Gac Sanit. 2021;35(S2):S302–S305

# Learning media based on augmented reality (AR) increased the skill of physical examination of the integumentary system of pregnant women in midwifery students

Hikmandayani[a], Mardiana Ahmad[a,*], Syafruddin Syarif[b], Budu[c], Irfan Idris[c], Stang[d]

[a] Department of Midwifery, Graduate School, Hasanuddin University, Indonesia
[b] Faculty of Engineering, Hasanuddin University, Indonesia
[c] Medicine Faculty, Hasanuddin University, Indonesia
[d] Faculty of Public Health, Hasanuddin University, Indonesia

ARTICLE INFO

*Article history:*
Received 28 June 2021
Accepted 30 July 2021

*Keywords:*
Learning media
Augmented reality
Skill
Physical examination of integumentary systems
Pregnant women

ABSTRACT

*Objective:* This research was to analyze the correlation of AR-based Learning Media to improving the physical examination of the integumentary system of pregnant women in midwifery students.
*Method:* The research method used Quasi-experimental with Non-Equivalent Control Group Design. The sample of 92 students was selected by a purposive sample, divided into two intervention and control groups. The intervention group was 62 students, and the control group was 30 students. Data collection was performed using a checklist to assess the skill of the physical examination of the integumentary system of pregnant women. To test the differences of skill before and after treatment in control and intervention groups used the Mcnemar test, whereas to know the differences in skill from time to time Cochran test was used.
*Result:* The results showed differences in the measurement of skills improvement in the control and intervention groups before and after the intervention was given. A more significant increase in skills occurred in the intervention group with a $p$-value <0.001 contributing after 1 week of giving a demonstration, and application-based (AR) skills increased by 66.1%. After two weeks it increased by 93.5%, and after two weeks it increased by 100%. So it could be concluded statistically that AR-based learning media was significant in improving the physical examination skills integumentary systems in pregnant women.


## Introduction

Pregnancy causes several common changes in women, almost all of the female organ systems undergo anatomic and functional changes due to increased hormones released by the placenta. One of the physiological changes that occur is a change in the integumentary system, including changes in pigmentation of the skin, vascular changes, glands changes, connective tissue changes, and changes in the nails and hair.[1] Hyperpigmentation occurs almost 90% in pregnant women, which is usually more striking in women with dark skin.[2] Striae gravidarum appears more frequently in the anterolateral abdomen (35%), hips (25%), thighs (14%), breasts (13%), and buttocks (13%). Melasma occurs in 70% of pregnant women. Melasma is also more common in women of dark skin type than white skin type.[3]

The researchers noted that the most common illness arising during pregnancy were skin eczema (16.3%), candidiasis (15%), and urticaria (15%). Specific dermatoses during pregnancy are ICP (17.5%), AEP (6.3%), PEP (2.5%), and no cases of PG.[4] Pigmentation changes are the most physiological skin changes that are 87.95% as the appearance of linea nigra, increased mucosal pigmentation, melisma and increased melanocytic nevus. Stretch marks in pregnant women occur at 46.96%, followed by vascular changes of 41.21%. This research concludes that the prevalence of physiological skin changes during pregnancy is 88.95%, and pregnancy-specific dermatosis is 8.72%.[5]

The knowledge and skills of midwife students in managing every change experienced by pregnant women require a unique approach using methods and multimedia, one of which can be used interactively is Augmented Reality (AR) currently experiencing progress and rapid development, AR has touched a variety of lives, especially in the field of education. Various fields are created using AR technology, by utilizing hardware and webcam cameras that are used in capturing objects and images that have been designed, as well as the current development with the application on smartphones, it will easier to translate into applications that will be designed later.[6] The reason for using AR is because the process is interactive, interesting, simple, effective, efficient, and has great potential for use in training media.[7] The AR application uses a camera that will detect markers that have been made and display a combination of real and animated images.[8]

AR technology is believed to be an effective educational media in promotion, one of which is in the health sector. The research from Perdana and Yusti about "Augmented Reality Application learning of human respiratory organs on an android smartphone" found

