SHORT COMMUNICATION

Mixed reality-based online interprofessional education: a case study in South Korea

Yong Joon Kang[1] and Yun Kang[2]

[1]School of Medicine, Jeju National University, Jeju and [2]College of Nursing, Taegu Science University, Daegu, Korea

Purpose: The purpose of this study was to explore undergraduate medical and nursing students' satisfaction with their mixed reality (MR)-based online interprofessional learning experience in South Korea.

Methods: This study used a case study design. A convenience sample of 30 participants (i.e., 15 third-year medical students and 15 fourth-year nursing students) participated in a 120-minute MR-based online interprofessional education (IPE) that consisted of visualization of holographic standardized patient with ischemic stroke, online interprofessional activity, and debriefing and reflection sessions. Following the MR-based online IPE, data were collected through Modified Satisfaction with Simulation Experience Scale survey and were analyzed using descriptive analyses and independent t-tests.

Results: Although medical and nursing students were highly satisfied with MR-based online interprofessional learning experience, nursing students were significantly more satisfied with it compared with medical students.

Conclusion: These results suggest that the integration of MR and online approach through the structured clinical reasoning process in undergraduate health professions programs can be used as an educational strategy to improve clinical reasoning and critical thinking and to promote interprofessional understanding.

Key Words: Interprofessional education, Medical students, Mixed reality, Nursing students

Introduction

There is an increasing awareness of the importance of interprofessional education (IPE) in undergraduate health professions programs. IPE is defined as teaching and learning the process where two or more health professions students learn with, from, and about one another to promote effective collaboration for delivery of safe and quality patient care [1,2]. However, education for undergraduate health professions students remains siloed as the training takes place mainly in their specific professional fields [3]. This can cause difficulties in working within a healthcare team after graduation if newly graduated healthcare professionals have no previous experience of interprofessional collaboration [3].

As an educational tool, mixed reality (MR) is one of the most emerging immersive technologies in undergraduate health professions education programs [4,5]. It is a type of augmented reality that allows digitally produced objects to be overlaid on a real environment,

Received: August 16, 2021 • Revised: October 13, 2021 • Accepted: November 9, 2021
Corresponding Author: Yun Kang (https://orcid.org/0000-0001-9914-8969)
College of Nursing, Taegu Science University, 47 Youngsong-ro, Buk-gu, Daegu 41453, Korea
Tel: +82.53.320.1752 Fax: +82.53.320.1761 email: ykang01157@tsu.ac.kr

Korean J Med Educ 2022 Mar; 34(1): 63-69
https://doi.org/10.3946/kjme.2022.220
eISSN: 2005-7288

using a headset [4]. As MR technologies, Microsoft HoloLens and HoloPatient application (Microsoft Corp., Redmond, USA) are recently used in nursing education in Western countries such as Australia and New Zealand [4-7]. The HoloPatient is a form of holographic standardized patients (HSPs) produced commercially by GiGXR. The use of MR enhances student motivation and engages in active learning [5,7]. It also assists students to develop clinical reasoning, judgement, and assessment skills, allowing them to collect visual and aural cues through improved visualization and reflective practice [5-7]. However, the use of MR in IPE is relatively new internationally and in South Korea. A recent pilot study in Australia demonstrated that MR provides a consistent method by which various health professions students (i.e., medicine, nursing, occupational therapy, and dietetics) could examine the same patient in the same circumstances [4]. Thus, MR can be applied to IPE, which may result in improving the understanding of each other's roles within healthcare teams.

Due to the current coronavirus disease 2019 (COVID-19) pandemic status, online approaches to facilitate delivering IPE is increasingly popular [8,9]. Health professions students perceived that online IPE was as effective as in-person session [8]. Health professions students also reported that online IPE provided opportunities to engage in collaborative problem-solving in a team and the importance of including their own professional perspectives [10]. Due to our personal experiences facing difficulties (e.g., geographical barriers if health professions students are from different school regarding the implementation of face-to-face IPE), we sought to develop and implement MR-based online IPE in which medical and nursing students could engage and develop interprofessional understandings.

Methods

1. Design

This study used a case study design through analysis of the survey. A convenience sample of 30 medical and nursing students was recruited through flyers on the bulletin board at one college of nursing and one school of medicine, respectively and voluntarily participated in this study. One mixed group consisted of three medical students and three nursing students, which resulted in a total of five groups.

