Combining Mobile Web-Based Virtual Reality and Simulation in Training Programs: An Extension of XR Education

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This study aims to determine the effects of mobile web-based virtual reality and simulation-integrated education on learning motivation, academic self-efficacy, and learning immersion. It was a quasi-experimental, single-group, pretest-posttest study conducted from April to May 2023, involving 16 high school students with an interest in nursing majors. Before data collection, participants were briefed on the study's objectives and procedures, and they voluntarily provided consent by signing the participation form. The collected data underwent analysis using descriptive statistics and non-parametric tests, specifically the Wilcoxon signed-rank test, employing the SPSS statistical software. The findings revealed statistically significant differences in learning motivation (Z=-2.70 p=.007) and academic self-efficacy (Z=-2.23 p=. 026), both of which were considered significant. In conclusion, students who underwent mobile web-based nursing skills integration education demonstrated improved learning motivation and academic self-efficacy after the education than before the education. Therefore, it is imperative to develop and implement various simulation education methods utilizing both online and offline platforms to motivate high school students.

Keywords: Mobile, Virtual Reality, Simulation, Nursing, Education.

1. Introduction

Adolescence signifies the pivotal phase of career development, comprising the process of decision-making and preparation that requires both direct and indirect experience to acquire various career insights(Lee & Park, 2020). Engaging in experiential activities that facilitate career decision-making can enable high school students to explore their aptitudes and interests, thereby improving their career identity and self-efficacy. To solidify this identity, it is imperative to engage in career experience activities, which serve as positive factors in career decisions. Students can gain valuable insights and knowledge about job-related experiences and fields of interest through both on-site and online experiences(Lim & Yang, 2021). Given the diversity of occupations available, the selection of careers has become a focal and

prioritized concern for high school students(Chun & Kim, 2015). Career experiences encompass educational activities that provide students with information about potential careers and foster adaptability through direct experiences(Chun & Kim, 2015). Ultimately, career education in high school lays the foundation for the values and ways of life related to the career a student chooses. However, current career education activities within schools are limited, predominantly focusing on basic career information exploration(Jang, 2019). In response, the Gwangju City Office of Education has implemented a joint curriculum across schools, allowing students to select and study participants aligned with their interests, considering their desired career paths and aptitudes. The nursing experience involves directly immersing oneself in the essential knowledge and skills of the profession. In Korea, a recent surge in the number of schools offering nursing programs, with enrollments increasing annually(Bae & kim, 2017). As interest in nursing as a specialized field with a high employment rate continues to rise, so do career experience activities. For high school students opting for nursing as their major, these activities positively impact their perception of nurses, their adaptation as nursing students, active participation in class and practical settings, as well as their overall preparation and motivation for the profession(Lee & Kim, 2022).

Self-efficacy and learning motivation play a critical role in influencing school adjustment, which is the relationship between confidence and performance in any activity and is shaped by experiences during the secondary school years(Yoo, 2001) Learning motivation serves as a source for educational activities, crucial for learners to develop their aptitudes and adapt to a rapidly changing academic landscape(Lee, 2009). Commitment to learning denotes an active tendency to learn and the ability to focus on one's abilities, fundamental for successful academic retention(Lee et al., 2020). Most students pursuing nursing face challenges in adjusting to college life, often leading to high dropout rates. This is predominantly attributed to the formidable stress associated with learning tasks, theory comprehension, and skill assessments, which subsequently decreases their motivation and self-efficacy(Choi & Kim, 2018). Therefore, it is imperative to analyze strategies for enhancing students' self-efficacy and adaptation to university life, bolstering their interest and motivation in nursing, and enhancing their immersion in their academic pursuits.

Nursing education consists of both theoretical and practical training, which is crucial for developing practical skills as a nurse(Seo & Kang, 2020). However, unlike in the past, with increased patient safety, there are fewer opportunities for students to learn by performing skills directly on patients(Benner et al., 2010). Nursing education is currently limited to traditional lectures and simple observations that apply new learning strategies to help students acquire important skills.

