

---

## Looking at the Effectiveness of Various Learning Media in Anatomy Education: The Case of a Medical Program in a Public University

---

SUSAN TARAWIFA<sup>1\*</sup>, RINA NOFRIS ENIS<sup>2</sup>, NYIMAS NATASHA AYU SHAFIRA<sup>3</sup> AND INTAN OKTARI<sup>4</sup>

### Abstract

Anatomy education has historically been facilitated by cadavers; therefore, students always need a mentor at all times of study. Along with the dense curriculum, students are required to be able to study independently so various media are needed that can facilitate the student learning process. This study aimed to determine the differences in the level of student knowledge of the anatomical learning materials provided through anatomy atlas, learning videos, and augmented reality (AR) in first-year medical students. This study was quasi-experimental. A total of 100 students became participants in this study that were then divided into 3 groups. Data were collected by giving pre-test and post-test to the student directly. The results of this study showed that the anatomy atlas and augmented reality significantly enhanced students' knowledge in anatomy learning ( $p=0,004$ ,  $p=0,000$ ) but there was no significant difference between the three media towards the increasing student scores ( $p=0,14$ ).

### Keywords

Anatomy education,  
curriculum, learning media,  
medical science

### Article History

Received 14 November 2022

Accepted 09 November 2023

### How to Cite

Tarawifa, S., Enis, R. N., Shafira, N. N. A., & Oktari, I. (2023). Looking at the effectiveness of various learning media in anatomy education: The case of a medical program in a public university. *Indonesian Research Journal in Education | IRJE |*, 7(2), 439 – 448.  
<https://doi.org/10.22437/irje.v7i2.21506>

---

<sup>1</sup>Universitas Jambi, Indonesia; Corresponding email: [susantarawifa@unja.ac.id](mailto:susantarawifa@unja.ac.id)

<sup>2,3,4</sup>Universitas Jambi, Indonesia

## Introduction

Anatomy is the foundation of medical science that studies the structure or parts of the human body that include size, shape, location, and relation to surrounding structures or organs. An understanding of the anatomy of the human body could be very a great deal wanted in clinical practice to ward off the possibility of failure throughout processes and in setting up a diagnosis in medical clinical practice (Utami et al., 2021). Gaining knowledge of strategies considerably determines studying results. Learning strategies are intently associated with learning strategies and studying styles. Therefore, students want to recognize the handiest studying method for them to optimize the studying method and enhance analysing effects (Abay et al., 2018)

In anatomy education, students can recognize organs and tissues of the human body through a cadaver. However, due to limited time and the increasingly dense curriculum, students are required to be able to study independently. This condition requires lecturers to add learning media that allows students to still understand anatomy learning materials. Currently, using multimedia as a learning media may be an opportunity. In addition, the usage of multimedia can also facilitate college students with a visual-auditory studying style (Nauko & Amali, 2021).

Various learning media are available today, especially information technology-based learning media. The existence of mobile devices which are used as learning media can facilitate the teaching and learning process and may make it less difficult for students. Some media that can be accessed through mobile devices and can attract the attention of students include digital anatomy atlases, learning videos, and augmented reality applications. The effectiveness of using atlases, videos, and AR teaching media can be measured through the extent of student knowledge (Utami et al., 2021). Based on this, the researchers had been inquisitive about comparing the level of students' knowledge in anatomy learning using the anatomy atlas, learning videos, and augmented reality in first-year medical students of the medical program, faculty of medicine and health science in a public university.

## Literature Review

In learning anatomy, there are two strategies used, particularly the integrative and non-integrative methods. Non-integrative learning techniques are carried out in academic establishments that still apply activated learning techniques and are given within the first year which is sustained until the second year. while the integrated learning method is implemented in academic establishments that implement a problem-based learning system (PBL) (Nugraha et al., 2019). PBL-based learning techniques can optimize student studying results in numerous aspects along with cognitive, psychomotor, and affective factors because with this PBL learning method students are more inquisitive about direct realistic learning. The role of the instructor in the PBL-based learning method is as a facilitator (Misidawati & Sundari, 2021).

