Japanese Journal of Comprehensive Rehabilitation Science (2025)

Original Article

Development and Evaluation of a Virtual Reality-Based Teaching Material for Interprofessional Education: A Case Study on Swallowing Videofluorography

Shotaro Komaki, ST, PhD,[1] Shogo Baba, RT, MMSc,[2] Yuuko Yotsumoto, OT, MHSc,[3] Takayuki Yamashita, PT, M.ed.,[4] Susumu Takayoshi, ST, MHSc,[1] Hisashi Niidome, RT, MMSc,[2] Megumi Imamura, RN,[5] Megumi Mihara, CW,[6] Daisuke Hirahara, RT, M.A.[7]

[1]Department of Speech-Language-Hearing Therapy, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[2]Department of Medical Radiological Technology, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[3]Department of Occupational Therapy, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[4]Department of Physical Therapy, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[5]Department of Nursing, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[6]Department of Care Work, Kagoshima Medical Professional College, Kagoshima-shi, Kagoshima, Japan
[7]Department of AI Research Lab, Harada Academy, Kagoshima-shi, Kagoshima, Japan

ABSTRACT

Komaki S, Baba S, Yotsumoto Y, Yamashita T, Takayoshi S, Niidome H, Imamura M, Mihara M, Hirahara D. Development and Evaluation of a Virtual Reality-Based Teaching Material for Interprofessional Education: A Case Study on Swallowing Videofluorography. Jpn J Compr Rehabil Sci 2025; 16: 37–45.

Objective: With the advancement of team-based medical care, effective interprofessional collaboration (IPC) has become increasingly important. However, implementing IPC without appropriate interprofessional education (IPE) remains challenging. This study aimed to clarify the educational effects of a virtual reality-based IPE teaching material on students' awareness and understanding of IPC. Specifically, it evaluated changes in awareness before and after lectures and the impact of different viewing environments on educational effectiveness.

Methods: A total of 224 students from six medical and welfare-related departments participated in lectures focused on IPC using a swallowing videofluorography scenario. The students were divided into three groups based on viewing environment: personal computer (PC), classroom screen, and virtual reality (VR). All groups viewed the same teaching material. Awareness and understanding of IPC were assessed before and after the lectures using a 12-item self-administered questionnaire.

Results: Post-lecture comparisons revealed significant increases in scores across all questionnaire items. In comparing the viewing environments, the VR group scored significantly higher than the PC group in the areas of "problem-solving skills" and "respectful attitude."

Conclusion: This study suggests that VR-based teaching materials are effective in enhancing students' awareness and understanding of interprofessional collaboration.

Key words: virtual reality, teaching material development, interprofessional collaboration, interprofessional education, swallowing videofluorography

Correspondence: Shotaro Komaki, PhD
Department of Speech-Language-Hearing Therapy, Kagoshima Medical Professional College, 5417−1, Aza utoguchi, Hirakawa-cho, Kagoshima-shi, Kagoshima 891−0133, Japan.
E-mail: st.komaki@harada-gakuen.ac.jp
Accepted: July 2, 2025.
Conflict of Interest: The authors declare no conflict of interest.

Introduction

In recent years, the shortage of healthcare professionals has become a serious global issue. The World Health Organization (WHO) has identified

interprofessional collaboration (IPC) as one approach to addressing this problem [1]. The United Nations also emphasizes universal health coverage (UHC) as part of the Sustainable Development Goals (SDGs), advocating measures to alleviate the shortage [2]. In Japan, team-based medical care has been promoted, and collaboration among various professional disciplines is emphasized in medical, pharmaceutical, and nursing education [3–5].

However, it is difficult to uniformly provide education on IPC-related concepts and practices, since the departments, faculty, and affiliated institutions responsible for instruction vary across schools [6]. Consequently, ensuring a consistent learning experience for all students remains a challenge [7]. Previous studies have also reported that scheduling difficulties are a major barrier to implementing interprofessional education (IPE) [8], and coordinating shared lectures across departments and instructors requires substantial effort [9].

