

Integration of Generative AI Character Mechanism and Virtual Reality Clues for the Development of Educational Games for Clinical Reasoning Training in Nursing Care

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Abstract

Ward nursing staff must collect information for new patients and perform clinical reasoning for health assessment and nursing diagnosis, which requires realistic ward situations and case studies. Combining game mechanics with standardized patient simulations is expected to improve trainees' communication skills and problem-solving abilities and enhance motivation. This study investigates the effectiveness of an educational game combining GenAI and virtual reality in training nursing diagnostic reasoning. We developed a GenAI dual-role mechanism (GenAI playing the role of a patient uncle Sam and a senior nurse sister) and constructed a virtual reality clues room space through SVVR. The learning objectives of the game: learners take on the role of a nurse and interact through dialogues to perform health assessments and clinical reasoning on Uncle Sam, as well as consulting with another experienced GenAI nurse to gain expertise and solve problems. The study participants were 16 formal nurse practitioners in Taiwan. The results of this study showed that the study was highly useful in that the learners had a high flow and did not have a high external cognitive load, but only an internal cognitive load slightly above the median of the five-point Likert scale (i.e., 3), and that the difficulty of the tasks could be considered for simplification in the future. The qualitative feedback indicated that the mechanism could create realistic clinical situations (81.25%), improve interview assessment skills (93.75%), facilitate clinical reasoning (75%), reduce stress (87.5%), and increase concentration (81.25%).

Keywords: situational simulation, situated learning, digital game, workplace, clinical reasoning

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Introduction

Nursing clinical reasoning is an integrated thought process encompassing knowledge, experience, and clinical observation. The reasoning process involves interpreting clinical data and evaluating assessment findings while considering the patient's and family's background, environment, and psychosocial aspects to determine the most appropriate clinical diagnosis and formulate corresponding nursing interventions or decisions (Mohammadi-Shahboulaghi et al., 2021). In practical application, nurses employ this reasoning process in clinical care, known as the “nursing process,” which comprises five primary steps: assessment, diagnosis, planning, implementation, and evaluation. Nurses systematically gather data on patients' physiological, psychological, spiritual, and social dimensions based on professional expertise and objective assessment results. This enables them to establish nursing diagnoses and formulate appropriate care plans to assist patients in improving their health status.

Previous educational training on the “nursing process” has involved traditional case-based teaching or clinical placements where nursing staff use Gordon's 11 Health Function Patterns assessment to collect patient data. However, constrained by the complexity of clinical settings and limited practice opportunities, nursing staff often struggle to master the application of reasoning processes, resulting in multiple limitations in clinical practice. For instance, insufficient clinical experience leads to inadequate judgment, lack of adequate practice and interactive feedback, low motivation in one-way instruction, and the high variability and unpredictability of clinical patient symptoms. These factors make it difficult for nursing staff to rapidly engage in clinical reasoning processes, resulting in reduced diagnostic accuracy and delayed decision-making (Liao et al., 2015). Therefore, there is a need to develop teaching strategies that are highly innovative, allow for repeated practice, feature highly realistic scenarios, and provide high levels of interactive feedback. This will effectively enhance nurses' communication skills and problem-solving abilities, further cultivating their critical thinking and clinical decision-making capabilities.

Experiential learning emphasizes that learners develop competencies through a process involving practical experience, reflection, and repeated practice. It asserts that knowledge is not unidirectionally transmitted but rather actively constructed by learners through engagement in experiential and reflective processes. By simulating scenarios or recreating clinical authenticity through case studies, it enhances immersion and problem-solving abilities (Ngu et al., 2025a). Game-based learning is recognized as an effective instructional strategy for enhancing learner engagement and motivation (Hassan et al., 2021). In challenging and rewarding environments, learners' active engagement can be promoted while simultaneously strengthening their decision-making abilities, critical thinking, and problem-solving skills (Ngu et al., 2025b). Chien et al. (2023) indicate that experiential learning through scenario-based digital games not only enhances learning motivation and sustains high flow states but also effectively improves decision-making performance and reduces learner anxiety.