There are two anatomy learning process applied to medical students specifically lectures and practicums. lectures are one of the learning processes that utilize a reasonably massive

study room because one lecture meeting is attended by 60-80 students. Lectures are led by lecturers who deliver anatomy learning material in a span of 50 to 100 minutes. In this process, lecturers no longer play an active role in delivering material, but students are also required to play an active role so that the learning process can take place both ways and focus on students. This process is called student-centered learning (SCL). During the practicum, students can be hands-on and observe directly the structure or organs of the human body that have previously been delivered during lectures. This process lasts about 100-150 minutes with a smaller number of students at each meeting. With these two learning processes, it is hoped that student's knowledge of the anatomy of the human body will enhance (Enis et al., 2020).

Learning media is a device that could assist teaching and learning activities so that the purpose of the message conveyed by the teacher will become clearer with the goal that learning can be carried out correctly and effectively. The feature of learning media, particularly as a tool for students with the purpose to apprehend the messages and information that have been conveyed with the aid of the lecturer so that the learning material can be extra easily understood by students. In addition, the learning media can also help students better understand. Learning media is also a tool that capabilities in conveying messages and also stimulates thoughts, emotions, interest, and desire to learn so that it can encourage a deliberate, useful, and controlled teaching and learning process (Nurrita 2018).

## **Methodology**

### ***Research design, site, and participants***

This research was quasi-experimental with a pretest and post-test design group. The nature of the quasi-experimental study enables the researchers to manipulate the condition in the teaching and learning process, the researchers gave treatments to the group that belonged to the experimental group and then analyzed the changes in the student's achievement compared to the other group. The research was conducted on the first-year students in the medical program of the Faculty of Medicine and Health Sciences in a public university. A total of 100 students participated in this study. The sample was then divided into 3 research groups, specifically the atlas group, learning videos, and augmented reality.

### **Data collection and analysis**

This study used primary data taken directly through pre-test and post-post questions. Before being given treatment, specifically the delivery of learning materials provided by learning media according to the research group; atlas, learning video, and augmented reality, students are given pre-test questions to assess prior knowledge. The post-test questions is given after the student gets treatment. The data obtained in the form of pre-test and post-test scores of students were then carried out normality tests by using the shapiro-wilk test. The students' pre-test and post-test scores were then compared to assess the effectiveness of learning media from each research group on increasing student scores. The data were then analyzed with the Wilcoxon test. The effectiveness of the three-learning media was also compared in this study which aimed to assess which media was the most suitable and effective

for students, and to compare the effectiveness of the three-learning media, a different test was carried out with the Kruskal-wallis test.

