Assigning Roles in Educational Escape Rooms for Nursing Students- Effective or Not?

Introduction

Professions in nursing require diverse sets of skills that do not limit to clinical expertise, but also extend to communication and teamwork with team members. They share different but adjacently related roles in terms of operating protocols and clinical decision-making. Nursing students have been trained with high-fidelity simulations to equip such competencies, which were traditionally proven to be an effective instructional strategy (Inayat et al., 2021). To complement the potential high-pressure nature of high-fidelity clinical simulations, educational escape rooms (EER) have emerged to better engage students (Bonaduce, 2024; Valdes et al., 2021). EERs depict a playful environment where students participate as a team in a series of problem-solving activities from puzzles and step forward to achieve the final objective of "escaping" the room. These procedures align with elements of collaborative problem-solving (CPS) that involves building a common understanding and utilizing it to resolve the problem situation (Sun et al., 2020).

Along with incorporating the EER, another main topic of this study is a role assignment as a design element in the high-fidelity simulations. Assigning roles to nursing students means providing them an opportunity to practice a certain clinical role and demonstrate knowledge and professional communication skills. There are existing studies that examine effects of role assignment in clinical simulation practices (Alexander, 2020; Weiler et al., 2018). However, it is necessary to transfer such effects to the emergent simulation environment such as EER with CPS activities, and resolve potential inconsistencies in previous findings.

Moreover, this study aims to capture students' engagement in an ordered network analysis (ONA) which visualizes temporal dynamics of epistemic activities. While epistemic network analysis (ENA) is relatively a well-established method for examining epistemic relationships in CPS discourses (Swieki et al., 2020), it primarily focuses on co-occurrence patterns and provides limited insight into the sequential flow of interactions (Fogel et al., 2021). ONA addresses this by analyzing the order of behavioral transitions, allowing for a more detailed understanding of CPS processes (Tan et al., 2024). Thus, this study aims to provide evidence on the effectiveness of role assignment on nursing students' engagement in CPS within EER. The research question is as follows: How do students' ordered process of CPS associate with each other, and differ between the group with and without role assignment?

Background

Role assignments have become an integral part of traditional high-fidelity simulations in nursing education. These roles often reflect actual clinical positions—primary nurse, assessment nurse, and medication nurse—and are used to simulate real-world responsibilities, enabling students to rehearse the dynamics of healthcare delivery in a team-based environment (Hooper & Carlson, 2024).

Research on role assignments in clinical simulations show perplexing results. An experimental study by Weiler et al. (2018) found that assigning specific roles significantly influenced students' critical thinking skills and various aspects of self-efficacy. Similarly, Litke-Wager et al. (2021) demonstrated that task-oriented role assignments positively affected performance in a neonatal resuscitation simulation. However, in some cases, role assignments were approached in somewhat questionable way or did not necessarily yield positive results. For example, in Alexander's (2020) study, roles were assigned based on perceived learning styles—a model widely criticized in educational psychology for lacking empirical support (Kirschner, 2017). Also, Hooper and Carlson (2024) found no difference in knowledge acquisition based on role assignment in a high-fidelity nursing simulation.

In existing EER literature, investigating independent design element has not occurred at scale. In their scoping review, Burbage and Pace (2024) reported that most educational escape rooms in healthcare fail to report on foundational design elements, including role structures. This oversight prevents researchers and educators from identifying patterns that might improve the instructional value of EERs. Based on the existing literature from high-fidelity simulation settings, it is sensible to expect thoughtfully designed role assignments in EERs to help structure collaboration, evenly distribute the cognitive load, and ensure balanced participation. It may also reveal leadership tendencies and foster professional identity formation. However, without rigorous study, these hypotheses remain speculative. Understanding the influence of structured roles is not only a matter of pedagogical interest but of practical value, as it would allow educators to design escape rooms that are both equitable and educationally impactful.