Furthermore, the Covid-19 pandemic has reduced opportunities for practical learning experiences, such as clinical training, making it even more difficult for students to engage in IPE [10]. Although the pandemic is now subsiding, many institutions continue to restrict clinical practicums for infection control. The training institution to which the authors belong aims to provide specialized knowledge and skills [11], but limitations were found in effectively teaching IPC.

Against this backdrop, the authors focused on the use of virtual reality (VR), a cutting-edge technology. Prior studies on VR-based IPE have shown positive outcomes: Williams reported that VR use improved IPC knowledge and collaboration, leading to safer patient care among nursing students [12]; Lee found that VR was well-received in palliative care education and contributed to improved understanding and attitudes among professional students [13]. Yamamoto et al. also suggested that information and communication technology can help overcome barriers to IPE [14]. These findings support the notion that VR can be effectively used for IPE.

The authors planned a demonstration-based IPC lecture using VR, with a focus on the field of dysphagia. This topic was selected because previous reports indicated that interprofessional swallowing support teams reduced the incidence of aspiration pneumonia [15], and that such teams alleviated the severity of eating and swallowing disorders [16]. In addition, the formation of such teams is one of the conditions for receiving specific medical reimbursement in Japan [17], and the effectiveness of multi-professional interventions in this field has been well-documented.

The objective of this study was to evaluate the educational impact of a VR-based IPE teaching material on students' awareness and understanding of IPC. In particular, we aimed to examine changes in awareness before and after the lectures and to assess how differences in viewing environments (personal computer [PC], classroom screen, and VR) affect educational outcomes.

Methods

1. Development and Production of the Teaching Material

Full-time faculty members from six departments at our institution—Nursing, Care Work, Medical Radiological Technology, Physical Therapy, Speech-Language-Hearing Therapy, and Occupational Therapy—collaborated to develop the teaching material. Three educational goals were set:

1. Students should be able to explain the definition and social background of interprofessional collaboration (IPC).
2. Students should understand and explain the roles and functions of each profession in swallowing support.
3. Students should recognize the significance of collaborating with other professions beyond their own specialty and be able to express this need in their own words.

The teaching material was based on the theme of swallowing videofluorography (VF), selected from the domain of eating and swallowing disorders. VF is a diagnostic procedure in which a patient consumes food containing a contrast agent (e.g., barium) under X-ray fluoroscopy, and the swallowing process is recorded on video or DVD to assess and diagnose swallowing function.

The teaching material consisted of a 15-minute video illustrating the entire VF process. Learners could observe the movements of professionals—physicians, nurses, radiological technologists, and speech-language-hearing therapists—through 360° video by changing their viewpoint. To support understanding from the students' perspective, all versions of the video (used by the PC, classroom screen, and VR groups) included textual annotations and video tickers to highlight key learning points, helping students understand professions beyond their own field. The VR version emphasized immersion to present a virtual collaborative scene. Key IPC situations included checking the test food before VF, managing a choking incident, and explaining results to the patient (Figure 1).

The video editing and processing were handled by JOLLY GOOD Inc. The VR viewing system used was the JOLLYGOOD+ system [18], which is designed for use in medical and welfare settings. The head-mounted display employed was the Pico G2 4K (Pico Technology Japan). This system allows for gaze tracking by detecting head movements and can record gaze logs during online use. Instructors can also write annotations in the VR space using a tablet.

2. Evaluation of the Teaching Material and Learning Effectiveness

This study targeted students enrolled in specialized training programs for healthcare professions. Second-year students participated from the Nursing and Care

Figure 1. An IPC scene in the teaching material.
(Upper left: workers checking the test food during a swallowing videofluorography test. Upper right: workers helping a choking patient; a superimposed text. Bottom: workers explaining the condition to a patient)

Work departments, while third-year students participated from the Medical Radiological Technology, Physical Therapy, Speech-Language-Hearing Therapy, and Occupational Therapy departments. At this point in their academic programs, students had generally completed lectures in their areas of specialization.

All four IPE lectures (Figure 2) were delivered within the course framework, and only students who attended all sessions were included in the evaluation. Each department's faculty conducted their respective lectures. To ensure consistency, detailed discussions on the syllabus and instructional flow were held in advance. Extensive video resources were used to standardize the learning environment across groups.

