to 1.65
12-week follow-up (T2)	Experimental vs control	4.50	0.49	<0.001	1.14	0.78 to 1.50

Table 3. Impact of the hybrid roleplay intervention on self-efficacy and cognitive load over time

Outcome	Time point	Group	Estimate (β)	Standard error (SE)	*p*-value	Effect size (Cohen's d)	95% confidence interval (CI) for d
Self-efficacy	Immediate post-intervention (T1)	Experimental	0.89	0.11	<0.001	0.99	0.64 to 1.34
		Control	0.10	0.12	0.40	0.13	-010 to 0.36
	12-week follow-up (T2)	Experimental	0.76	0.11	<0.001	0.85	0.50 to 1.20
		Control	0.18	0.13	0.20	0.23	-0.06 to 0.53
	Within group (T1-T2)	Experimental	-0.13	0.10	0.21	-0.14	-0.32 to 0.04
		Control	0.08	0.10	0.30	0.11	-0.10 to 0.32
Cognitive load	Immediate post-intervention (T1)	Experimental	-1.23	0.18	<0.001	-0.84	-1.19 to -0.49
		Control	-0.10	0.14	0.48	-0.13	-040 to 0.13
	12-week follow-up (T2)	Experimental	-1.05	0.18	<0.001	-0.72	-1.07 to -0.37
		Control	-0.20	0.15	0.30	-0.25	-053 to 0.02
	Within group (T1-T2)	Experimental	0.18	0.12	0.25	0.22	-0.06 to 0.50
		Control	0.10	0.15	0.45	0.13	-0.20 to 0.36

Other secondary measures, similarly using mixed-effects models, showed significant effects on the experimental group: self-efficacy and cognitive load. The interaction of group and time was significant for self-efficacy at T1, β=0.89, SE=0.11, p<0.001, and T2, β=0.76, SE=0.11, p<0.001. The overall effect sizes for self-efficacy were large, Cohen's d=0.99 (95%CI: 0.64 to 1.34) at T1 and d=0.85 (95%CI: 0.50 to 1.20) at T2. These findings indicate that the participants in the experimental group achieved a high level of confidence in their ability to perform tasks related to documentation and that this effect was maintained over the follow-up period.

The cognitive load assessed by the NASA Task Load Index has shown significant decreases in the experimental group compared to the control group. Interaction effects were significant at T1, β=-1.23, SE=0.18, p<0.001, and T2, β=-1.05, SE=0.18, p<0.001. Negative effect sizes, d=-0.84, 95%CI: -1.19 to -0.49 at T1 and d=-0.72, 95%CI: -1.07 to -0.37 at T2, indicating that participants in the experimental group perceived documentation tasks as less cognitively demanding after the intervention, a benefit maintained at follow-up.

Within-group analysis revealed important insights into the progression of self-efficacy and cognitive load over time for both the experimental and control groups. For self-efficacy, participants in the experimental group exhibited a negligible decrease between T1 and T2, with an effect size of d=-0.14 (95%CI: -0.32 to 0.04; p=0.21), indicating that the large gains achieved immediately post-intervention were sustained during the follow-up period. In contrast, the control group demonstrated a small, nonsignificant increase in self-efficacy from T1 to T2, with an effect size of d=0.11 (95%CI: -0.10 to 0.32; p=0.30), reflecting limited natural progression without significant intervention impact. Moreover, for cognitive load, the experimental group showed a slight increase between T1 and T2, with an effect size of d=0.22 (95%CI: -0.06 to 0.50; p=0.25), yet cognitive load remained substantially lower than baseline levels. The control group, on the other hand, experienced only minimal changes in cognitive load between T1 and T2, with an effect size of d=0.13 (95%CI: -0.20 to 0.36, p=0.45), indicating negligible changes over time. These within-group findings underscore the significant and sustained improvements in self-efficacy and reductions in cognitive load in the experimental group, demonstrating the long-term benefits of the hybrid roleplay intervention compared to the control group's limited changes.

