Journal of Posthumanism
2025
Volume: 5, No: 6, pp. 266–277
ISSN: 2634-3576 (Print) | ISSN 2634-3584 (Online)
posthumanism.co.uk

DOI: https://doi.org/10.63332/joph.v5i6.2009

Implementing Augmented Reality through Assemblr Edu to Improve Skill of Intravenous Medication among Nurse Students in Yogyakarta Nursing College

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Abstract

In nursing, education technology changes constantly. Over the last 50 years, computer-based simulations, virtual patients, and interactive online courses have evolved in health professions education. Despite several learning tools, none have enhanced nursing abilities. This study will determine whether Assemblr Edu enhances nursing students' intravenous administration. This research used controls and interventions in a quasi-experimental design. The intervention group received assembly instruction for one month, whereas the control group learned manual drug delivery. The study involved 116 second-semester nursing students. SPSS 26 using a paired t-test assessed the study's results and calculated the sig value. Assemblr Edu enhances nursing students' drug administration skills more than the guidebook (0.000). Assemblr edu helps nursing students administer intravenous drugs. This research may assist nursing educators and policymakers create AR-based learning media to enhance nursing abilities across institutions.

Keywords: *Assemblr Edu, Improving, Skill, Intravenous, Nursing Student.*

Introduction

Technology in education is currently advancing at a rapid pace, with one example being nursing education. This demonstrates the need to investigate how educational digital technologies might be used as an important element of learning activities to increase quality and relevance in nursing education (Meum et al., 2021). The progress of Telehealth in nursing necessitates the training of nursing educators to enhance competency, which involves the development of technology throughout the nursing education phase (Ramis et al., 2023).

A study by O'Connor et al. (2021) identified the need of establishing clear boundaries and pedagogical directives, comprehending and implementing online privacy settings, and employing co-creation strategies with students and practitioners to enhance the quality of health education (Rutledge et al., 2021). The imperative to revolutionise and elevate nursing education through technology has driven nurse educators to develop novel teaching strategies and adopt new educational frameworks to promote the acquisition of practical skills, hence boosting the quality of clinical practice (Barisone et al., 2019).

Advancements in educational technology enhance the probability of more effective and efficient learning. Industry requirements evolve annually due to global competitiveness fostering ongoing technical progress (Devagiri et al., 2022). The advancement and acceptance of novel educational

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approaches indicate that a segment of society is receptive to new technology and concepts, hence progressing (Iqbal et al., 2022). Recent advancements in high-speed networking and compact mobile computing devices have intensified the demand for more profound human-digital interactions beyond conventional flat panel displays (Xiong et al., 2021). Significant efforts remain necessary to provide software that facilitates smooth, dependable, and effective integration into clinical practice and teaching (McKnight et al., 2020).

Various technologies have been created by nursing educators and implemented in educational institutions to date. Augmented and virtual reality (AR & VR) are two of the most groundbreaking technological developments now available, with significant potential to enhance the educational system. (Al-Ansi et al., 2023). It signifies a technology that remains in robust development, albeit was conceived some decades ago [10]. Among these methodologies, augmented reality (AR) is a technology that is rapidly gaining traction worldwide (Avila-Garzon et al., 2021). Augmented Reality (AR) has emerged as a prominent study domain within educational contexts, serving as a supportive technology for learning and teaching methodologies (Chang et al., 2022).

Nursing students want accessible, affordable, and enjoyable technology. Augmented reality offers pupils an engaging experience situated in a real-world context. Augmented Reality allows users to interact with the real world augmented with supplementary virtual data or visuals, including three-dimensional holograms (Berman & Pollack, 2021). Azuma, 1997 (Koumpouros, 2024) was stated that augmented reality systems should possess three characteristics: the capability to integrate virtual and real things into a physical context, facilitate real-time interaction, and include three-dimensional virtual objects. The reviews from (Garzón et al., 2020) also The use of AR applications in education is crucial since it enhances students' academic performance and motivation to learn. In addition to facilitating communication of information at any time and place, social media platforms serve as an excellent source for generating networking opportunities to foster social engagements and potential employment (Haleem et al., 2022).

