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「福岡大学医学部看護学科紀要」創刊にあたって

福岡大学医学部看護学科

主任　宮城由美子

昭和 50 年開設の福岡大学附属看護専門学校を発展的に改組され，平成 19 年 4 月福岡大学医学部看護学科，さらに平成 23 年に医学研究科看護学専攻が開設されました．長きにわたり多くの看護職が臨床・教育の場で活躍されていることは福岡大学としても大きな財産です．

福岡大学の長い看護教育の歴史の中，この度「福岡大学医学部看護学科紀要」を刊行する運びとなりました．

ドナ・ディアー（Donna Diers）は「すべての看護師は研究をする事ができるし，また研究をしなければならない」と述べており，看護の様々な分野の人々が連携・協力して研究を行い，得られた成果を公表していくことも必要といわれています．

福岡大学医学部にはすでに「福岡大学医学部紀要」が刊行されております．今回刊行いたします「福岡大学医学部看護学科紀要」は，看護に特化した紀要であり，本看護学科の教員，特に若手教員や院生・修了生，福岡大学病院等の臨床看護師の皆様が大いに活用していただくため，自らの教育力・看護実践力を磨き，看護実践と研究・教育を繋げるためにも，一層看護研究に取り組んでいただきたいと願っております．

学術研究に集結ということはありません．ここに発表された論文が，さらに次のステップに進むことを期待し，本紀要が看護学の発展につながることを祈念しております．

福岡大看護紀（*Nurs. Bull. Fukuoka Univ.*）：1，1–9，2025

実践報告

Implementation Process of a Virtual Reality Simulation-Based training program for learning Bedside Environments Based on the ARCS Model

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Abstract

Objective: This study aimed to design a virtual reality（VR）training program for first-year nursing students to learn about bedside environments based on the attention, relevance, confidence, and satisfaction model（ARCS Model）and describe and discuss the implementation process.

Methods: A VR simulation-based training program for teaching bedside environments was conducted among 99 first-year nursing students. Responses were obtained from the students on a four-point scale for each of the four components of the ARCS model, as well as an analysis of the students' reactions during the VR experience, as observed by the faculty.

Results: Over 97% of the participants responded "agree" or "somewhat agree" to all four items of the ARCS model. Once the VR experience began, students were cheerful and eagerly participated in the training. During the debriefing, the students related their learning to previously learned content and were satisfied with the facilitator's explanations.

Conclusion: VR training based on the ARCS model has the potential to increase participants' interest and motivation in learning, suggesting that the training approach using VR-based prebriefing and debriefing is an effective method for achieving learning objectives and is important for increasing students' confidence and satisfaction.

Key words: ARCS model, bedside environment, nursing education, simulation, virtual reality

ARCS モデルに基づいたベッドサイド環境を考えるシミュレーション型 VR 演習の実施プロセス

要旨

目的：看護学科 1 年生を対象に，ARCS モデルに基づいたベッドサイド環境を考える VR 演習をデザインし，実施プロセスを記述し考察する．

方法：看護学科 1 年生 99 名を対象にベッドサイド環境を考えるシミュレーション型 VR 演習を実施し，ARCS モデルの 4 要素ごとに 4 段階で学生から回答を得るとともに，教員が観察した VR 体験中の学生の反応を分析した．

結果：ARCS モデルの 4 つの項目すべてについて，97% 以上の参加者が「同意する」または「やや同意する」と回答した．VR 体験が始まると，学生は歓声を上げ，熱心に演習に参加する様子が観察された．デブリーフィングでは，学生が既習内容と関連づけて学習を深めたり，ファシリテーターの説明に納得したりする様子が観察された．

結論：ARCS モデルに基づく VR を用いた演習は，学生の学習に対する興味や意欲を高める可能性がある．VR 体験前後のブリーフィングとデブリーフィングを用いた演習デザインは，学習目標を達成するための効果的な手法であり，学生の自信と満足感を高めるうえで重要であることが示唆された．