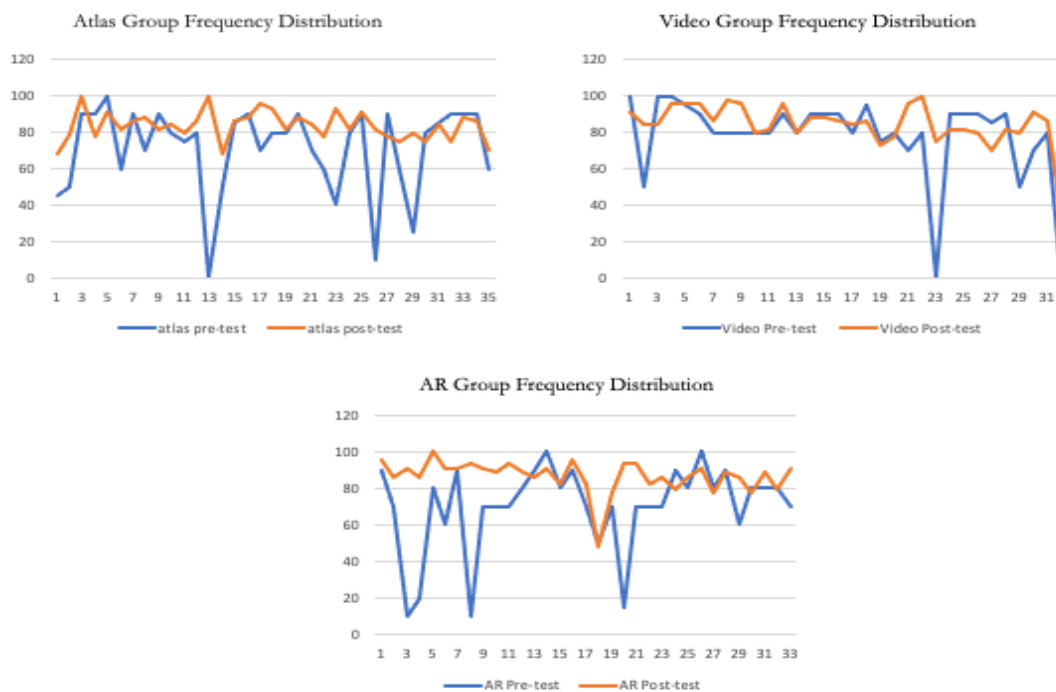
### Results and Discussion

A total of 100 students who participated in the overall anatomy practicum activities were the subjects of this study. The subjects were divided into three groups. Students who received learning materials through atlas media were 35 students. Then 32 students were learning via videos and 33 students were through augmented reality. The average results of the pretest and posttest values in all groups can be seen in the following tables and figure.

**Table 1.** *The frequency distribution of pre-test and post-test scores*

Groups	N	%	Pre-test		Post-test	
			Mean	Deviation Standard	Mean	Deviation Standard
Atlas	35	35%	71	24	83,70	7,97
Video	32	32%	78,13	23,61	84,60	11,63
AR	33	33%	69,85	23,93	86,66	9,01
Total	100	100%				

**Figure 1.** *The frequency distribution pre-test and post-test scores*



Based on the results of the analysis that had been carried out on 100 students, it could be seen that there was an increase between the pre-test and post-test scores of students in each group. Table 1 showed the highest post-test score was in the group with the augmented reality learning media, which was 86.66, while the lowest post-test score was in the group with atlas learning media, which was 83.70. In the frequency distribution diagram for the three groups, it can be concluded that the increase in scores between pre-test and post-test with the highest frequency was in the group with the AR learning media, while the increase in scores between pre-test and post-test with the least frequency was in the group with the learning video.

The Wilcoxon test was carried out with the aim of knowing the effect of providing learning media in each group by calculating the difference in the post-test and pre-test scores of students in each group. The result can be seen in table 2.

**Table 2.** *The Wilcoxon hypothesis test*

Groups	Data	Mean	Difference	Z table ( $\alpha=5\%$ )	Z Count	P
Atlas	Pre-test	71	12,7	1,96	-2,899	0,004
	Post-test	83,7				
Video	Pre-test	78,13	6,47	1,96	-1,122	0,262
	Post-test	84,6				
AR	Pre-test	69,85	16,81	1,96	-3,619	0,000
	Post-test	86,66				

The results of the Wilcoxon test obtained a p-value  $<0.05$  for the group with the atlas learning media and augmented reality (p-value=0,004, p-value=0.001) which means that there was a significant difference in the value between the pre-test and post-test or in other words there was an effect of giving material through both of that media on students' understanding. Different results were shown by the group with the learning video, where the results of the analysis test showed a p-value  $>0.05$  (p-value=0,262) which meant there was no significant difference between students' pre-test and post-test scores or there was no difference between students' understanding of anatomy material before and after getting learning material through learning video media.

The effectiveness of the three-learning media was also compared in this study which aimed to assess which media is the most suitable and effective for students. The Kruskal-Wallis test was carried out with the aim of knowing the differences in the effectiveness of the three anatomy learning media.