2. MR-based online interprofessional education

We divided the MR-based online IPE into three parts, using the clinical reasoning cycle [11] as a structure. Each part was timed and represented 120 minutes of activity. We used the HSP, namely HoloPatient who portrayed the symptoms of ischemic stroke. In South Korea, stroke is an emergency disease in which the time from onset to treatment is important as the third leading cause of death [12].

For part 1, medical and nursing students met the HoloPatient at their own institution, respectively due to time and resource constraints. A facilitator saw the HSP representing the changes in the level of consciousness, decreased functions of the right side (i.e., facial droop and arm drift) and slurred speech clearly and displayed vital signs in emergency department, wearing the HoloLens, which was projected onto the screen. So, medical and nursing students could see a live streamed HSP in the same environment at the same time. They were asked to spend 10 minutes immersed in HSP of the screen, using from the first step to the third step of the structured clinical reasoning cycle [11].

In part 2 of the 100-minute online IPE, the activity was to emphasize interactive learning and active participation [13]. The interactive approach was facilitated using group discussion, selected presentations, and non-judgmental feedback from two co-facilitators (i.e., one medical faculty and one nursing faculty). In the first step, medical and nursing students in groups had ten minutes to share part 1 activity using from the first step to the third step of the structured clinical reasoning cycle. Then, selected groups presented about what they discussed from the first step to the third step in order during the 10 minutes. They in groups discussed the care plan, using the four steps to the seven steps of the structured clinical reasoning cycle. Mini-lectures were interspersed with group sessions and were used to summarize ideas, show the relationship between theory and practice and re-emphasize the main point.

In part 3, medical and nursing students debriefed their experiences with two co-facilitators. This allowed them to reflect on their learning and how to take that forward. It helped them to examine their values and beliefs and influence their attitude toward interprofessional collaborative practice.

3. Outcome measures

This study used the Modified Satisfaction with Simulation Experience Scale (SSES) designed as a 5-point Likert scale (1 point=very unsatisfied, 2 points =unsatisfied, 3 points=neutral, 4 points=satisfied, and 5 points=very satisfied) to measure medical and nursing students' satisfaction with their MR-based online interprofessional learning experience [14,15]. The SSES comprises three components: (1) debriefing and reflection (questions 1 to 7); (2) critical thinking and reasoning (questions 8 to 11); and (3) clinical learning (questions 12 to 24). We added question 25 to evaluate the immersed learning experience from MR context. We also added question 26 to 33 to evaluate the online interprofessional learning (Table 1). We calculated the total scores, yielding an index with a minimum score of 33 and a maximum score of 165.

The Cronbach's alpha of the original SSES in a previous study was 0.77 [14]. Internal consistency of each subscale was reported high: 0.94, 0.86, and 0.85, respectively [14]. In this study, the Cronbach's α of each subscale was high: 0.88, 0.85, 0.95, and 0.94, respectively. We made minor wording changes to 10 to 24 in order to fit MR and stroke contents. The English version of the modified SSES was translated into Korean by the second author [15]. Back translation was conducted by one bilingual South Korean nursing and medical professors.

4. Data collection procedure

This study was conducted in May 2021. All participants were asked to complete the survey after the MR-based online IPE.

5. Data analysis

This study used the IBM SPSS ver. 21.0 (IBM Corp., Armonk, USA) for survey. We undertook descriptive analyses to summarize participants' characteristics. We also used independent t-tests to compare the means of the survey of the two samples. All p-values <0.05 were used to identify statistical significance.

6. Ethical considerations

This study obtained the Ethical approval from the Institutional Review Board of Jeju National University (IRB no., 2021-04-001). We received all participants' informed written consent before the start of this study.