Enhancing the competencies of nursing educators is essential for the production of an increasing array of educational media to aid the learning process. Numerous research have advocated for a form of augmented reality-based instruction to include technology into nursing education (Turner, 2022). Nonetheless, these novel digital platforms have empowered instructors to transcend conventional pedagogies, fostering a student-centric, engaging, and fulfilling learning experience for learners (Dhar et al., 2021).

Despite the advancements in technology by nursing educators, numerous challenges persist in the use of suitable and effective technology, presenting both impediments and opportunities for nursing educators. Access to technology, including the internet and devices, is disproportionately distributed, particularly in rural and isolated regions (Koumpouros, 2024). Numerous educational institutions lack sufficient technology infrastructure (computers, projectors, etc.) (Devagiri et al., 2022). The quality of internet signals and the erratic availability of electricity in classrooms are significant impediments (Arena et al., 2022).

Nursing educators possess limited capacity to stay abreast of technological advancements and innovations applicable to nursing education. Not all educators possess sufficient proficiency in utilising technology for educational purposes [9]. Insufficient training for educators to utilise technology properly persists. Educators may encounter challenges in incorporating technology into the educational process. Furthermore, the curriculum and educational materials have not

consistently facilitated the effective use of technology (Iqbal et al., 2022) . The reluctance of educators to embrace change and their apprehension about new information technologies also constitute impediments (Garzón et al., 2020) .

Contemporary technology advancements increasingly depend on network capabilities, rendering access challenging in remote regions. The deployment of educational technology necessitates substantial investment in both hardware and software for skill acquisition (Garzón et al., 2020). Students require engaging learning media that is relevant to real-world contexts, interesting, and interactive (AlGerafi et al., 2023). Students continue to encounter challenges in comprehending the curriculum due to restricted on-campus learning time and insufficient resources. In online education, student motivation and self-discipline present significant challenges (Abdolrezapour et al., 2023). The digital generation exhibits distinct learning patterns, necessitating an adaptation of instructional methods by educators. Excessive dependence on technology may also present difficulties (Boboc et al., 2022). The fundamental worry in the use of technology is data security and student privacy amidst these problems (Ellßel & Flemming, 2022).

This research is essential as the advancement of digital learning media in nursing education is inevitable, although existing innovations have not entirely succeeded in enhancing skills related to medication administration across distinct institutions. This research introduces an innovative approach to integrating technological improvements, namely through techniques aimed at effectively incorporating technology into the curriculum and optimising learning methodologies. This research aims to create augmented reality-based assembly learning media utilising a 3D approach to enhance the capabilities of nursing education institutions in adapting to the digital era.

Research Methodology

Research Design

This study employs a quantitative research methodology with a quasi-experimental design, comprising control and experimental groups. The control group will receive learning materials in the form of manuals, whereas the intervention group will be provided with augmented reality-based assembly educational media.

Population and Sample/Material

The population in this study is students in three highly accredited nursing education institutions in three Yogyakarta districts. Meanwhile, the number of respondents was 116 students. The calculation of the number of respondents using G*power with a population of 528 respondents The respondents consisted of second-semester students who will be undergoing basic nursing courses two. Respondents were divided into a control group and an intervention group of 58 students each. Respondents were carried out pre-tests and post tests before being given interventions.

Instrumen/Procedure

The instruments used include a structured skills checklist that has been validated and used by the Association of Indonesian Nurse Education Institutions to assess the skills of intravenous medication administration in nursing students. This checklist contains the drug administration procedure which includes the tool preparation stage, pre-interaction, orientation, work stage, termination stage, and documentation stage. The assessment was carried out using the OSCE (Objective Structured Clinical Examination) method.