キーワード：**ARCS** モデル，ベッドサイド環境，看護教育，シミュレーション，バーチャルリアリティ

1 INTRODUCTION

Understanding and assisting individuals with daily activities play an essential role in nursing. Fawcett (1993) identified four central concepts in nursing: human beings, the environment, health, and nursing, with the environment being defined as the context in which nursing occurs. To maintain an individual's life, whether during illness, illness prevention, recovery, or health promotion, it is necessary to arrange a bedside environment that sets the stage for life. Privacy and safety issues often arise, particularly in bedside environments (O'Connor et al., 2012). Thus, observing and appropriately adjusting such environments are important responsibilities of nurses.

The competencies required of nurses are clearly stated in the "Technical Items and Attainment Levels at Graduation for Nursing Education" by the Ministry of Health, Labor and Welfare (2019). One of the items, environmental adjustment skills, requires students to create a comfortable bedside environment for patients, either alone or under supervision. However, it is not easy for students to observe a patient's living environment and create an appropriate bedside environment using the knowledge and skills they have learned during their first practice (Kikuchi & Kadowaki, 2021). Given these facts, it is challenging for first-year students to apply the knowledge and skills related to bedside environments, which they acquire in their basic nursing education, in a clinical setting.

The effectiveness of simulation learning has been reported regarding the environmental adjustment skills of nursing students (Masuda et al., 2009; Shiraki et al., 2019). Shiraki et al. (2019) reported that learning using a simulator in a practice room that reproduced a bedside environment promoted careful observation, hazard prediction, and appropriate environmental adjustment among students. Students may be able to practice appropriate bedside environmental adjustments through experiences that allow them to visualize the clinical setting prior to practice.

Billings and Halstead (2021) reported that multimedia learning is effective in helping students understand psychomotor domain skills, emotional situations, and patient care situations. They also reported that it was effective in engaging students and encouraging critical thinking because it stimulated multiple senses, including visual and auditory. Thus, multimedia learning involving the visual and auditory senses may be effective in helping students understand the clinical setting, which is full of diverse information and where patient-nurse interactions occur.

Virtual reality (VR), a type of multimedia, has been used in education since the early 1990s (Gorden & McGonigle, 2018). It is a learning technology that allows users to conveniently experience a realistic 360-degree view of an object or location through a goggle-type device. Users are visually aware that they are in a virtual space like reality, and they can interact with virtual objects using their human senses (Chang et al., 2024). Compared to conventional educational methods, it has been reported that learning is possible without time or location constraints (Shorey & Ng, 2021) and that technology can be learned in a safe environment without affecting reality (Johnson, 2023). Plotsky et al. (2021) reported that VR-based education in nursing has been used primarily for psychomotor skills, soft skills, such as attitude and judgment, systematic procedures, such as aseptic manipulation, and emergency response training. Furthermore, it has been suggested that VR-based education is associated with increased levels of student motivation and satisfaction (Shorey & Ng, 2021) and helps improve preparation and confidence in clinical practice (Bonito, 2019). Therefore, learning to observe actual clinical bedside environments using VR before clinical practice and considering appropriate bedside environments may be effective.

To increase the attractiveness of educational activities, it is necessary to focus not only on learning effectiveness but also on the needs of learners. Keller (1987) proposed the attention, relevance, confidence, and satisfaction model (ARCS model) as an educational design that focuses on learners' motivation to learn. In this study, we focused on simulation learning that incorporated the

ARCS model and designed a training program using VR. The purpose of this study was to design a VR-based training course for first-year nursing students using a simulation that considers bedside environments based on the ARCS model, and to describe and discuss the implementation process. This study has implications for the education of pre-practice students regarding environmental adjustments aimed at improving their nursing practice skills.