Table 1. The Modified Satisfaction with Simulation Experience Scale

Satisfaction with Simulation Experience Scale–Modified
Debrief and reflection (using a 5-point ordinal scale)
1. The facilitator assisted me to determine if I had met the learning outcomes.
2. The facilitator summarized key points during the debriefing.
3. I had the opportunity to reflect on and discuss my learning during the debriefing.
4. The debriefing provided an opportunity to ask questions.
5. The facilitator provided feedback that helped me to advance my understanding of acute ischemic stroke.
6. Reflecting on and discussing the visualization enhanced my learning.
7. The facilitator made me feel comfortable and at ease during the debrief.
Case study: critical thinking and clinical reasoning (using a 5-point ordinal scale)
8. The visualization and case study developed my critical thinking skills.
9. The visualization and case study developed my clinical reasoning and decision making ability in relation to drug therapy.
10. The visualization helped me to understand the importance of ascertaining the time of symptoms onset or last documented normal.
11. The visualization helped my understanding of the relationship of atrial fibrillation and CVA.
Clinical learning (using a 5-point ordinal scale)
12. The visualization tested my ability to apply theory to practice situations.
13. The visualization reinforced content taught in the course.
14. The visualization improved my understanding of identifying signs and symptoms of a CVA.
15. The visualization helped me to see the relevance of what I learned in the course to patient care.
16. The visualization tested my capacity to set goals and plan care for treating a patient post CVA.
17. The visualization helped me to recognize my theory strengths and weaknesses.
18. As a result of the visualization I felt more prepared for educating patients about how beta blocker medications work.
19. The visualization has built confidence in my ability to apply CVA knowledge in practice.
20. The visualization was effective in enhancing my understanding of care of the patient post CVA concepts.
21. The visualization enhanced my understanding of the importance of interprofessional collaboration when caring for a post CVA patient.
22. The visualization increased my understanding of how beta blockers work.
23. The visualization assisted me to identify safety points in relation to patient administration of thrombolytic medication.
24. This was a valuable learning experience.
Additional question (using a 5-point ordinal scale)
25. I believe that the visualization will enhance my understanding of patient conditions and treatment taught in other courses.
Online interprofessoinal learning (using a 5-point ordinal scale)
26. Online interprofessional learning was effective in applying the knowledge I learned.
27. Online interprofessional learning was a useful learning experience.
28. Feedback from other health professions was constructive.
29. Online interprofessional learning helped me to communicate with other health professions in clinical settings.
30. It was possible to interact and discuss with other health professions directly during online interprofessional learning.
31. Online interprofessional learning has built confidence in my ability to work collaboratively with other health professions.
32. Online interprofessional learning was good to test my ability to build relationships with patients.
33. Online interprofessional learning was valuable for preparing for future collaborative healthcare practice.

CVA: Cerebrovascular accident.

Results

Fifteen 3rd-year medical students and fifteen 4th-year nursing students participated in the MR-based online IPE. The medical students consisted of six female (40%) and nine male (60%) students. Nursing students consisted of 11 female (73.3%) and four male (26.7%). Nursing students were significantly more satisfied with MR-based online interprofessional learning experiences (p=0.030) (Table 2).

Table 2. Comparison of Satisfaction with the Mixed Reality-Based Interprofessional Education

Variable	Max score for each subscale	Mean ± SD	t-value	p-value
The Modified SSES: 33 questions	165		-2.293	0.030
Medical		151.07 ± 11.907		
Nursing		161.67 ± 13.367		
Subscale				
Debriefing and reflection: 7 questions	35		-1.165	0.254
Medical		32.20 ± 3.144		
Nursing		33.47 ± 2.800		
Critical thinking and clinical reasoning: 4 questions	20		-2.799	0.009
Medical		15.93 ± 3.173		
Nursing		18.67 ± 2.059		
Clinical learning: 13 questions	65		-2.648	0.013
Medical		55.53 ± 8.340		
Nursing		62.07 ± 4.667		
Online interprofessional learning: 8 questions	40		-0.050	0.960
Medical		37.98 ± 3.788		
Nursing		38.04 ± 3509		

SD: Standard deviation.

Discussion

To our knowledge, this was the first study to use MR technology for IPE among undergraduate medical and nursing students in South Korea. MR in undergraduate health professions programs is novel and innovative that needs to be taken into consideration. This study showed that although medical and nursing students were highly satisfied with MR-based online interprofessional learning experience, nursing students were significantly more satisfied with it compared with medical students. Recently, an Australian pilot study reported that thirteen health professions students (i.e., medicine, nursing, occupational therapy, and dietetics) consistently recognized pain as a patient need [4]. This finding supports the recent pilot study [8]. This is because the use of MR in this study allowed medical and nursing students to view the same HSP displaying the symptoms of ischemic stroke that could appear realistic although this took place at their own institutions respectively. Thus, this finding suggests that the use of MR in IPE can be effective with other health professions students, even full healthcare teams despite being in geographically different areas.

This study showed that medical and nursing students were highly satisfied with MR-based online IPE regarding debriefing and reflection. It seems that two co-facilitation through interactive approach in online IPE was effective. This finding supports the recent study that highlighted the importance of facilitators when using technology to facilitate IPE [10]. Thus, regardless of the form of health professions students' discussions in IPE, it is crucial for facilitators to monitor health professions students' interactions and intervene when necessary to correct any misunderstanding, engage them in deeper learning, and summarize key points.