Data Analysis

Design This study used a quasi-experimental methodology utilising a non-random control group pretest-posttest design. Non-Equivalent Control Group Design The acquired data will undergo statistical analysis utilising SPSS 26. Prior to conducting the hypothesis test, assessments of normality and homogeneity are performed. The normality test results, utilising the Kolmogorov-Smirnov and Shapiro-Wilk methods, indicated a p-value greater than 0.05, signifying that the data follows a normal distribution. The homogeneity test yielded a score of 0.511, indicating $p > 0.05$, which signifies that the data is normally distributed. The paired t-test results indicate a significance (2-tailed) value of 0.000, or less than 0.05, demonstrating a difference in mean scores between the pre- and post-test evaluations of skills in both the control and intervention groups. A substantial correlation exists between the efficacy of Assemblr Edu Augmented Reality and the enhancement of intravenous medicine skills among nursing students at Yogyakarta Nursing College, Indonesia.

Result

Utilisation of Assemblr Edu necessitates downloading the Assemblr program from the Play Store on Android devices or immediately scanning the barcode via a scanning service on a PC or tablet. This is a display assembly for Android.

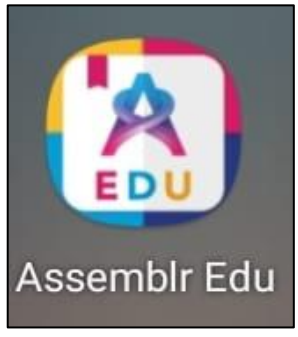

Figure 1. Display Assemblr Edu on Play Store

Additionally, sctudents may scan the barcode to proceed with their preferred menu choices. This is an illustrative illustration used in the educational resources on drug administration.

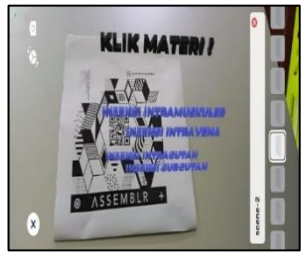

Figure 2. Display Of Drug Administration Materials

The table 1.1 below shows the demographics of respondents who participated in this study including gender, age and cumulative achievement index scores:

No	Characteristics Gender	Intervention Group N : 58		Control Group N : 58	
		Frecuency	Percentage (%)	Frecuency	Percentage (%)
1	Men	9	15.5%	9	15.5%
2	Women	49	84.5%	49	84.5%
Total		58	100%	58	100%

Table 1. Demografic Responden of Assemblr Edu

No	Characteristics Age	Intervention Group N : 58		Control Group N : 58	
		Frecuency	Percentage (%)	Frecuency	Percentage (%)
1	18th	37	64%	42	72%
2	19th	15	26%	15	26%
3	20th	6	10%	1	2%
Total		58	100%	58	100%
No	**GPA score**	**Intervention Group N : 58**		**Control Group N : 58**	
		Frecuency	**Percentage (%)**	**Frecuency**	**Percentage (%)**
1	< 3	4	6.9%	11	19%
2	> 3	54	93.1%	47	81%
Total		58	100%	58	100%

From the table above, it can be seen that the majority of respondents are female, 84.5%, aged 18 years and have a GPA of 3<.

Based on the results of the assessment in the pre-test, the results of 1 student (2%) who passed and 57 who did not pass (98%), while the results of the post test using the skills checklist measurement tool, the results were obtained that the skills of students in the intervention group were 58 students who were declared to have passed (96%), and 2 students were declared not to have passed (4%).

No	Characteristics	Intervention Group N : 58				
		Mean	SD	Skill Level		Amount
				Pass	Not Pass	
1	Pre Test Skill	70.32	3.642	1	57	58
2	Post Test Skill	83.94	3.578	56	2	58

Table 2. Skills of Intravenous Medication Before and After Intervention Group with Assemblr Edu Among Nursing Student in Yogyakarta Nursing College, Indonesia

Meanwhile, in the control group, the results of the pre-test were obtained as many as two students who passed (3%) and 56 who did not pass (97%). Meanwhile, the post-test scores were 43

students who were declared to have passed (74%) and 15 students were declared not to have passed (26%).

