Original Article

Journal of Advances in Medical Education & Professionalism

A Mixed-Method Study: Investigating the Impact of Different Learning Media on Undergraduate Students' Knowledge, Performance, and Motivation in Physiology Courses

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> Abstract

Introduction: Physiology encompasses examining the body's everyday activities, which is crucial for understanding health before disease onset. The physiology course at Hasanuddin University is included in the biomedical science curriculum. Traditionally delivered via a teacher-centered methodology, this strategy frequently results in rote memorization. To resolve this, active learning methodologies utilizing many media enabled students to choose their preferred instructional tools and augment their knowledge and drive. This study seeks to evaluate the influence of different learning media on undergraduate students' knowledge, presenting skills, and motivation in physiology courses.

Methods: We executed a mixed-method study, including quantitative and qualitative approaches, utilizing a sequential explanatory design, wherein quantitative data was initially gathered. We proceeded with qualitative data collecting to elucidate and reinforce the previous findings. We engaged 100 students to assess their knowledge and presenting skills. The evaluative instruments employed were multiple-choice questions and assessment rubrics. To ascertain the reasons and motivations for student engagement in learning physiology, we engaged nine student respondents, categorizing them into three groups: active participants, neutral participants, and non-participants. We assessed the motivations for student learning engagement with a qualitative questionnaire, which was then complemented by Focus Group Discussion (FGD) interviews.

Results: Findings indicated a greater involvement of female students (67%) and individuals from non-SBMPTN paths (62%). Most pupils favored PowerPoint (52%) and video (20%) as educational material. Substantial enhancements in posttest scores were observed following the utilization of these media. Researchers observed significant enhancements in posttest scores following presentations that utilized PowerPoint and video media (Wilcoxon, $p<0.01$). Students who presented the genitourinary system via video medium achieved superior scores compared to those who utilized PowerPoint (Mann-Whitney $p=0.001$, $p<0.01$). Qualitative studies indicated that active learning strategies enhanced student involvement and motivation, making learning more engaging and pleasurable.

Conclusion: Active learning using specific media such as PowerPoint and video markedly improves knowledge, engagement, and motivation among students in physiology courses.

Keywords: Active learning; Learning media; Knowledge; Performance; Motivation

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Please cite this paper as:
Ariyandy A, Yusuf I, As'ad S, Esa T, Afandi IN, Akhmad CN, Bachtiar RR, Sunarno I, Budu B. A Mixed-Method Study: Investigating the Impact of Different Learning Media on Undergraduate Students' Knowledge, Performance, and Motivation in Physiology Courses. J Adv Med Educ Prof. 2025;13(2):105-116. DOI: 10.30476/jamp.2025.104419.2056.

Received: 11 October 2024
Accepted: 01 February 2025

Introduction

Physiology is a fundamental biomedical discipline examined during the initial semester of medical education. This discipline examines the standard physiological functions of the human body and is regarded as a fundamental pillar of medical science. Human physiology is crucial for comprehending the primary functions of the body organs, which are necessary for sustaining bodily functioning and enhancing quality of life. It is the foundation of disease science in clinical medical education (1). The traditional concept of teaching describes a lecturer engaging in teacher-centered learning, serving as the sole source of information for students, who passively acquire the content. Instructors thoroughly elucidate the content, yet they yield diminished learning outcomes and reduced student motivation. The lecturer's method is inversely proportional when employing an active learning strategy in physiology instruction. In implementing active learning, educators may incorporate scenarios, group discussions, presentations, or flipped classroom methodologies into the learning environment.

Active learning methodologies have garnered attention as a viable approach to enhance the quality of education. Active learning entails students' engagement in the educational process via group discussions, case studies, simulations, or collaborative projects. This strategy enables students to develop conceptual comprehension and enhance problem-solving skills more actively. Previous research comparing active learning methods with traditional methods demonstrates a 90% efficacy of active learning in enhancing cognitive abilities, memory retention, performance, and student engagement—seven to ten.

Instructors can impart physiology to students through active learning, which enhances comprehension and facilitates long-term knowledge retention (2). Student-centered pedagogy will enhance student engagement, establish instructional equilibrium, and cultivate a sense of accountability for learning among students (3). Employing an active learning methodology, physiology instruction can incorporate audiovisual material and leverage cutting-edge technology to elucidate the holistic mechanisms of organ function inside the body.

Lecturers want students to engage more actively in comprehending concepts and enhancing problem-solving skills through active learning. Extensive research on active learning has been conducted. Nonetheless, it is imperative to research the extent of knowledge and engagement, particularly in physiology courses for medical students. Furthermore, additional information is required regarding the educational media selected by students in active learning at the Faculty of Medicine, Hasanuddin University.

The selection of learning media in active learning is essential for enhancing student engagement. In active learning, the selected educational media must adapt to the student's competencies and requirements in comprehending the material's content. Educational media can be audiovisual and employ cutting-edge technology. Consequently, selecting appropriate learning media can facilitate the effective execution of active learning and enhance student learning outcomes.

Methods

This research utilized a mixed-method sequential explanatory design, combining quantitative and qualitative data to evaluate the effects of various learning media on undergraduate students. To ascertain the validity and reliability of the questionnaire employed, we executed a comprehensive evaluation process involving 100 students to assess their knowledge and presentation performance, thereby gathering quantitative data.

