Nursing Students Satisfaction Using Virtual Reality As Learning Media

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Abstract

Technology-based simulation learning methods have great potential to support education for students in the health sector. One of the innovations that can be done is virtual reality. In using virtual reality, paying attention to the quality of virtual reality services to provide learning satisfaction and motivate students to be active in the learning process is essential. VNursLab designed VR as an additional learning media for Padjadjaran University nursing students. Therefore, this study aims to identify nursing students' satisfaction with using VR as a learning media simulator.The method used is pre-experimental quantitative research and a one-shot case study approach. The sampling used in the study was purposive. Eighty-six respondents completed the research by following the VR simulation for 20 minutes and continued filling out the PSSUQ (Post-Study System Usability Questionnaire) questionnaire. The data were analyzed using descriptive analytics by finding the mean value of each aspect of the assessment obtained from the mean of each element of the respondent. The results show that the overall quality of VR VNursLab is good (2.2), with a mean value of system quality (2.3), mean InfoQual (2.21), and IntQual (2.28). Based on these results, VR VNursLab as a learning media with virtual simulation methods has a good quality of use assessment and provides satisfaction with nursing students' use.

Keywords: education technology, nursing education, usability, virtual reality

Introduction

The quality of clinical skills and competencies that are lacking in nursing students can lead to not achieving the health status of patients when required to become a nurse, so there is a need for learning methods that can support the knowledge and skills of nursing students following the competency requirements required by professional nurses. The advancement and widespread use of digital technology is associated with a promising source of effective and efficient health professional education and training systems (Crisp, Gawanas, and Sharp 2008). Education through digital technology in the learning process is defined as digital education or educational learning (e-learning). E-learning is not limited to online and offline computer-based education but also includes open online courses, the use of virtual reality, virtual patients, smartphone-based learning, the use of games and gamification, and the use of specific applications that support the achievement of goals in the learning process (Saxena et al. 2016).

The simulation learning method is one of the methods that can be used to support the improvement of nursing students clinical skills. This learning method can provide a safe environment for students to practice their skills by establishing clinical procedures, thus helping students repeatedly practice without worrying about patient safety (Hilleren, Christiansen, and Bjørk 2022). Learning methods with the use of technology must be carried out through practical simulations so that they are representative of achieving students' nursing knowledge and clinical judgment (Letcher, Roth, and Varenhorst 2017).

Technology-based simulation learning methods are developed and begun to be used by educators, one of which is the development of Virtual Reality (VR). The use of virtual reality will provide an active learning experience for individuals by providing accurate virtual perception according to the user's wishes and training the ability to interact and explore with objects and perform a series of actions or procedures that facilitate practical learning (Cao and Cerfolio 2019). With simulation methods, VR is considered very practical for training focusing on clinical and surgical procedures (Kyaw et al. 2019).

The successful use of VR as a learning medium supports clinical skills and students' learning satisfaction. Learning satisfaction obtained in using VR as a learning medium is obtained from students' perceptions of the quality of service that will be provided from using VR with the experience felt during VR use. Thus, to obtain student satisfaction in digital education, universities need to understand and provide maximum e-learning service quality by supporting interaction between users and the system, being able to motivate users, and not hindering the learning flow (Permana et al. 2018). Many factors shape the quality of e-learning services, such as learning design, learning technology used, system quality, information quality, and support and administrative services (Pham et al. 2019).

VNursLab, or Virtual Nursing Skill Simulation Lab, is an interactive 3D learning media development project and virtual reality developed by researchers from the Faculty of Nursing at Padjadjaran University. VNursLab was developed to prepare nursing students to have good-quality skills and be globally competitive. The advantages of the development of VNurslab are the first interactive 3D-based nursing action simulator and virtual reality in Indonesia, integrating nursing cases and actions that will stimulate students to think critically, and easy to use without the time and place limits. VNursLab has developed by making three types of virtual reality-based nursing actions: suction procedures, urine catheter installation, and wound care. However, evaluating virtual reality usabilities, such as system quality, information quality, and visual quality, in nursing students, has never been done. Thus, the quality of using virtual reality as a learning media simulator for nursing students has yet to be obtained.