No	Characteristics	Control Group N : 58				
		Mean	SD	Skill Level		Amount
				Pass	Not Pass	
1	Pre Test Skill	70.39	4.462	2	56	58
2	Post Test Skill	78.94	3.701	43	15	58

Table 3. Skills of Intravenous Medication Intervention Group with Assemblr Edu Among Nursing Student in Yogyakarta Nursing College, Indonesia

Before the data was statistically tested, the Kolmogorov Smirnov normality test and homogeneity test were performed, and it was shown with a Q-Q curve image of the plot showing that the data was normally distributed. The following is a picture of the QQ plot in the control and intervention groups.

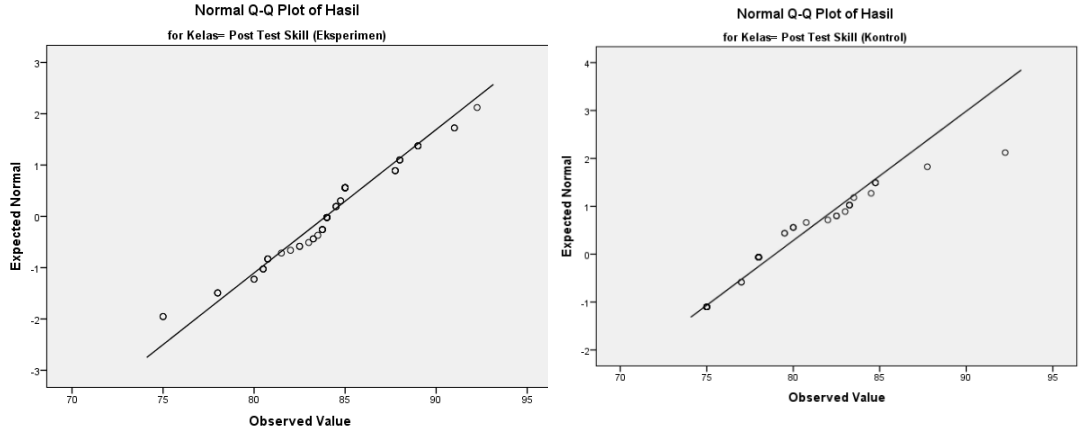

Figure 3. Q-Q Plot of Control Groups and Interventions Groups

From the results of the statistical paired t test, a significance value of 0.000 was obtained which showed $\alpha<0.05$ which means that the edu assembler has been able to increase the skill of giving intravenous drugs to nursing students. The table below shows the results of the paired t-test.

Characteristics		Paired Sample t-test	
		Intervention Group N : 58	Control Group N : 58
		Sig. (2-Tailed)	Sig. (2-Tailed)
Skills	Pre-Test	.000	.000
	Post-Test	.000	.000

Table 4. Paired Sample t-test

Discussion

Sociodemographic characteristics, including urban or rural residency, significantly affect students' perceptions and access to education. Students from rural regions may encounter supplementary difficulties in acclimating to the metropolitan setting of the school, thereby impacting their academic performance. By comprehending these sociodemographic attributes, educational institutions such as the Yogyakarta School of Nursing may formulate more inclusive and adaptive learning programs, and furnish the requisite support to guarantee that all students possess equitable prospects for achievement. This also facilitates the formulation of policies and strategies that can improve the quality of education and student welfare within the nursing education context (Chen et al., 2023). By comprehending the sociodemographic attributes of its students, educational institutions such as the Yogyakarta School of Nursing may create more inclusive and adaptive learning programs suited to the varied requirements of their student body. This insight enables institutions to develop curricula and support systems that tackle the distinct obstacles encountered by various student demographics, guaranteeing that every individual, irrespective of gender, age, or academic background, has equitable opportunity for success (AlGerafi et al., 2023)(Amahmid et al., 2019) (Pucciarelli et al., 2019).