2 TRAINING DESIGN AND TRAINING PRACTICES

2.1 Training Positioning

The participants were in the second semester of the first year. Figure 1 illustrates the department's first-year curriculum. Students underwent two days of practical training at medical and welfare facilities during "Early Clinical Exposure" in August. However, this practical training was a shadowing training accompanied by professionals and consisted mainly of observations. Therefore, the "Clinical practicum, Fundamental nursing I" at the end of the second semester of the first year is full-scale practical training in which students receive patients.

The VR-based training program is a 50-minute "summary" of the final unit of "Daily Living Nursing Skills" in the second semester of the first year of the School of Nursing, Faculty of Medicine. The target students were 108 first-year students in the Department of Nursing at the Faculty of Medicine, University A. Table 1 provides an overview of the training program.

The VR-based training program focuses on four of the learning objectives of the "Daily Living Nursing Skills" course: 1) To be able to explain the significance of living a person's daily life and the characteristics of daily activities, 2) To be able to explain the psychological state of the patient being assisted, 8) To develop attitudes that

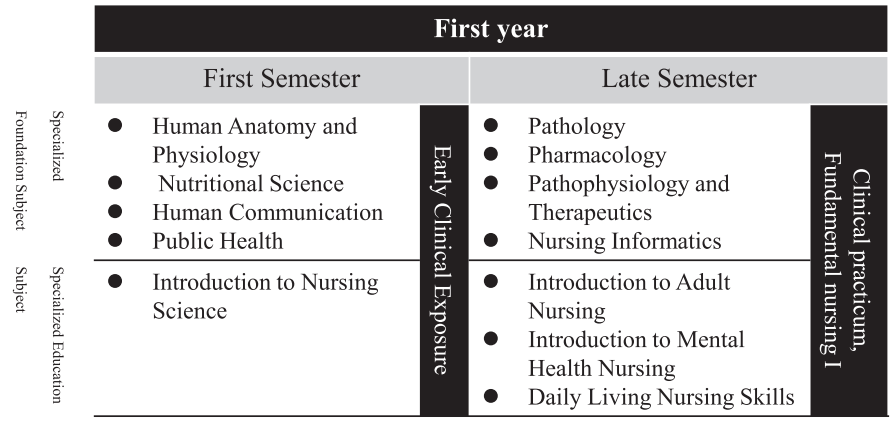

Figure 1. Curriculum

Table 1. Training Summary: Virtual Reality Training for the Bedside Environment

Subjects Study Unit	Daily Living Nursing Skills Unit "Summary"
Subject Learning Objectives	1) To be able to explain the significance of living a person's daily life and the characteristics of daily activities 2) To be able to explain the psychological state of the patient being assisted 3) Explain the purpose, basic techniques, and rationale of daily life support technology 4) Explain the purpose, basic techniques, and rationale for vital sign measurement 5) Ability to practice evidence-based, reliable assistive technology 6) Ability to practice vital sign measurement skills 7) Ability to practice assistance while checking condition and reactions through appropriate communication 8) To develop attitudes that ensure safety and comfort, promote independence, and protect privacy and dignity when providing assistance 9) Develop an attitude of practicing assistance from the patient's point of view 10) Acquire an attitude of independent study and exploration toward the acquisition of evidence-based assistance techniques for each patient
Learning Objectives of the VR Exercise	1) Accurately observe the patient's bedside environment 2) Explain the rationale for creating a bedside environment 3) Explain the role of nursing in ensuring safety and comfort, promoting independence, protecting privacy, and preserving dignity by observing the patient's bedside environment

ensure safety and comfort, promote independence, and protect privacy and dignity when providing assistance, and 10) Acquire an attitude of independent study and exploration toward the acquisition of evidence-based assistance techniques for each patient."

Based on this, we set three learning objectives for the training program: 1) accurately observe the patient's bedside environment; 2) explain the rationale for preparing the bedside environment; and 3) explain the role of nursing in ensuring safety and comfort, promoting independence, protecting privacy, and preserving dignity by observing the patient's bedside environment.