Subsequently, we will gather qualitative data by assessing motivation for student learning involvement with a qualitative questionnaire, followed by focus group discussion interviews. This research was conducted during the even semester of 2023/2024, namely from April to June 2024. Out of 120 participants in the screening, 100 met the inclusion and exclusion criteria. The preliminary phase of the research, termed pre-active learning, involved socialization and obtaining informed consent. It completed a Google Form questionnaire that included inquiries regarding respondent characteristics and multiple-choice pre-test questions. The subsequent phase of the study is active learning. The phase involves preparing active learning materials for group discussions and presentations utilizing the two mostly preferred learning mediums selected by students. The third phase of the study, post-active learning, requires students to complete a Google form that includes a qualitative mini-essay and a multiple-choice posttest, followed by the collection of Focus Group Discussion (FGD) data a few days later. Researchers validate and interpret data through the triangulation of questionnaires, interviews, and focus group discussions, as well as by triangulating sources, including respondents, lecturers, and experts. Figure 1 shows a summary of the research stages.

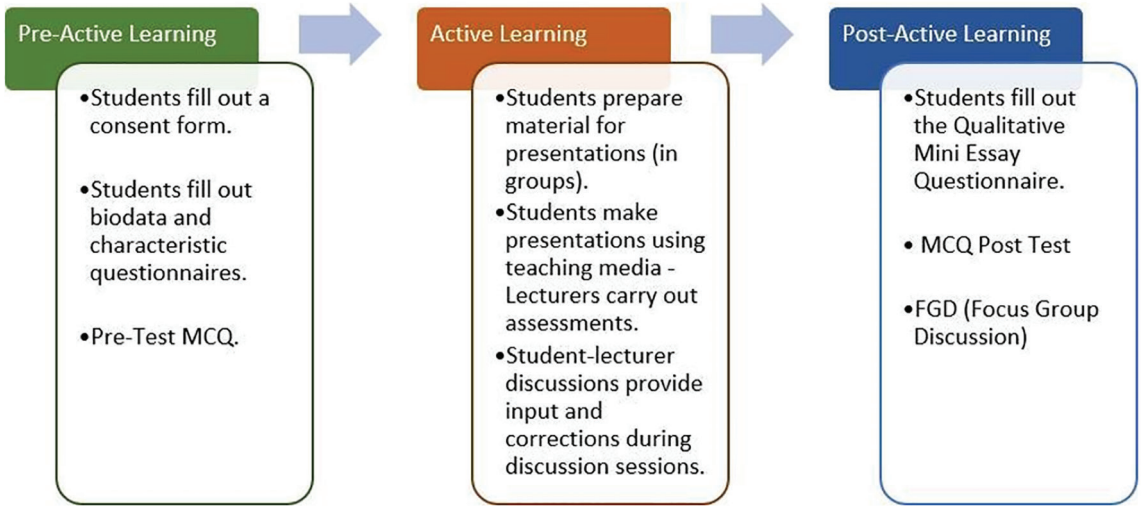

Figure 1: Stages of Research

Validity

The questionnaire items were created according to accepted frameworks in educational research and evaluated by subject matter specialists to guarantee content validity. This procedure ensured that the questions accurately represented the study aims and were suitable for the target group.

Reliability

Cronbach's alpha was used to evaluate the internal consistency of the questionnaire. The resultant score demonstrated a high dependability, affirming that the tool consistently assessed the desired constructs. This procedure was essential for guaranteeing the integrity of the data gathered. The improvements to the methodology section promote transparency and bolster the credibility of the study conclusions.

Focus Group Discussion (FGD)

For the interview, we held focus group discussions with nine student participants (five males and four females) and documented responses until theoretical saturation was achieved. Researchers can ascertain theoretical saturation when respondents' answers are consistent and yield no fresh insights. The interview lasted roughly one hour and was conducted in person or by Zoom. This interview guide includes open-ended questions regarding the motivations and circumstances influencing their inclinations (active, inactive, neutral) towards active learning in physiology and their feedback on future recommendations for enhancing active learning. All interviews were captured audiovisually and transcribed verbatim. The transcription outcomes were subsequently examined utilizing QDA Miner. Researchers use focus group discussions (FGDs) as this strategy is efficacious for gathering qualitative data to elucidate the underlying reasons for attitudes and behaviors (4, 5).

Researchers then categorized the class into subclasses A and B. Class A pertained to the physiology of the reproductive system. At the same time, Class B focused on the physiology of the genitourinary system. The researchers categorized topic A into the subtopics "female reproduction" and "male reproduction" and topic B into the subtopics "urine formation" and "Renin Angiotensin Aldosterone System (RAAS)." The presentation employs PowerPoint and video media, the two most preferred learning modalities according to student selection. The researchers subsequently partitioned class A into four groups, each consisting of 12 to 13 pupils. The categories are Group 1, male reproduction (PowerPoint); Group 2, male reproduction (video); Group 3, female reproduction (PowerPoint); and Group 4, female reproduction (video). For class B, the researchers further segmented the participants into four groups, each consisting of 12 to 13 kids. The categories are Group 1: urine formation (PowerPoint); Group 2: urine formation (video); Group 3: RAAS (PowerPoint); and Group 4: RAAS (video). Students collaboratively produce educational materials for one hour. Subsequently, each student group will offer his/her subject utilizing the active learning method for 10 to 15 minutes.

Ethical Consideration

The researcher validated and examined the data by triangulating questionnaires, interviews, focus group discussions, and sources: respondents, lecturers, and experts. This study obtained ethical approval by the research ethics committee of the Faculty of Medicine, Hasanuddin University, with

reference number 91/UN4.6.4.5.31/PP36/2024.