The lecture sequence was as follows:

1. Lecture 1: A self-administered questionnaire assessing IPC awareness was administered prior to the lecture. An introductory lecture was then given, covering the definition, background, and importance of IPC.
2. Lecture 2: Students learned to operate the VR device and viewed a VR video unrelated to IPC (for acclimation purposes).
3. Lecture 3: Group work was conducted to explore the roles and functions of professionals involved in eating and swallowing support teams.
4. Lecture 4: Students were divided into three groups for the main IPC scene (VF scenario), with each group using a different viewing method: (1) personal computer (PC group), (2) classroom screen (classroom screen group), and (3) VR device (VR group).

Up to Lecture 3, all students received identical instruction. For Lecture 4, students were grouped to balance performance based on their total questionnaire scores from Lecture 1. The same video content was shown to each group via their assigned viewing method.

The questionnaire administered before and after the lectures included 12 items assessing students' knowledge, interest, and understanding of the roles of various professions in IPC. Responses were rated on a five-point Likert scale (1 = "not at all" or "strongly disagree" to 5 = "very well understood" or "strongly agree").

As detailed in the next section, participants were informed that their answers would not affect their grades and were asked to respond based on their honest thoughts.

Two types of evaluations were performed. Evaluation 1 compared questionnaire results before and after the lectures (Lectures 1 and 4). Evaluation 2 analyzed the effects of different viewing environments on students' awareness and understanding of IPC, based on post-lecture responses in Lecture 4. Three groups were established: the PC group, classroom screen group, and

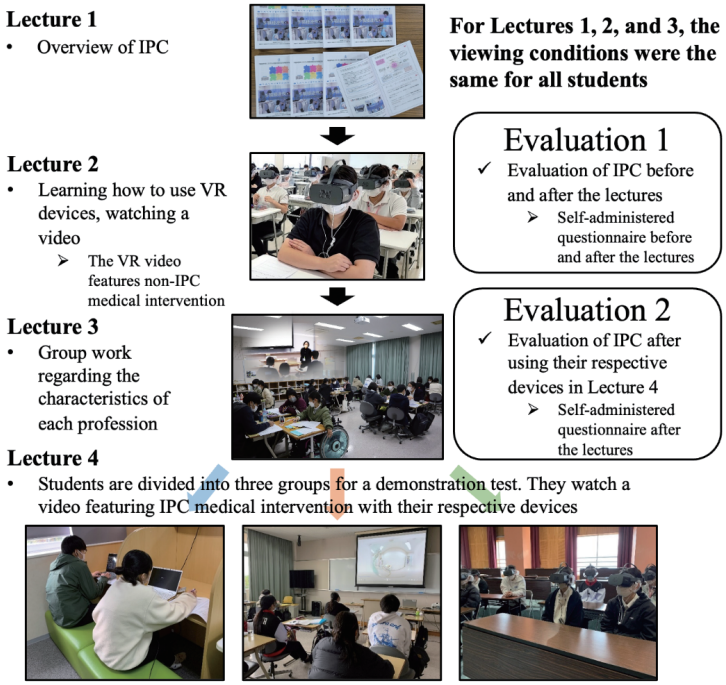

Figure 2. Progression of IPC lectures.

Table 1. Basic information on the survey participants.

	n	(%)	Average age (*SD*)
Total	224	—	—
Department			
Medical Radiological Technology	71	31.7	20.9 (1.7)
Nursing	63	28.1	19.6 (0.5)
Physical Therapy	34	15.2	20.2 (0.9)
Speech-Language-Hearing Therapy	27	12.1	21.4 (3.2)
Occupational Therapy	17	7.6	20.6 (0.5)
Care Work	12	5.4	28.6 (10.8)
Gender			
Male	99	44.2	21.1 (2.9)
Female	125	55.8	20.8 (3.9)

Note: *SD* represents standard deviation.

VR group. The grouping reflected different lecture formats—PCs for remote learning during outbreaks and classroom screens for face-to-face instruction.

All 12 questionnaire items were analyzed. For Evaluation 1, the Wilcoxon signed-rank test was used. For Evaluation 2, the Kruskal—Wallis test was used to identify significant differences, followed by the Steel—Dwass test for post-hoc analysis. A significance level of 0.05 was set for both tests.

