



(RESEARCH ARTICLE)



## A Beta Test of virtual simulation using digitally simulated family and gamification - through a family nursing seminar for home visiting nurses

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### Abstract

We organized a family nursing seminar employing virtual simulation for home visiting nurses. The seminar utilized gamification and a digitally simulated family to enhance family nursing competence. This study aims to evaluate the effectiveness of a seminar by conducting a  $\beta$  test of a virtual simulation. This study employed a descriptive design. Study period was from November of 2022 to January of 2023. Study participants were seven home visiting nurses at four Home-Visit Nursing Agencies in Japan. In the virtual simulation, participants communicated with the digitally simulated family created with Unreal Engine 5.0.0. Before and after the seminar, participants were asked to complete the Family Nursing Competency Scale and data were gathered through an open-ended questionnaire. The total scores on the Family Nursing Practice Competence Scale all increased after the seminar. In feedback, the instructor commented that the simulation scenarios and level of difficulty were appropriate but that the time schedule needed to be revised. Participants also commented on the reality and tension in the digitally simulated family and the lack of discussion. The integration of gamification and the digitally simulated family was positively accepted and increased the sense of reality and tension of the participants. However, there were problems with the recognition of achievement, time management of the debriefing sessions. Further modifications to this seminar design are needed.

**Keywords:** Virtual Simulation; Digitally Simulated Family; Gamification; Home Visiting Nurses; Family Nursing

### 1. Introduction

The transition of medical care from facilities to home is progressing due to the super-aging population and soaring medical costs in Japan. Therefore, the importance of home visiting nurses is increasing. In Japan, the family has a significant influence on the living conditions of patients so that the family is called the second patient. The home visiting nurses face many challenges in caring for families as a unit in nursing practice. To solve these challenges, they are required to have knowledge and skills in family nursing. Despite this, home visiting nurses have far fewer training opportunities than hospital nurses. Additionally, there is limited interaction with other Home-Visit Nursing Agencies. Since thought-based simulation learning is more important than nursing skills in family nursing, online learning could be effective.

With the spread of COVID-19 in 2020, online technology is increasingly used in education to reduce face-to-face interactions, and evidence indicates that computer-based virtual simulation improves learning outcomes [1]. Therefore, we organized a family nursing seminar for home visiting nurses through virtual simulation that can be provided

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regardless of location and time. First, we adapted gamification and a digital simulated family into the seminar design to be able to conduct effective seminars. This is because active learning and simulation-based education that adopts gamification have been shown to increase student motivation for learning [2-4]. Further, a study to determine the effects of virtual game simulation on nursing students' nursing diagnoses and clinical practice reported that the control group's mean total score on a cognitive survey of nursing diagnoses was significantly higher and more effective than the experimental group [5].

Second, the instructor has played the role of the patient or the family in existing virtual simulation. However, that method was insufficient in terms of fidelity of the psychological aspects. When the instructor plays the role, the learner may be nervous or embarrassed because the instructor's face, far from family, is visible on the screen. That makes it difficult for learners to be fully immersed in the simulation sessions. For this reason, a digitally simulated family was implemented to play the role of the family. The screen shows a digitally simulated family, not the instructor face, allowing the learner to focus on the simulation. For these reasons, we report a Closed beta test of a virtual simulation utilizing gamification and a digitally simulated family. This study aims to evaluate the effectiveness of a seminar by conducting a  $\beta$  test of a virtual simulation.

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## **2. Methods**

### **2.1. Study Period**

Study period was from November of 2022 to January of 2023.

### **2.2. Study Design**

This study employed a descriptive design.

### **2.3. Participants**

Study participants were seven home visiting nurses at four Home-Visit Nursing Agencies in Japan who were contacted (identified) through snowball sampling, and their consent to participate in the study was obtained in writing.

### **2.4. Data Collection & Analysis**

For a  $\beta$  test to ensure an acceptable seminar design, opinions were exchanged among the instructors from the viewpoint of a formative evaluation. An anonymous open-ended questionnaire was administered to the study participants to learn their opinions of the seminar. Further, the purpose of this seminar is to improve family nursing skills, and we measured family nursing skills before and after the seminar using the Family Nursing Competency Scale for generalist nurses [6]. The opinions expressed were analyzed to verify the adequacy of the learning materials and learning strategies prepared.

### **2.5. Outline of the Seminar**

The virtual simulation here was designed based on the Healthcare Simulation Standards of Best Practice Simulation Design [7]. Participants engaged in e-learning on Introduction to Family Nursing, Family Information Gathering, and Assessment and Intervention before attending the seminar. This e-learning consists of 6 videos of 10 minutes each.

In this seminar, the elements of Storytelling, Competition, Cooperation, and Challenge were used as gamification theory [8]. Study participants learn by selecting their own actions, such as "talking to the family" or "checking the medical record. The study also contains elements of gamification, such as the fact that the family reactions change depending on the study participant intervention, and good intervention leads to higher levels of home visiting nursing skill points. In the family care simulation, the instructor played the role of a family, and a digitally simulated family was utilized for this simulation. In actual family nursing, home visiting nurses communicate with families during visits to assess and care for them. In this seminar, to train the communication between home visiting nurses and the patient's family, we set up a situation in which the home visiting nurse communicates with the patient family after the patient care.

The seminar was led by three instructors, who shared the roles of host, family member, facilitator, and home visiting nurse visiting a patient for the first time. The digitally simulated family was created with the game engine UnrealEngine 5.0.0, and iPhone13 and Live Link Face v1.1.2 were utilized for motion capture to express facial expressions. The facial expressions of instructors playing the family were captured using an iPhone, and these expressions are then portrayed on the faces of the digitally simulated family. Therefore, participants can communicate with a lifelike and expressive digitally simulated family through the monitor.