2.2 Training Design

The VR-based training program was designed, implemented, and evaluated based on the ARCS (Keller, 1987) and instructional design models. The ARCS model aims to improve motivation to learn and consists of four components that influence it (Attention, Relevance, Confidence, and Satisfaction). Table 2 shows the definitions of each component (Kellar, 2009).

2.3 Training Content

The VR content used in this training program was created by members of the nursing department and uploaded to "JOLLY GOOD +" for public viewing. The content uses "a patient undergoing artificial knee joint replacement surgery" as a case study to observe the patient's bedside environment from the nurse's perspective. For training, Scene 1 was the afternoon of the first day of hospitalization (two days before surgery), and Scene 2 was the morning of the fifth day after surgery. Table 3 shows the contents of each scene.

2.4 Training Methods

The training was conducted with all students in a lecture hall staffed by nine faculty members. The faculty members included one video operator, one facilitator, and seven people to manage, distribute, and collect the VR goggles. Of these, four performed the tasks.

Table 2. ARCS Components and Definitions

Component	Definition
Attention	Captivate the learner's interest. Stimulate the curiosity to learn.
Relevance	Encourage a positive attitude in the learner. Satisfy personal needs and goals
Confidence	Try to believe and realize that learning can be successful and that it is up to an individual's own ingenuity to succeed.
Satisfaction	Reinforce achievement through internal and external rewards

Table 3. Virtual Reality Content for Bedside Environments

	Case	Patient undergoing knee replacement surgery. Admitted to a private room.
Scene 1	Summary	Patients walking with a cane prior to surgery have not adapted to the environmental change of hospitalization. Given the context of hospitalization and impending surgery, focusing on adaptation to the environment and fall prevention is important.
	Context Setting	Afternoon of first day in hospital (2 days before surgery) When the charge nurse visited the patient's room, the patient was sitting on the edge of the bed reading papers.
	Patient Setting	Consciousness is clear. Sitting on the edge of the bed.
	Bedside Setting	(1) All bed fences are down. (2) The bed is slightly elevated and the patient's feet are not on the floor. (3) Patient is not wearing any footwear. (4) The bed power cord is exposed at the foot of the bed. (5) A cane is placed in front of the bedside table, opposite the patient's sitting position. (6) Nurse calls are bundled and hung on the wall out the patient's reach. (7) A medicine cabinet, tissue paper, mugs, toothbrushes, thermometers, clocks, plastic bottles, and various documents are placed in a messy manner on the over table. (8) The door of the bedside table is left open and personal belongings kept inside are visible.
Scene 2	Summary	Patients recovering well after surgery also begin rehabilitation, gradually expanding the range of activities they can perform on their own (e.g., walking to the toilet). It is important for patients to maintain motivation for rehabilitation and prevent falls and stumbles.
	Context Setting	The morning of the fifth postoperative day When the charge nurse visited the room to prepare for a shower, the patient was sitting on the edge of the bed touching a storage box on wheels in front of her.
	Patient Setting	Consciousness is clear. Rehabilitation has begun and she is able to walk on her own.
	Bedside Setting	(1) All bed fences are down. (2) The patient is wearing slippers. (3) The patient is working on an IV stand. (4) The patient is sitting shallowly on the edge of the bed, trying to remove items from a storage box on wheels. (5) An unused walker is left at the foot of the bed. (6) Nurse call is bundled up and hooked to the wall and not in the patient's hands.

Table 4. Training Schedule

Pre-briefing（5 minutes）		
Scene 1	First day of hospitalization（2 days before surgery）（5 minutes）	1st 2nd
Scene 2	Postoperative day 5（4 minutes）	1st 2nd
Scene 3（Advanced）	Postoperative day 2（5 minutes）	1st
Debriefing（10 minutes）		
Summary（10 minutes）		

Table 4 presents the training schedules.