Moderation analysis

Hierarchical structure orientation was assessed using a culturally adapted scale that measures preferences for hierarchical structures in professional settings. The scale was rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating stronger hierarchical preferences. The moderation analyses showed a significant interaction between intervention with lower hierarchical orientation scores, showing that the participants' cultural orientations moderated the effectiveness of the intervention. It was recorded that the nurses with lower hierarchical orientation scores had a higher increase in quality for the documentation than those with high orientation scores, underlining the influence of cultural factors in educational interventions. The summary of these results is shown in **Table 4**.

Table 4. Influence of hierarchical orientation on intervention effectiveness

Group	Interaction estimate (β)	SE	p-value	Documentation quality improvement (β)	SE	p-value
Hierarchical orientation interaction	-0.32	0.14	0.022	-	-	-
Low hierarchical orientation	-	-	-	5.78	0.67	<0.001
High hierarchical orientation	-	-	-	4.14	0.71	<0.001

SE: standard error

Some moderation analyses were conducted to explore whether cultural factors might affect the effectiveness of the intervention. These analyses showed a significant interaction between the intervention and hierarchical orientation scores (β=-0.32; SE=0.14; p=0.022). The improvements in the quality of documentation were better for participants with low hierarchical orientation scores, with β=5.78, SE=0.67, and p<0.001, compared to the high hierarchical orientation scores, with β=4.14, SE=0.71, and p<0.001. This finding suggests that participants'

cultural orientation moderated the effectiveness of the intervention somewhat, with those with higher scores in hierarchical orientation being nurses whose improvements in the quality of documentation were minor. The finding underlines the relevance of cultural factors in designing and implementing educational nursing interventions.

Qualitative findings

Semi-structured interviews with 15 participants from the experimental group offered a more profound exploration of the experiences and perceptions nurses have of exposure to the hybrid roleplay intervention. Participants were purposively sampled to capture a wide variation in experience; thus, age ranged between 24 and 55 years old (M=35.7; SD=8.3), while clinical experience ranged from 2 to 30 years (M=10.5; SD=7.2). The four major themes identified through reflexive thematic analysis following Braun and Clarke provide a contextual and rich background to the quantitative findings [21]. The thematic analytic process was rigorous: two researchers independently coded the data initially, followed by collaborative refinement of themes to produce high interrater reliability, κ=0.84, 95%CI: 0.79 to 0.89. A summary of the key demographic characteristics of each participant is presented in **Table 5**.

Table 5. Participant characteristics for the qualitative study (n= 15)

No	Participant code	Age (years)	Years of clinical experience	Position
1	P1	30	5	Nurse
2	P2	24	2	Novice Nurse
3	P3	45	12	Nurse
4	P4	50	20	Charge Nurse
5	P5	28	3	Nurse
6	P6	52	25	Senior Nurse
7	P7	40	15	Senior Nurse
8	P8	48	18	Nurse Manager
9	P9	34	7	Nurse
10	P10	33	10	Nurse
11	P11	36	9	Senior Nurse
12	P12	42	22	Senior Nurse
13	P13	50	30	Nurse
14	P14	52	19	Nurse Manager
15	P15	55	28	Senior Nurse

Theme 1: Enhanced confidence in documentation skills

This theme captured the overall increase in confidence described by the participants in their documentation skills. Improvement in confidence was invariably attributed to the interactive, practical nature of the roleplay scenarios. Participants reported getting ample practice and honing skills in these scenarios without real consequences.

A nurse with five years of experience (**P1**) related to this as follows:

"I always second-guessed myself in my documenting before the roleplay. Now, I really feel more certain about what I'm writing and why I am writing it. The practice we had with the roleplays really helped me get confident in what I chose to do."

This increase in confidence appeared to be rooted in three key intervention components: repeated practice, immediate feedback, and reflective practice. Participants appreciated that they were put in multiple documentation scenarios, the resultant reinforcement of skills for repeated practices, and that the format for the roleplay was also helpful for immediate feedback from peers and facilitators on how to refine their skills quickly. Also, embedding Gibbs' reflective cycle helped participants critically assess their performance, increasing confidence in conducting documentation tasks [18].

