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Conference Paper

The Storyboards for the Development of VRS-Based Laboratory Learning in the Cardiovascular System

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ABSTRACT

Clinical and laboratory learning is imperative in achieving the competency target of nursing students. Due to the COVID-19 pandemic, learning must be done online; therefore, the practice of laboratory and clinical learning could only be conducted somewhat. The development of virtual learning media that minimizes face-to-face and represents clinical and laboratory situations is urgently needed nowadays. This research aims to develop a VRS storyboard as the media for learning cases of the cardiovascular system. This research followed Research and Development (R&D), which were shortened into 5 steps (literature review, concept creation, concept model development, model testing and evaluation, and content model evaluation). The storyboard and case framework was developed from the results of FGDs and workshops and based on the NLN/ Jeffries Simulation model. The study's findings indicate the availability of nursing care storyboards about cases of Cardiovascular Disorders for student simulations based on best nursing practices consisting of learning objectives, scenes, actions, challenges, and elements of transfer, as well as opportunities to ask questions. The storyboard format allows interactive learning in terms of material, practice in nursing care skills, and nursing actions in a safe and immersive environment during the COVID-19 pandemic.

Keywords: Nursing care, laboratory and clinical learning, storyboard

Introduction

The COVID-19 pandemic in Indonesia has significantly impacted all sectors, including education, curriculum redesign, and learning methods. According to Circular Number: 262/E.E2/KM/2020 issued by the Ministry of Education and Culture, activities during the COVID-19 pandemic were designed as work-from-home and study-from-home. The challenge in nursing education is the change from face-to-face learning (offline) to online, which requires a lot of preparation in a short time (Taha et al., 2020). In laboratory and clinical learning, students cannot practice in a hospital due to the risk of contracting COVID-19 and death (Dewart et al., 2020), so learning innovations that can facilitate are needed. Online learning is a Learning Management system (LMS) with e-lecture methods, e-practical Labs, e-Problem base learning, skill, and clinical learning, and the most popular learning is Moodle, Blackboard (Baig et al., 2020) and Microsoft team (Sutterlin, 2018). However, online learning can make students more stressed than face-to-face, so it is necessary to design learning that reduces stress, is fun, and can evaluate. Evaluation of online learning is carried out in a formative and summative manner (Baig et al., 2020) the current challenge is psychomotor domain assessment, Virtual stations, and game worlds like SecondLife that can be used for the OSCE assessment (Swicegood & Haque, 2015). In addition, virtual patients can also provide a variety of exciting and novel ways to assess student achievement (Padilha et al., 2019).

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Learning methodologies impact the quality of learning; laboratory practice is the primary strategy for facilitating the learning of comprehensive nursing care, encompassing cognitive, emotional, and psychomotor. The use of quality media requires substantial (Meyer et al., 2016; Vinet & Zhedanov, 2011) so currently, lab learning uses video and simulation with manikins. Along with policies and changes in information technology that quickly change the conventional learning paradigm, digital technology, especially mobile phones and tablet devices and related applications, allows vast access (Chang et al., 2018). Nursing and midwifery education is required to find accessible and innovative learning methods and create students into professionals who are ready to work (Butt et al., 2018). Media and potential applications in nursing education are Virtual Reality (VR) (Chang et al., 2018; Islam et al., 2017). Development, application, and integration of content in the actual world is very possible with conditions, namely technology support and ease of access, (Sherman et al., 2012). Users of VR technology can interact with it by moving their hands, feet, eyes, joysticks, heads, and other body parts. Currently, VR is utilized for various things, including media, communication, tourism, and education (Permana et al., 2019) games, health/medical (Parsons et al., 2017), and other fields. Virtual reality education for nurses and midwives can change both academic and practical learning because it can overcome situational and organizational barriers related to developing clinical experimental skills, (Cobbett & Snelgrove-Clarke, 2016). VR is a valuable technique as an interactive learning solution to solve the knowledge gap between students and real-world experience (Liaw et al., 2020), safe and improves student performance competence (Foronda et al., 2017), as well as clinical reasoning (Zacharzuk-Marciano, 2017), at a lower cost than conventional (Butt et al., 2018; Haerling, 2018; Padilha et al., 2019; Puspitaningrum et al., 2019; Rourke, 2020).