**Table 3.** *The Kruskal-Wallis test result*

Learning Media	N	Mean Rank	<i>p-value</i>
Atlas	35	50,74	0,142
Video	32	43,16	
<i>Augmented Reality</i>	33	57,36	
<i>total</i>	100		

The results of the Kruskal-Wallis test obtained a p-value of 0.142. These results indicated that the probability value was more than 0.05 (p-value=0,142) and statistically this value illustrates that there was no significant difference in the effectiveness between the use of learning media of anatomy atlas, learning videos, and augmented reality on the introductory anatomy material in first year medical students of the Medical Program, Faculty of Medicine and Health Science in a public university.

### **Discussions**

Based on studies carried out on 100 first-year medical students, the highest post-test scores had been found within the group with AR learning media. Furthermore, there had been an increase in the distinction between the average post-test and pre-test scores inside the 3 groups of learning media. In the atlas group, there was an increase in the post-test score compared to the pre-test score with an average increase of 12.7. The learning video group had a score difference of 6.47 and the augmented reality group had an average increase in post-test scores of 16.81. The Wilcoxon analysis test was used to determine the significance of the enhancement in student scores after receiving treatment and it was found that there was a significant increase in student post-test scores in the atlas and AR groups where the p-value was greater than 0.05. (p-value=0.004, p-value=0,001). This showed that there was a significant difference between the pretest and posttest scores in the atlas and AR groups.

However, different results were obtained by the video group, where the value of  $p > 0.05$  (p-value=0.262), which meant that there had been no huge difference between the pretest and post-test scores inside the group. In addition, the Kruskal-Wallis analysis test was also carried out to determine the differences in scores enhancement in the three learning media. The test results found that the probability value was  $> 0.05$ , which statistically indicates that there are no significant differences between the learning media atlas anatomy, learning video, and augmented reality at the time of the anatomy practicum. The result of the analysis test conducted was p value  $> 0.05$  (p value=0,25) which indicated that there was no significant difference between students who used 3-dimensional applications and students who no longer used 3-dimensional applications. However, this 3-dimensional application was preferred by students and they more easily recognized anatomical systems with the 3-dimensional applications, so that during this study 3-dimensional applications consisting of augmented



reality were taken into consideration as powerful in enhancing student knowledge (Boulos, 2022).

In the research conducted by Chen et al. (2020) regarding the use of virtual reality as a form of application to enhance anatomy studying results, it showed that from the results of the Kruskal-Wallis test, a p-value of 0.780 was obtained. This showed that there was no significant difference between student groups with the virtual reality learning media and student groups with video learning media. These results were also consistent with the results of this study (Chen et al., 2020). Different results were obtained by Zhen Ye et al, where there was a difference effect of giving 3-dimensional models in comparison to conventional learning models on anatomy studying. (Yen et al., 2020). This difference in results can occur because the success of the teaching and learning process is not only based on learning media, but many other supporting factors include how lecturers introduce the materials.

The results of this study showed that there was a significant enhancement in the post-test scores of students who were given anatomical material through augmented reality media. This is because augmented reality students were easier to identify body structure compared to using atlases or videos. In AR, students can see the human body structure from various angles and can be rotated 360° so that the image appears more real. Furthermore, the AR teaching media also can increase students' motivation and interest in analyzing complicated anatomical structures such as bones, muscles, and nerves that are generally difficult to understand (Park et al., 2019)

Learning videos also have several advantages including being more flexible so that they can be accessed anytime and anywhere using a smartphone. In addition, videos can also help students understand difficult anatomical materials. In this study, it was stated that video media did not have a significant effect on increasing student scores. This is because students found it a bit difficult to understand the anatomical materials which were given by learning video, compared to the 3-dimensional media such as the AR. The learning video only showed 2-dimensional objects, so some students felt the symptoms of computer vision syndrome such as dizziness, red and watery eyes (Bölek et al., 2021).

The anatomy atlas is a basic and obligatory learning media that continues to be implemented as the principal learning media during anatomy practicum. The existence of video and AR learning media is only as additional learning media similar to the use of atlas media. This atlas also has several benefits, specifically via showing 2-dimensional visuals equipped with colorful and really attractive schematic images that could increase college students' enthusiasm in studying anatomy. Anatomy atlas is a traditional studying method that is still implemented these days due to the ease of having access to atlas books, specifically now that there are electronic books that can be accessed for free by students. This offers convenience for some students, where students can understand anatomy material without having to pay to buy an anatomy atlas book.