Evaluation of the use of learning media in students is needed to support the learning process and the desired learning outcomes. The availability of VNursLab and the use of virtual reality as learning media are expected to provide a quality virtual reality experience for nursing students so that it can motivate them to participate in the simulation-based

learning process with the use of technology. Therefore, the main objective of this study is to identify and evaluate the usefulness of virtual reality as a learning media simulator for students.

Research Method

The research was conducted using pre-experimental quantitative research with a one-shot case study approach where the researcher only intervenes once and then holds a post-test on the respondents used to determine the usefulness of VR as a learning media simulator for nursing students. The research was conducted with a cross-sectional time approach. The faculty of nursing Padjadjaran University with a purposive sampling technique, conducted the research. The inclusion criteria set in the study were active students in the second year, the third year, and the fourth year who did not tend to simulate sickness or cybersickness with the characteristics of nausea, vomiting, eye fatigue, dizziness, and ataxia. Respondents who only participated in the study once it was completed were considered dropout samples. Thus, 86 students participated in this study.
Furthermore, the selected respondents will choose and set the time together with the researcher for the intervention of using VR. After the intervention schedule was agreed upon, the respondents followed the intervention of using VR VNursLab at the Faculty of Nursing, Padjadjaran University. The intervention was carried out by allocating 20 minutes for respondents to use VR. The VR used in this study is the urine catheter insertion procedure. Before using VR, respondents were given a brief explanation of how to use VR and the procedure for inserting a urinary catheter. After doing the simulation, respondents were given a break for 10 minutes before continuing to fill out the PSSUQ adaptation questionnaire.

Lewis first developed the PSSUQ adaptation questionnaire in 1992 to evaluate the usability of a products or systems in learning activities (Hajesmaeel-Gohari et al. 2022). This questionnaire has three versions with the third version having 16 questions (Lewis 2012). This questionnaire has four aspect scores, one overall score, and three subscales. The overall assessment is an average calculation of responses to questions from 1 to 16, which are used to see the evaluation of usability and satisfaction of use felt by respondents regarding virtual reality. The first aspect assessed is the System Quality (SysQual) aspect which aims to evaluate the quality in VR with the mean value obtained by calculating the average score from questions 1 to 6 from each respondent. The second aspect analyzed is Information Quality (Infoqual) which is used to evaluate the quality of information. The mean value of InfoQual is obtained from the sum of the average scores of questions 7 to 12 from all respondents. The Interface Quality (IntQual) aspect is the last aspect analyzed. IntQual aims to evaluate the quality of the interface with the value obtained from the sum of the average scores of questions 13 to 15 from all respondents. The adapted PSSUQ questionnaire has been tested for face validity by experts following the research field and has been tested for reliability with very high instrument reliability results ($r_{11} = 0.96$).

The data obtained from respondents were analyzed by quantitative descriptive method to obtain the mean value. The usability assessment of the use of virtual reality on nursing students was analyzed by finding the mean value of each aspect of all respondents. Data interpretation is the result of the overall mean value of respondents, not the mean of each respondent on the analyzed aspects. Data analysis will use the help of SPSS Window version 25 to get the mean value.
In conducting research, researchers implement ethical principles, namely, respect for human dignity, respect for privacy and confidentiality, respect for justice and inclusiveness, and balancing harms and benefits (Notoatmodjo 2018). This study has obtained ethical approval and consideration with ethical number 1005/UN6.KEP/EC/2022. Each participant has agreed to participate in the study.