The following account from a novice nurse with two years of experience (**P2**) demonstrates how feedback influenced perceptions: *"Getting immediate feedback during the roleplays was eye-opening. I could see where I was making mistakes and correct them on the spot. It's really boosted my confidence in my day-to-day documentation."* This theme strongly connects with the quantitative improvements in self-efficacy scores and thus emphasizes how the intervention affected participants' perceptions of their capabilities

Theme 2: Realism and relevance of scenarios

Participants of all studies consistently appreciated the realism of the roleplay scenarios and how these were immediately transferred into clinical practice. Scenarios of high fidelity, created in great detail after validation by expert panels, especially seemed to bridge the gap between theoretical knowledge and its application in practice. A nurse with 12 years of experience (**P3**) also said:

> *"The scenarios felt so real; it was like actually being on the ward, but with the chance to stop and think about how to document properly. This immediately made applying what we learned to our real work easy."*

The realism of the scenarios was facilitated by several factors, including but not limited to complexity, time pressure, and cultural specificity. Scenarios were developed to involve multiple conditions of patients and interdisciplinary interactions and to make them as close as possible to real clinical situations. Real-time constraints are also featured in the roleplay exercises, simulating fast-paced real-world settings. Moreover, the scenarios were adapted for the Indonesian healthcare setting in terms of its unique cultural and organizational environment. This enhanced the relevance and authenticity of the scenarios to the participants. As one charge nurse with 20 years of experience (P4) responded:

> *"I liked how the scenarios made them real in our healthcare system work environment, like how we engage patients' families and our collaborative practices. In fact, it was an added help to make the learning relevant to our everyday work."*

This theme has helped explain the large effect sizes in the quantitative test of documentation quality since realistic practice probably was instrumental in facilitating the effective transfer of skills to actual clinical documentation.

Theme 3: Integration of digital skills

This theme represents the positive views of participants concerning their experiences with the digital elements of the intervention, including the opportunity to practice with electronic health record systems during the roleplay. Most nurses reported that this aspect of the intervention made them feel comfortable and efficient with digital documentation. As one nurse with three years of experience (**P5**) summarized:

> *"Learning to use the EHR system during roleplay was incredibly helpful. It's made me much faster and more accurate in my daily work. I feel much more comfortable with technology now."*

Integration of digital skills was manifested by hands-on electronic health record (EHR) practice, gains in efficiency, and improved information retrieval. All participants mentioned experiencing an opportunity to interface with a mock EHR system that reduced anxiety about using technology. This was also an opportunity for nurses to reflect on their gains in speed and accuracy of documentation using digital tools. In addition, participants reported improved access and utilization of electronic patient information that enhanced overall effectiveness with digital documentation.

As one of the senior nurses with 25 years of experience (**P6**) reflected, *"As one who started my career with paper charts, I was somewhat apprehensive about electronic documentation. The roleplay sessions really helped me to see some of the benefits of EHR and feel more confident using them."* The present theme puts into perspective the observed reductions in cognitive load. It suggests that increased familiarity with the digital tools might have contributed to perceiving the documentation tasks as less demanding.

Theme 4: Cultural considerations in documentation

This theme provided an understanding of how the participants negotiated the cultural domain of documentation in the Indonesian healthcare setting. Several nurses reported how the intervention had assisted them in negotiating professional requirements for documentation with cultural imperatives, especially on communication along hierarchical structures. A senior nurse with 15 years of experience (**P7**) said

> *"The roleplay taught me to document clearly while respecting our hierarchical structure. It is a fine balance, but the scenarios helped me understand how to be precise and culturally appropriate in my documentation."*

Key elements of this theme included hierarchy, dynamics between the patients and their families, and consideration of languages. Responses shared learning about respectfully documenting concern or disagreement in a hierarchical system. The intervention provided cultural awareness that expects families to be actively involved in care and how to document the same appropriately. Also, nurses reflected that the guidance on balancing their documentation between professional and culturally sensitive language has been valued.

The cultural competence in the documentation was summarized by one nurse manager with 18 years of experience (**P8**) thus: *"The roleplay scenarios really outlined that cultural context in which we are trying to document. We learned also to be clear and professional while respecting our cultural norms. This is very important, enabling our documentation to be proper and culturally correct."* This theme provides an important context to the moderation effect of hierarchical orientation observed from the quantitative analysis by demonstrating how culture can affect the application of documentation skills in practice.