Peer-review under responsibility of the scientific committee of the 3rd International Nursing, Health Science Students & Health Care Professionals Conference. Full-text and the content of it is under responsibility of authors of the article.
* Corresponding author.
*E-mail addresses:* mardianaahmad@pasca.unhas.ac.id, pmc@agri.unhas.ac.id (M. Ahmad).

https://doi.org/10.1016/j.gaceta.2021.10.040

that the application can help students understand breathing organ material and can be an alternative multimedia solution for learning about respiratory organs.[9] The utilization of AR technology can provide knowledge more effectively. It can be observed directly so that it is expected to improve cognitive, affective. Interactive abilities in educational media users.[10] one obstacle faced by students in the absorption and understanding of this material is not taught in detail the topic of physiological change, because of the limited media related to it. Responding to these problems, researchers take advantage of technological development by designing and building learning media that are interesting and easily understood by students using the Augmented Reality application as the media of learning. This application also uses additional animation in the form of video animation of the process of changing the integument system in pregnant women. That way, students can be more skilled in carrying out physical examinations, especially the examination of the integument system in pregnant women.

## Method

The research plan was using experimental research, the design of the research was Quasi-experimental with a non-Equivalent Control Design. The population was all level II students of Midwifery Diploma III of Polytechnic of Ministry of Health Gorontalo. The sampling technique used purposive sampling techniques that met the inclusion and exclusion criteria, then divided into two sample groups: a.

### *Research site*

This research was conducted in January–February 2020 at the Polytechnic of Ministry of Health Gorontalo and has received a recommendation of ethical approval with protocol number 11215/UN4.14.7/TP.01.02/2019.

### *Data types and sources*

Data were collected from the sample in the form of respondents' characteristics (age and GPA) and data on the pure graduation rate of students on the OSCE state for the physical examination of pregnant women on level II students of midwifery diploma III. Then the data related to the research variable was the students' skill score using a checklist sheet of the physical Examination integumentary system of pregnant women.

### *Data collection technique*

Data relating to the characteristics of respondents were collected from academics and the management of the midwifery study program. In addition, data on research variables were collected by conducting direct evaluations of students doing a physical examination practicum on an integument system for pregnant women. In both groups, a pretest was used using a checklist sheet; after that, at the first meeting, the control group was given treatment first by giving demonstrations and lecture methods, then the next meeting was held post-test by using the checklist to evaluate the skills of the students so on until they were taken three measurements. After that, the intervention group was given treatment in the form of demonstration and media application of AR then the next meeting was given a post-test using a checklist to measure students' skills until three times were taken.

## Result

Table 1 shows that in the control and intervention groups, there is a difference in skills between the initial measurement and measurement of week one after being treated with values. It is the same between the initial measurement and measurement of week two and the initial measurement and measurement of week 3.

**Table 1**
Differences in respondent skills between measurements in the control group and the intervention group in the Polytechnic Ministry of Health Gorontalo.

| Skills | Skills f (%) | | | | | |
|---|---|---|---|---|---|---|
| | Week 1 | | Week 2 | | Week 3 | |
| | Unskilled *n* (%) | Skilled *n* (%) | Unskilled n(%) | Skilled *n* (%) | Unskilled *n* (%) | Skilled *n* (%) |
| **Initial** | | | | | | |
| *Control (n = 30)* | | | | | | |
| Unskilled | 20 (66.7) | 10 (33.3) | 7 (23.3) | 23 (76.7) | 0 (0.0) | 30 (100.0) |
| Skilled | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| *p*-value | 0.002[a] | <0.001[a] | <0.001[a] | | | |
| *Intervention (n = 62)* | | | | | | |
| Unskilled | 21 (33.9) | 41 (66.1) | 4 (6.5) | 58 (93.5) | 0 (0.0) | 62 (100.0) |
| Skilled | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) |
| *p*-value | <0.001[a] | <0.001[a] | <0.001[a] | | | |
| **Week 1** | | | | | | |
| *Control (n = 30)* | | | | | | |
| Unskilled | | | 4 (13.3) | 16 (53.3) | 0 (0.0) | 20 (66.7) |
| Skilled | | | 3 (10.0) | 7 (23.3) | 0 (0.0) | 10 (33.3) |
| *p*-value | | 0.004[a] | <0.001[a] | | | |
| *Intervention (n = 62)* | | | | | | |
| Unskilled | | | 2 (3.2) | 19 (30.6) | 0 (0.0) | 21 (33.9) |
| Skilled | | | 2 (3.2) | 39 (62.9) | 0 (0.0) | 42 (66.1) |
| *p*-value | | <0.001[a] | <0.001[a] | | | |
| **Week 2** | | | | | | |
| *Control (n = 30)* | | | | | | |
| Unskilled | | | | | 0 (0.0) | 7 (23.3) |
| Skilled | | | | | 0 (0.0) | 23 (76.7) |
| *p*-value | | | 0.016[a] | | | |
| *Intervention (n = 62)* | | | | | | |
| Unskilled | | | | | 0 (0.0) | 4 (6.5) |
| Skilled | | | | | 0 (0.0) | 58 (93.5) |
| *p*-value | | | 0.125[a] | | | |