Results

This study used a mixed sequential explanatory research methodology, commencing with quantitative data. The researcher subsequently employs qualitative data to elucidate and reinforce prior findings from quantitative research conducted in the physiology class utilizing a paired pre-post quasi-experimental approach. This study used a mixed sequential explanatory research methodology, commencing with quantitative data. The researcher employs qualitative data to elucidate and reinforce prior findings from quantitative research conducted in the physiology class, utilizing data from the preceding groups, Class A and B. Class A is partitioned into four groups, each group comprising 12 to 13 students. Similarly, researchers organized Class B into distinct categories and subtopics to mitigate bias—the physiology of the reproductive system in Class A and the physiology of the genitourinary system in Class B. Researchers categorized the class into two subtopics: reproductive system physiology and the female and male reproductive subtopics. The genitourinary physiological system was categorized into renin-angiotensin-aldosterone (RAAS) and urine production.

Researchers established the sample using a purposive sampling method based on pre-defined inclusion and exclusion criteria. The researcher categorized the subjects into two categories, Classes A and B allowed the students to select their preferred groups from seven media options. Researchers present seven media options: PowerPoint, video, poster, narrative, song, roleplay, and poem. Before presenting students with alternatives, the researchers facilitated educational media socialization to ensure that the students comprehended the media format before making their selections. The researchers subsequently asked the students to identify and select their preferred learning media for studying physiology. The researcher selected the two highest-ranked educational media for evaluation. Ultimately, researchers evaluated the extent of knowledge, presentation efficacy, and motivations for engagement in physiology classes grounded in students' two mostly preferred educational media.

Researchers evaluated the students' knowledge levels twice before and during the presentation, utilizing the two mostly favored teaching modalities. The evaluation of knowledge proficiency employs previously untested multiple-choice questions. Subsequently, the researcher evaluated the presentation utilizing the two mostly favored educational mediums and validated rating criteria (6). Researchers utilized SPSS Version 24 (64-bit edition), licensed by IBM, to analyze the quantitative data. The Wilcoxon test assessed knowledge scores in the two groups before and during the presentation. The posttest knowledge scores of the two groups were compared using the Mann-Whitney test. Ultimately, they proceeded with the Spearman correlation test to ascertain the association between the presentation and posttest scores in classes A and B. Researchers conducted Focus Group Discussions (FGD) to gather qualitative data on the motivations for engaging in active learning in physiology. Nine students participated in the focus group discussion. The researchers subsequently categorized nine respondents into three groups: active, neutral, and inactive, with three respondents in each group. This division is predicated on analyzing the responses of the nine participants in the qualitative mini essay at the preliminary phase of the research.

Quantitative analysis results Univariate

The quantitative data were evaluated using SPSS Version 24 (64-bit edition), licensed by IBM, with reliability verified via Cronbach's alpha. The elevated reliability score indicated that the questionnaire items exhibited internal consistency, hence affirming the validity of the knowledge and motivation evaluations performed in the study.

We secured research consent and gathered data on characteristics (age, gender, last semester GPA, entry route to medical faculty, location of residence, and off-campus tutoring participation) of one hundred students 2023 medical faculty cohort respondents. We categorized the classes into Class A, focusing on the physiology of the reproductive system, and Class B, concentrating on the physiology of the genitourinary system. We distributed the questionnaires among students in class using a Google Forms link. Before the presentation, we collected this primary data at the onset of pre-active learning—Table 1 and Figure 1, 2.

Researchers gathered the data; it was found that a more significant proportion of female student respondents participated in the study compared to male student respondents (67% vs. 33%), whereas most respondents were aged ≥18 years, comprising 90%. Additionally, a more significant proportion of student respondents with a GPA of 3.0 or higher participated in this research (90%). The predominant responses among the students originated from the non-regular SBMPTN track, with the majority residing with their families (62%). Ultimately, researchers discovered that most student responders (69%) lacked external

Table 1: Characteristics of combined Class A and Class B respondents

Variable	Class A (n=5)	Class B (n=50)	Total (n=100)	p
	N (%)	N (%)	N (%)	
Age				
≥18 years old	47 (52.2)	43 (47.8)	90 (100)	0.317*
<18 years old	3 (30)	7 (70)	10 (100)	
Gender				
Male	17 (51.5)	16 (48.5)	33 (100)	1*
Female	33 (49.3)	34 (50.7)	67 (100)	
Tutoring outside Campus				
Yes	17 (54.8)	14 (45.2)	31 (100)	0.665*
No	33 (47.8)	36 (52.2)	69 (100)	
Last Semester GP				
≥3.0	46 (51.1)	44 (48.9)	90 (100)	0.739*
<3.0	4 (40)	6 (60)	10 (100)	
FK entry route				
SBMPTN	19 (50)	19 (50)	38 (100)	1*
Non SBMPTN	31 (50)	31 (50)	62 (100)	
Place of residence				
Family home	35 (56.5)	27 (43.5)	62 (100)	0.149*
Boarding house/fla	15 (39.5)	23 (60.5)	38 (100)	