Furthermore, student learning outcomes were not only influenced by the aid of learning media but also influenced by the numerous different elements, both internal and external factors. Internal factors which could affect studying outcomes consist of physiological factors which include physical and spiritual conditions and psychological elements including students' intelligence levels, studying motivation, and interest in studying. External factors that affect

learning results consist of studying facilities and infrastructure, study time, instructor competence, learning environment, and learning techniques. These cause no significant difference between the three-learning media (Puspasari et al., 2020).

### **Conclusion**

In this study, it was found that there was a significant increase in the anatomical materials provided through the anatomy atlas and augmented reality, although there were no significant differences in the three-learning media. It can be concluded that in addition to the use of an atlas, augmented reality and learning video can also be used as additional learning media that can facilitate student learning styles and make it easier for students to understand anatomy materials. However, there were difficulties in conducting pre-test and post-tests due to internet network problems for some students. In addition, when using the AR applications, many students found it difficult to download the application. This study can also be a reference for institutions to apply video learning media and augmented reality in the learning process, especially during anatomy practicum. This study is also expected to be a reference for other researchers to be able to examine the effectiveness of learning media in other practicums.

### **Declaration of Conflicting Interests**

The authors declared no potential conflicts of interest.

### **Acknowledgment**

The authors' gratitude goes to all students who had participated in this study, as well as to the anatomy lecturers at the Faculty of Medicine and Health Science, Universitas Jambi who had assisted in carrying out this study.

### **References**

- Abay, N. A., Wungouw, H. I., & Berhimpon, S. (2018). Hubungan Gaya belajar Dengan Nilai Hasil Ujian Modul sistem gastro-intestinal, hepatobilier Dan Pankreas Pada Mahasiswa Angkatan 2016 Fakultas Kedokteran Universitas Sam Ratulangi. *Jurnal e-Biomedik*, 6(2). <https://doi.org/10.35790/ebm.6.2.2018.22107>
- Bahriah, E. S., Dewi, L. U., & Irwandi, D. (2021). Pengaruh media penilaian formatif online quizz terhadap Hasil Belajar siswa Materi Sistem periodik unsur. *JRPK: Jurnal Riset Pendidikan Kimia*, 11(1), 19–26. <https://doi.org/10.21009/jrpk.111.04>
- Boulos, A. N. (2022). Evaluation of the effectiveness of online education in anatomy for medical students during the COVID-19 pandemic. *Annals of Anatomy - Anatomischer Anzeiger*, 244, 151973. <https://doi.org/10.1016/j.aanat.2022.151973>
- Bölek, K. A., De Jong, G., & Henssen, D. (2021). The effectiveness of the use of augmented reality in anatomy education: A systematic review and meta-analysis. *Scientific Reports*, 11(1). <https://doi.org/10.1038/s41598-021-94721-4>