3. Ethical Considerations

Participants were informed verbally and in writing that their participation in the self-administered questionnaire survey was voluntary and that they could withdraw at any time, even after giving consent. It was also explained that participation would not affect their academic evaluation. This study was approved by the ethics review board of the authors' institution (Approval No. 21013).

Results

1. Basic Information on Survey Participants

The demonstration lectures and surveys were conducted between September 1 and December 19, 2022. A total of 224 students who attended all four IPE lectures were included in the analysis. Table 1 presents the number of participants by department and their average ages. Of the total participants, 99 (44.2%) were male and 125 (55.8%) were female.

Among the six departments, only the departments of Physical Therapy and Occupational Therapy had prior experience participating in 12-hour joint lectures. The remaining departments had not previously participated in cross-disciplinary lectures or systematic learning related to IPC.

2. Evaluation 1: Results of Pre- and Post-Lecture Questionnaire

The average total score across all questionnaire items increased from 3.5 (SD ± 0.9) before the lectures to 4.3 (SD ± 0.6) after the lectures. Cronbach's alpha was 0.732 before the lectures and 0.834 after the lectures. Significant improvements ($p < 0.05$) were observed across all 12 questionnaire items after the lectures.

The item that showed the largest increase was Q1: "What is your current level of knowledge and understanding of IPE?" The median (interquartile range) increased from 2 (1−3) before the lectures to 4 (4−4) afterward. The effect size was calculated at 0.85 (Table 2).

3. Evaluation 2: Post-Lecture Results by Viewing Device

Seventy-seven students were assigned to the PC group, 75 to the classroom screen group, and 72 to the VR group.

Among the 12 questionnaire items, statistically significant differences among groups were found in Q9 and Q12. Q9 asked, "Do you think that knowing

Table 2. Changes in the knowledge of and interest in IPC before and after the lectures.

	Question	Before	After	*p* value	*z* score	Effect size (*r*)
Q1	What is your current level of knowledge and understanding of IPE?	2 (1−3)	4 (4−4)	$p < .001$	12.15	0.85
Q2	Do you think that a team approach will improve the quality of care and medical care for the subject (patient/user)?	5 (4−5)	5 (5−5)	$p < .001$	4.39	0.18
Q3	Do you think that understanding other professions will help you appropriately meet the needs of the subject (patients/users)?	5 (4−5)	5 (4−5)	$p < .001$	3.58	0.17
Q4	Do you think you can acquire teamwork skills naturally if you develop your expertise?	4 (3−5)	4 (3−5)	0.0017	3.13	0.13
Q5	Do you think you can improve your communication skills by learning IPE?	4 (3−4)	4 (4−5)	$p < .001$	4.43	0.21
Q6	Do you think that working with people from different professions will help you propose support measures that you cannot develop if you are only involved in a single profession?	5 (4−5)	5 (4−5)	$p < .001$	3.75	0.15
Q7	How well do you think you understand the members (professionals) of an eating and swallowing support team?	2 (2−3)	4 (4−4)	$p < .001$	11.33	0.75
Q8	How well do you think you understand the functions of an eating and swallowing support team?	2 (2−3)	4 (4−4)	$p < .001$	11.73	0.81
Q9	Do you think that knowing the roles of the professionals involved in an eating and swallowing support team will enhance your problem-solving skills?	4 (4−5)	5 (4−5)	$p < .001$	7.17	0.33
Q10	How well do you think you understand the role of your profession in an eating and swallowing support team?	3 (2−4)	4 (4−5)	$p < .001$	11.04	0.70
Q11	How well do you think you understand the roles of other professions in an eating and swallowing support team?	2 (2−3)	4 (4−4)	$p < .001$	11.10	0.74
Q12	Do you think that learning IPC will help you develop an attitude of trust in and respect for others?	4 (4−5)	5 (4−5)	$p < .001$	3.31	0.15

Note: The Before and After columns in the table represent the median figures (first quartile—third quartile). Cliff's delta was used to calculate effect sizes.

the roles of the professionals involved in an eating and swallowing support team will enhance your problem-solving skills?" Q12 asked, "Do you think that learning IPC will help you develop an attitude of trust in and respect for others?"

