



Registered Nurses' Experiences of Using a 3D Game in the Development of clinical Competency: A qualitative Study

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Abstract

Background: Health professionals should receive lifelong education to maintain competency in medication administration and ensure safe medical practice. Game-based education is one way to enhance and ensure health professionals' medication competency.

Objectives: This study aimed to describe registered nurses' experiences of the Imagine 3D game and their views of the effectiveness of this game-based education program in improving their medication competency.

Methods: This qualitative interview study included eight registered nurses who completed an education program based on the 3D game Imagine, which aims to strengthen medication administration competency. Data were collected via semi-structured interviews between March and April 2019 and analyzed using content analysis.

Results: Three themes were extracted from the study with the following concepts: (1) experiences of playing; (2) the usability of the game in verifying nurses' medication competency; and (3) the game's effectiveness in fostering registered nurses' medical competency. On analyzing the nurses' personal experiences, the game-based education program was valuable in training nurses to enhance their medication administration competency. Participants reported that the game was comfortable to play and useful in repeated medication administration tasks, and it increased their self-reflection and even changed their actions based on learning. The nurses reported that the game was most beneficial to nursing students and recent graduates and was used especially during the introductory period. Moreover, based on the interviews, the game was also useful in continuing education; therefore, it should be applied in all healthcare professionals' training.

Conclusions: This study shows that a 3D computer game can be useful for nurses to foster their knowledge and expertise in medication administration tasks.

Keywords: Nurses, Clinical Competence, Interview, Gamification

1. Background

Medication-related activities are essential parts of the regular work of registered nurses. To avoid respective errors, medication administration (MA) competency should be refreshed (1, 2) and checked regularly (2). Computer game-based learning provides a modern way to teach and ensure medication competency. Game-based learning is widely used and studied in various fields of medicine and health education (3, 4).

Information technology (IT) progress has increased interest in game-based learning. The teaching strategies used in the past were only effective for some learners

(5). Previous studies suggested that game-based learning is suitable for health professionals, especially novices (6). Students are interested in using various games, thus gaining experience in real-life situations (7). Through such games, students can practice real-life situations and prepare for clinical practice (8).

Game-based learning can positively influence student satisfaction, motivation, and learning outcomes (3, 9) and may be effective for teaching (10). As individuals learn differently, teachers have different teaching methods (9). However, more than traditional teaching methods may be needed, and teachers should also incorporate

technological advances in their courses (5). In traditional and game-based learning, students' motivation is essential. However, compared with traditional learning methods, game-based learning can improve users' performance, motivation, and critical thinking skills (11).

Recently, the benefits of playing have been studied in different settings, such as in higher education (12) or from students' perspectives more in general (7, 9). However, to the best of our knowledge, there is a lack of studies on health professionals working in clinical settings, particularly regarding medication competency. Previous studies were primarily based on quantitative measures. Still, there is a need to focus on frontline healthcare professionals involved in direct patient care and their experiences of the effectiveness of a game-based education program to foster their knowledge and expertise in MA.

2. Objectives

This study aimed at describing registered nurses' experiences of the Imagine 3D game and its effectiveness in improving their medication competency.

3. Methods

3.1. Participants

The participants were registered nurses from three hospitals in Finland working in clinical practice ($n = 8$) who participated in a quasi-experimental intervention study. The nurses selected for the study interviews were allocated to the game group and played the Imagine medication game. This study was part of a larger mixed-methods quasi-experimental intervention study reported elsewhere (Luokkamäki et al. [Unpublished study]).

3.2. The medication Game Development

The 3D game intervention was developed in 2016 and 2017 (13). Two IT companies were responsible for the technical implementation of the game. Imagine consists of four fields concerning nurses' MA competency: Field 1 correct patient involves identifying the patient before MA; field 2 correct medication information involved, for example, patients' updated medication information; field 3 correct medication, pharmaceutical form, correct dose, and patient medication education involved, for example, the patient in the medication process, and field 4 correct route and correct time of MA, and drug response involved, for example, treating a patient who had difficulty swallowing.

3.3. Data Collection

Data were collected through semi-structured interviews conducted at three Finnish hospitals. The authors developed a semi-structured interview guideline that was pre-tested in an interview with two nurses. Between March and April 2019, the third author of this article conducted interviews and audio recordings. Each interview lasted between 18 and 43 min (an average of 29.53 min and a total of 2 h, 29 min, and 33 s). The interviews had three main themes: Experiences when playing the game, the actual usefulness of the game in verifying nurses' medication competency, and the development of registered nurses' medication competency (Figure 1).