Generative AI (GenAI) is increasingly being applied in educational training across various fields. Its advantages include generating realistic interactions and providing instant feedback (Rahman & Watanobe, 2023), making it well-suited for use in digital standardized patients and professional senior mentors (Ngu et al., 2025a; Ngu et al., 2025c). Furthermore, GenAI standardized patients can respond to history-taking and engage in instant conversations with the same tone as real patients, enabling learners to practice clinical consultation and assessment in a safe, realistic environment. Therefore, this study integrates an AI dual-role mechanism, where AI assumes the roles of both Uncle Sam (the patient) and Nurse Sister (the senior nurse)

(as shown in Figure 1). Through SVVR technology, a virtual reality space is constructed (as shown in Figure 2). Learners engage in dialogic interactions to conduct health assessments and clinical reasoning with Uncle Sam, while consulting the experienced AI nurse to access professional knowledge and resolve problems. Finally, the effectiveness of this approach in nursing clinical reasoning training is examined.

Figure 1
Dual-Role GenAI Mechanism Educational Game

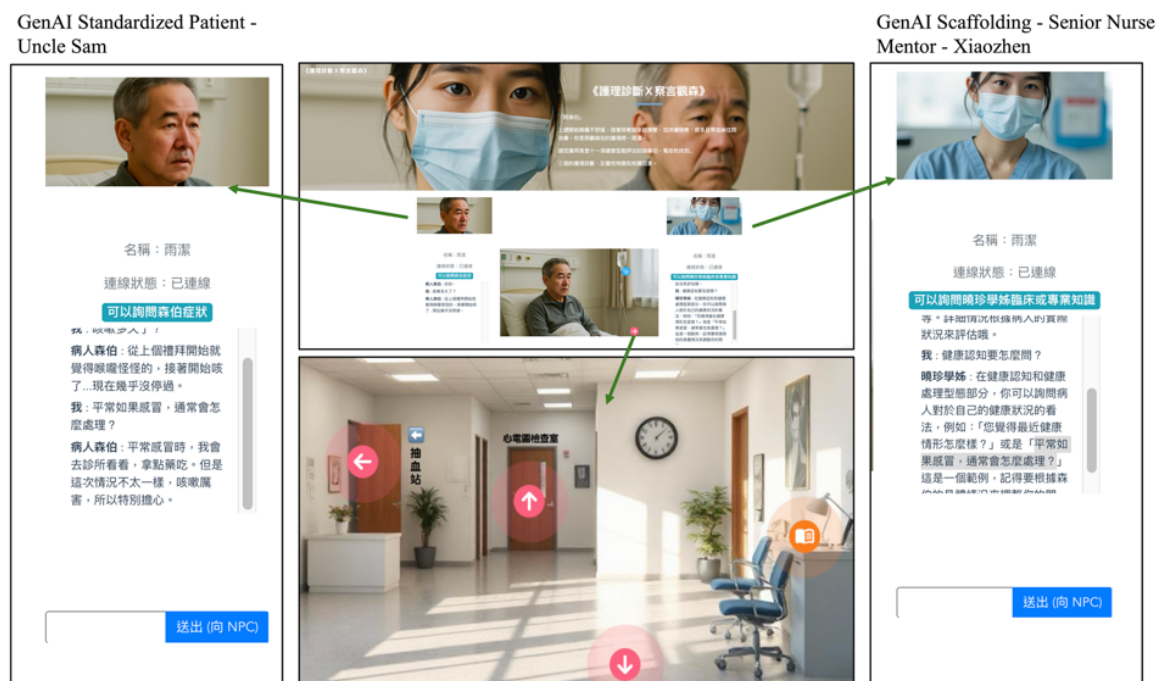
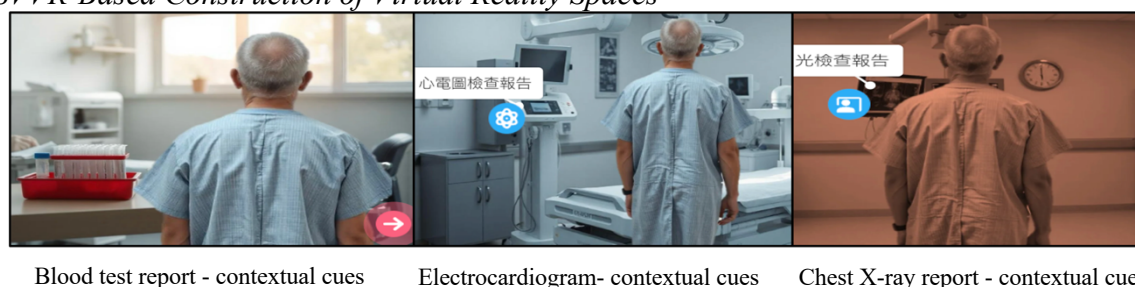