Results

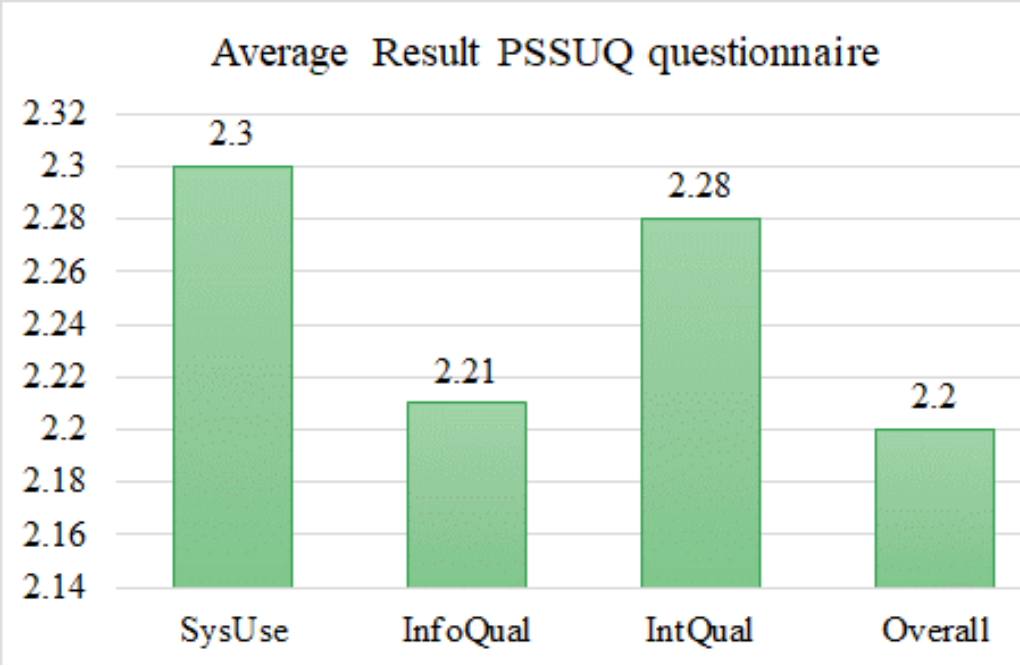
Demographic characteristics in this study include class, gender, and age. The number of respondents totalled 86 students in the second, third and fourth years. Most

respondents who participated in this study were senior students, with a total of 32 respondents. Most respondents are female and in the age range > 20 years or in late adolescence. An explanation in the form of a frequency distribution table presentation for each demographic characteristic is in Table 1 below.

Table 1. Characteristics Demographic of Respondents

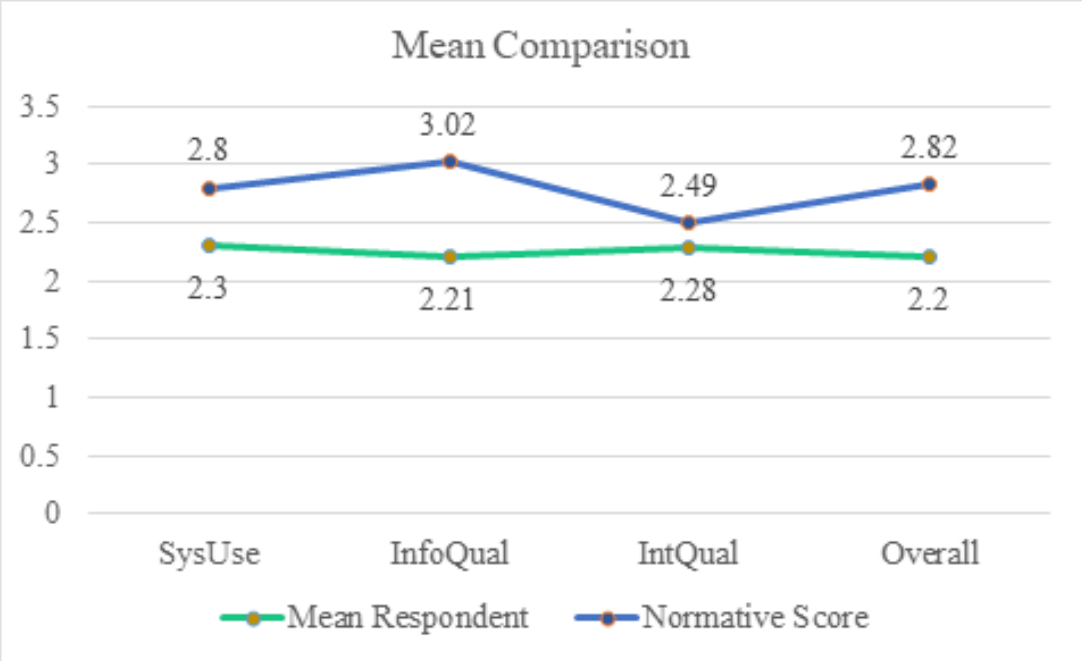
Demographic	Frequency	Percentage (%)
Year Of Class		
Senior year student	**32**	**37.2**
Third year student	**26**	**30.2**
Second year student	**28**	**32.6**
Sex		
Male	**9**	**10.5**
Female	**77**	**89.5**
Age		
18 - 20 years old	**40**	**46.5**
> 20 years old	**46**	**53.5**
Total of respondents	**86**	**100%**