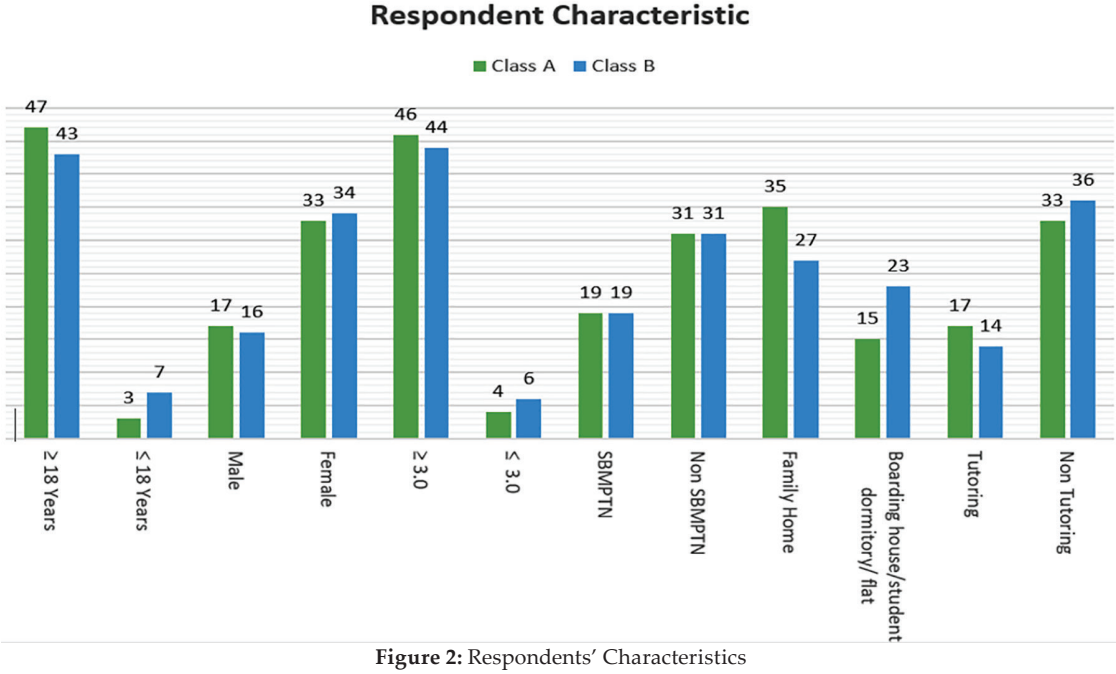

Figure 2: Respondents' Characteristics

academic support.

Subsequently, we gathered data to ascertain that the instructional media students preferred and selected most frequently in active learning physiology courses. Before distributing the questionnaire, the researcher facilitated socialization by presenting instances, formats, and models of instructional media that may be utilized. Subsequently, researchers administered questionnaires featuring options for instructional media to 100 students from both Class A, focused on reproductive physiology, and Class B, centered on genitourinary physiology (Table 2).

Among the seven educational media presented to 100 students, over half of them (52 students) selected PowerPoint as their preferred medium. In the second stage, 20 students opted for video educational media, followed by nine students who favored story media for learning. In the fourth stage, seven students chose role play learning media. The remaining selections were less popular: six students preferred song media, five selected poster media, and only one chose poetry.

Subsequently, in the second phase, namely during the presentation session, the researcher utilized the two educational media chosen by the students: PowerPoint and video. Previously, students were allotted time to develop material

Table 2: Distribution of selection of educational media in Class A and Class B

No.	Educational media	n (total=100)	%
1	PowerPoint	52	52
2	Videos	20	20
3	Poster	5	5
4	Story	9	9
5	Song	6	6
6	Roleplay	7	7
7	Poetry	1	1

Descriptive tests

Table 3: Distribution of Presentation Scores Per Group in Classes A and B

Presentation Performance	Mean±SD
Class A Reproductive System Physiology	
Subtopic Male Reproduction (PowerPoint)	4.0±0.0
Subtopic Male Reproduction (Video)	3.7±0.27
Subtopic Female Reproduction (PowerPoint)	3.3±0.67
Subtopic Female Reproduction (Video)	3.8±0.44
Class B Genitourinary System Physiology	
Urine Formation Subtopic(PowerPoint)	3.7±0.44
Urine Formation Subtopic (Video)	3.2±0.83
RAAS Subtopics (PowerPoint)	3.2±0.74
RAAS Subtopics (Video)	3.4±0.65

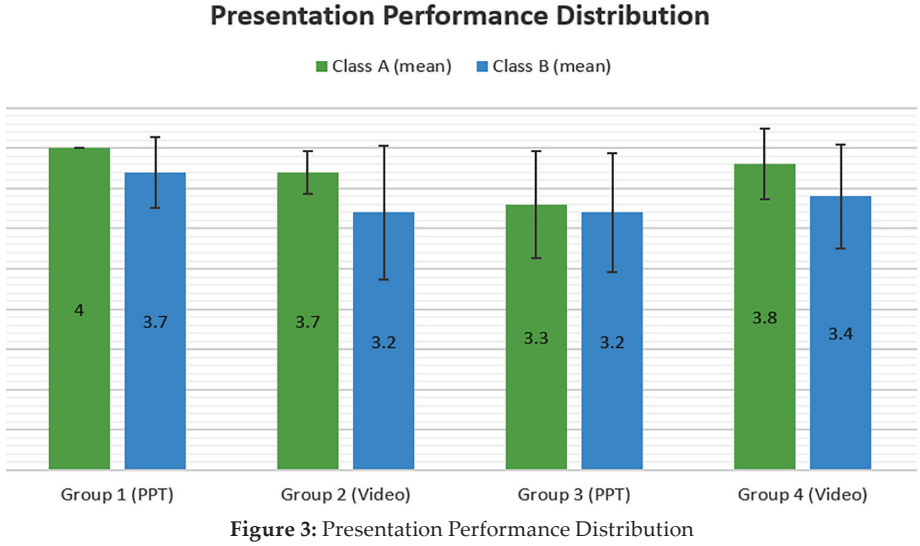

Figure 3: Presentation Performance Distribution

collaboratively and deliver a presentation by designating 2-3 classmates as presenters. Using rubric, the researcher evaluated the presentation by examining media content, relevance, self-assurance, and creativity. To mitigate bias in the data, the researchers categorized it into two groups based on distinct topics (reproductive system and genitourinary system) and subtopics (male and female reproduction, urine formation, and RAAS).