A critical component of sociodemographic studies is gender. Educational institutions must acknowledge the distinct problems and opportunities faced by male and female students. Nursing programs frequently draw a greater proportion of female students, as demonstrated by the demographics at the Yogyakarta School of Nursing. This gender disparity may require focused initiatives to guarantee that male students, who may perceive themselves as under-represented, receive the necessary encouragement and support to succeed. Institutions should also confront cultural preconceptions that may restrict female students' professional ambitions, providing them the confidence and leadership skills to thrive in historically male-dominated sectors of healthcare.

Age is a significant determinant that influences learning. Students in their twenties, the primary demographic at numerous nursing schools, frequently have distinct problems, including the need to balance academic obligations with part-time employment and to adjust to the rigours of higher education. Institutions can leverage sociodemographic insights to develop adaptable learning schedules, conduct time management courses, or implement mentorship programs that assist students in effectively overcoming these problems. Schools could implement bridging courses or customised support systems to facilitate the reintegration of older students returning to schooling after a career hiatus (Vo et al., 2023).

The findings of this study indicate that despite the development of numerous technologies by nursing educators, the appropriate and successful implementation of these technologies encounters significant challenges, yet presents a substantial possibility for the progression of nursing technology. These limitations mostly arise from disparities in facilities and competencies among institutions concerning infrastructure and training (Rauschnabel et al., 2022). Nevertheless, there remain challenges that must be addressed to ensure its effective implementation throughout all educational institutions. Numerous studies have employed augmented reality technology, particularly in this assembly, encompassing (Yasa et al., n.d.) which applies assemblr in learning digestive anatomy. In addition, research from (Rizqiyah et al., 2024) Additionally, Assemblr incorporates human organs into the education of elementary school students. The assembly is utilised to examine dental and oral care through [25], design (Febriyani et al., 2024) and 3D Geomatry (Suaib & Sutriyani, 2024). The application of

assembler in the healthcare and nursing sector remains restricted, presenting an opportunity for nursing educators to enhance this medium as a tool for teaching nursing skills. The results correspond with extensive research trends promoting the utilisation of immersive and interactive tools in teaching. Assemblr Edu's augmented reality features offer students authentic, experiential learning opportunities, enabling them to hone and enhance their skills in a secure, risk-free setting. This enhances confidence and equips pupils to adeptly manage real-world medical situations. The data presented in the table strongly indicate that Assemblr Edu is a successful approach for enhancing nursing education outcomes. The incorporation of this into academic curricula can substantially enhance the development of proficient and adept healthcare practitioners, meeting the escalating needs of the healthcare industry.

The advancement of Augmented Reality-based Assemblr EDU media has demonstrated advantages in enhancing comprehension of educational materials, due to its engaging three-dimensional content, proximity to real-world scenarios, and heightened interaction between instructors and students.

The intervention's efficacy is due to its capacity to offer a realistic, risk-free setting for students to practise giving parenteral drugs regularly. This practical methodology, augmented by AR technology, reconciles theoretical understanding with clinical application. Research conducted by Pan and Sana (2021), Verify that interactive learning methodologies augment critical thinking and skill development in nursing students, resulting in heightened confidence and proficiency during clinical rotations (Pan & Sana, 2021). Assemblr edu provides an engaging and informative experience by utilising animated images or objects superimposed on real-world elements. Nonetheless, due to the nascent applicability of Assemblr edu in the nursing profession, its use by educators has not been widespread. Assemblr edu offers significant adaptability, encompassing the visualisation of educational materials and supplementary medical simulations for drug administration, infusion, nasogastric tube insertion, and catheter insertion (Triana & Hariyastuti, 2024). Assemblr edu is also useful in other fields, like as architectural design visualisation. Assemblr edu facilitates the visualisation of anatomical illustrations of the human body, enabling students to comprehend them more efficiently while conserving both time and financial resources. Assemblr edu may offer a distinctive experience that enhances student engagement. Assemblr Edu may provide a distinctive experience that enhances student engagement, facilitating comprehension for learners (Vaida & Pongracz, 2022). Students acquire a superior understanding of virtual drug administration prior to engaging with patients, fostering motivation and facilitating an engaging and interactive learning experience. This Assemblr does not necessitate any costly specialised equipment; children can enjoy a positive experience just by downloading the Assemblr edu app from the Play Store and logging in with a barcode. Assemblr Edu may also be available on widely used devices at an affordable price. Assemblr Edu enhances the efficacy and realism of skills training. Assemblr Edu offers elements that allow for unrestricted movement, as users operate inside the real world and do not necessitate specialised expertise (Majid N, Rafli M, 2023).