3.4. Data Analysis

The data were analyzed using inductive content analysis (14). First, each interview tape was transcribed, which resulted in 58 transcription pages. Second, the first author of this study read the transcribed interviews several times. The focus was on nurses' experiences of the medication game and its effectiveness in developing medication competency. Data saturation was reached when no new information was found on a topic. Subsequently, the data were organized under three main themes: (1) experiences of playing; (2) usability of the game in verifying nurses' medication competency; and (3) effectiveness of the game in fostering registered nurses' medication competency. The main themes included seven sub-themes: (1) past gaming experiences; (2) user experience of the game; (3) the nature of the game; (4) suitability to ensure nurses' medication competency; (5) missing content areas in the game; (6) learning; and (7) the usefulness of the game.

3.5. Ethical Considerations

This study was approved by the University of Eastern Finland Committee on Research Ethics (2018). Prior to the initiation of the study, research approval was obtained from the hospitals involved. Before study inclusion, participants received written and oral information about the study and signed an informed consent form for voluntary participation in the study. The study was conducted in accordance with the ethical principles of research with human participants and ethical review in the human sciences in Finland (15).

4. Results

4.1. Characteristics of the Participants

This study included eight registered nurses (all female) from the medical wards of three Finnish hospitals. The age ranges were under 25 years to between 56 - 60 years. Most participants (75%, $n = 6$) had prior experience with learning

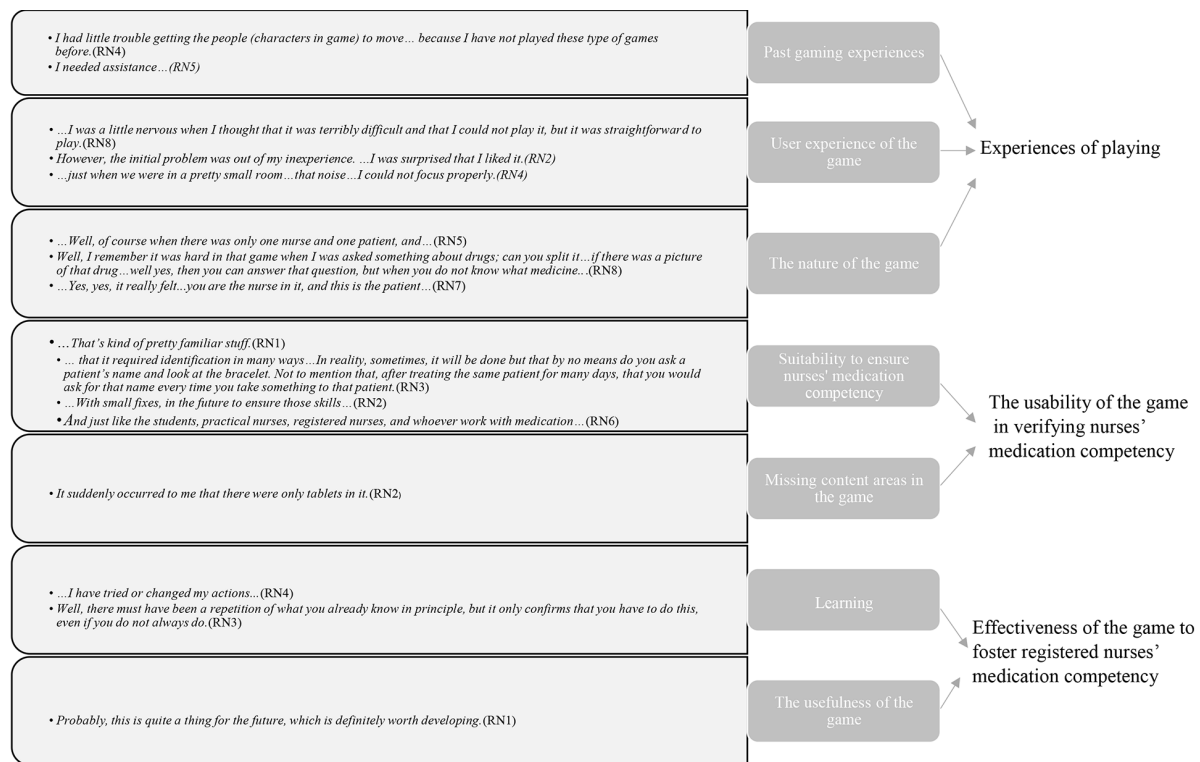


Figure 1. Themes, sub-themes, and citation of the interview

platforms and electronic medical records for several years; therefore, participants were sufficiently skilled to work with a computer.