The following is a graph of the average value of all aspects in evaluating the usability of virtual reality VNursLab on nursing students



Diagrams 1 Virtual Reality Usability Assessment on Nursing Students (n=86)

To get the evaluation value of the usability of virtual reality for nursing students, it is necessary to compare the average value obtained from each aspect of the research with the third version of the PSSUQ normative value set by (Lewis 2012) with a confidence interval of 99%.



Diagrams 2 Comparison of VR PSSUQ Values with Normative PSSUQ Values (n=86)

Discussion

In analyzing the evaluation of use, lower scores interpret better results on the evaluation of use. The results of the research that has been done show the highest average value of 2.3 in the SysUse aspect or the aspect of system quality. Meanwhile, the lowest average value is on the overall aspect of user satisfaction with the quality of virtual reality, with an average value of 2.2 from all respondents. Thus, the lower the average value obtained, the more it shows that VR has good usability and users or nursing students are satisfied with using VR as a learning medium related to virtual simulation of clinics.

The sysqual aspect or aspect of system quality is an assessment component used to evaluate system usability and satisfaction with the use of nursing students on how well the quality of the system works and helps achieve the objectives of using the media. With an average value of 2.3, compared to the normative value set by Lewis (2012) with a confidence interval of 99%, the average system quality obtained is still below the normative average value. This interprets that the quality of the VNursLab virtual reality system is still in the excellent category. Nursing students are satisfied with using the system provided by virtual reality as a learning medium. This is in line with learning media that provide a satisfying learning experience using must-have features or systems that are appropriate to the needs, engaging, and have a good and clear material structure (Permana et al. 2018).

System quality in the use of VR refers to the system characteristics obtained from devices or web services available to users (Y. Chen 2013). System quality assessment includes components of system reliability, ease of access, response time, and system flexibility (Lee et al. 2020). The assessment of good system quality aspects in VR VNursLab is obtained because the VR designed can contain a coherent and specific urine catheter insertion procedure system, so that users will feel the procedure in real life even in a virtual environment. The VR operating system also contains a game-like system, where the procedure is structured with the user will get concise material regarding the use of VR and urine catheter procedures, try VR simulations of urine catheter installation accompanied by task directions, and continued with VR simulations independently without being briefed. In addition, VR is also easy to access with the help of motion controllers to be able to operate tools or materials as desired

by users in a virtual environment. The time response to the use of VR is also appropriate. When the user needs a material or tool, VR will constantly display a variety of tools or materials that are needed during the clinic simulation with the help of motion controller operation.

