

Student-Staff Co-Developed Immersive Virtual Reality and Engineered AI Prompts to Enhance Therapeutic Communication

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Abstract

Although students frequently use generative AI for various purposes, their limited understanding of effective usage and critical evaluation often reduces its educational value. This study examines the impact of AI-assisted prompt engineering and explicit instruction in therapeutic communication on nursing students' clinical communication skills during immersive virtual reality (IVR) simulations. Analysis of thirty-seven student scripts across three stages—initial, AI-refined, and therapeutically enhanced—revealed that initial responses were factual and impersonal, reflecting limited AI literacy. Without explicit guidance, students struggled to optimise AI outputs for therapeutic communication. However, prompt engineering led to more structured, empathetic, and patient-centred responses. Thematic analysis of student reflections indicated increased confidence and self-awareness. These findings underscore the essential role of prompt engineering in empowering students to maximise AI's educational benefits and develop advanced communication skills, highlighting the need for targeted instruction to fully realise AI's potential in nursing education.

Keywords: Nursing Education; Virtual Reality; Communication; Prompt Engineering; Generative AI

1. Introduction

Artificial intelligence (AI) is rapidly transforming higher education through applications such as adaptive learning and personalised feedback (Sallam, 2023). However, despite students' frequent use of generative AI, many lack the skills in effective prompt engineering and critical evaluation, which often limits its educational value. While AI-driven simulations and immersive virtual reality (IVR) have shown promise in enhancing experiential learning and communication skills among healthcare students (Elendu et al., 2024), evidence

on using AI and prompt engineering to improve therapeutic communication in scenario-based activities remains scarce (Patil et al., 2024).

This study addresses this gap by evaluating how an IVR game—developed through a student-staff partnership and incorporating AI-driven prompt engineering—affects undergraduate nursing students’ therapeutic communication skills and self-reflection in simulated clinical scenarios. By combining immersive technology with structured prompt engineering, the study explores a practical approach to maximising AI’s potential in nursing education.

2. Methodology

Study Design

This study employed a retrospective, qualitative descriptive design to explore undergraduate nursing students’ experiences and perceived learning outcomes following participation in an immersive VR-based communication skills tutorial. The intervention was delivered as a three-hour tutorial session within the regular curriculum for Year 1 undergraduate nursing students.

Intervention Development

The IVR game and three-hour tutorial were co-developed by two nursing students and one engineering student with faculty guidance from the School of Nursing and the Industrial Centre. During the tutorial, students worked in pairs, participated in two scenarios, and alternated as communicator and observer. The learning process followed three structured steps:

1. **Interactive Gameplay and Peer Critique:** Students interacted with the virtual patient avatar, recorded their spoken responses, and generated speech-to-text transcripts for peer feedback.
2. **Prompt Engineering for Dialogue Refinement:** Using prompt engineering techniques, students iteratively refined their dialogues using various AI tools according to their preference and selection.
3. **Application of Therapeutic Communication Principles:** Students further enhanced their conversations by applying therapeutic communication principles.

Students were also involved in the game’s development and reflected on their learning experiences.

Data Collection

Data were collected from undergraduate nursing students during the IVR

simulation tutorial session using an in-class worksheet to document their communication scripts and game reflections.

Outcome Measures

Stepwise Communication Competency

To evaluate the impact of prompt specificity on the quality of therapeutic communication in a stepwise process, the 5-item DPCC-MS (Doctor-Patient Communication Coding – Medical Students) framework was used as the primary assessment tool (Renaud & Côté, 2017) to assess healthcare students' performance with a 4-point Likert scale (Superior = 4, Expected = 3, Borderline = 2, Insufficient = 1), plus the 'not applicable' option (Cronbach's alpha = 0.90).

Students interacted with virtual patients and recorded their initial spoken responses using speech-to-text technology. All student responses were categorised into three stages to examine their progression in communication competence, benchmarking against the DPCC-MS:

1. Initial Student Response
2. AI-refined Response
3. AI-refined and Therapeutically Enhanced Responses

Game Reflection: Perceived Impact on Communication Skills and Self-Reflection

Students were invited to submit a written reflection as part of their in-class activity. The guiding question for reflection was: "Share your experience with the game briefly."

Data Analysis

Content analysis of the student-generated nurse-patient communication scripts from the educational activities was conducted. The initial analysis was performed using an AI-based assessment tool, which identified the presence and quality of these communication elements. For the reflections, key themes were extracted from the written reflections, focusing on students' experiences, perceived improvements, challenges, and insights gained throughout the intervention. The analysis was subsequently reviewed and refined by two independent researchers to ensure credibility and depth of interpretation.

3. Results and Discussion

Forty Year 1 students enrolled in the undergraduate nursing programme participated in the VR-based prompt engineering learning activity as part of their regular tutorial class. Of these, 37 students (female: n = 23) submitted

written reflections on their experiences during the session. All submitted responses were included in the analysis, with implied consent for use in publication. The qualitative feedback was systematically reviewed to identify key themes in students' perceptions of the activity.

Patterns of Communication Progression, Prompt Utilisation, and Benchmark Achievement

Analysis of stepwise communication competency showed clear improvement across three stages. Initially, students' responses were factual and lacked emotional engagement. After AI-assisted self-refinement, responses became more structured and empathetic. Explicit prompts consistently led to superior or expected DPCC-MS ratings, while vague or generic prompts resulted in only minimal or superficial changes, often remaining at borderline or insufficient levels. Moderately explicit prompts produced some improvement but did not consistently reach the superior level.

Four distinct patterns of progression were identified (Table 1).