Post-hoc analysis using the Steel—Dwass test showed that the VR group scored significantly higher than the PC group for both Q9 and Q12 ($p < 0.05$; Table 3, Figures 3 and 4).

Discussion

This study evaluated changes in students' awareness and understanding of interprofessional collaboration (IPC) before and after demonstration lectures conducted across multiple departments at our institution, as well as the impact of different viewing environments—including VR devices—on educational outcomes.

First, regarding the change in awareness and understanding of IPC, all 12 questionnaire items showed a significant increase in scores after the lectures. Notably, for Q1, which asked about students' knowledge and understanding of IPC, the median score (interquartile range) increased substantially from 2 (1–3) before the lectures to 4 (4–4) afterward. The results indicated a favorable evaluation of interprofessional education (IPE) by the students. We believe this outcome demonstrates that the teaching material successfully fulfilled its intended objective of helping students understand the significance of learning IPC. Additionally, the theme of swallowing videofluorography contributed to students' understanding of the functions and roles of an interprofessional swallowing support team, thereby deepening their knowledge of interprofessional intervention.

Second, regarding the effect of different viewing environments on educational outcomes, we analyzed the questionnaire responses by dividing participants into three groups: (1) PC group, (2) classroom screen group, and (3) VR group. The VR group scored significantly higher than the PC group on two items out of the 12: Q9, which assessed "problem-solving skills," and Q12, which assessed "respectful attitude."

We believe that the higher Q9 scores in the VR group may be attributed to the immersive nature of the virtual experience. Unlike conventional screens, VR enables a 360-degree perspective that provides a more clinical, on-site experience. This allows learners to actively grasp the overall situation and context, thereby facilitating decision-making and problem-solving. Lee

Table 3. Comparison of post-lecture self-administered questionnaire results by viewing device.

Question	PC group	Classroom screen group	VR group	Kruskal-Wallis test (p value)	Kruskal-Wallis test (chi-squared)	Kruskal-Wallis test (degree of freedom)	Steel-Dwass test (p value)
Q1	4 (4–4)	4 (3.5–4)	4 (4–4)	0.508	2.32	3	—
Q2	5 (5–5)	5 (5–5)	5 (5–5)	0.142	2.14	1	—
Q3	5 (4–5)	5 (4–5)	5 (4–5)	0.310	3.58	3	—
Q4	4 (4–5)	4 (3–5)	4 (3–5)	0.284	3.79	3	—
Q5	4 (4–5)	4 (4–5)	4 (4–5)	0.796	1.01	3	—
Q6	5 (5–5)	5 (4–5)	5 (5–5)	0.885	0.24	2	—
Q7	4 (4–4)	4 (4–4)	4 (4–5)	0.111	5.99	3	—
Q8	4 (4–4)	4 (4–4)	4 (4–4.25)	0.405	2.91	3	—
Q9	4 (4–5)	5 (4–5)	5 (4–5)	0.024*	7.41	2	0.038* (PC: VR)
Q10	4 (4–5)	4 (4–4)	4 (4–5)	0.262	3.99	3	—
Q11	4 (4–4)	4 (4–4)	4 (4–4)	0.921	0.48	3	—
Q12	5 (4–5)	5 (4–5)	5 (4.75–5)	0.020*	9.76	3	0.041* (PC: VR)

*$p = < 0.05$

Note: PC group, Classroom screen group, and VR group in the table represent the median figures (first quartile—third quartile).