Figure 2
SVVR-Based Construction of Virtual Reality Spaces



Methods

This study is a pilot investigation involving 16 licensed practicing nurses in Taiwan. The procedure consisted of a 5-minute introduction to the game platform and rules, a 30-minute gameplay session, and a 10-minute questionnaire survey. The study assessed learners flow, activity anxiety, game feedback (game usefulness, game ease of use), perceived game elements, and cognitive load. The questionnaire's supplementary section comprised seven semi-structured questions, primarily investigating whether the game's mechanisms enhanced learners' understanding of Gordon's 11 Health Function Patterns and improved comprehension of the clinical reasoning process for nursing diagnoses.

Results and Discussions

According to the single-sample Wilcoxon signed-rank test as shown in Table 1, participants' scores on the flow scale—overall flow ($M = 4.14$, $SD = 0.58$), flow antecedents ($M = 4.09$, $SD = 0.59$), and flow experience ($M = 4.18$, $SD = 0.63$)—were significantly higher than the median of the scale (i.e., 3). The mean activity anxiety score ($M = 2.73$, $SD = 0.88$) on the activity anxiety scale was below 3. Table 2 Participants' scores on game feedback ($M = 4.50$, $SD = 0.56$), game usefulness ($M = 4.45$, $SD = 0.61$), game ease of use ($M = 4.56$, $SD = 0.67$), and game elements ($M = 4.27$, $SD = 0.70$) were significantly higher than 3. Participants in Table 3 scored significantly above 3 for both intrinsic cognitive load ($M = 3.53$, $SD = 0.64$) and generative cognitive load ($M = 3.96$, $SD = 0.49$). Conversely, participants scored significantly below 3 for extrinsic cognitive load ($M = 2.18$, $SD = 0.99$).

Through qualitative feedback analysis, participants indicated that scenarios helped clarify assessment directions and enabled them to infer appropriate nursing diagnoses based on patient responses. The GenAI Senior nurse could quickly guide them on how to question patients, provide definitions and characteristics of nursing diagnoses, and offer clues about related factors. Standardized patients further facilitated nursing staff in focusing on learning objectives.

The qualitative feedback indicated that the mechanism could create realistic clinical situations (81.25%), improve interview assessment skills (93.75%), facilitate clinical reasoning (75%), reduce stress (87.5%), and increase concentration (81.25%).

Table 1

The Mean and Standard Deviation of Learners' Flow and Learning Anxiety (N = 16)

	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>Sig.</i>
Overall Flow	4.14	0.58	3.41***	< .001
Flow antecedents	4.09	0.59	3.41***	< .001
Flow experience	4.18	0.63	3.36***	< .001
Learning anxiety	2.73	0.88	-1.00	0.317

*** $p < 0.001$

Table 2

The Mean and Standard Deviation of Learners' Game Feedback, and Game Elements (N = 16)

	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>Sig.</i>
Game Feedback	4.50	0.56	3.44***	< .001
Game Usefulness	4.45	0.61	3.46***	< .001
Game Ease of Use	4.56	0.67	3.40***	< .001
Game elements	4.27	0.70	3.31***	< .001

*** $p < 0.001$

Table 3

The Mean and Standard Deviation of Learners' Cognitive Load (N = 16)

	<i>M</i>	<i>SD</i>	<i>Z</i>	<i>Sig.</i>
Intrinsic cognitive load	3.53	0.64	2.63*	0.009
Extrinsic cognitive load	2.18	0.99	-2.56*	0.010
Germane cognitive load	3.96	0.49	3.43***	< .001

* $p < 0.05$, *** $p < 0.001$

Conclusions and Limitations

This study developed an education-oriented digital game aimed at training nursing personnel to collect data and perform nursing diagnostic reasoning using the Gordon 11 Health Function Patterns assessment. The game design mechanism trains learners to complete the nursing diagnosis process within simulated clinical scenarios. Through interaction with dual GenAI agents and realistic scenario simulation, learners gather data within the space to enhance the experiential learning process.