The use of VR in Indonesia is still limited, especially in the field of nursing, research related to the application of VRS in acute respiratory infection (ARI) nursing care in the IGD Puskesmas setting, outcomes enable the training of nursing care abilities in a secure and realistic setting (Permana et al., 2019). The real avatar-based learning method learning can improve nursing students' self-directed learning (Lindayani, 2018), so it needs to be redeveloped on other themes in nursing. The nursing department of the University of Muhammadiyah (UMP) is currently in the process of developing a virtual lab, but there is no virtual lab available, so it is very relevant to develop virtual-based media research. The purpose of this research in general is to produce a prototype and a Virtual Reality Simulation (VRS) learning model to build a student clinical learning experience in handling cardiovascular cases in a laboratory setting.

Material and Methods

This study employed to research and development (R&D) design to create specific media and evaluate their efficacy (Sugiyono, 2019). An expert group in nursing science consisting of Emergency Nursing lecturers, senior nurses, and IT and VR experts collaborated to develop an e-learning learning series with cases of care and emergency conditions in the cardiovascular area. A Focus Group Discussion (FGD) was used to construct the cases, and two workshop sessions were used to develop the storyboards. In this study, 4 steps were carried out as a modification of the entire R&D process, namely (1) Drafting the concept and platform, (2) Developing the content and platform, (3) Examining the content and platform, and (4) Evaluating the content and platform. FGD participants consisted of VRS platform IT experts, KGD nurse lecturers, and nurses from hospitals who had worked for at least 5 years in the emergency unit, medical surgery, and/or heart unit area of 10 people. The research instrument consisted of FGD instruments, namely questions for FGD activities consisting of developing virtual-based learning methods and discharge planning for patients with cardiovascular problems. This study developed the storyboard and cases in FGD activities and workshops based on the NLN/Jeffries simulation framework (Cowperthwait, 2020; Farra et al., 2016; Permana et al., 2019). Then, the storyboard design was modified based on Farra's (2016) studies. The VRS storyboard comprises learning objectives, scenes, activities, challenges, diversionary tactics, and questions and answers.

Results and Discussion

The case Development and Focus Group Discussion (FGD)

The FGD activity aims to obtain and develop the concept of a VRS storyboard from starting cases and developing prototypes. The criteria for FGD participants are emergency room nurses with a minimum of 5 years of work experience, working in the emergency room, and understanding virtual media. Understand games and challenges, think critically, and quickly determine diagnosis, action, and evaluation under pressure. The development of cardiovascular system cases was designed through FGD activities. The case development follows the learning objectives; the result of the case development is that the case is a real case that was developed, including the subject, structure of signs and symptoms, setting of the place, type of examination, assessment in the emergency department, patient triage, diagnosis, intervention, and evaluation.

All are designed based on actual conditions in nursing practice, and cases can provide real experiences in the hospital. The selection of cases in the cardiovascular system with heart rhythm abnormalities (STEMI) was chosen because this case is an emergency case and requires immediate treatment. The setting of the place used is the emergency room, where nurses can perform independent and collaborative interventions. Diagnosis, Outcomes, and Intervention Standards of Indonesian Nursing guide nursing diagnoses. The primary nursing diagnosis that appears in patients with STEMI is a decrease in cardiac output. The expected outcome is an increase in cardiac output, while the intervention standard uses acute cardiac care. Limitations of major and minor characteristics in STEMI cases can be seen in table 1 as the key to assessment and diagnosis.

Table 1. STEMI case signs & symptoms and justification for VRS

No	Signs and symptoms	Rationalization
1.	There is no family history of heart disease, hypertension, and diabetes	Eliminating STEMI diagnosis
2.	Patient smoking	Disease precipitating factor
3.	Shortness of breath patient	Signs and symptoms of STEMI
4.	Typical or typical chest pain that persists (more than > 20 minutes) and does not go away with rest	Signs and symptoms of STEMI
5.	The patient grimaced, burning pain and being crushed by a heavy load. Pain radiates to the left back and neck with a pain scale of 8	Data on acute pain problems
6.	Blood pressure: 160/90 mmHg, Respiration: 26 x/minute, Pulse: 126 x/minute, Temperature: 35.8, SpO2: 91%. Fast, irregular pulse; the client looks restless, cold, and nauseous	Data on the problem of decreased cardiac output
7.	ECG results: STEMI, ST-Elevation at I, AVL, V5, V6 (ST anteroseptal elevation)	STEMI diagnosis

Storyboard VRS-Cardiovascular Nursing Care (VRS-CNC)

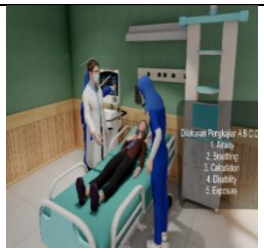
The platform is based on the design of researchers and a team of IT experts who master the platform and are experts in their fields. To ensure that the platform created is by the expected results, previously, there was an apperception and discussion from the research team and IT team to determine the VRS media. The software used is 3-dimensional software and Unity assets in the fields of Health and medicine for interaction and development of VRS application forms. Further development of the VRS-CNC application will be packaged in the android platform and the display monitor. After the learning objectives were determined, the expert team developed a VRS scenario.