As shown in Table 3 and Figure 3, in class A, regarding the physiology of the reproductive system, students utilizing PowerPoint achieved the highest score in the male reproduction subtopic, with a Mean±SD of 4±0. In contrast, the highest score for the female reproduction subtopic was obtained through video, with a Mean±SD of 3.8 ± 0.44. In contrast, class B pertains to the physiology of the genitourinary system. The performance of student PowerPoint presentations was highest in the Urine Formation subtopic, with a Mean±SD of 3.7±0.44. In contrast, presentations utilizing video in the RAAS subtopic had a Mean±SD of 3.4±0.65.

As shown in Table 4, researchers obtained data utilizing educational media, PowerPoint presentations, and video content. Researchers acquired data indicating that the MCQ scores following student presentations utilizing PowerPoint educational media were superior

Table 4: Differences in MCQ scores before and after presentation using PowerPoint or video educational media in classes A Reproductive System and B Genitourinary System

Group	Post	Post	p
	Median±(min-max)	Median±(min-max)	
Class A *Reproductive Physiology* (PowerPoint) vs Class B *Genitourinary Physiology* (PowerPoint)	80±(50-90)	60±(40-90)	0.034*
Class A *Reproductive Physiology* (video) vs Class B *Genitourinary Physiology* (video)	60±(20-90)	90±(30-100)	0.001**
Class A Reproductive Physiology *(PowerPoint)* vs Class A Reproductive Physiology *(video)*	80±(50-90)	60±(20-90)	0.061
Class B Genitourinary Physiology *(PowerPoint)* vs Class B Genitourinary Physiology *(video)*	60±(40-90)	90±(30-100)	0.001**

* Mann Whitney, significant P<0.05; Mann Whitney Test

in the reproductive system physiology (Class A) compared to the MCQ scores of students in the genitourinary system physiology (Class B) (p=0.034, p<0.05*). Conversely, this is not the case for video educational media. The students' MCQ scores following the video presentation in genitourinary system physiology (Class B) were superior to those in reproductive system physiology (Class A) (p=0.01, p<0.01**). The researchers subsequently conducted a comparison based on the titles of the physiology topics, specifically the physiology of the reproductive system and the genitourinary system. Researchers found that the physiological value of the Genitourinary system (Class B) in students utilizing video media for presentations surpassed that of students employing PowerPoint media (p=0.001, p<0.01**). The opposite was the case with the reproductive system (Class A). The scores of pupils utilizing PowerPoint presentations were superior to those who employed video material. This finding lacked statistical significance (P=0.061). The results of the difference in MCQ scores before and after presentations using PowerPoint or video educational media in classes A Reproductive System and B Genitourinary System are illustrated in Figures 5 and 6. Additionally, in Table 5, the researcher examined the link between the marks obtained during student presentations utilizing PowerPoint or video educational media and the subsequent MCQ grades. Nonetheless, no statistically significant association was identified.

Qualitative analysis results, characteristics of FGD respondents

Nine students participated as respondents in the focus group discussion. Researchers categorized three respondents into each group: those who opted for active participation (3 students), neutral participation (3 students), and inactive participation (3 students). Researchers utilized a purposive sampling strategy to collect respondent data by analyzing replies obtained from qualitative questionnaires at the onset of the pre-active learning phase.

Students' engagement: actively, inactively, or neutrally

This section elucidates the rationale and encourages student participation in implementing active learning in physiology courses.

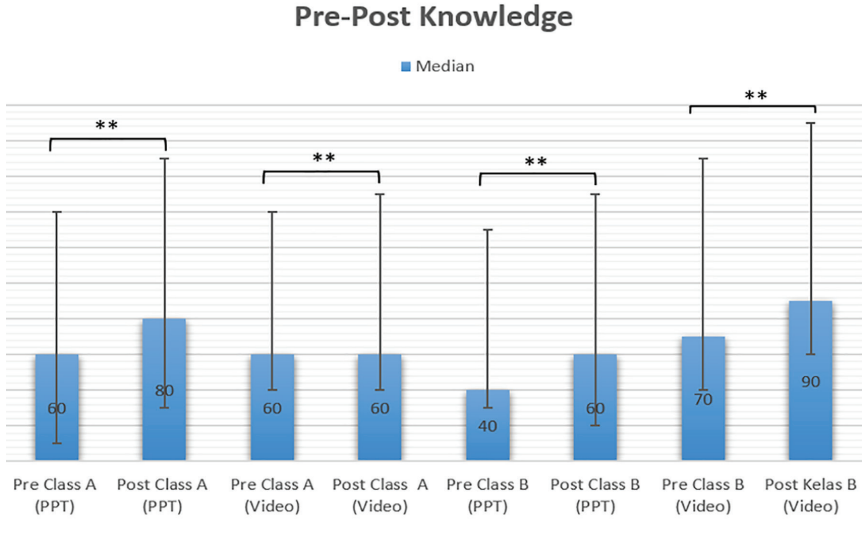

Figure 4: Pre-post MCQ test knowledge within the group (Class A and Class B)