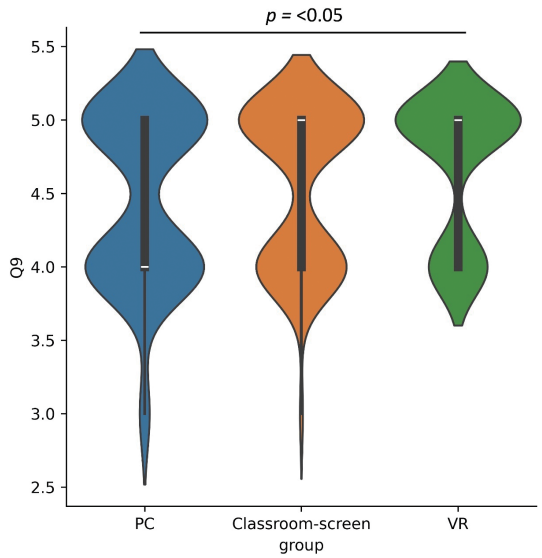

Figure 3. Results for each viewing device.
Note:
Q9: Do do you think that knowing the roles of the professionals involved in an eating and swallowing support team will enhance your problem-solving skills?

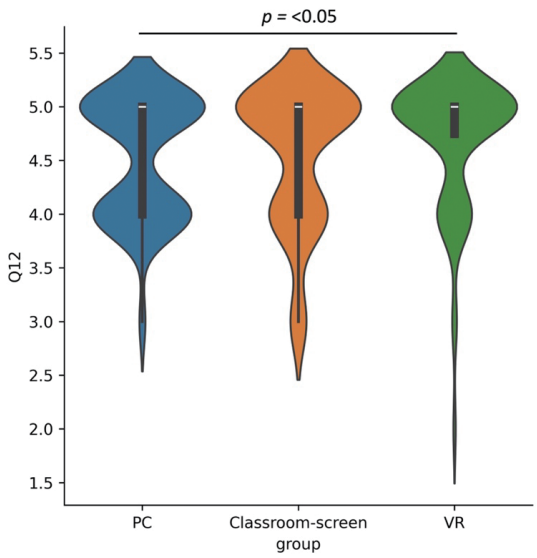

Figure 4. Results for each viewing device.
Note:
Q12: Do you think that learning IPC will help you develop an attitude of trust in and respect for others?

et al. previously reported that VR simulations for nursing students significantly enhanced neurological assessment skills and academic self-efficacy through problem-based learning [19], suggesting that VR may be effective in fostering problem-solving abilities.

Regarding Q12, the improvement in students' respectful attitudes suggests that VR enhanced their understanding of IPC and strengthened their sense of respect toward other professions. Buchman et al. also found that immersive VR experiences increased empathy and respect through a stronger sense of presence [20]. While remote learning via PC has become more common, such platforms are limited in their ability to convey 360-degree situational awareness. Students may find it difficult to observe the full context in which professional expertise is applied. In contrast, VR provides an experience closer to real clinical settings and contributes to a deeper understanding of IPC.

In recent years, there has been a growing demand for educational environments in healthcare and welfare that offer both effective learning outcomes and practical, hands-on experiences. Consequently, learning platforms that utilize cross-reality (XR) technologies, including VR, are receiving increased attention. While VR may not fully replicate real-world clinical experience, it is nonetheless an effective tool for knowledge acquisition and stimulating learners' imagination through immersive exposure.

Various VR resources have been developed and utilized in the medical field [21, 22], but few studies in Japan have focused on the use of VR in IPC education [23]. Although this study centered on swallowing support, IPC is equally important in other healthcare domains, such as Covid-19 care and oncology [24, 25]. There is a growing need to develop VR-based content that allows students to experience IPC in diverse clinical contexts and acquire the competencies necessary for collaboration [26, 27].

This study has three key limitations. First, differences in departmental curricula may have influenced students' awareness of IPC. Because the specialized knowledge required varies across the six participating departments, each has distinct curricular content. These differences may have affected the baseline understanding and attitudes toward IPC.

Second, the number of students varied widely among departments, and in some cases, sufficient data could not be collected. When sample sizes are small, the reliability of statistical analyses and estimated effect sizes decreases, increasing the risk of overestimating results [28]. To address this limitation, it is necessary to continue implementing demonstration lectures and accumulating data to increase sample size.

Third, social desirability bias may have influenced students' responses. In the healthcare field, collaboration among professions is socially encouraged, which may have shaped students' attitudes independently of the educational content. However, evidence indicates that multidisciplinary collaboration is essential for meeting diverse patient needs and leads to improved outcomes in health and social care [29, 30]. Therefore, even if such bias exists, it may still be valid to leverage it in promoting IPE.