First, a prebriefing（5 min）was conducted. The facilitator used slides to explain the learning objectives, contents/methods, case studies, issues, VR goggle operation, and precautions, etc. The participants watched Scenes 1 and 2 twice each in VR or video. After completing all four sessions, Scene 3 was viewed once as an advanced session without assignments. Because the content of Scene 3 was postoperative management, which the first-year students had not yet learned, we explained that it was part of the advanced session that was experienced by second-year students. The VR experience was one per student; however, some students requested a second VR experience. Twenty-five VR goggles were used. We explained that the experience should be performed in a seated position to avoid VR sickness and that the goggles should be worn correctly and according to the instructions. We also explained that the VR experience was not mandatory and that students could watch the images on the screen if they wanted to do so. The training task involved viewing Scenes 1 and 2 and describing the bedside environment in detail using a recording form. Because first-year students had difficulty remembering and recalling what they observed, we asked them to concentrate on their observations during the VR experience and write on the recording form while watching the video projected on the screen. After the VR experience and viewing the videos of Scenes 1 and 2, each student considered the reasons and rationale for inappropriate environmental scenes and shared them with all participants.

2.5 Facilitation Contents

2.5.1 Attention

To arouse students' curiosity, VR was used as a training method, and to sustain interest, a clinical nursing situation related to what they had studied in the first year was selected as the subject matter. The target students had not experienced VR on campus since enrollment. To encourage them to engage in training with an inquisitive mind, we presented them with a task in advance and encouraged them to engage in the task and experience VR by looking around 360° and talking with neighboring students about what they noticed. Prior to experiencing VR, the situation of the case study patient was explained to the first-year students according to their readiness. They were then encouraged to observe the bedside environment while imagining the patient's feelings.

2.5.2 Relevance

For the participants to understand what they were learning for and be aware of the goals, the subjects' learning goals were presented at the prebriefing session, and the current achievement status was checked with the participants. In particular, regarding the learning objectives of 1.2.8.10, which were the focus of this training program, we explained, based on evidence, that the participants should "understand the patient's daily life," "provide assistance according to the patient's psychological situation," "ensure safety and comfort," "promote independence," "protect privacy," and "practice attitudes that protect dignity."

Next, the learning objectives of VR training were presented. To achieve this goal, the students were instructed to observe actual clinical situations using VR. It was also explained that in the "Clinical practicum, Fundamental nursing I" scheduled one month later, the trainees will practice "observation of bedsid e environment" in a clinical setting, and the relevance to the content of this training was explained. We also added that the VR content to be experienced was filmed at the actual practice site.

2.5.3 Confidence

Positive feedback was provided to help the students understand what was expected of them during the assignment and to recognize that they had successfully completed the assignment as a result of their previous learning and efforts. During the debriefing session, individual student realizations were highlighted and shared with all participants. Students were also informed that their realization would help them achieve their learning goals by leveraging their existing knowledge.

2.5.4 Satisfaction

It is important for students to recognize the significance of learning through this training program and receive positive feedback that they have achieved their goals through their efforts. To this end, we explained that the students were ready to learn "Clinical practicum, Fundamental nursing I," which was included in the relevance content.

3 METHODS

3.1 Setting and Participants

The study was conducted at the University of Fukuoka, Faculty of Medicine, Department of Nursing, and it involved 108 first-year students.

3.2 Data collection

The study was conducted on December 22, 2023. The purpose and methods of the study were explained orally and in writing to VR-trained students. The survey items included each component of the ARCS model; Attention: Was it interesting?; Relevance: Did the training content on "Environmental Adjustment Techniques" affect clinical practice?; Confidence: Can you use "Environmental Adjustment Techniques?" Satisfaction: Were you satisfied with the training program?

The respondents were asked to answer these four items on a four-point scale ("agree," "somewhat agree," "somewhat disagree," and "disagree"). The survey was conducted online using Microsoft Forms.

3.3 Data analysis

Simple tabulations were performed for the four components of the ARCS model.