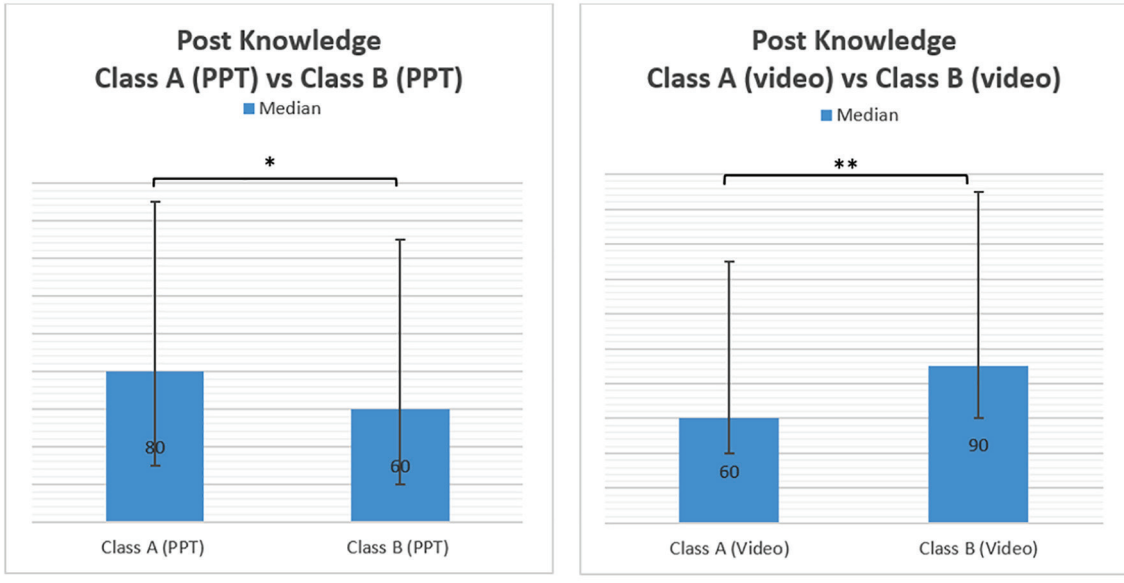

Figure 5: Post knowledge between the group, Class A Versus Class B, PowerPoint (PPT) or Video

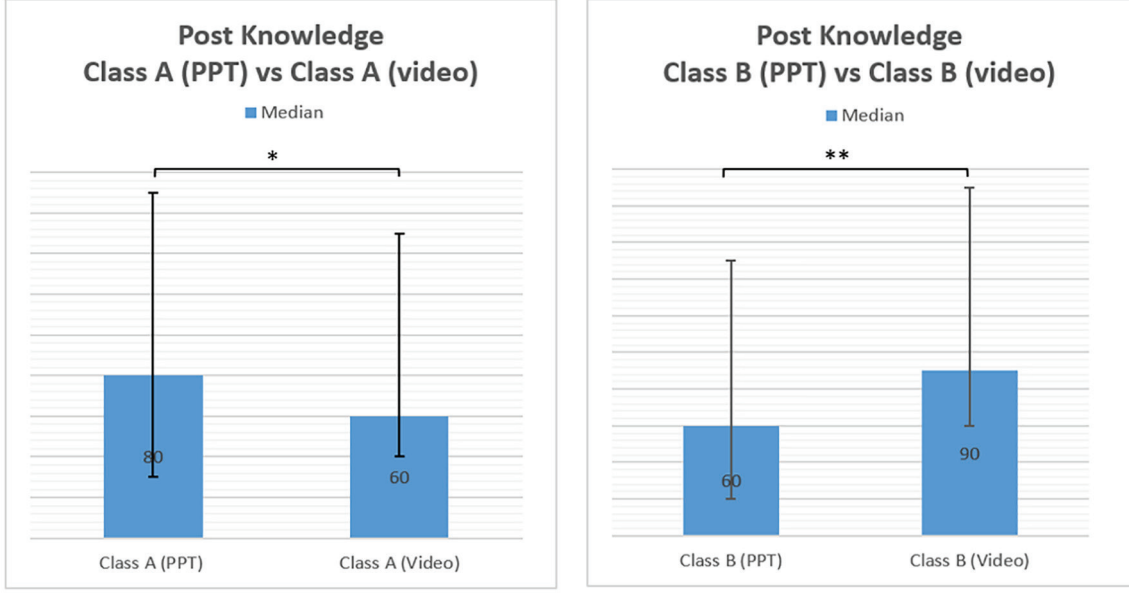

Figure 6: Post knowledge between the group, Class A Versus Class B, PowerPoint (PPT) or Video

Table 5: Correlation between student presentation scores and post-test results

Group	Frequency (n)	Significance (*p*)	Coefficient Correlation (r)
Class A Reproductive Physiology (PowerPoint)	25	0.530	0.379
Class A Reproductive Physiology (Video)	25	0.794	-0.162
Class B Genitourinary Physiology (PowerPoint)	25	0.553	-0.359
Class B Genitourinary Physiology (Video)	25	0.553	0.359
*Spearman, significant p<0.05			

Spearman Correlation Test

The researchers categorized students into three groups: active, neutral, and inactive.