Recently, with the advent of the Fourth Industrial Revolution and educators increasing accessibility to advanced technologies, online education is increasing at a rapid pace; smartphones, smart TVs, and tablet PCs are being used for various educational methods, and the mobile field is gradually expanding in the medical environment. Mobile education is utilized as an effective educational medium because it minimizes time and space constraints and facilitates repeated playback through individual learning(Bang & Kim, 2018). Particularly, virtual reality utilizes devices to create a virtual world that does not exist and enables various forms of interaction through human sensory cognition(Bang & Kim, 2018). Additionally, the educational models used for hands-on training have the advantage of being similar to the

human body and can be practiced repeatedly in safe environments(Kim & Kim, 2020). In addition, deep learning networks are being used for a variety of purposes, such as the segmentation of traits, the extraction of vital information, and the categorization of diseases in plants, animals, and fishes (Cho et al., 2024; AlZubi, 2023; Wasik and Pattinson, 2024; Porwal, 2024).

Studies on the application of simulation and virtual reality have shown positive effects on learners' problem-solving skills, academic achievement, self-confidence, and educational satisfaction(Jung & Chae, 2020). However, limited research on blending virtual reality and simulation in practical education exists. Therefore, this study aims to provide a mobile web-based virtual reality and simulation convergence education to check its effectiveness and aid high school students in selecting a career.

2. Contents

2.1 Study design

This study employed a one-group pretest-posttest design to determine the effectiveness of mobile web-based virtual reality and simulation convergence education. Learning motivation, academic self-efficacy, and learning immersion were measured as a pretest. Subsequently, an intervention was provided, while the posttest was measured using the same variables as the pretest.

2.2 Participants

This study was conducted with 16 high school students selected through the high school credit support center of the Ministry of Education in G city who were interested in nursing and participated in a 34-hour nursing practice experience program. The number of participants for the pre-and post-program comparison was calculated using G*Power 3.1.9 with a significance level of .05, effect size of .8, and power (1-β) of .9 for the Wilcoxon Signed Rank test.

2.3 Measurements

2.3.1 Learning Motivation

The learning motivation measurement tool utilized in this study, based on the work of Hicks and Klimoski(Hicks & Klimsski, 1987) and employed by Han Young-jin(Han, 2004), comprises six items: interest in education, expectation of education, willingness to improve through education, conscientiousness in education, inclination to participate in education, and persistence in education. Each item is assessed on a 5-point Likert scale ranging from “not at all” to “very much,” with higher scores indicating higher motivation to learn. In Han Young-jin's(Han, 2004)study, Cronbach's α was .78, while in this study, it yielded a value of .76.

2.3.2 Academic Self-efficacy

An academic self-efficacy measurement tool developed by Yoo Hyun-Hyun was used(Yoo, 2001) The instrument consists of 24 items, including learner confidence (seven items), learning persistence (six items), learning task preference (six items), and learning effort (five items). Each item was answered on a 5-point Likert scale ranging from “not at all” to “very much,” with higher scores indicating higher academic self-efficacy. The Cronbach's α was .87

in Yoo Hyun-Hyun(Yoo, 2001) and the Cronbach's α in this study was .88.

2.3.3 Learning Immersion

Seok Im-bok used a learning immersion measurement tool produced by elementary school students (Seok, 2008) , while Lee Jae-shin modified and supplemented it to suit high school students(Lee, 2009). The instrument consists of 35 items, including matching challenges and abilities (four items), integration of behavior and consciousness (five items), clear goals (two items), specific feedback (five items), focus on the task (three items), sense of control (two items), loss of self-consciousness (five items), distorted sense of time (three items), and self-purposeful experience (six items). Each item was answered on a 5-point Likert scale ranging from "not at all" to "very much," with higher scores indicating higher levels of learning immersion. In Lee Jae-shin's(Lee, 2008) study, Cronbach's α was .96, and in this study, Cronbach's α was .96.

2.4 Data collection and Ethical consideration

The data collection period was from April 15 to May 15, 2023, and the data was collected using Google Forms. We explained the purpose and procedures of the study, confidentiality, and anonymity and informed them that they could withdraw at any time if they experienced any side effects or risks during the study. After signing the consent form, the participants were asked to respond to the survey via a link.