Method
Escape Room
The EER used in this study was co-designed with an experienced nursing educator. In this scenario, students encountered four steps of the nursing process model: notice, interpret, intervene, and reflect (Tanner, 2006). There were six lockboxes in the room, each of which led participants to engage in a specific clinical task, which included dosage calculation and lab results interpretation. There were puzzles associated with each task, of which solutions were three-digit codes used to unlock the boxes. Students would find a gold coin marked with a letter in each box. When all six boxes were unlocked, the coins were then put together to uncover the final solution,

which formed the word "advocacy." It links to one of the core virtues of nursing, and to successfully "escape" the patient room (Figure 1).

[Insert Figure 1]

The activity lasted approximately 30 minutes for all teams. Assigned roles for the experimental group included primary nurse, medication nurse, assessment nurse, and, when applicable, a monitoring nurse for four-member teams. Students brought their own stethoscopes and could request hints from the researcher at any point. Facilitators observed without intervening, except when student safety was at risk.

Participants
The participants were 20 second-semester baccalaureate nursing students from a public university in the southeastern United States. Ten students were placed in control groups, and ten in experimental groups, with role assignment as the intervention. Participants were recruited through convenience sampling and participated voluntarily without incentives. All had prior experience with clinical simulations, but none had participated in educational or entertainment-based escape rooms. Audio recordings were made with participants' consent, and each student was assigned a pseudonym to ensure confidentiality. The study was approved by the institutional review board.

Data Collection & Analysis
Data were drawn from transcripts of audio recordings capturing student conversations during the EER. Recordings were collected using internal audiovisual equipment in the university's simulation lab, then exported, cleaned, and transcribed for analysis. To address the research question, transcripts were segmented into message units and coded using a collaborative problem-solving (CPS) framework (Table 1), adapted from Sun et al. (2020) and Buseyne et al. (2024). Initial coding was conducted by all researchers, achieving interrater reliability with Cohen's kappa exceeding .76. We used Ordered Network Analysis (ONA) to investigate temporal dynamics of CPS, offering an extension to traditional Epistemic Network Analysis (ENA). The analysis, including statistical testing and network visualization, was conducted using the ENA web tool (https://www.epistemicnetwork.org/).

[Insert Table 1]

Results

Figure 1a and 1b show ordered network models from the control group and the experimental group, respectively. Both groups generally showed the most frequency in re-occurrence of *Establishing Common Ground* (A2), and it was mostly directed from other sharing and negotiating movements. For the control group, this behavior was mostly preceded by codes A1 and B3. In other words, the control group tended to seek a common understanding based on shared knowledge and potential solutions.

On the other hand, the experimental group showed strong directions from *Sharing Knowledge and Understanding* (A1) and *Responding to Ideas or Proposed Solutions* (B1) to *Establishing Common Ground* (A2). In addition, both groups often repeated *Sharing Knowledge* (A1), but the experimental group showed Responding to Others' Ideas as frequently as A1. And though relatively moderate, the control group's behavior of *Discussing Strategy* (B3) often recurred in a sequence, as shown by the bigger node of B3 in Figure 1a.

Upon comparison between the two groups, a non-parametric Mann-Whitney test was conducted to prove statistical significance. The control group was shown to be significantly different from the experimental group along the X-axis (U=380.00, p=.00, r=-.98) instead of the Y-axis (U=197.00, p=.90, r=-.03). Based on this result, Figure 2 depicts how each group shows CPS behaviors in proximity within a moving stanza size of 4, on the horizontal dimension. For instance, while the control group frequently showed an ordered sequence from *Discussing Strategy* (B3) to *Establishing Common Ground* (A2), the experimental group frequently proceeded from *Sharing Knowledge and Understanding* (A1) and *Monitoring Execution* (B2) to *Establishing Common Ground* (A2). In addition, the experimental group showed a strong connection from A2 to *Responding to Ideas or Proposed Solutions* (B1).

These findings from the comparison reveal that the experimental group attempted to form the common conceptual space from current information and the team's progress, while the control group's common space is directed by conversations on potential strategy and solutions. The experimental group also vividly presents behaviors of moving on from the common space with consensus to negotiating moves.