Numerous colleges utilise Assembler Edu to assist nursing students in excelling at the Objective Structured Clinical Examination (OSCE). The OSCE is an essential element of nursing education, evaluating students' clinical competence in a series of standardised, realistic scenarios (Bahar et al., 2017) (Natalia, 2021) (PP, 2021). Through the simulation of these scenarios in Assembler Edu, students can acclimatise to the exam style, pinpoint areas for enhancement, and acquire the necessary practice to excel under pressure. This focused preparation has demonstrated efficacy in enhancing OSCE results, leading to increased success rates among

nursing students. Assembler Edu promotes collaborative learning and cultivates a sense of community among students(Prasetiawati et al., 2023). Elements like collaborative projects, discussion forums, and peer evaluations promote information sharing, feedback provision, and mutual learning among students. This collaborative method reflects the teamwork essential in healthcare environments, equipping students to collaborate efficiently with peers in their future professions.

The incorporation of Assembler Edu into nursing education signifies a substantial advancement in the modernisation of healthcare teaching. By equipping students with novel tools and resources, institutions are boosting educational quality and fostering the development of talented, confident, and compassionate healthcare professionals (Stunden, 2024). As the healthcare industry's expectations grow, technologies such as Assembler Edu will become increasingly vital in creating the future generation of nurses.

The incorporation of Assembler Edu into nursing education signifies a pivotal step in healthcare training. This revolutionary platform equips students with advanced tools and resources, delivering an interactive and engaging learning experience that connects theoretical knowledge with practical application. Utilising augmented reality, Assembler Edu enables nursing students to see and practise intricate processes, such as parenteral medicine administration, within a controlled and risk-free setting.

Conclusion

The research findings indicate that augmented reality-based assemblr ized learning medium significantly enhances nursing students' competence in giving intravenous medications. Nonetheless, there remain challenges that must be addressed to ensure its effective implementation throughout all educational institutions.

The advancement of Augmented Reality-based Assemblr Edu media has demonstrated advantages in enhancing comprehension of educational materials, due to its engaging three-dimensional content, proximity to real-world scenarios, and heightened interaction between instructors and students.

The findings of this study indicate that the advancement of digital learning media enhances educational quality and offers valuable insights for policymakers in nursing education.

The outcomes of this study have significance for future scientific research in nursing education, highlighting the necessity of integrating engaging and interactive technology with suitable teaching methodologies.

The constraint of this study is the restricted number of participants. The research is endorsed by the leader of the institution conducting it.

Funding Statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

Ns. Istichomah.,S.Kep.M.kes: Conception and design of study, Acquisition of data, Analysis and/or interpretation of data

Dr.Tukimin Bin Sansuwito:, M.P.H Drafting the manuscript, Revising the manuscript critically

for important intellectual content, Approval of the version of the manuscript to be published.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

The data supporting the findings of this study are available upon request from the corresponding author. Due to the nature of this research, participants were not asked for permission to share their data publicly, so supporting data is not available.

Acknowledgements

The authors would like to express their gratitude to the institutions that facilitated the completion of this research. Special thanks to the scholars and colleagues who provided invaluable feedback on the drafts. We also extend our heartfelt thanks to our families for their unwavering support.

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