2.5 Research Process

Before the training, the participants' general characteristics, learning motivation, academic self-efficacy, and learning immersion were measured. Mobile web virtual reality utilizes the Cospaces Edu platform, which allows users to experience IV therapy content using a smartphone or tablet[Fig. 1]. Cospaces Edu is a 3D-based VR/AR block-coding program that can be used by students anytime and anywhere. It can also be utilized for offline training using VR headset equipment if required. During the pre-orientation, students were taught how to use the platform (Cospaces Edu) as a prelude to the mobile web VR experience, and the instructor shared and sent the students a link to access Cospaces Edu. The scenario consisted of performing an intravenous technique correctly according to the procedure, with a quiz at the end to allow students to progress to the next step. It took approximately 10–15 min to complete. The simulation training used the BT-CSIV-S model (BT-CSIV-S, BT Inc., Korea), which is traditionally used to practice intravenous skills. It took approximately 15 min to complete the task. Each student participated in the mobile web-based virtual reality and simulation convergence education program three to four times, and the intervention time was 120 min. After training, a post-test was conducted, as previously described.

<Intravenous fluid infusion scenario>

SITUATION: You are reviewing an outpatient admission, Mr. Stablemac (F/30, Pneumonia), after escorting him to his room. He has a history of asthma and is complaining of increasing dyspnea with cough and secretions and is feeling weak. You see a prescription for 5% D/W 500 mL IV 20 gtt. Perform according to procedure.

<Scenario quiz>

Q1. After pulling the skin taut, choose a method of execution.

1) Withdraw the probe the length of the catheter in small increments as you enter the skin into the vessel.

2) Hold the catheter with the four sides up with your other hand.

3) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

4) After the catheter is fully inserted, release the tourniquet with the hand not holding the catheter.

Q2. After holding it with the slope side up, choose the method of execution.

1) Hold the catheter insertion part with one hand.

2) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

3) Adjust the infusion rate according to the prescription.

4) Help the subject to assume a comfortable position.

Q3. After inserting the catheter into the vein, select the method to ensure that

1) If blood backs up into the catheter, grasp the center of the catheter, slightly decrease the insertion angle of the catheter, and withdraw the probe the length of the catheter while advancing the catheter into the vessel.

2) Withdraw the stylet in small increments along the length of the catheter while advancing the catheter into the vessel.

3) After the catheter is fully inserted, release the tourniquet with the hand not holding the catheter.

4) Press down on the tip of the catheter as it is inserted into the vessel with one hand while quickly removing the stylet with the other.

Q4. After withdrawing the probe in small increments, choose a method of administration.

1) Help the subject to assume a comfortable position.

2) After the catheter is fully inserted, release the tourniquet with the hand not holding the catheter.

3) Use one hand to hold the catheter insertion in a steady grip.

4) Press the tip of the catheter into the blood vessel with one hand while quickly removing the probe with the other.

probe with the other hand.

Q5. Choose a procedure after releasing the tourniquet.

1) Immediately after removing the probe, connect the tubing from the fluid set to the center of the catheter to prevent blood from flowing down through the catheter.

2) Press down on the end of the catheter inserted into the blood vessel with one hand while quickly removing the stylet with the other.

3) Adjust the rate of fluid infused according to the prescription.

4) With the other hand, loosen the regulator on the fluid set and observe the fluid infusion and any signs of infiltration, such as swelling or pain, at the venipuncture site.

Q6. Quickly remove the probe and select a procedure.

1) Use your other hand to loosen the adjuster on the fluid set and observe whether the fluid is injected and whether there are any symptoms of infiltration such as swelling, pain, etc. at the venipuncture site.

2) Write the date and time of catheterization and the size of the catheter on the adhesive bandage or dressing.

3) Immediately after removing the probe, connect the tube from the fluid set to the center of the catheter to prevent blood from flowing through the catheter.

4) Wipe the injection site with an antiseptic cotton ball in a 5 to 8 cm circle from the inside out.

Q7. Observe for symptoms of infiltration and then choose a procedure.

1) Hold the catheterization site in place with one hand.

2) Write the date and time of catheterization and the size of the catheter on the securing band-aid or dressing.

3) Help the person get into a comfortable position.

4) Place the fluid infusion tube in a stable position and secure the catheterization site with a band-aid or transparent dressing so that the catheterization site does not bend when the catheter is removed.

Q8. After securing the catheterization site, select a procedure.