The second aspect, namely the infoqual aspect or information quality aspect, is an assessment carried out to evaluate the usefulness of VR on the ease of information that can be understood using virtual reality. This aspect also evaluates how good and clear the quality of information is that is useful to assist students in using virtual reality. The average value obtained in this study is 2.21, which, when compared, the average value obtained is still smaller than the predetermined normative value. This means that the quality of information presented by VNursLab virtual reality is in the excellent category. In addition, the value obtained is also included in the best value of the three aspects analyzed in the quality of virtual reality use. This can happen because virtual reality is a learning media that can create a sense of real presence for users in a virtual space. Thus, if the virtual space created is sufficiently interactive and quality, users will experience emotional and behavioral reactions in a natural environment (Baniasadi, Ayyoubzadeh, and Mohammadzadeh 2020). This reaction allows educational material or information, the learning objective, to be conveyed effectively and adequately, considering that nursing student education requires the quality of simulations that can interpret a clinical situation or provide genuine nursing care. In addition, a user cannot experience virtual reality in real terms when the object or system does not have the proper reaction, so ensuring the quality of the information provided in virtual reality is very important.

In the VR urine catheter insertion procedure, VNursLab presents information that includes procedures for using VR, assessment procedures for installing urine catheters, an explanation of the use of tools and materials used in simulating urine catheter insertion procedures, and students can also practice in advance by using the guides that are available in simulating urine catheter insertion. Providing comprehensive information helps students to prepare themselves more optimally to perform virtual installation of urine catheters, so that students can simulate the use of VR to install urine catheters independently. The information presented in VR has been compiled by professionals in the field of health and education, so that the quality of information provided is accurate and has been adapted to the needs and objectives of clinical simulation learning of urine catheter insertion procedures.

The third aspect analyzed in the quality of virtual reality use is the intqual aspect or interface quality. This aspect aims to evaluate nursing students' satisfaction with the quality of the interface quality of the system in using virtual reality as a learning medium. The average value obtained from the interface quality aspect is 2.28. These results are classified as good because they have a lower value when compared to the normative average value set. Interface quality in the use of VR is defined as the quality of interaction between users and objects in the virtual world, where users must be able to understand and handle these objects (Thériault, Robert, and Baron 2004). The role of the interface allows users to see virtual world objects, so the more senses that are stimulated in the virtual world, the greater the feeling of immersion in the user (Gatica-Rojas and Méndez-Rebolledo 2014). This good interface quality assessment can be obtained because VR has a visualization or depiction of virtual objects that are clear, modern, and in accordance with the actual clinical environment. The design in VNursLab's VR visualization is also displayed with a variety of image viewing angles, allowing users to obtain a good quality and comprehensive 3D image visualization. Virtual reality VNursLab designs VR by paying attention to the details of standard operating procedures following real clinical skills standards. VR also pays attention to the steps in clinical skills and natural clinical principles. Thus, it can provide an excellent visual quality experience to its users.

In the use of technology-based learning media such as the use of VR, the quality of the interface plays an important role. This is confirmed by Yu (2022) that the design or

visual quality of the designed learning media is positively proportional to the effectiveness of the learning process, as evidenced by the satisfaction of students. In related research, it is also confirmed that the learning process that pays attention to visual quality or learning content significantly shows better learning outcomes. In addition, the design or quality of media has a strong and positive influence on the learning process for new and continuing learners, where the effectiveness of learning is more perceived if the learner is satisfied with the teaching materials provided, assessment strategies, and assignments given during the learning process.

The last aspect assessed is the overall aspect or also known as overall value. This assessment is conducted to evaluate the satisfaction of using virtual reality from nursing students. This study has the best value compared to the other three aspects. Thus, it was found that nursing students felt satisfied with the quality of using VNursLab virtual reality. The satisfaction of using VR is felt by students because the quality of virtual reality learning media provides a valuable simulation experience for nursing students. Cole, Shelley, and Swartz (2014) suggest that in the use of online learning media, things that are important to consider and significantly affect satisfaction and effectiveness in online-based learning and technology perceived by students are the content or information provided, the accuracy of the services provided, and the design or visual quality displayed. With the use of virtual reality as a learning media that provides real experience through virtual simulations and with the support of good system quality, students will feel satisfaction with using virtual reality as a learning media simulator.