The team created the VRS-Cardiovascular Nursing Care (VRS-CNC) storyboard with assistance from an expert team made up of UMP information technology experts, the department of emergency and critical nursing, the Health Sciences Faculty, and emergency and intensive care Nurses. There are three sessions in the VRS-CNC storyboard: the first (1) focuses on patient triage and ABCDE assessment and the second session (2) focuses on providing students' experiences for diagnosis, intervention, evaluation, and the third session (3) is a nursing posttest questionnaire. Furthermore, students are asked to perform nursing care for patients with cardiovascular system problems, namely STEMI. After completing all these VRS sessions, students will receive feedback using an average nursing care performance score on the application of care with a range of 0-100. Students in VRS take on the nurse role in the hospital emergency room. Modeling instructional scenarios are used to ensure that all content parts are generated consistently based on learning objectives. The compilation of storyboards and scenarios was developed based on the framework of (Cowperthwait, 2020) covering learning objectives, scenes, actions, challenges, diversions, and debriefing.

Table 2. Cases in nursing care with STEMI patients as an illustration of a VRS storyboard

Learning Objective	**Scene**	**Actions**	**Challenges**	**Redirect: Formative Feedback Facilitation**
Perform therapeutic communication Triage to determine the patient's emergency level	Place: emergency room (ER) In the emergency room, the nurse welcomes the patient. The patient lies in bed holding his chest and complains of severe pain, burning, and does not go away with rest, and is accompanied by his family. 	The nurse must be near the patient and carry out therapeutic communication. If the nurse is near the patient, a selection balloon will appear and contain questions. Question: What should I do? a. Say greetings; Hello, b. Good morning, sir. I am the nurse on duty today c. Ask about patient complaints d. Audio: what is your complaint at this time? e. Do a physical examination f. Audio: I will do a physical examination on you.	It would be best if you introduced yourself to them when you initially saw them. Answering time: 20 seconds In the next phase, asking for complaints and physical examination Answering time: 20 seconds	The patient will remain uneasy and turn away from the nurse if the decision is incorrect. a. If the response is accurate, a message stating that your response is accurate and the justification, "during the first meeting with the patient must say greetings and 100 points," will show. b. If the response is accurate, a notification will show up. The correct answer and justification will appear "on the results of the assessment, the patient's complaints are found to be short of breath and do not go away with rest,

To continued…

		g. The nurse decides the patient's triage after assessing the patient's condition. h. Audio: I did check A, B, C, D, E i. Please choose the answer and move it using the joystick	shortness of breath and restlessness". Get 100 points Note: the correct answer is the value

Learning objectives, scene, and Action

The VRS storyboard is created as a media simulation learning tool that offers a case for students to apply ideas and concepts of anatomy, physiology, pathophysiology, and nursing processes. The learning objectives refer to the AIPNI curriculum which has been applied by the Nursing Study Program, Faculty of Health Sciences, UMP, in achieving competence in providing nursing care to adult patients with STEMI. According to the VRS's learning objectives, students should be able to after finishing the simulation session:

a. The use of therapeutic communication in nursing care
b. Perform triage to determine the patient's emergency level
c. Recognizing the signs and symptoms of STEMI
d. Perform a focused assessment of patients with AMI
e. Analyzing the anatomy, physiology, and pathophysiology of the patient's condition
f. Carry out the nursing implementation for STEMI patients
g. Carry out nursing evaluations

A statement or image option panel part of the storyboard is used to explain each scene. The storyboard includes photos and 3-dimensional images of every furniture, appliance, and item in the hospital ER room to give developers specific details to use while making 3D objects. Key elements in VRS Scenario preparation are problem-solving, facilitation of responses to user actions, and activity progress (Cowperthwait, 2020). The communication pattern is designed according to communication that occurs within oneself and displays discussions within oneself or thoughts with oneself. A triage selection panel will appear when the nurse approaches the patient and completes the necessary triage and communication treatment procedures until it is possible to postpone it.