4.2. Experiences of Playing

The game experience was examined based on three sub-themes: (1) past gaming experiences; (2) user experiences of the game; and (3) the nature of the game.

Past gaming experiences: Participants reported they had not played games similar to Imagine or other games in the past. This was observed, for example, by the difficulty of moving game characters on the screen. Therefore, some participants needed more advice on Imagine and how to play it.

The user experience of the game: Participants who had little experience in playing games were initially a little nervous. After overcoming initial difficulties, some participants found the game easy and exciting. However, some reported having experienced difficulties in moving the characters and, therefore, being unable to focus on the questions. The restless environment was also reported to affect the gaming experience.

The nature of the game: The participants felt that the visual aspect and mobility of the game character required

more development. Despite these visual deficiencies, the game was reported to be fun to play with and logical and educational.

4.3. The Usability of the Game in Verifying Nurses' Medication Competency

The game's usability for verifying nurses' medication competency was classified under the following sub-themes: (1) suitability to ensure nurses' medication competency; and (2) missing content areas in the game.

Suitability to ensure nurses' medication competency: Participants reported that the game helped to foster the nurses' medication competency. It partly included learning new information, but the game was mostly a review of familiar MA tasks. Some participants were excited about the game, while some of them did not consider themselves "a gaming person."

Participants reported that the game would suit students, recent graduates, and during the orientation period for all learners, practical nurses, registered nurses, and those who participated in MA processes.

Missing content areas in the game: Participants reported that the game focused on oral medications and that intravenous, subcutaneous, and intramuscular

medications were not included. Participants also commented that the game should be configured to more comprehensively cover various aspects of nurses' medication competency to secure successful results. For example, participants suggested that several aspects regarding MA, pharmaceutical form, identifying allergies, good practices of MA, and patient identification could additionally be covered.

4.4. Effectiveness of the Game to Foster Registered Nurses' Medication Competency

The game's effectiveness in fostering registered nurses' medication competency was classified into two sub-themes: (1) learning; and (2) the usefulness of the game.

Learning: Participants reported they would generally know how to act in different situations, but clinical situations would not always correspond to the ideal state provided in this game-based environment. Some participants reported a perceived discrepancy between the game-based situations and clinical reality and have tried to change their behavior after playing the game.

Some reported that they had learned something new about MA tasks and that their competency had probably developed further or appreciated the feedback they received.

The usefulness of the game: Participants reported that they would know basic things, such as basic medications provided at their own ward, but by accessing different sources, such as asking their colleagues, they would need to learn more about medications that are less commonly administered.

Most participants reported they wished to play Imagine in the future. In contrast, those who reported technical difficulties did not show any interest in playing anymore.

5. Discussion

This study aimed to assess the impression of nurses regarding medication-based training to foster MA competency. Based on the nurses' reports in this study, the game can be considered a valuable instrument for training and fostering MA competency. Previous studies have also shown that gamification could be considered effective in improving learning outcomes in healthcare professionals (3) and enhancing their engagement and motivation in the learning process in a medical context (16). However, the response to the game is not always positive, and gamification can be seen as ineffective (17).

Nonetheless, the present gaming experience was reported to be affected by bad experiences in the past or by minimal experiences with gaming, as reported

by the participants. In the latter case, the energy and attention of the participants may have been diverted toward irrelevant issues, weakening their focus on the actual topic. Volejnikova-Wenger et al. (18) stated that games navigational difficulties negatively influenced learning outcomes.

This study showed that it is important to make a game technically smooth in a manner that players can focus on the essential and relevant parts without being distracted by difficulties related to the characters' movements. In addition, some participants required more instructions than others. The lack of clear instructions is also reported to present critical issues in a previous study (6), where the difficulty of moving the game characters was reported to be influenced by playing experiences, enthusiasm to play, and focus on the covered topics. In another previous study, technological challenges influenced engagement with the learning instrument, and the difficulties in moving the characters distracted participants (18). A game that does not work may frustrate players (6). Therefore, in future applications of the present game, addressing nurses' MA competency and eliminating or minimizing such distractions will be important. Furthermore, it is important to assist individuals with the difficulties of playing computer games, particularly those with less gaming experience or lacking essential computer skills. Technology comfort is a crucial factor in facilitating pleasant gaming and learning experiences.

In their study, Aloweni et al. (6) concluded that in the future, we would need new teaching methods, such as games that match the future generations' learning styles and needs. A previous study showed that games might suit younger students (17). In a study by Popil and Dillard-Thompson (19), nurses reported needing various games. The present study showed that not everyone seems interested in game-based learning, although opinions may change with increasing gaming experience. Previous studies have demonstrated that good teachers use new teaching methodologies (20); however, it is also important to consider different types of learners. Further, new technologies create new opportunities and challenges for teachers (21). Developing new teaching methods also increases teachers' competencies.