[Insert Figures 2 and 3]

Discussion
This study revealed how CPS behaviors unfold in a structured sequence during the EER for nursing education. Using ONA to map the temporal interactions between participants, we identified directed patterns that led to

certain group behaviors, such as the creation of a common space for shared understanding. We noticed that in the experimental group with assigned roles, participants were more likely to contribute individually grounded ideas that were integrated into the team's approach. The control group, lacking defined roles, showed stronger recurrence in refining collective strategies, suggesting a broader reliance on group validation before progressing. These differences show the impact of structured roles on shaping the coordination and progression of CPS behaviors during simulations.

In the context of nursing education, these findings emphasize the pedagogical value of embedding role assignment in simulation design. The structured roles appeared to enhance students' awareness of team dynamics and individual responsibilities, facilitating efficient monitoring of team progress and deeper engagement in task coordination. While both groups engaged in collaborative behaviors, the experimental group demonstrated more focused transitions from individual input to team-wide synthesis. This suggests that nursing students may benefit from CPS tasks that mirror authentic clinical structures, where clear role delineation is common. Role assignment allowed participants to anticipate peer contributions and streamline cognitive effort toward problem-solving, fostering a more advanced and targeted common ground for decision-making.

Despite these contributions, the study has several limitations. The data were primarily derived from transcript-based discourse analysis, which limits insights into non-verbal behaviors such as gestures, eye gaze, or interface interactions that may also shape CPS. Additionally, the study did not explore long-term learning effects, such as the transfer of collaborative skills to real clinical environments. There is also the possibility of facilitator bias or variance in how students interpreted their roles, which could influence engagement differently across groups. Finally, the specific context of EER and its constraints may not fully generalize to broader simulation formats used in diverse educational settings. Future research should integrate multimodal data—including screen recordings and gesture tracking—to capture a richer picture of collaborative interactions. Combining these methods with qualitative interviews would offer deeper insight into students' perceptions of their roles and how these shaped their engagement and reasoning during the simulation. Another direction is to investigate alternative design features, such as introducing competitive elements or gamified incentives, which may further influence motivation and team dynamics. Furthermore, exploring how role assignment interacts with other variables— like prior experience, cognitive load, or emotional state—could offer deeper understanding of the mechanisms underlying effective CPS in simulation-based learning.

Conclusion

This study addresses a key gap in literature by examining role assignments in EER through a learning sciences lens, providing evidence of how this design feature structures CPS processes. By tracking behavioral sequences and analyzing group discourse, the findings highlight that defined roles can facilitate coordination, shared understanding, and task progression. These insights can inform the development of more authentic and pedagogically effective clinical simulations in nursing education.

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Table 1. Coding scheme and examples

Category	Codes	Example Quote
A. Shared Knowledge	A1. Shares knowledge and understanding	*Respiratory is changing. Oh, there's a change in O2. We need to get to 94.*
	A2. Establishes common ground	*I feel like that could only be a level of consciousness, right?*