Discussion

This study examines the effectiveness of a culturally tailored hybrid roleplay-based intervention in improving the quality of nursing documentation among Indonesian nurses [1,3,4,22,23]. The results of this study documented significant and sustained improvement at 12 weeks in the quality of the documentation produced by the intervention nurses, as well as in their self-efficacy and cognitive load. These findings, coupled with the rich qualitative insights gained, not only support the effectiveness of this new approach but also question current paradigms in nursing education within LMICs. The cultural tailoring of the intervention played a critical role in its effectiveness. For example, the intervention used the Indonesian language (Bahasa Indonesia) in all training materials, roleplays, and discussions to ensure clarity and comfort for participants. Additionally, scenarios were developed to reflect common documentation challenges specific to the Indonesian healthcare system, such as hierarchical interactions between nurses and physicians or family-centered decision-making processes, enhancing the intervention's relevance and engagement. These adaptations demonstrate the importance of aligning educational interventions with local cultural and professional practices to maximize their impact. Hierarchical orientation, reflecting respect for authority and seniority in Indonesian healthcare, also moderated intervention outcomes. Nurses in more hierarchical settings responded better to structured training and senior guidance, enhancing self-efficacy and reducing cognitive load. Conversely, those in less hierarchical environments showed varied engagement, underlining the importance of cultural context in shaping intervention outcomes.

The sizable improvement in documentation quality, measured in the experimental group, is Cohen's d=1.28 at T1 and 1.14 at T2, significantly greater than the modest improvements observed in the control group, which had Cohen's d values of 0.30 at T1 and 0.40 at T2, indicating a marked difference between the two groups over and above the effects from prior simulation-based interventions. Comparison with similar studies reveals that the hybrid roleplay model demonstrated superior outcomes compared to traditional didactic approaches. For instance, Zhang *et al.* [22] recorded a 45% improvement in accuracy for documentation, whereas an improvement of almost 60% was achieved through this intervention. This striking variance in results may be due to our intervention's uniquely hybrid nature, incorporating synergistic use of traditional roleplay, digital simulation, and reflective practice in ways not hitherto done. Together, these provide a multi-modal learning experience that can meet the complex nature of documentation learning in a way that single-modality interventions cannot.

What is particularly noteworthy is that these gains in improvement persisted at the 12-week follow-up. A perennial criticism of healthcare education is that most interventions are short-term. This durability of effect might be understood from the perspective of Kolb's ELT: the cycling of the intervention design through concrete experience, reflective observation, abstract conceptualization, and active experimentation likely contributed to deeper learning and heartier skill development [12]. Therefore, this result places experiential learning at the forefront of nursing documentation education and, arguably, general nursing pedagogy [24].

Large intervention effects on gains in self-efficacy and reduction of cognitive load point to important intervention insights into psychological mechanisms underlying improved practice in

documentation [23-24]. Large effect sizes indicated that the intervention enhanced skills and altered a nurse's perception and approach to the documentation task [25-28]. This kind of change, both in the cognitive and affective realms, may be fundamental for sustaining practice improvement over time, but it is a hypothesis that needs further research.

The hierarchical orientation of participants moderated the intervention's effectiveness, reflecting the importance of cultural and organizational dynamics. Observed large intervention effects on self-efficacy and cognitive load findings would imply that hierarchical orientation has a moderate effect on intervention effectiveness. Hierarchical orientation in the Indonesian healthcare context, where there is a strong respect for authority and seniority, likely influenced nurses' receptivity to the intervention. Nurses in more hierarchical settings may be more responsive to structured training and guidance from senior staff, which may have contributed to improved self-efficacy and reduced cognitive load. On the other hand, nurses in less hierarchical settings might have experienced different levels of engagement or autonomy in their learning, affecting the intervention's overall effectiveness. This variation underscores the critical role that cultural factors—particularly organizational culture—play in shaping the outcomes of educational interventions. The finding reiterates the important role that cultural factors play in educational interventions, especially within the LMIC context, like Indonesia, where cultural norms such as hierarchical structures and communication styles significantly impact learning and practice. For instance, in Indonesia, healthcare workers often respect the chain of command, and senior nurses or doctors play a central role in guiding practices and decision-making. As such, interventions that do not account for these cultural dynamics may not fully engage participants or result in the desired outcomes. Indeed, the findings challenge the one-size-fits-all approach commonly used in global health initiatives with culturally nuanced interventions. Variation in improvements by hierarchical orientation would suggest that future interventions must be targeted at the national level and possibly at the organizational or individual level if maximum effectiveness is to be realized [29-30].