Key Themes from Student Reflections on VR-Based Communication Learning

Analysis of students' reflections after the VR exercise revealed key themes regarding how AI-assisted learning improved their communication skills, confidence, self-awareness, and approach to patient interactions:

1. Immersive Realism and Engagement

"The overall design for the game is smooth; patients have realistic responses just like what a patient may ask in a hospital setting. It really inspires me when I am faced with such situations." (Student 1)

2. Communication Skill Development

"In this activity, after I give out my words, the system will introduce an appropriate response which helps me to understand how I can improve my communication skills." (Student 34)

3. Emotional Awareness and Patient-Centred Care

"The conversation simulation helped me recognise what I am going to face while communicating with clients and building a sense of sensitivity to clients' emotions, fostering a trust-caring relationship." (Student 5)

4. Reflection and Self-Improvement

"This VR game allows me to reflect on my immediate response to the

patient's concerns and questions, and thus I can practice my communication skills based on the weakness shown during the conversation with Roy." (Student 19)

5. Creativity and Innovation in Learning

"The pills machine is quite a creative idea for us as new users in VR and attracts us to keep playing it." (Student 18)

Discussion

The integration of AI-assisted prompt engineering with explicit instruction in therapeutic communication represents a significant advancement in nursing education, enhancing students' clinical communication skills. Blended approaches facilitate skill transfer (Ching & Ho, 2025), with VR simulations promoting critical thinking, practice, feedback, and empathy. Furthermore, higher levels of AI literacy are associated with improved communication competency.

Consistent with recent studies, the combination of AI technologies, particularly in IVR environments, with structured teaching—as scoping reviews highlight the benefits of AI-driven personalisation, iterative feedback, and VR's immersive learning experiences (Cucci et al., 2025)—is effective. Generative AI tools enhance confidence and learning outcomes when supported by deliberate pedagogical scaffolding (Gonzalez-Garcia et al., 2025).

Our findings reveal that students' initial responses were predominantly factual and impersonal, lacking emotional validation, indicating limited AI literacy and an inability to effectively leverage generative AI for self-learning. Without explicit guidance, students struggled to optimise AI outputs for therapeutic communication. The introduction of explicit prompt engineering markedly transformed response quality, resulting in more structured, empathetic, and patient-centred communication, with the highest competency levels observed in the final stage.

Despite these promising results, the study has several limitations, including a single-cohort design, lack of a control group, scripted simulations, and reliance on self-reported reflections. Future studies should employ objective measures and assess long-term skill transfer.

4. Implications

This study concludes that integrating AI-driven prompt engineering with IVR training effectively enhances nursing students' empathetic, patient-centred communication, self-reflection, self-learning, and advanced skills. Structured

prompts yielded the strongest improvements, while reflections revealed greater engagement and self-awareness. These findings underscore the pivotal role of prompt engineering in realising the full educational potential of AI. On a global scale, they signal AI-integrated education as a promising future trajectory in healthcare pedagogy. Combining structured AI prompts with immersive simulation provides a scalable and effective model for therapeutic communication training. Continued guidance and feedback are recommended, alongside future multi-site, controlled studies to evaluate long-term retention and clinical transferability.

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Ethical Declaration Statement

The project has been approved by the Departmental Research Committee of The Hong Kong Polytechnic University (Reference Number: HSEARS20251004007).

Generative AI Policy

The authors used GPT-4.1 to extract preliminary themes and elements from communication response and reflection scripts, as described in the data analysis section, and for grammar editing. Scite was utilised during the literature review process. After utilising the tool/service, the author(s) thoroughly reviewed and edited the content as necessary and assumed full responsibility for the publication's content.

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Table 1. Communication Progression Patterns, Example Prompts, and DPCC-MS Benchmark Ratings (n = 34)

Communication Pattern	Scripts (n)	Example of Prompt Used (Student code number)	DPCC-MS Benchmark at Final Stage	Description	Example Response	
					Initial	Final
Most Effective Initial Conversations	3	No prompt needed or simple prompt: Please check for clarity.” (S03)	Superior (4) or Expected (3)	Consistently strong patient-centered communication from the outset, maintained or enhanced through each stage.	“I know you are negative now. You can have your autonomy to choose your things to do before you die. But our nursing team will help you and try our best to help you recover.”	
Least Effective Initial but Best Progressions	14	Explicit prompt: “Refine this response using therapeutic communication techniques such as empathy, validation, normalization, and open-ended questions.” (S11)	Superior (4) or Expected (3)	Marked improvement from borderline/insufficient to superior/expected after explicit prompting.	“It is just for the health screening and don’t be worried about this.”	“It sounds like you’re wondering why this is necessary, which is a very common question, especially for someone your age. Can you tell me what specific part of the procedure is on your mind right now?”
Moderate/Mixed Progression	10	Moderately explicit prompt: “Make this response more supportive and clear.” (S22)	Expected (3) or Borderline (2)	Some improvement, often reaching expected but not superior; communication is supportive but not fully patient-centred.	“You should not worry.”	“It’s understandable to be concerned. Let’s talk about your worries.”
Least Effective Performance Without Significant Progression	7	Vague/generic prompt: “Can you improve this response?” (S29)	Borderline (2) or Insufficient (1)	Minimal change, typically due to vague prompts; communication remains factual, directive, or lacking empathy.	“I understand you are afraid of it but the information from Google must not be 100% correct...”	“I understand you are afraid of it but the information from Google must not be 100% correct...”

Note:

- **DPCC-MS Benchmark at Final Stage:** Indicates the typical rating achieved in the final response for scripts in this pattern, based on the DPCC-MS scale (Superior = 4, Expected = 3, Borderline = 2, Insufficient = 1).
- **Example of Prompt Used:** Illustrates the type of AI prompt that led to the observed communication pattern.