- Chen, S., Zhu, J., Cheng, C., Pan, Z., Liu, L., Du, J., Shen, X., Shen, Z., Zhu, H., Liu, J., Yang, H., Ma, C., & Pan, H. (2020). Can virtual reality improve traditional anatomy education programmes? A mixed-methods study on the use of a 3D skull model. *BMC Medical Education*, 20(1). <https://doi.org/10.1186/s12909-020-02255-6>
- Enis, R. N., Putri, I. K., Fitri, A. D., & Kusdiyah, E. (2020). Korelasi Rerata Nilai Posttest Terhadap Nilai Objective Structured Practical Examination (OSPE) Anatomi Dan Histologi Mahasiswa Kedokteran Blok 1.1 FAKULTAS Kedokteran Dan Ilmu Kesehatan Universitas Jambi Tahun 2019. *Jurnal Medika Malabuyati*, 4(2), 95–103. <https://doi.org/10.33024/jmm.v4i2.2758>
- Misidawati, D. N., & Sundari, P. (2021). Penerapan model PBL dalam matakuliah teori Pengambilan Keputusan untuk meningkatkan Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Educatio FKIP UNMA*, 7(3), 922–928. <https://doi.org/10.31949/educatio.v7i3.1290>
- Nauko, Y. S., & Amali, L. N. (2021). Pengenalan Anatomi Tubuh Menggunakan teknologi augmented reality berbasis android. *Jambura Journal of Informatics*, 3(2), 66–76. <https://doi.org/10.37905/jji.v3i2.11720>
- Nugraha, Z. S., Khadafianto, F., & Fidianingsih, I. (2019). Refleksi Pembelajaran anatomi Pada Mahasiswa kedokteran fase ketiga melalui applied and clinical question. *Refleksi Pembelajaran Inovatif*, 1(1), 21–27. <https://doi.org/10.20885/rpi.vol1.iss1.art3>
- Nurrita, T. (2018). Pengembangan media Pembelajaran Untuk meningkatkan Hasil Belajar siswa. *MISYKAT: Jurnal Ilmu-Ilmu Al-Quran, Hadist, Syari'ah Dan Tarbiyah*, 3(1), 171. <https://doi.org/10.33511/misykat.v3n1.171>
- Park, S., Kim, Y., Park, S., & Shin, J.-A. (2019). The impacts of three-dimensional anatomical atlas on Learning Anatomy. *Anatomy & Cell Biology*, 52(1), 76. <https://doi.org/10.5115/acb.2019.52.1.76>
- Utami, P., Hastami, Y., Munawaroh, S., & Wiyono, N. (2021). Efektivitas Media Pembelajaran Anatomi kadaver dibandingkan video Terhadap Pemahaman Neuroanatomi Pada Mahasiswa Kedokteran. *Smart Society Empowerment Journal*, 1(1), 26. <https://doi.org/10.20961/ssej.v1i1.48598>
- Wijaya, K. G., Sudirman, P. L., & Ani, L. S. (2018). Perbedaan Tingkat kebersihan Rongga Mulut Pada Mahasiswa kedokteran Gigi Dengan Mahasiswa Kedokteran Umum di Fakultas Kedokteran Universitas udayana. *Bali Dental Journal*, 2(1), 24–30. <https://doi.org/10.51559/bdj.v2i1.20>
- Ye, Z., Dun, A., Jiang, H., Nie, C., Zhao, S., Wang, T., & Zhai, J. (2020). The role of 3D printed models in the teaching of human anatomy: A systematic review and meta-analysis. *BMC Medical Education*, 20(1). <https://doi.org/10.1186/s12909-020-02242-x>
- Özen, K. E., Erdoğan, K., & Malas, M. A. (2022). Evaluation of views and perceptions of the medical faculty students about distance anatomy education during the COVID-19 pandemic. *Surgical and Radiologic Anatomy*, 44(1), 61–71. <https://doi.org/10.1007/s00276-021-02867-7>
- Puspasari Kiay Demak, I. ., Sari, P. ., & J. Tandirerung, F. . (2020). Perbedaan Tingkat Pemahaman Dalam Pembelajaran Anatomi Yang Menggunakan Preparat Basah (Kadaver) Dengan Preparat Kering Pada Mahasiswa Kedokteran Universitas

### Biographical Notes

**SUSAN TARAWIFA** is a lecturer at the medical program, Faculty of Medicine and Health Science, Universitas Jambi, Indonesia.

**RINA NOFRIS ENIS** is a lecturer at the medical program, Faculty of Medicine and Health Science, Universitas Jambi, Indonesia.

**NYIMAS NATASHA AYU SHAFIRA** is a lecturer at the medical program, Faculty of Medicine and Health Science, Universitas Jambi, Indonesia.

**INTAN OKTARI** is a lecturer at the medical program, Faculty of Medicine and Health Science, Universitas Jambi, Indonesia