The overall effectiveness of this hybrid roleplay intervention points to several critical implications for practice and policy. It calls for an essential remaking of nursing education curricula in Indonesia and other LMICs by infusing conventional programs with experiential learning methods, especially those with integrated digital components [31-33]. Such a shift may more adequately prepare nursing professionals through improved competence performance [34-35]. Highlights from the positive results of the intervention concerning its digital components bring to the fore the urgent need for investment in technological infrastructure within healthcare [36-38]. These policies should be supportive by equipping digital tools in the facilities and ensuring reliable connectivity to the internet to support education and improve documentation practices. The interactional influence of hierarchical orientation also indicates a critical area related to training in cultural competence for educators, ensuring that people who design and deliver educational interventions can respond appropriately to cultural nuances [39].

Furthermore, improvements sustained at follow-up suggest similar interventions may be similarly effective in continuous professional development programs. They could encourage healthcare organizations to provide regular training sessions using experiential learning with practicing nurses [40-41]. Finally, although this study focused on nurses, the principles of hybrid roleplay could be applied to other healthcare professionals, with policy supporting interprofessional education using similar methods to enhance overall documentation and communication among entire healthcare teams [42].

Qualitative findings add a rich interpretation of the impact of the intervention and complement and illuminate the quantitative results. Enhanced confidence is a theme supporting and contextualizing the quantitative findings of a large increase in self-efficacy scores. The realism and relevance of the scenarios help explain large effect sizes for improvements in documentation quality, suggesting that intervention design supports the effective transfer of skills to the clinical setting. Integrating the digital skills theme gives meaning to the reduced cognitive load reported in the quantitative data. It is suggested there that the increased comfort with technology contributed to nurses' perception that the demands of the documentation task were not as challenging. Finally, the cultural considerations in the documentation theme can add more depth to the moderation effect of hierarchical orientation by highlighting cultural factors'

complex interaction with applying new documentation skills. The hierarchical orientation of participants moderated the intervention's effectiveness. Nurses with lower hierarchical orientation achieved greater improvements, reflecting cultural influences on receptivity to training. These findings highlight the importance of tailoring interventions to cultural norms, particularly in LMICs, where hierarchical structures play a pivotal role in healthcare practices. These qualitative insights support the quantitative findings and establish that the effects of this intervention are multi-dimensional since the changes ranged from the development of skills to building up confidence, enhancement of cultural competence, and technological proficiency. This comprehensive insight into the impact of the intervention is useful for guiding future implementations and adaptations of this type of program in varied healthcare contexts.

In this vein, future studies should focus on a few key areas that serve to further develop and test the hybrid roleplay intervention. The hybrid roleplay intervention in this study consisted of a structured learning module where nurses participated in roleplay scenarios designed to simulate real-life nursing documentation tasks. These scenarios were tailored to reflect common challenges in the Indonesian healthcare setting and were followed by guided reflection and feedback sessions. The intervention combined both traditional roleplay, in which participants enacted realistic documentation tasks and digital components that allowed for asynchronous learning and reflection. The module was designed to be interactive, allowing participants to engage in both simulated and clinical settings to practice, refine, and apply their skills. To further develop this intervention, longer-term longitudinal studies (over 1–2 years) should be conducted to assess the durability of impacts on quality documentation and patient outcomes, including correlations with such metrics as length of stay, readmission rates, and patient satisfaction. Additionally, incorporating artificial intelligence (AI)-driven feedback mechanisms within scenarios could provide immediate, individualized feedback that enhances efficiency and effectiveness within this particular intervention [43-44]. In addition, an investigation of virtual reality technology would provide fully immersive, high-fidelity documentation scenarios, thereby simulating those rare or high-stakes situations that traditional roleplay may not duplicate [45]. Cross-cultural comparative studies also be necessary to determine how the intervention performs across cultural contexts to develop a flexible, globally applicable model [46]. Economic analyses can be important in their own right, valuing the cost-effectiveness of scaling the intervention against traditional methods and thus being able to provide rich data to decision-makers [47]. Finally, a plan for developing and testing personalization algorithms, which could further tailor the scenarios to cultural backgrounds, learning styles, and performance data, would be developed to maximize the effectiveness of the intervention for each participant [48-49].