3.4 Ethical considerations

The ARCS model evaluation questionnaire was conducted anonymously, and when the questionnaire was distributed to the students, they were informed verbally and in writing that their responses were voluntary, that they would not be disadvantaged in any way, and that the information obtained through the research would not be used for any purpose other than the survey. The responses were made anonymously using the online survey tool "Forms." This enabled the security of the response data and the protection settings for the response data. Access was controlled and the data obtained were restricted to viewing by researchers only. Consent was obtained by completing the questionnaire. This research was conducted as part of Faculty Development, and the questionnaire data were used to evaluate teaching practices. The data collected did not include any personal information or information related to personal information, attributes or psychological characteristics. Furthermore, there was no invasion of the subjects during the data collection process. Consequently, prior ethical review was not conducted. There are no conflicts of interest to disclose in this study.

4 RESULTS

4.1 Student reactions after VR training

Responses were received from 99 of 108 respondents (91.7% response rate).

Figure 2 presents the results of the four-point rating for each of the four components of the ARCS model after training. More than 97% of the respondents answered "agree" or "somewhat agree" to all four items.

4.2 Student reactions during the VR experience

Figure 3 shows the students during VR training. The following are the students' reactions during the VR experience, as observed by the faculty:

- When the VR experience began, the students wearing goggles looked around cheerfully and concentrated on their experience. During the VR experience, students observed the same direction as the students next to them, voiced what they noticed, and engaged in interactive learning. They were also observed making exploratory observations while voicing their questions and findings. Meanwhile, students watching the video on the screen enthusiastically recorded their observations on a recording sheet. During training, no student was dozing off or preoccupied with anything other than the training.

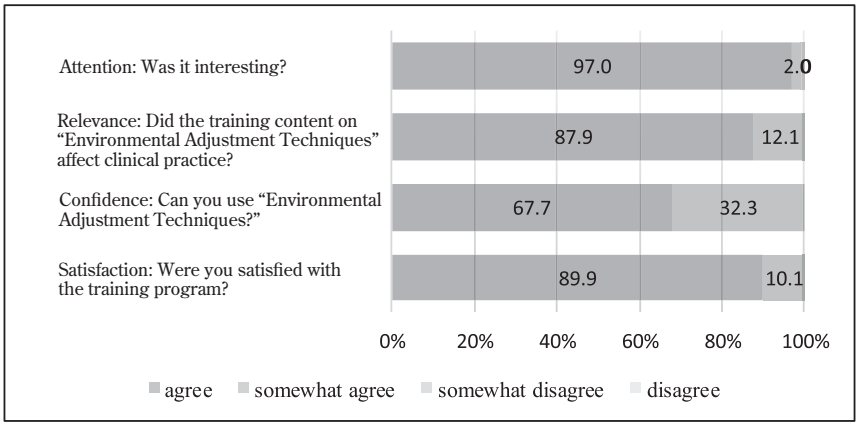

Figure 2. Student Ratings of the Four Components of the ARCS Model

- The VR content was a summary of what was learned during the course. Students used the knowledge they had acquired to explain the rationale behind their observations.
- During the VR experience, students were observed looking at the entire picture, fixing their viewpoints, looking for problem areas, and becoming aware of issues. During the debriefing session, students nodded their heads and participated in the facilitator's explanations with conviction and understanding.
- The training was held in a lecture room, but it was explained beforehand that participants were free to look at each other and talk to each other. The participants were relaxed, with cheers and smiles.

5 DISCUSSION

5.1 Enhancing Learning Motivation in VR Training Based on the ARCS Model

To stimulate and maintain students' motivation to learn, it is essential to acquire and maintain the type of attention that motivates them (Kellar, 2009). In this training, technology was used as the learning environment and VR, a multimedia teaching aid, was provided. The OECD Center for Research and Innovation in Education (Tatsuta & Hirasawa: translation, 2013) reported that a learner-centered approach to technology-enhanced learning that promoted student learning was effective. This focuses not on which technology is used in the act of teaching, but on which technology is effective in meeting the needs of learners. In other words, students were the main actors in the learning process. The students in this study had experience with 2D audiovisual materials and hands-on lab training but not with VR. Furthermore, previous research suggests that students are increasingly proficient in technology, and that its use increases their engagement in learning (Martin & Bolliger, 2018). Therefore, the VR experience could be tailored to the students' needs. Initial VR training to experience clinical situations may have stimulated students' interest in learning and promoted

Figure 3. Students in VR training

their curiosity.