Motivation is an essential factor in the learning process (16), and so it was in nursing students' responses to game-based learning (17). Previously, intrinsic motivation was reported to be positively influenced by feedback (22). In this study, some nurses preconceived notions of gaming. Some of them, but not all participants, overcame these prejudices as they gained experience in the game. It is also important to keep players motivated throughout the game. There must be a right balance between skills and challenges so that those who move on faster can keep playing (22). The game used in this study gave feedback

immediately during the play. Previous studies reported the lack of immediate feedback (6) as a negative aspect (23). In this study, the nurses reported that playing made them think about their own actions, and some of them “felt a sting” because they realized that, in practice, their actions did not always match their expectations.

In addition to these technical aspects, it is important to pay attention to the visual aspects of the game, as well as the game’s realism. Specifically, game realism is important for promoting engagement in game-based learning (4). A previous study showed a lack of realism to be one of the negative aspects (23). When the game represents real-world situations, players can practice and be more prepared when similar situations occur in real life (8). In this study, the game was developed for research purposes only and not for commercial uses.

The nurses reported that patients would not typically be as involved in their real-life medication process as in the present game. From a safe medication process perspective, nurses must be more actively involved with patients in medication-related activities (24). Addressing these important medication-related issues is essential because all nurses are involved in MA.

In this study, all nurses considered the MA tasks as an important topic. If a topic is not considered important, interest in gaming may wane. Recognizing when and how games should be used in teaching is essential (25). A previous study demonstrated that the specific topic of a course might prevent a positive response to game-based learning (17). Some nurses reported trying to change their practice according to the game, particularly regarding patient identification. This study demonstrated that the game is an effective method for refreshing medication-administration tasks, as was highlighted in a previous study (6). It is recommended that in the future, intravenous MA should also be included in the game.

Even if an educational game aims to improve competency, playing can make learning enjoyable, or learning may even occur unnoticed. Previous studies have demonstrated that playing games is an enjoyable way to learn (4, 19) and can lead to positive behavior changes (3) and learning outcomes (26). It is also sometimes an enjoyable method to master new topics (17). A previous review found no negative outcomes attributable to gamification in health professionals’ education (3). However, more research is needed on educational gaming and its application in nursing because gamification may not always motivate learning (17).

The game also keeps students awake and attentive (5). Although older health professionals and non-gamers may struggle to play games (6), playing may help arouse players’ interest in the game. In this study, a clinical nurse who did not consider herself a gaming person was excited about playing and wanted to play more often in the future.

Based on the nurses’ perceptions in this study, the game would be most beneficial for nursing students and recent graduates and may be used for enhancing and repeating the knowledge of all healthcare professionals. A previous study also demonstrated that the game would be more suitable for novice nurses (6).

5.1. Limitations and Strengths

This study had several limitations and strengths. All nurses who participated in this study were medical ward nurses. Since three Finnish hospitals participated in this study, the present results may not be generalizable to all nurses. Although different age groups were well-represented, the generalizability of the present results might have been jeopardized as all participants were female. A semi-structured interview form was developed for this study and pre-tested in two nurses. The interviews were conducted in a quiet environment. We used the consolidated criteria for reporting qualitative research (COREQ) checklist to guide study reporting (27).

5.2. Conclusions

In conclusion, registered nurses found that the present medication game was useful for strengthening their medication competency. The game made nurses think about MA tasks and self-reflect on their actions, and sometimes even changed their activities. The game focuses on tablet medications, which play a crucial role in nurses’ daily tasks. Nurses may know how to act in different situations, such as patient identification, but in reality, they may skip certain parts of the related procedures. This study demonstrates that game-based learning focusing on MA tasks is suitable for all nursing staff and other healthcare professionals. It is recommended that intravenous medication administration should also be included in future adaptations of the game.

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Footnotes

Authors’ Contribution: All authors were involved in planning the study design, data collection, and writing the manuscript. MH, KVJ, and SS were involved in 3D game development. KMK performed the data collection and spelling. SL performed the data analysis. All authors participated in either drafting the article or revising it critically. All authors approved the submitted version.

Conflict of Interests: There was no conflicts of interest.

Ethical Approval: This study is approved by the University of Eastern Finland Committee on Research Ethics (15/2018).

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Informed Consent: All participants gave informed consent for the research, and their anonymity was preserved.

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