Additionally, the VR teaching material used in this study was implemented within a single institution.

Although VR content is gradually becoming more widespread in healthcare education, VR materials specifically designed for IPE remain limited. Generalizability to other institutions and fields requires further study. Nonetheless, the VR content used in this study employed 360-degree video, which can be easily reproduced elsewhere with appropriate equipment. Although initial investment is required for head-mounted displays and playback systems, our institution's implementation demonstrated that time and cost related to travel and scheduling for face-to-face joint training can be significantly reduced [31].

Thus, VR teaching materials offer high feasibility and cost-effectiveness. With further standardization and equipment-sharing, broader implementation in educational settings is anticipated.

Conclusion

This study suggests that the use of virtual reality (VR) technology in interprofessional education (IPE) may contribute to fostering collaborative attitudes among students from different professional backgrounds. The findings indicate that VR-enhanced IPE can be an effective approach to strengthening interprofessional collaboration (IPC). Furthermore, promoting IPC through such educational interventions may help address the ongoing shortage of healthcare professionals.

Acknowledgments

This study was conducted as part of the Ministry of Education, Culture, Sports, Science and Technology's Demonstration Project on the Utilization of Advanced Technologies in Professional Training Colleges (Contract No. [649]).

Reference

1. Gilbert JHV, Yan J, Hoffman SJ. A WHO report: Framework for action on interprofessional education and collaborative practice. J Allied Health 2010; 39(3) Suppl. 1, 196−7.
2. The Ministry of Health, Labour and Welfare. Website regarding universal health coverage. https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000158223_00002.html (cited 2024 Feb. 16).
3. The Ministry of Education, Culture, Sports, Science, and Technology. Medical education model core curriculum. http://www.mext.go.jp/component/b_menu/shingi/toushin/__icsFiles/afieldfile/2017/06/28/1383961_01.pdf (cited 2024 May 27).
4. The Ministry of Education, Culture, Sports, Science, and Technology. Pharmacy education core curriculum. https://www.mhlw.go.jp/content/11121000/001198015.pdf (cited 2024 May 27).
5. The Ministry of Education, Culture, Sports, Science, and Technology. Nursing education core curriculum. https://www.mext.go.jp/component/a_menu/education/detail/__icsFiles/afieldfile/2017/10/31/1217788_3.pdf (cited 2024 May 27).
6. Qiao J, Xu J, Li L, Ouyang YQ. The integration of immersive virtual reality simulation in interprofessional education: A scoping review. Nurse Educ Today 2021; 98: 104773.
7. Hatakeyama M, Kojima T, Kozuka J, Shimada M. A Survey on the Opportunity when Clinical Training Students who Aim at the Speech -Language - Hearing Therapist Associate with Other Professional Occupations. The Annual Bulletin of Musashino University Institute of Human Sciences 2020; 9: 43−57. https://mu.repo.nii.ac.jp/record/1448/files/humansciences9_04.pdf (cited 2024 Jun. 2).
8. Maeno T, Haruta J, Takayashiki A, Yoshimoto H, Goto R, Maeno T. Interprofessional education in medical schools in Japan. PLoS ONE 2019;14(1): e0210912.
9. Fowler T, Phillips S, Patel S, Ruggiero K, Ragucci K, Kern D, et al. Virtual interprofessional learning. J Nurs Educ 2018;57(11): 668−74.
10. Liaw SY, Ooi SL, Mildon R, Ang ENK, Lau TC, Chua WL. Translation of an evidence-based virtual reality simulation-based interprofessional education into health education curriculums: An implementation science method. Nurse Educ Today 2022; 110: 105262.
11. The Ministry of Education, Culture, Sports, Science, and Technology. What is specialized training college? https://www.mext.go.jp/a_menu/shougai/senshuu/1280727.htm (cited 2024 May 29).
12. Williams D, Stephen LA, Causton P. Teaching interprofessional competencies using virtual simulation: A descriptive exploratory research study. Nurse Educ Today 2020; 93: 104535
13. Lee AL, Debest M, Koeniger-Donohue R, Strowman SR, Mitchell SE. The feasibility and acceptability of using virtual world technology for interprofessional education in palliative care: A mixed methods study. J Interprof Care 2020; 34(4): 461−71.
14. Yamamoto T, Yamamoto M, Abe H, Sakai I. Exploring barriers and benefits of implementing interprofessional education at higher health professions education institutions in Japan. J Allied Health 2021; 50(2): 97−103.
15. Aoki S, Hosomi N, Hirayama J, Nakamori M, Yoshikawa M, Nezu T, et al. The multidisciplinary swallowing team approach decreases pneumonia onset in acute stroke patients. PLoS ONE 2016; 11(5): e0154608.
16. Toda F, Kagaya H, Baba M, Shibata S, Ozeki Y, Kanamori D, et al. Effect of swallowing rounds on the outcome of dysphagic patients. Jpn J Compr Rehabil Sci 2015; 6: 50−5.
17. The Ministry of Health, Labour and Welfare. Overview of FY2020 medical fee revisions, individual items. https://www.mhlw.go.jp/content/12400000/000605493.pdf (cited 2023 Jan. 16).
18. JOLLYGOOD+System. Jolly Good, Inc. https://jollygoodplus.com/about/(cited 2023 Jan 20).
19. Lee JS, Son HK. Evaluation of a virtual reality simulation to improve problem-based learning for neurologic