Furthermore, Mayer's (2020) cognitive theory of multimedia learning describes a cognitive process wherein learners receive verbal, audio, and visual information through their sensory organs, categorize and transform them into comprehensible representations, and connect them to relevant knowledge in long-term memory to deepen learning. Students who participated in this training also observed the bedside environments through VR, organized and selected information from the words and actions of patients and nurses, connected it to their acquired knowledge, and connected it to answers to tasks and rationales. Training using VR, which includes audio and visual images, is considered an effective method for facilitating students' cognitive processes and achieving effective learning.

Moreover, motivation to learn requires recognizing that the learning content is related to students' personal goals and motivations (Kellar, 2009). The motivation to learn increases when learners succeed in learning that they believe is valuable to them (Bauman, 2016). This training was positioned as a summary of lectures and training on the basic content of subjects related to life nursing skills. Simultaneously, as an introduction to clinical practice, the objective was to apply what has already been learned in clinical situations. Bauman's (2016) Layered Learning Theory reported that contextualized learning experiences link didactic content with practical real-world experiences. The training was conducted using VR content that closely mimicked the clinical environment. This allowed the students to recognize the relevance of clinical practice and connect it to their existing knowledge. Thus, high-fidelity VR training is considered a useful learning method for linking previously learned basic content to clinical practice.

5.2 Enhancing the Effectiveness of VR Training through Prebriefing and Debriefing

Previous studies have reported that VR is not fully effective when used for educational purposes (Günay & Zaybak, 2018). Kyaw (2019) used learning theory in an intervention design with VR and reported that no learning theory was used in the design of VR interventions. This may explain why VR education has not been fully effective.

The training was not completed solely through the VR experience but was designed based on the ARCS model, with prebriefing and debriefing conducted before and after the VR experience to integrate learning. Prebriefings in simulation learning are considered essential to establish the psychological safety of learners and to clarify learning goals and the corresponding content and tasks (INACSL, 2016). In particular, explaining how to participate is important because it directs learners' attitudes toward learning (Turner & Harder, 2018). In the prebriefing, the learning objectives, tasks, and situation of the scenes were explained. The students were also encouraged to observe the environment and imagine the emotional state of the patient. Furthermore, students were guaranteed permission to speak freely. We argue that these interventions made the students feel comfortable participating in the training and led to lively discussions. Furthermore, the debriefing session was intended to deepen students' understanding of simulation learning. This requires constructive engagement and a positive reception that supports collaborative learning (INACSL, 2016). In the debriefing session, we endeavored to elicit each student's awareness and provide positive feedback to achieve the learning objectives. Through these efforts, we established that students gained learning opportunities to understand their issues fully, leading to an important level of confidence and satisfaction.

In summary, VR training based on the ARCS model has the potential to increase student interest and motivation in learning. The results also suggest that a training approach involving pre- and post-VR experience prebriefing and debriefing is an effective method for achieving learning objectives and is important for increasing confidence and satisfaction among students. We believe that this project can be applied not only to nursing education in Japan but also to nursing education programs in other countries. Moreover, we believe that education using VR technology has a wide range of applications in international collaborative research and education, and we hope that this research will contribute to this.

In the future, it will be necessary to consider the relation between the content learned with learning in the second year and beyond, and how factors such as "confidence" and "satisfaction" will affect future learning outcomes, to comprehensively evaluate the educational effectiveness.

Conflicts of interest

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

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