Its novelty and potential impact lie in this avant-garde hybrid roleplay intervention against such a complex problem. The seamless integration of traditional pedagogical methods with state-of-the-art technology and a culturally sensitive approach represents a paradigm shift in nursing education [32]. Its success within the Indonesian context, with a diverse range of health service settings and nuances in cultural influences, speaks toward a high degree of adaptability and potential for widespread impact. This is in keeping with improved technical skills and cultural competence, which are representative of the current gap in nursing education approaches, especially within LMICs. The intervention at this moment described at this moment has been culturally sensitive. It represents an easily scalable solution to the challenges thrown up by the growing impetus toward digitization that faces global health services [26,50]

The potential impact goes beyond nursing documentation. This intervention was based on experiential learning, technology integration, and cultural tailoring principles that can revolutionize approaches toward healthcare education and quality improvement initiatives in resource-constrained settings. This study challenged assumptions about what is possible in such settings and provides avenues for innovation in global health education using high-tech and high-touch educational interventions [51]. This study gave a hopeful model for improving nursing documentation in LMICs and points out a new standard for educational interventions in healthcare. This hybrid roleplay approach, informed by experiential learning theory and enhanced through technology, is a blueprint for complex healthcare challenges in culturally diverse resource-constrained settings. Lessons from such an intervention could, therefore, prove

instructive for workforce development that would be befitting of high-quality and culturally competent health care amidst the globally raised and rapidly digitalizing health systems.

This study has several strengths, including its innovative hybrid approach combining traditional roleplay, digital simulation, and reflective practice, and its focus on cultural tailoring. These elements make it a unique contribution to nursing education in LMICs. Additionally, the long-term follow-up adds value by demonstrating the sustainability of the intervention's impact. However, the study also has limitations. The quasi-experimental design limits causal inferences, and the sample was restricted to one hospital, which may affect generalizability. This study's sample size was 132 participants, which falls below the a priori calculated minimum of 154. While the study maintained sufficient statistical power for the primary analyses, this limitation may affect the generalizability of the findings and the robustness of subgroup analyses. Future studies should address these limitations through randomized controlled trials and multi-center studies. Additionally, while cultural factors were considered, a more in-depth investigation into how specific cultural variables, such as communication styles, hierarchical structures, and attitudes towards authority and professionalism, may influence intervention outcomes would be valuable. These cultural elements can significantly shape how healthcare workers engage with training programs and the adoption of new practices, making it important to explore them in greater detail in future research.

Conclusion

This research provided strong evidence of the effectiveness of culturally tailored hybrid roleplay-based intervention in improving nursing documentation quality, self-efficacy, and cognitive load for Indonesian nurses. The intervention addressed both technical skills and cultural factors suggesting it could serve as a promising model for nursing education in LMICs. The sustained improvements at 12 weeks post-intervention highlight the durability of these changes and challenge the short-term nature often associated with healthcare education interventions. Additionally, the moderation effect of hierarchical orientation underscores the importance of cultural nuance in educational design. This intervention represented a significant advancement in tackling nursing documentation challenges, combining traditional pedagogical methods with digital components and cultural sensitivity. As healthcare systems become increasingly digitized and globalized, this intervention offers a scalable and contextually appropriate solution for enhancing healthcare education in resource-constrained settings. Future research should focus on longitudinal studies, AI-driven feedback, virtual reality in simulations, and cross-cultural comparisons to further refine and expand the model.

Ethical consideration

The study was approved by the Health Research Ethics Committee of Dr. Moewardi General Hospital (Approval Number: 1.682/IX/HREC/2023) on 6 September 2023. Written informed consent was obtained from all participants, who were informed of their right to withdraw at any time without consequence. Data confidentiality was ensured by removing personal identifiers. Qualitative participants were also informed about the additional time required for interviews and their right to withdraw from this part of the study without affecting their participation in the quantitative component.

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Competing interests

The authors declare no conflict of interest.

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Underlying data

De-identified participant data can be made available upon requests directed via email to the corresponding author. The instruments used in this study can be found at https://doi.org/10.6084/m9.figshare.27923091.v3.

Declaration of artificial intelligence use

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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