examination in nursing students. Iran J Public Health 2023; 52(10): 2128–37.
20. Buchman S, Henderson D. Interprofessional empathy and communication competency development in healthcare professions' curriculum through immersive virtual reality experiences. J Interprof Educ Pract 2019; 15: 127–30.
21. Pira GL, Aquilini B, Davoli A, Grandi S, Ruini C. The use of virtual reality interventions to promote positive mental health: Systematic literature review. JMIR Ment Health 2023; 10(1): e44998.
22. Taghian A, Abo-Zahhad M, Sayed MS, Abd El-Malek AH. Virtual and augmented reality in biomedical engineering. Biomed Eng Online 2023; 22(1): 76.
23. Yamashita T, Hirahara D, Shimoi T. Considering the possibility of interprofessional education from the perspective of highly realistic virtual reality education. Japan Society of Physical Therapy Education 2023; 19–3(27): 3.
24. Salawu A, Green A, Crooks MG, Brixey N, Ross DH, Sivan M. A proposal for multidisciplinary tele-rehabilitation in the assessment and rehabilitation of COVID-19 survivors. Int J Environ Res Public Health 2020; 17(13): 4890.
25. Taberna M, Gil Moncayo F, Jané-Salas E, Antonio M, Arribas L, Vilajosana E, Peralvez Torres E, Mesía R. The multidisciplinary team (MDT) approach and quality of care. Front Oncol 2020; 10: 85.
26. Buitron de la Vega P, Dimitri N, Araujo Brinkerhoff C, Stern A, Damus K, Miselis H, et al. Virtual reality simulated learning environments: A strategy to teach interprofessional students about social determinants of health. Acad Med 2022; 97(12): 1799–803.
27. Carmont H, McIlfatrick S. Using virtual reality in palliative care: A systematic integrative review. Int J Palliat Nurs 2022; 28(3): 132–44.
28. Button KS, Ioannidis JPA, Mokrysz C, Nosek BA, Flint J, Robinson ESJ, et al. Power failure: Why small sample size undermines the reliability of neuroscience. Nat Rev Neurosci 2013; 14(5): 365–76.
29. West MA, Borrill CS, Dawson J, Scully J, Carter M, Anelay S, et al. The link between the management of employees and patient mortality in acute hospitals. Int J Hum Resourc Manag 2002; 13(8): 1299–310.
30. West MA, Guthrie JP, Dawson JF, Borrill CS, Carter M. Reducing patient mortality in hospitals: The role of human resource management. J Organ Behav 2006; 27(7): 983–1002.
31. Harada Gakuen. FY2023 report on the project to promote interprofessional education for medical technology professionals. Kagoshima: Harada Gakuen; 2024. pp. 56–59. https://harada-gakuen.ac.jp/igisen/wp-content/uploads/2024/03/令和５年度　成果報告書.pdf (cited 2025 May 30).