1) Insert the catheter into the vessel and withdraw the probe in small increments along the length of the catheter.

2) Adjust the infusion rate according to the prescription.

3) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

4) After the catheter is fully inserted, release the tourniquet with the hand not holding the catheter.

Q9. After adjusting the fluid rate, choose the method of implementation.

1) Write the date and time of catheter insertion and the size of the catheter on a securing band-aid or dressing.

2) Use one hand to hold the catheterization site in place.

3) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

4) With the other hand, loosen the regulator of the fluid set and observe whether the fluid is injected and whether there are infiltration symptoms such as edema and pain at the venipuncture site.

Q10. How should the needle be discarded?

1) Dispose of the needle in a hazardous waste container, uncapped.

2) Dispose of the needles in your regular waste container, uncapped.

3) Throw the needle in the trash, uncapped.

4) Disinfect and reuse needles without recapping.

Q11. Where should you dispose of the syringe and cotton balls? Please choose.

1) Dispose of them in a special container for hazardous waste.

2) In a special container for general waste.

3) Throw in the trash.

4) Sanitize and reuse.

Q12) You are preparing a bag of IV fluids. Please check the following.

1) Check the expiration date, presence of foreign substances, etc.

2) Check the fluid volume, presence of foreign substances, etc.

3) Check the date of manufacture, color of the fluid, etc.

4) Check the expiration date, color of the fluid, etc.

Q13. I want to connect the infusion bag and infusion set. Please select the order of connection.

1) Wipe the rubber stopper on the bag with water>Open the infusion set controller>Plug in the infusion set and fill about 1/3 of the reservoir with fluid

2) Wipe the rubber stopper of the infusion bag with a disinfecting cotton ball>Open the infusion set controller>Plug in the infusion set and fill about 1/2 of the reservoir with infusion.

3) Wipe the rubber stopper of the infusion bag with disinfectant cotton>Lock the infusion set regulator>Plug in the infusion set and fill 1/2 of the dropper with infusion.

4) Wipe the rubber stopper on the bag with water>Lock the infusion set regulator>Plug in the infusion set and fill about 1/3 of the dropper with fluid.

Q14. Select a method for accurate patient identification.

1) For accurate patient identification, ask for the patient's name in an open-ended manner and verify the patient (name, registration number) by comparing the admission bracelet with the medication card (or computer printout).

2) Check the subject (name, registration number) against the patient list for accurate patient

identification.

3) Check the subject's name against the medication card (or computer printout) for accurate patient identification.

4) Check the subject's name against the hospitalization bracelet for accurate patient identification.

Q15. What is not related to the purpose, methods, and precautions of intravenous infusion?

1) The purpose of an intravenous infusion is to achieve immediate and maximum effect of the drug and to maintain the balance of water and electrolytes

2) You should not bend the arm that is being infused during an IV.

3) When you go to bed, you should sleep on the side of your arm that is infused intravenously.

4) You should also refrain from raising your arm.

Q16. What is the next step in administering intravenous fluids after explaining the purpose to the patient?

1) Hang the IV bag on the IV rack next to the bed and place the tip of the bag close to the area to be injected into the subject.

2) Have the subject assume a comfortable position, with the arm positioned lower than the heart, and check the condition of the vein.

3) Tie a tourniquet 12~15 cm above the area where the vein is in good condition.

4) Select a site with a prominent vein that is straight and longer than the length of the catheter to be inserted as the injection site.

Q17. After placing the tip of the IV set close to the area to be injected, what's the next step?

1) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

2) Perform hand hygiene with hand sanitizer and identify the vein to be punctured.

3) Select a prominent area where the vein is straight and longer than the length of the catheter to be inserted as the injection site.

4) Have the subject assume a comfortable position and position the arm lower than the heart, then check the condition of the vein.

Q18. What is the next step after checking the vein status?

1) Hold the catheterization site with one hand.

2) Tie a tourniquet 12~15 cm above the area where the vein is in good condition.

3) Help the subject assume a comfortable position.

4) After sanitizing your hands with hand sanitizer, clean the vein to be punctured 5~8 cm from the inside out with a sterile swab.

Q19. What's the next step after applying a tourniquet?