Factors influencing students' decisions to engage actively

a. Active Learning encourages students to be more independent

"The active learning approach will foster students' autonomy and inquisitiveness..…." *[Active Learning Verbatim Transcript; Position: 18 - 18; Created by: ROG FLOW; 6/19/2024 20:15; Weight score: 0].*

b. More interactive than conventional

"Occasionally, we employ traditional methods;

however, utilizing active learning techniques fosters greater interactivity.…..” *[Active Learning Verbatim Transcript; Positions: 16 - 16; Created by: ROG FLOW; 6/19/2024 19:39; Weight score: 0].*

Factors influencing students' decision to refrain from active participation

1. Disproportionate allocation of responsibilities

“When employing an active method, the chairman occasionally allocates responsibilities unevenly among members, resulting in learning that is not holistic based on the distributed material...” *[Active Learning Verbatim Transcript; Position: 18 - 18; Created by: ROG FLOW; 6/19/2024 20:16; Weight score: 0].*

2. Comprehension of the material provided

“There is a drawback to this active learning method, as it involves creating and presenting material in front of the class. Typically, the group leader allocates the presentation material to each member. When I, as a student, receive material “A”, I focus solely on studying and understanding material “A”, which leads to a lack of engagement with other assigned materials….” [*Active Learning Verbatim Transcript; Positions: 16 - 16; Created by: ROG FLOW; 6/19/2024 19:41; Weight score: 0].*

The rationale for students opting for neutrality

1. It is advisable to integrate active and conventional methods to prevent monotony.

“I favor a composite of materials. The combination of active and traditional approaches enhances my understanding, mainly when the presenter uses PowerPoint for explanations. Integrating active learning approaches would benefit the instructor and prevent monotony.…..” *[Active Learning Verbatim Transcript; Position: 18 - 18; Created by: ROG FLOW; 6/19/2024 20:14; Weight score: 0].*

2. We advocate for a hybrid approach of active-conventional method due to its necessity for further elucidation.

“Physiology is a scientific discipline that examines bodily functions and encompasses extensive discourse. Certain subjects are manageable for solo study, while others necessitate direct instruction for enhanced comprehension. Therefore, let us integrate active conventional methodologies. The application involves students initially studying individually, followed by presentations intermingled with the lecturer’s comments to guide us.…..” *[Active Learning Verbatim Transcript; Position: 18 - 18; Created by: ROG FLOW; 6/19/2024 20:01; Weight score: 0].*

Integration of Quantitative and Qualitative Data

This section presents the integration of quantitative and qualitative data findings. The results indicate mutual support between the two data types. The combined findings are illustrated in Figure 4-8.

In quantitative research, scholars evaluate three dimensions of students: knowledge level, learning performance (specifically presentation assessment), and motives for learning participation. An extensive investigation was undertaken regarding the third dimension, motives for learning participation. The researcher employed qualitative methods to enhance the material. Consequently, the integrated data comprised quantitative findings from an open-ended questionnaire and qualitative insights from focus group discussions to explore the motives for learning participation.

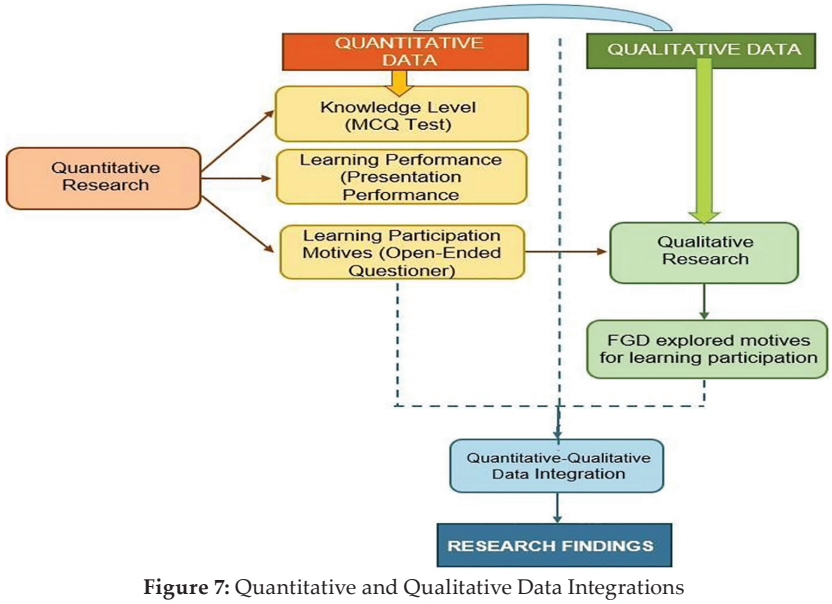

Figure 7: Quantitative and Qualitative Data Integrations

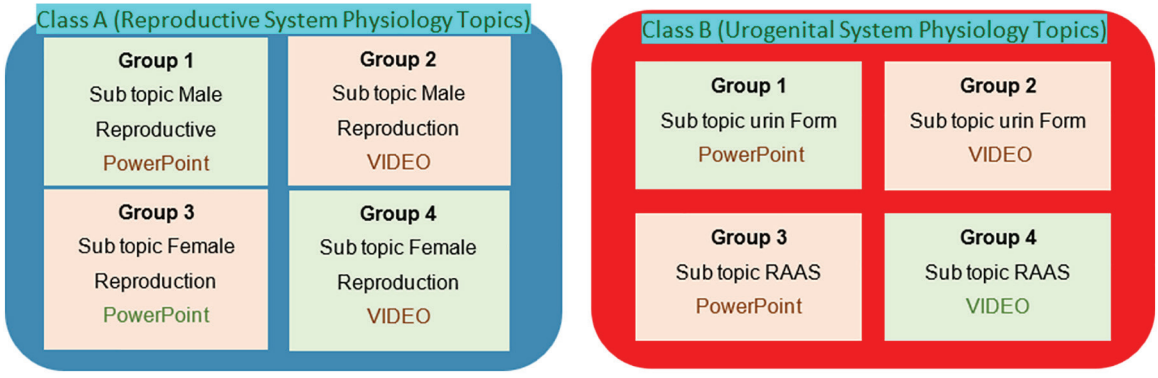

Figure 8: Classification of Presentation Groups, Topics, and Sub-topics

Discussion

The Influence of Various Learning Media on Undergraduate Students' Knowledge

According to the data presented in Table 2, most students prefer PowerPoint and video learning media as their favored educational tools. These media are particularly popular among students and frequently utilized in high schools before college. Nonetheless, some students opt for alternative learning media, such as poetry and roleplay. This research indicated that PowerPoint presentations and video media enhanced MCQ post-test outcomes across all classes (Table 3).