In this study, nursing students were significantly more satisfied with MR-based IPE experience than medical students regarding clinical learning. The recent COVID-19 situation shortens and limits clinical learning experiences for health professions students, particularly nursing students in South Korea. The use of MR in IPE can give an opportunity for health professions students

not only to meet a HSP like a real patient but also to think like a healthcare professional such as doctors and nurses. Also, it can offer health professions students opportunities to develop skills in observing and noticing physical cues, which can improve their adaptation to changes in pateints health and how to interact with other health professionals in health care team.

This study has some limitations. First, the findings in this study may not generalize in South Korea, because one medicine and one nursing institutions were studied. Second, the survey was completed immediately following the MR-based online IPE. Posttest results of the survey may be different if participants were provided a longer waiting period.

In conclusion, this study suggests that the integration of MR and online approach through the structured clinical reasoning process in undergraduate health professions programs can be used as an educational strategy to improve clinical reasoning and critical thinking and to promote interprofessional understanding.

ORCID:

Yong Joon Kang: https://orcid.org/0000-0002-3550-7755;
Yun Kang: https://orcid.org/0000-0001-9914-8969

Acknowledgements: None.

Funding: No financial support was received for this study.

Conflicts of interest: No potential conflict of interest relevant to this article was reported.

Author contributions: YJK and YK: conception and desing of the study, data collection, analysis and interpretation, writing the article and the final approval of the verstion to be approved.

References

1. Hunter S, Arthur C. Clinical reasoning of nursing students on clinical placement: clinical educators' perceptions. Nurse Educ Pract. 2016;18:73-79.
2. Costa DK, Kuza CC, Kahn JM. Differences between nurse- and physician-assessed ICU characteristics using a standardized survey. Int J Qual Health Care. 2015; 27(5):344-348.
3. Evanoff B, Potter P, Wolf L, Grayson D, Dunagan C, Boxerman S. Can we talk?: priorities for patient care differed among health care providers. In: Henriksen K, Battles JB, Marks ES, Lewin DI, eds. Advances in Patient Safety: From Research to Implementation. Rockville, USA: Agency for Healthcare Research and Quality; 2005:5-14.
4. Frost J, Chipchase L, Kecskes Z, D'Cunha NM, Fitzgerald R. Research in brief: exploring perceptions of needs for the same patient across disciplines using mixed reality: a pilot study. Clin Simul Nurs. 2020;43:21-25.
5. Ditzel L, Collins E. Holograms in nursing education: results of an exploratory study. J Nurs Educ Pract. 2021;11(8):43-52.
6. Collins E, Ditzel L. Holograms enhance student learning. Nurs N Z. 2018;24(10):26.
7. Frost J, Delaney L, Fitzgerald R. Exploring the application of mixed reality in nurse education. BMJ Simul Technol Enhanc Learn. 2020;6(4):214-219.
8. Jones TA, Vidal G, Taylor C. Interprofessional education during the COVID-19 pandemic: finding the good in a bad situation. J Interprof Care. 2020;34(5):633-646.
9. Evans SM, Ward C, Reeves S. Online interprofessional education facilitation: a scoping review. Med Teach. 2019;41(2):215-222.
10. Solomon P, Baptiste S, Hall P, et al. Students' perceptions of interprofessional learning through facilitated

online learning modules. Med Teach. 2010;32(9):e391-e398.

11. Levett-Jones T, Hoffman K, Dempsey J, et al. The 'five rights' of clinical reasoning: an educational model to enhance nursing students' ability to identify and manage clinically 'at risk' patients. Nurse Educ Today. 2010; 30(6):515-520.
12. Korean Statistical Information Service. Statistics Korea Web Site. http://www.index.go.kr/potal/main/EachDtlPage Detail.do?idx_cd=1012. Accessed May 6, 2021.
13. Knowles MS. The modern practice of adult education: from pedagogy to andragogy. Englewood Cliffs, USA: Cambridge Adult Education; 1980.
14. Levett-Jones T, McCoy M, Lapkin S, et al. The development and psychometric testing of the Satisfaction with Simulation Experience Scale. Nurse Educ Today. 2011; 31(7):705-710.
15. Hanson J, Andersen P, Dunn PK. Effectiveness of three-dimensional visualisation on undergraduate nursing and midwifery students' knowledge and achievement in pharmacology: a mixed methods study. Nurse Educ Today. 2019;81:19-25.