1) Select a prominent area with a vein that is straight and longer than the length of the catheter to be inserted as the injection site.

2) Pull the skin 2~3 cm above or below the area to be venipunctured taut with the thumb of one hand.

3) With your other hand, hold the catheter with the four sides up.

4) If blood backs up into the catheter, hold the center of the catheter and slightly lower the angle of insertion.

Q20. What's the next step after identifying the injection site?

1) After sanitizing your hands with hand sanitizer, clean the vein to be punctured 5~8 cm from the inside out with a sterile swab.

2) Insert the catheter into the vein at a 15° to 30° angle, depending on the direction of blood flow.

3) Immediately after removing the probe, connect the tube of the fluid set with the center of the catheter to prevent blood from flowing down through the catheter.

4) With your other hand, unscrew the regulator on the IV set and observe if the fluid is flowing and if there are any symptoms of infiltration, such as swelling or pain, at the venipuncture site.

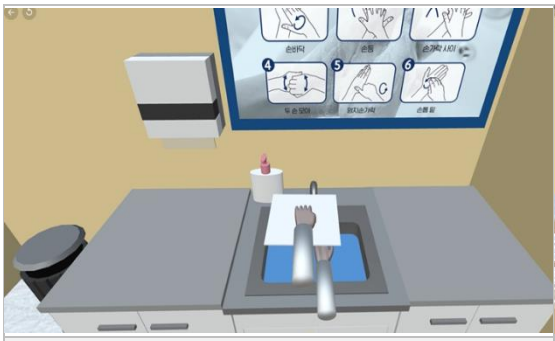
Q21. What is the next step after disinfecting the injection site?

1) Hold the catheterization site with one hand.

2) Immediately after removing the probe, connect the tube of the fluid set to the center of the catheter to prevent blood from flowing down through the catheter.

3) Pull the skin taut with the thumb of one hand 2~3 cm above or below the area to be venipunctured.

4) Place the catheter in a stable position so that it doesn't move when you place the fluid infusion tube.