Usability assessment is a fundamental factor in seeing users' satisfaction with a system and a consumer product. In using VNursLab virtual reality to install urine catheters, all aspects get good scores because VR provides quality and actual user experience for nursing students. In addition to the experience, the excellent value of using VR is also obtained from the ease of use in operating VR as a clinical learning media. This good assessment is obtained considering that in VR, manipulation of the virtual environment interface that is intuitive, direct, and flexible is the most significant thing in influencing the ease and experience of use. Evaluation of the use of VR as a learning media is closely related to the sense of user control or the user's control ability in operating VR. This aspect is the most critical because when users believe that they are actively controlling the virtual environment, users will feel the experience is more accurate and minimize the possibility of side effects from using VR (Jinhae, Kahyun, and Junho 2019).

Essential factors in evaluating the usability of VR as a learning medium are also confirmed by Huang and Lee (2022), who analyzed that there are three crucial factors in assessing the usability of VR, namely interactive quality factors, including the level of presence, interactivity, usability, and user learning ability; dynamic compatibility factors that refer to the visual stimulus perceived by users and the consistency of stimuli from virtual objects controlled in VR to users including the view or visual perspective of VR and stability in the use of VR; and the third factor is additional factors in the use of VR which includes the smooth operation of the system, the sound effects provided, the vibration felt, and the quality of immersion felt by users. Of the three essential factors mentioned, the VNursLab virtual reality assessment factors analyzed include information quality, system quality, and visual quality. These critical factors need to be assessed and evaluated for quality in using VR as a learning media simulator.

Good quality learning media services can positively affect the satisfaction of use in the learning process felt by students (Pham et al. 2019). Kim and Ahn (2021) found that the learning effect of virtual reality has a significant positive correlation with the score of virtual reality technology recognition, virtual reality experience, learning satisfaction, learning needs, and intention to use learning media in continuous learning for students. VNursLab virtual reality as a learning media for nursing students has good system quality, information quality, visual quality, and quality of use to be used as a learning media with virtual clinical simulation methods carried out by nursing students. By providing quality VR-based

learning media accompanied by satisfaction of use felt by nursing students, it is possible to increase learning motivation in students. With increased motivation, students are expected to practice and improve their clinical skills more actively. Thus, with competent nursing student clinical skills, it is possible for students to become professional nurses who can provide comprehensive nursing care for patients in the future. The VR tools were limited and needed to provide more oculus.

Conclusion

Virtual reality VNursLab is of interest to nursing students as a new and innovative learning media. VNursLab virtual reality has good quality regarding systems, information and visuals displayed. Thus, virtual reality can be a learning medium to provide an authentic virtual experience under the procedure or skill objectives. With good usability and experience quality, students also feel satisfaction using virtual reality as a learning medium.

Research with continuous implementation of VR allows the production of objective data regarding the effect of applications on learning outcomes and students' desire to reuse VR as a learning medium. This study has limitations by only being able to describe the evaluation of usability in general from the aspects of the quality of use of VR systems, information, interface, and satisfaction with the use of VR as learning media. Further research is needed to evaluate other factors that affect the usefulness of VR as a learning medium, especially with structured, sustainable implementation used by nursing students.

The evaluation of using VNurslab virtual reality shows that the value of the system aspect is the lowest compared to that of the other four factors. Therefore, researchers suggest the need for evaluation and development related to the quality and usability of the system in VNursLab virtual reality. Thus, later, the system's increased quality can further improve the usability of virtual reality as a learning media simulator for nursing students.

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