VRS-CNC storyboard Challenge and Redirection

The "challenge" section of the simulation specifies the circumstances in which the user must act following the scenario offered (Cowperthwait, 2020). The challenge is used as a tool for assessing material mastery and clinical skills by reacting to the triggers of the presented situation. Students are challenged to use appropriate behaviors, such as communication, assessment procedures, triage, clinical judgments, assessment, nursing diagnoses identification, and interventions, in response to scenarios in the form of questions in this VRS. Each of these formative assessment questions will have a choice of answers and will be graded 100 points for the correct response. The user will receive an average value after the VRS, with a range of 0-100. Because of the multilayer summative evaluations used in this assessment, this session can be used by lecturers as a learning exercise. The time limit presents another difficulty because users only have 20 seconds to respond correctly to each question. For nursing actions, on the other hand, if an error happens, they are given a 20-second opportunity. If they are successful, they move on to the next step; if

unsuccessful, they are returned to the previous phase. On the other way around, for nursing actions, if an error occurs, they are given a 20-second opportunity, or they will proceed to the next phase if they succeed; otherwise, if this stage is not successful, they will return to the previous phase.

Debriefing, technical support, and learning preparation

To analyze user performance during a VRS session, debriefing is included in this VRS. The user will assemble information on all problems, solutions, and average scores after the VRS session and provide feedback. The ability to record all sessions on the monitor or screen is another feature of VRS. Debriefing resources include written information and VRS video recordings. A group of subject matter experts created the Q&A's trigger questions. VRS includes tutorials, sample sessions, and learning modules for assistance and development. Information about navigation and interaction is included in a lesson that explains how to use VRS. by training in the emergency nursing room to handle and administer nursing care. Before using VRS -CNC, students should read the given learning modules, including a sample session at the start of the activity.

The development of this storyboard takes the conceptual framework of development from previous studies (Farra et al., 2016; Permana et al., 2019) specifically the creation of VRS storyboards through the use of intra-personal communication in the form of floating questions, which serve as interactive instruments between users and their reactions to the virtual environment. Students can exercise critical thinking and reflection on practice through interpersonal communication (Suzanne Campbell, 2019). The utilization of intrapersonal communication in this context, along with the ability to make judgments in response to specific events, adds additional elements and educational opportunities to the earlier storyboard development. By using VRS, it is possible to integrate the design of psychomotor learning level 3 instructional questions in the realm of Bloom's Taxonomy, and this aims to test students' ability to employ therapeutic communication techniques. Questions and activities in the virtual include cognitive, affective, and psychomotor tests, even developing level 4 abilities in Millers Pyramid in the AIPNI curriculum (Fitri et al., 2016). VRS is one of the breakthroughs in learning methods that can evaluate the level of learning with higher results (Permana et al., 2019).

The VRS's capabilities should be thoroughly investigated, particularly in fostering the best learning environment possible, providing a therapeutic remediation experience in challenging circumstances, and promoting experimentation. Using simulation, nursing students can practice their clinical skills in a secure setting. Through repeated exposure to educational information like fundamental clinical skills as a new practitioner, VRS offers a secure and welcoming learning environment that can improve patient safety (Butt et al., 2018; Rourke, 2020; Sinclair et al., 2015). It was further stated that game-based VRS in nursing effectively improves learning mastery (affective, cognitive, psychomotor) and remembering material (Butt et al., 2018). Virtual simulation is an effective educational strategy to increase student engagement. Attendance, immersion, and cost are the three components of virtual simulation in nursing that can be incorporated into the engagement cycle that demonstrates student achievement (Shin et al., 2019).

This VRS was prepared based on the guidelines for handling the hospital in an emergency setting and the management of Acute Coronary Syndrome (ACS) compiled by (Dokter Perhimpunan Spesialis Kardiovaskular Indonesia, 2015). In addition, the research team also used the New Guidelines for the Indonesian Nursing Diagnosis Standards (Tim Pokja SDKI DPP PPNI, 2017). Pokja the Indonesian Nursing Outcomes Standards (Pokja SLKI DPP PPNI., 2019) and the Indonesian Nursing Intervention Standards (Pokja SIKI DPP PPNI, 2018) which are very characterized and have local wisdom. The VRS-CNC storyboard is an innovation combining nursing care with standard diagnoses and interventions based on IDHS, SLKI, SIKI, and collaborative actions. Compared to the previous storyboard, this VRS presents male and female nurses according to Islamic characters. Combined with 3D applications, unity, and interactive

concepts with floating questions, panels that can be selected also provide complete tools for action. However, this storyboard only focuses on STEMI patients at the initial treatment level; in the next phase, it can be developed in intensive care.

Conclusion

This study developed VRS-CNC storyboards based on the best techniques suggested by the literature to create high-quality learning items. A team of IT experts with expert input developed this storyboard. Moreover, the VRS storyboard was expected to be a picture of students handling STEMI patients in the emergency room. The VRS-CNC storyboard needed to be developed again so that it could be maximized on the android platform and personal computers.

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