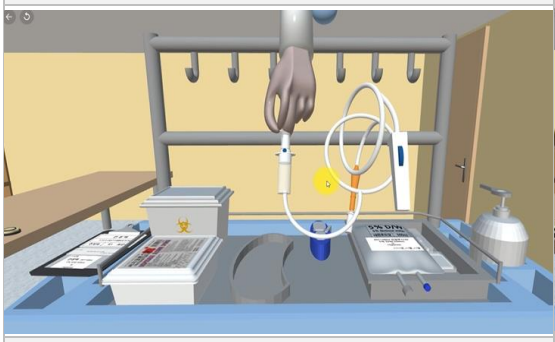


Performing hand hygiene

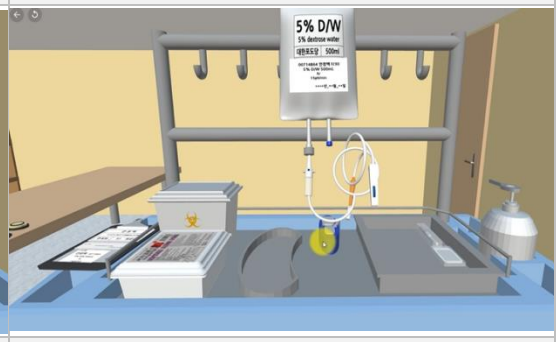
Preparing supplies

Checking Medication Labels

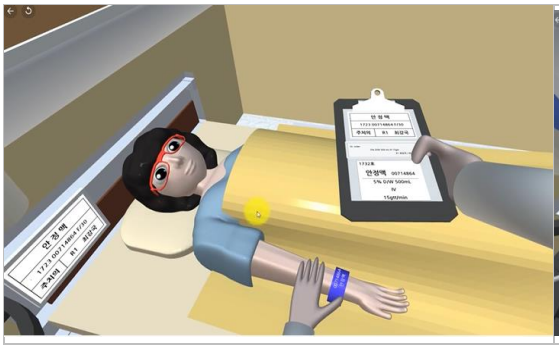
Checking fluids



Prepare Fluid Sets

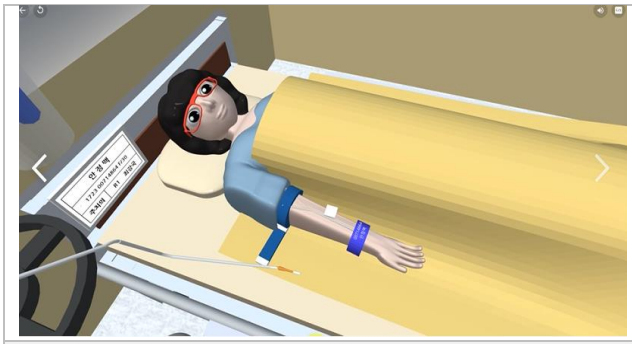


Connecting Fluids and Fluid Sets

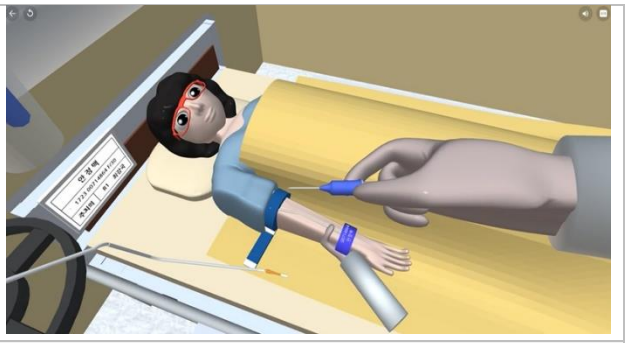


Verifying patient name and registration number

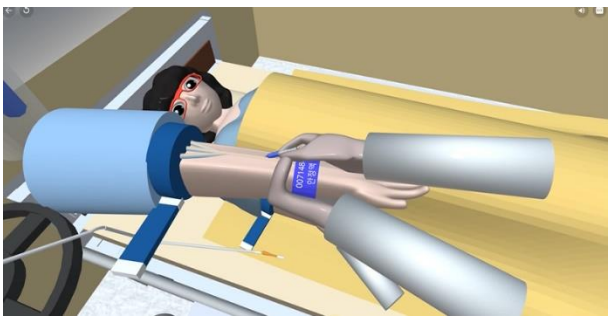
Sanitize hands & apply a tourniquet



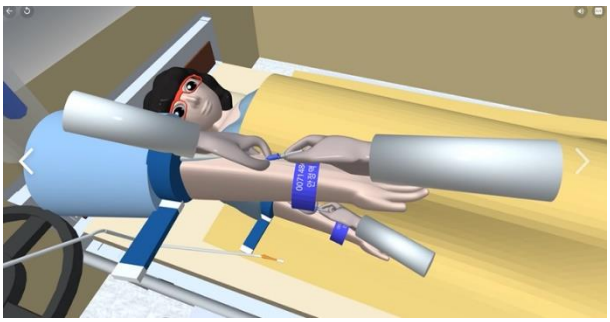
Identify injection site & disinfect with alcohol swab



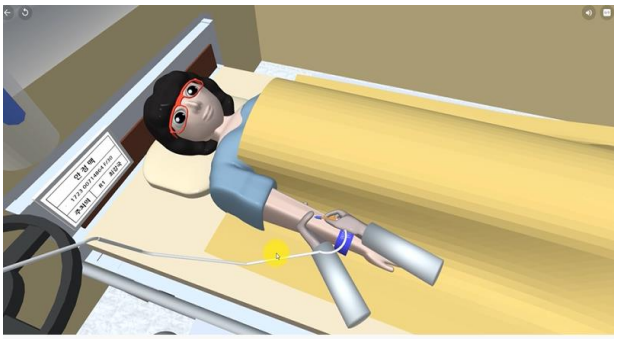
Prepare the vascular catheter



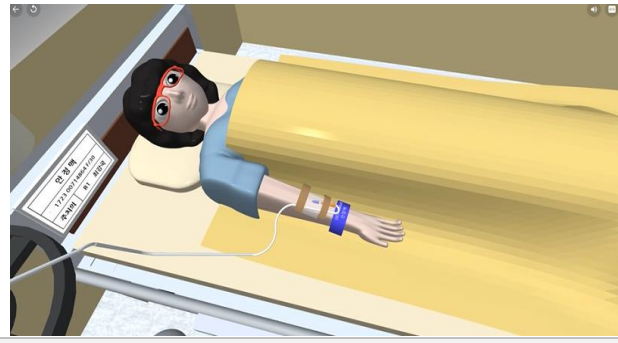
Preparing to catheterize at a 15° to 30° angle