[a] *p*-value McNemar test.

**Table 2**
Differences in respondent skills in the control and intervention groups at the Polytechnic Ministry of Health Gorontalo.

| Skills | Control ($n = 30$) | | Intervention ($n = 62$) | |
|---|---|---|---|---|
| | Unskilled $n$ (%) | Skilled $n$ (%) | Unskilled $n$ (%) | Skilled $n$ (%) |
| Initial | 30 (100.0) | 0 (0.0) | 62 (100.0) | 0 (0.0) |
| Week 1 | 20 (66.7) | 10 (33.3) | 21 (33.9) | 41 (66.1) |
| Week 2 | 7 (23.3) | 23 (76.7) | 4 (6.5) | 58 (93.5) |
| Week 3 | 0 (0.0) | 30 (100.0) | 0 (0.0) | 62 (100.0) |
| ***p-value*** | **<0.001**[a] | | **<0.001**[a] | |

[a] Cochran-test.

If there is a significant difference between week one skills and week 2 skills, it is like week one skills of week 1 with week 3 in the control and intervention groups. Respondents in both groups tended to become skilled in carrying out a physical examination of the integument system.

Based on the Cochran test results in Table 2 shows a significant difference in skills ($p$-value < 0.001) between each measurement (beginning to week 3). Students in the control group, when initial measurement, are unskilled (0%). One week after being given a demonstration and lecture shows the tendency of students to be still unskilled (33.3%). 2 weeks after the demonstration and lecture show the tendency of students to become skilled (76.7%). Three weeks after the demonstration and lecture, all students become skilled in carrying out a physical examination of the integument system (100%). Baseline data of Students in the intervention group in the initial measurements are unskilled (0%). One week after the demonstration and application show the tendency of students to become skilled (66.1%). Two weeks after being given a demonstration and application showed that almost all students become skilled (93.5%). Finally, 3 weeks after the demonstration and application show, all students (100%) become skilled in carrying out the physical examination of the integument system.

## Discussion

Based on the data in the control group, improvement of student skills was very slow, whereas, in the intervention group, the first had experienced an increase of 66.1% of students who were skilled with the provision of demonstration methods and AR-based learning media. It can be interpreted that students are increasingly opening AR application is also increasing student skills in carrying out integumentary physical examination skills in pregnant women, students from weeks to weeks more skilled so that these skills can be attached a long time to student memory. However, many students are not yet skilled in the control group if only giving conventional learning without using media. Especially those based on technology in presenting learning media, proven by the delay in increasing students' skills in the control group. Students are already very proficient in the intervention group from the first week of the method demonstration and AR-based learning media. In conventional learning, students have difficulty identifying physical forms and changes in the integumentary system of pregnant women. Students only learn while imagining and seeing the demonstration given by the lecturer without any thought process from concrete to abstract. While in the laboratory, there is no phantom or teaching aids that help students in carrying out physical examination skills of integumentary systems of pregnant women plus integumentary system material in pregnant women is complicated material, so learning without technology assistance in the form of visual/AR media does not improve student skills.