Results indicate that learners demonstrated increased engagement and participation during the game, with lower levels of activity anxiety. The interface was easily manipulated, and scenarios were realistic. This game is suitable for the teaching phase prior to clinical placements, serving as a preparatory training tool for nursing students before entering real clinical settings. It familiarizes them with nursing assessment techniques and clinical reasoning processes, thereby enhancing their clinical decision-making abilities. Battegazzorre et al. (2020) further noted that virtual patient simulation scenarios help nursing professionals become familiar with clinical environments, enhance communication confidence, and promote effective interactive behaviors. Additionally, virtual cases can provide a safe and contextualized practice environment, guiding students to cultivate sensitivity toward clinical practice and reflective abilities. Based on these findings, future studies are recommended to adopt experimental and control group designs to more deeply explore the impact of game-based learning on nursing clinical reasoning outcomes. At the same time, simplifying task difficulty according to learner ability should be considered to reduce cognitive load, thereby further optimizing the learning experience and educational effectiveness.

References

- Battegazzorre, E., Bottino, A., & Lamberti, F. (2020, December). Training medical communication skills with virtual patients: Literature review and directions for future research. *In International Conference on Intelligent Technologies for Interactive Entertainment* (pp. 207–226). Cham: Springer International Publishing.
- Chien, C., Ho, Y.-T., & Hou, H.-T. (2023). Integrating Immersive Scenes and Interactive Contextual Clue Scaffolding Into Decision-Making Analysis Ability Training Game. *Journal of Educational Computing Research*.
<https://doi.org/10.1177/07356331231205058>
- Hassan, M. A., Habiba, U., Majeed, F., & Shoaib, M. (2021). Adaptive gamification in e-learning based on students' learning styles. *Interactive Learning Environments*, 29(4), 545–565.
- Liao, P. H., Hsu, P. T., Chu, W., & Chu, W. C. (2015). Applying artificial intelligence technology to support decision-making in nursing: A case study in Taiwan. *Health informatics journal*, 21(2), 137–148.
- Mohammadi-Shahboulaghi, F., Khankeh, H., & HosseinZadeh, T. (2021). Clinical reasoning in nursing students: A concept analysis. *Nursing Forum*, 56(4), 1008–1014.
<https://doi.org/10.1111/nuf.12628>
- Ngu, P.-C., Chien, C.-C., Ho, Y.-T., & Hou, H.-T. (2025a). A generative AI educational game framework with multi-scaffolding supports workplace competency development. *Computers & Education*, 105421–105421.
<https://doi.org/10.1016/j.compedu.2025.105421>
- Ngu, P., Chien, C., & Hou, H. (2025b). Design of a Situated Emergency Decision-Making Educational Game Framework Using Mobile Instant Reasoning Scaffolding. *Journal of Computer Assisted Learning*, 41(5). <https://doi.org/10.1111/jcal.70118>
- Ngu, P. C., Chien, C. C., Mao, I. C., Ho, Y. T., & Hou, H. T. (2025c). *Design and fidelity evaluation of a generative AI-based standardized patient consultation simulation game with character fidelity optimization techniques*, paper presented at IIAI International Congress on Advanced Applied Informatics (IIAI LTLE 2025), July 13-19, 2025, Kitakyushu, Japan.
- Rahman, Md. M., & Watanobe, Y. (2023). ChatGPT for Education and Research: Opportunities, Threats, and Strategies. *Applied Sciences*, 13(9).
<https://doi.org/10.3390/app13095783>

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