Inserting vascular catheter

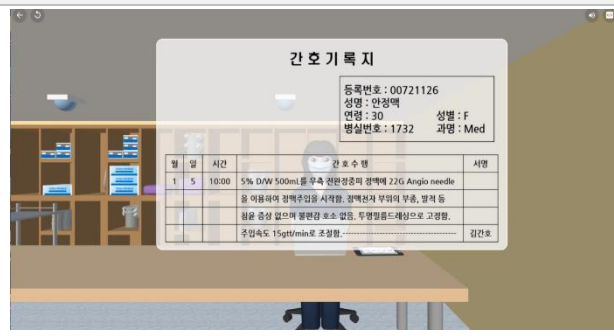


Connecting the vascular catheter and fluid set



Adjusting Fluid Rate & Dressing

Performing Hand Hygiene



Nursing Record

[Fig. 1] Cospace Platform

3. Results

3.1 Participant data

Looking at the general characteristics of the 16 high school students who participated in mobile web-based virtual reality and simulation convergence education, seven (43.8%) were male, nine (56.3%) were female, 14 (87.5%) made their own decisions when deciding on their career (employment, further education), and two (12.5%) followed their parents or teachers. In terms of academic achievement, 10 students (62.4%) scored on average [Table 1].

[Table 1] Demographic characteristics

Categories	Classification	n(%)
Gender	Male Female	7(43.8) 9(56.3)
Career Decision-making	Self-selection advice from parents or	14(87.5) 2(12.5)

	teachers	
Academic Achievement	very good	1(6.3)
	good	4(25.0)
	average	10(62.4)
	bad	1(6.3)

3.2 Pre-post comparison of mobile web-based virtual reality and simulation convergence training

The research analysis results showed that learning motivation was high from 4.22 points before education to 4.70 points after education. Statistically significant differences after training (Z=-2.70, p=.007). Academic self-efficacy increased from 3.67 pre to 4.18 post, with a statistically significant difference (Z=-2.23, p=.026), indicating a higher level of self-efficacy. In the sub-domains, there were statistically significant differences in learner confidence (Z=-2.73, p=.006), learning persistence (Z=-2.70, p=.007), and learning effort (Z=-2.52, p=.012). Learning immersion improved from 3.80 pre to 4.13 post-training, but was not statistically significant (Z=-1.55, p=.121). The subdomains showed no significant differences (p>.05) [Table 2].

[Table 2] Pre-post comparison of mobile web-based virtual reality and simulation convergence training

Variables		Pre-post test	Mean	Z	p
Learning Motivation		pretest	4.22	-2.70	.007
		post-test	4.70		
Academic Self-Efficacy	total	pretest	3.67	-2.23	.026
		post-test	4.18		
	Learning Confidence		3.88	-2.73	.006
			4.50		
	persistence of Learning		3.56	-2.70	.007
			4.30		
	Learning task Preference		2.94	-1.76	.078
			3.54		
	Degree of learning effort		3.50	-2.52	.012
			4.34		
Learning Immersion	total	pretest	3.80	-1.55	.121
		post-test	4.13		

	Cognitive Flow		3.77 4.10	-1.24	.214
	Affective Flow		3.83 4.15	-1.55	.121

4. Discussion

This study was conducted to examine the effectiveness of a mobile web-based virtual reality and simulation education program for high school students through their career experience in nursing and to help students apply for nursing after graduation.

There was a statistically significant increase in learning motivation after applying the mobile web-based virtual reality and simulation education programs. This is similar to a study that found that learning with virtual reality technology has a positive effect on learning motivation among high school students, and that virtual reality experiences can focus attention on learning and make them feel confident and satisfied(Kim et al., 2019), and a study that found that learning motivation improved after an art appreciation class using virtual reality(Lee & Kim, 2020). In this study, the use of virtual reality as a new educational medium and simulation practice through direct skills may have had a positive effect on students' interest and motivation to learn. Particularly, students demonstrated active participation in intravenous injections, which they were most interested in, as a result of combining virtual reality experience with hands-on simulation experience.