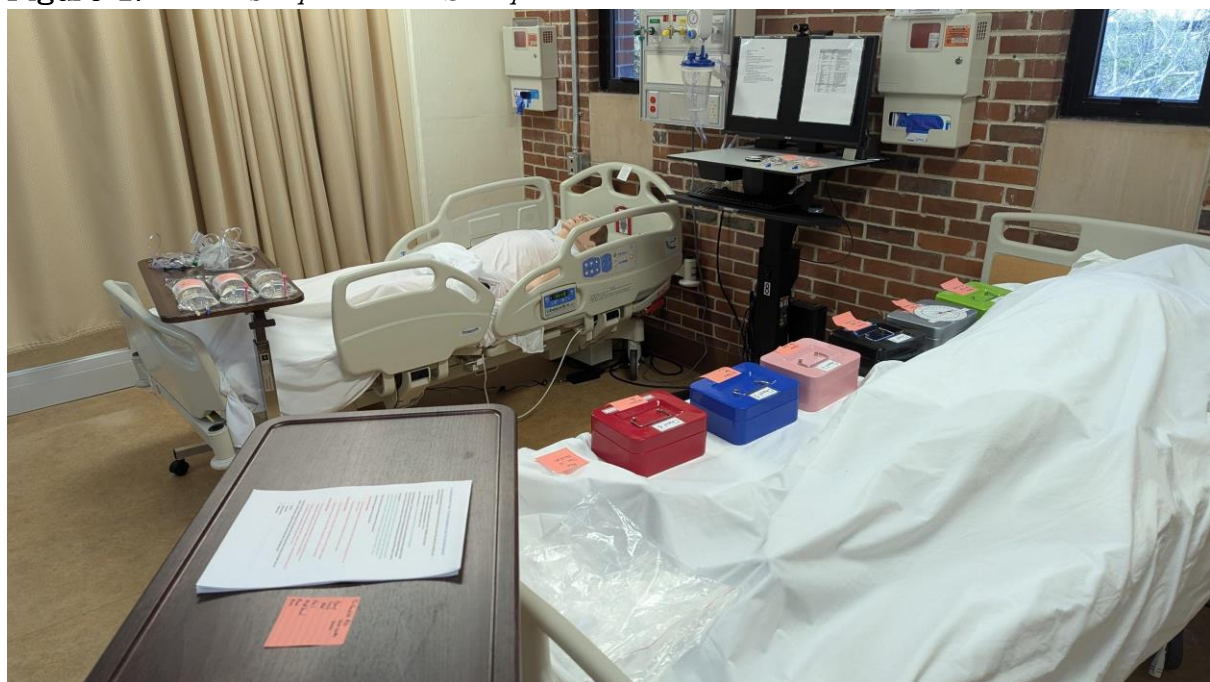| B. Negotiation & Coordination | B1. Responds to other's ideas or proposed solutions | *(Maybe the nasal cannula?) → It was at 91 and the respiratory rate is 26 so I think a nasal cannula should be okay.* |
	B2. Monitors execution (progress and result)	*So breathing was probably the nasal cannula, and that's five. But then what else do we have?*
	B3. Discusses strategies	*We can take the first hint over there and just get started.*
C. Maintaining Team Function	C1. Takes initiatives to advance collaboration processes	*- When do you guys want to start on that? - Good job! Okay, let's get through this.*
	C2. Pays attention to task division & individual role	*Do you want me to just use the numbers for the thing?*

Figure 1. *The Escape Room Setup*

Figure 2. *Individual network models from control group (2a; left; red) and experimental group (2b; right; blue)*
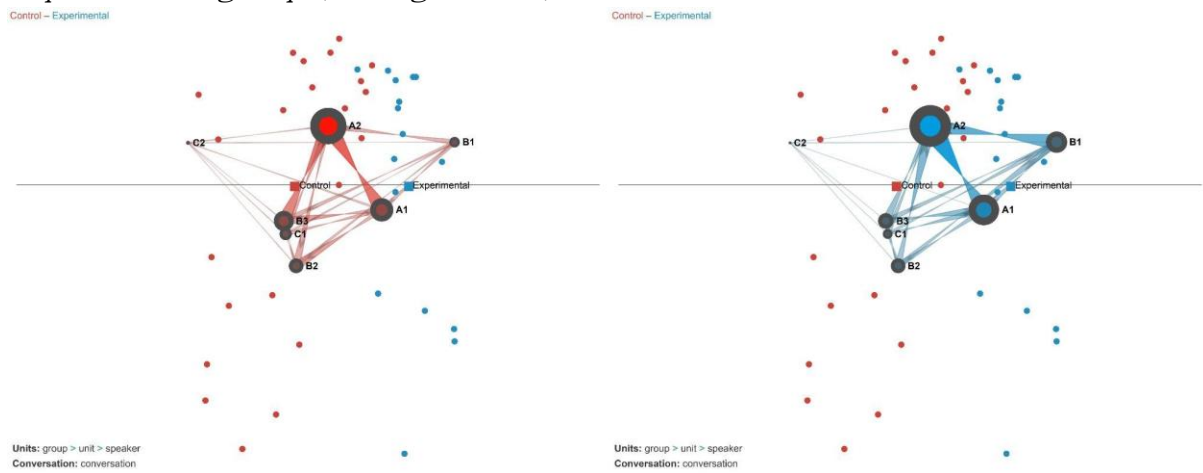

Figure 3. *Network model in comparison of two groups*