The result of this research are in line with the research of Tri Yuliono, 2017 shows results there are differences in the value of the pretest before being treated and post-test after being treated with AR media. The mean value of students after being taught with AR media was 77.4 higher than the value of students before being taught with AR media was 50.16.[11] based on the results of the data analysis test, the researchers assumed that the provision of demonstrations and AR-based learning media could facilitate students in learning the material of the physical examination of the integument system in pregnant women because students were given a demonstration while being able to see 3D images and video skills in the application, making it easier for them to understand existing materials, plus intervention carried out from time to time that was during three meetings can increase understanding and train students better in carrying out the physical examination skills of the integumentary system in pregnant women. In the use of AR technology, mobile devices are needed. Mobile devices such as laptops, personal digital assistants, and cellphones in education are better than when using a desktop computer or not using a mobile device as an intervention. People quickly adapt to the mobile use of pocket PC devices in learning activities. It is smooth and easy interaction between students and the software used. The research above shows that the application of learning that utilizes mobile devices as a learning medium is possible to do.[12,13]

Research conducted by assessed the effectiveness of learning using conventional learning media and AR learning media in Malaysia. The result is that AR learning media provides students with more understanding of the material than conventional learning media.[14] Augmented Reality media can improve the mastery of the concept of integument system material in pregnant women because it has fulfilled several criteria for appropriate learning media. In this case so that that teaching materials can be delivered effectively, educational technology tools are needed to stimulate the concept of learning with holistic, meaningful, authentic, and active criteria. The above research results follow those stated by Indarwaty, Ichwan, and Putra in their research on interactive learning media for introducing human anatomy using the AR method.[15]

The benefits and effects of AR on improving learning outcomes are in line with subsequent research by Jerabek. The research results show that AR can be a didactic innovation tool and contribute to more effective and better educational activities.[16] The case of research conducted by Sungkur, Panchoo, and Bhoyroo with the results of their research is that the application of AR has been proven to help understand complex concepts that the average student has many difficulties in understanding. The advantage of using AR technology in the physical examination skill of the integument system in pregnant women is an attractive visual display, able to display a series of integumentary system changes in pregnant women, including skin, hair, nails coherently, it happens because it can display 3D objects that seem to exist in the real environment.[17] The benefits of the Augmented Reality media above are also following the results of research from Mustaqim that stated that the use of instructional media in education could stimulate students' mindset to think critically about problems and events that occur daily because the nature of educational media is to help participants students in the teaching and learning process with the presence or absence of educators in the education process so that the use of instructional media with Augmented Reality can directly provide learning wherever and whenever students want to carry out the

learning process. Learning media of Augmented Reality can visualize abstract concepts for understanding and structure of an object model enabling augmented reality as a better medium following the objective of the learning media.[18]

By looking at the characteristics of the media, Augmented Reality can train students to think from concrete to abstract. These strengths are needed to understand the integument system material in complicated pregnant women.[19] Based on the description above, the learning process using augmented reality-based learning media is very important to improve students' understanding and skills about the integument system pregnant women. The resulting media is monotonous with the text and includes multimedia audio/visual elements, even animation that makes it easy for students to understand the material. The utilization of AR technology can enable students to access learning wherever and whenever easily. As a scientific approach method, learning with AR can visualize abstract concepts to understand and structure an object model to enable AR as a more effective media following the learning objectives because it can improve cognitive, affective, and interactive abilities and get closer to complex things.[20,21]

## Conclusion

Students' skills in performing a physical examination of the integumentary system in pregnant women increase by giving demonstrations and using AR-based learning media. A more remarkable skill improvement occurred in the intervention group with a $p$-value <0.001 contributing after 1 week of giving demonstrations and application-based (AR), there is an increase in skills of 66.1%. After two weeks, it increased by 93.5%, and after three weeks, it increased by 100%. Therefore, the use of AR media in the learning process in other courses is also essential.

## Conflicts of interest

The authors declare no conflict of interest.

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