Academic self-efficacy increased significantly after the application of the mobile web-based virtual reality and simulation training program. Self-efficacy refers to the ability to perform the actions necessary to attempt or maintain successful behavioral changes. This indicates confidence in specific situations. Increased self-efficacy throughout school life with confidence or various activities. By applying a virtual simulation training program with an upper gastrointestinal bleeding scenario for nurses(Park, 2018), and a virtual simulation (Vsim) with a hypoglycemic shock and compartment syndrome subject scenario for nursing students(Oh & Kim, 2021), confidence significantly improved, which is similar to the results of this study. Virtual simulations and simulation convergence exercises help improve confidence because they are safe environments in which students can practice repeatedly, even if they make mistakes(Park, 2018). The mobile web-based virtual reality utilized in this study enables students to perform intravenous fluid therapy in a virtual space with a smartphone and follow the procedure in a precise manner, while the simulation practice allows students to practice the skill directly through a mannequin.

Virtual simulation learning, which enables learners to learn individually, receive feedback on their performance, and repeat the nursing process, improves the self-directed learning ability of nursing students(Oh & Kim, 2021). Students gain confidence through repeated learning and continuous efforts for successful nursing. In the course of this study, it seems that students successfully perceived their competence while checking the results of their nursing performance during the mobile web-based virtual reality experience and were interested in

practicing with mannequins. Additionally, based on previous research suggesting that in-depth experience is effective in improving self-confidence, academic self-efficacy was significantly improved as a result of providing experiences that could be repeated.

Learning immersion was not statistically significant after employing the mobile web-based virtual reality and simulation education programs. This is similar to a study that applied virtual reality and lab simulation to nursing students(Kim & Choi 2023), and compared to a previous study(Lee & Ryu, 2021). This indicates that virtual reality through a screen is less realistic because it does not directly provide nursing care; however, this study does not reveal significant immersion despite utilizing mobile web-based virtual reality and a real simulator. A previous study indicated that students who experienced PC-based virtual reality after a simulation had higher learning engagement than those who experienced both PC-based virtual reality and simulation(Kim & Choi 2023). Therefore, the study reveals that experiencing simulation practice using a mannequin first and virtual reality afterward is a way to improve the learning flow.

Learning flow comprises the experience of being immersed in an activity, being active, and enjoying it. A study comparing the differences between virtual reality, simulation, and traditional lecture-based education methods reported that virtual reality and simulation had higher learning engagement(Chae, 2021). Conversely, this study faces challenges in directly comparing the differences in operating methods as well as sequences and virtual simulation (Vsim). This enables self-learning without spatial restriction. Virtual reality (VR) applies virtual reality in minimal space, a high-fidelity simulator that can realize a hospital-like environment, and a low-fidelity simulator. These are all employed to master simple skills, which have some effect on learning immersion. It is possible to repeat skills directly in a virtual space and increase the effectiveness of education by enhancing students' interest, motivation, and immersion in active learning(Hyun & Lee, 2020). Therefore, it is crucial to consider various content developments and methods to utilize simulation education.

5. Conclusions

Students who attend nursing colleges may not be able to adapt while living in college and may be eliminated in the middle. Recently, colleges and universities have been running career experience programs for middle and high school students to help them adjust to college life and choose careers that suit their interests and aptitudes. Additionally, schools utilize simulation, VR, AR, and XR to provide practical training as the healthcare environment changes while patient safety and rights are emphasized.

In this study, students' learning motivation and academic self-efficacy improved after undergoing mobile web-based virtual reality and simulation training. The subdomains of academic self-efficacy, learner confidence, learning persistence, and learning effort, were found to be significantly higher after the training. These results indicate the essence of high school students undergoing various career experiences before selecting a career path. Particularly, students are more interested in applying for nursing majors when they experience the skills firsthand. This study’s findings reveal the use of various educational media such as simulation and virtual reality experiences, which positively impact learners' motivation and

enhance their self-confidence.

Therefore, we make the following recommendations. It is imperative to develop various nursing education contents that combine virtual reality and simulation while conducting repeated research. Additionally, it is crucial to research to confirm the effectiveness of education for various audiences.

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