## 2.6. Ethics

The researcher explained the ethics to the home visiting nurses who voluntarily attended the research guidance in writing and orally. The explanation included the study aims, no advantages or disadvantages of participation, and anonymity. This study was conducted with approval from the ethics review committee of the university the authors belong to (No. 21-37).

## 3. Results and discussion

Table 1 shows the demographics of the participants. The participants were two females and five males, with a mean age of 30.86 ( $\pm 3.64$ ) years. The number of years of clinical nursing experience was from 3 to 17 years, with a mean of 8.28 years ( $\pm 4.10$ ). The number of years of home visiting nurse experience was from 3 to 10 years, with a mean of 5.29 years ( $\pm 2.12$ ). The numbers of valid responses were six before and four after the seminar. The total scores on the Family Nursing Practice Competence Scale for generalist nurses and the scores on each subscale all increased (Table 2). The following are the opinions of the organizers and participants extracted after the beta test. The instructor commented that the simulation scenarios and level of difficulty were appropriate but that the time schedule needed to be revised. Participants also commented on the reality and tension in the digital simulated family and the lack of discussion. (Table 3).

**Table 1** Characteristics of Seminar Participants (n = 7)

Age	Years of experience as a nurse	Years of experience as a home visiting nurse
27	5	4
26	3	3
32	9	6
32	9	5
31	7	5
30	8	4
38	17	10

**Table 2** Family Nursing Competency Scale for generalist nurses scores

Total and subscale Family Nursing Competency scores	before seminar n = 6		after seminar n = 4	
	mean	SD	mean	SD
Total score	215.3	$\pm 72.9$	253.0	$\pm 88.5$
Collecting of family information	76.8	$\pm 22.7$	90.0	$\pm 30.8$
Family assessment	32.8	$\pm 12.8$	40.3	$\pm 13.3$
Family care planning	19.1	$\pm 7.2$	23.5	$\pm 9.4$
Family care	69.0	$\pm 25.2$	78.0	$\pm 26.1$
Evaluation of family care	17.5	$\pm 6.9$	21.3	$\pm 9.9$

**Table 3** Opinions of instructors and participants. (n = 7)

Opinion of instructors
E-learning is not being used for care planning.
They prioritized care based on daily experience.

Case and situational settings were appropriate for simulation education.
The difficulty level was appropriate.
Communication was real.
Not enough time for debriefing.
Opinion of participants
I usually work with a limited number of people, so it was nice to talk to other nurses.
I didn't realize the instructors were playing the role of the simulated family.
I was nervous about talking to the simulated family. (2)
Although the case was different from my specialty, I realized that there were some commonalities when talking with the participants.
It is doubtful that I will ever be able to practice good care.
I looked at the life gauge on the screen and recognized that I could fail three more times.
All discussions ended before reaching a conclusion. (3)

#### 4. Discussion

From the instructor opinions, they felt that the simulation setting was appropriate and that the participants were able to communicate in a realistic atmosphere, so we do not see any problem with the simulation session using a digital simulated patient. Ortega et al. (2022) [9] suggest that online simulations may be more immersive for active observers than face-to-face Situation-Based-Training. In addition, learners who participated in the Virtual gaming simulation (VGS) reported that the VGS was very realistic, similar to a clinical experience [10]. In this study, also, we found the possibility of increased immersion, as indicated by participants' comments such as "I didn't realize the instructors were playing the role of a simulated family" and "I was nervous about talking to the simulated family."

On the other hand, there is potential for improvement regarding the use of e-learning and the time for debriefing. Since the debriefing is an important opportunity to deepen learning after the actual case study and simulation [11,12], we believe that sufficient time should be provided for the debriefing, considering a design that allows for repeated group challenges. According to the opinions of the participants, it was good that they were able to interact with other nurses and learn about cases outside of their own area of expertise. This is because most Home-Visit Nursing agencies in Japan are small and there is not much interaction among home visiting nurses. However, they were concerned about their confidence in their own growth and the completeness of the seminar. These points suggest that support for improving learner self-efficacy and appropriate closing of the seminar need to be considered. Specifically, we believe that it is necessary to create an environment in which participants can relearn at their own pace by utilizing a few more e-learning elements.

In addition, since the "life gauge," one of the game elements, gave participants a sense of security that it was okay to fail, it is also important to develop the value of experiencing failure in the learning process and the ability to overcome such failures. The total scores on the Family Nursing Practice Competence Scale and the scores on each subscale all increased, suggesting that learning at the seminar may have had some effect on family nursing practice competence. In considering the above points, the seminar design should be modified regarding debriefing time and methods and learning that will help learners feel their own growth. The modified seminar should be implemented, and the improvement of participant family nursing competency should be verified.

#### Limitations

This study shows the possibility of seminars utilizing digital technology and gamification theory. However, the seminars were conducted in a limited region of Japan, and the findings from this study were not obtained with general home visiting nurses. Therefore, to generalize the findings, it is necessary to collect more data by conducting seminars in various regions.

## 5. Conclusion

Regarding the learning materials, the user interface with game elements and the digitally simulated family were immersive in the communication and worked to motivate participants to learn. Issues remain regarding the relevance of learning through e-learning and the sense of accomplishment for participants who did not take the simulation session. Regarding the learning strategy, on the other hand, time planning was an issue as the discussion was more active than expected due to the lack of daily engagement with home visiting nurses at other facilities and the lack of sufficient debriefing time.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors have no conflicts of interest associated with this study.

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