The observed increase in scores followed the utilization of diverse learning media, specifically PowerPoint and video. These findings corroborate prior research indicating that PowerPoint and video as educational media enhance learning outcomes and foster improved classroom dynamics, literacy, and oral and visual competencies (7, 8). Furthermore, PowerPoint and video facilitate articulating concepts clearly, ensuring uniform comprehension among students, thereby augmenting the efficacy of knowledge transfer (9, 10). Nonetheless, studies indicate that the outcomes are comparable to those of conventional media (11).

The Influence of Various Learning Media on Undergraduate Students' Presentation Outcomes

According to the data in Table 3, the group assigned the male reproduction subtopic achieved the highest score for student presentations utilizing PowerPoint in class A, focused on reproductive system physiology. Conversely, in class B, concerning the physiology of the genitourinary system, the group studying urine formation had the highest score. Additionally, the group assigned the female reproduction subtopic secured the highest score for student presentations employing videos in class A. In class B, the group obtained the highest score focused on the Renin Angiotensin Aldosterone System subtopic.

The varying scores in PowerPoint and video presentations may correlate with the distinct learning preferences among students in the four groups. The students who achieved the highest scores excelled in the PowerPoint presentation, demonstrating a visual learning style emphasizing the elucidation of images and objects within the subtopic of male reproduction and urine formation. Conversely, the group that excelled in the video presentation predominantly comprised auditory learners, focusing on the subtopic of female reproduction and RAAS. Auditory learners grasp systematically organized narratives more swiftly, often without meticulous attention to visual elements.

Previous research indicates that various learning styles significantly affect the students' intentions when selecting learning media, thereby serving as a crucial factor in the educational process. Additionally, variations in learning styles impact the efficacy and design of materials used for processing and presenting information (12, 13).

The Influence of Various Learning Media on Undergraduate Students' Motivation

Students who opt for inactivity perceive that the task allocation from the chairperson is inequitable, and the assignment of specific topics constrains their exploration of supplementary material. Nonetheless, educators can mitigate this issue by adopting blended learning strategies, which involve reinforcing content at the outset of sessions through module assignments and instructional video tutorials. Additionally, educators can consolidate learning post-presentation by offering constructive feedback on the substance and delivery of student presentations. This reinforcement is likely to enhance student outcomes. Research indicates that active learning modules and supplementary video tutorials correlate with increased self-confidence and improved final grades among students.

Many neutral students believe blended learning requires further implementation, as they can independently cover various topics or engage in group discussions. Nonetheless, they encounter certain materials that pose challenges, necessitating clarification and guidance from proficient lecturers. Additionally, students express the need for enhanced compilation and presentation of materials and reinforcement from lecturers through prior modules and video tutorials. The efficacy of blended learning in enhancing student comprehension aligns with previous research indicating that in a flipped classroom—akin to blended learning—empowering lecturers to provide video tutorials and modules at the outset can facilitate active learning and elevate the students' final grades (14-16).

This research has several potential biases. Firstly, students selected PowerPoint as their primary learning medium due to their familiarity with it since high school, leading to a preference for this format. Furthermore, the researchers only compared knowledge and presentation performance between the top two chosen media: PowerPoint and video. They did not consider the minority of students who indicated alternative learning methods, such as posters, stories, songs, roleplay, and poetry, in the initial questionnaire. This oversight may alienate these students, as they might feel compelled to participate in PowerPoint and video presentations that do not align with their interests, thereby diminishing their overall engagement in active learning.

This study possesses multiple limitations that warrant consideration. The study size was confined to 100 students from one institution, limiting the generalizability of the findings to other contexts. The research primarily concentrated on PowerPoint and video as educational mediums, neglecting a broader spectrum of tools that could impact the learning results. Third, although validated multiple-choice questions and rubrics were employed, there is still potential for additional refining and external validation to enhance the assessment rigor. The study evaluated short-term information acquisition and performance, neglecting the long-term implications on knowledge retention and application. Ultimately, while theoretical saturation was attained in the focus group discussions (FGDs), integrating perspectives from a broader and more varied qualitative sample could enhance the findings.

Conclusion

Implementing active learning through chosen media, such as PowerPoint and video, enhances knowledge retention, student engagement, and motivation. Active learning employs diverse methodologies and involves students. Consequently, the educational environment becomes more stimulating and interactive, facilitating the comprehension of lecture content.

Acknowledgment

The researcher wishes to convey profound appreciation to the lecturers and assistants of the physiology department at the Faculty of Medicine, Hasanuddin University. He also extends gratitude to the class of 2023 FKUNHAS students for their participation as research respondents. Additionally, the researcher acknowledges the collaborative research grant funds from the Faculty of Medicine, Hasanuddin University, in 2024, reference number 4667/UN4.6/PT.01.05/2024.

Authors' Contribution

All authors contributed to the discussion, read and approved the manuscript, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

The authors declare no conflicts of interest.

References

1. Bailey DM, Davies B, Castell LL, Newsholme KA, Jordinson M. Human Physiology. Nature. 1989;61(2):1.
2. Goodman BE. An evolution in student-centered teaching. Adv Physiol Educ. 2016;40(3):278–82.
3. Brown Wright G. Student-Centered Learning in Higher Education. International Journal of Teaching and Learning in Higher Education. 2011;23(3):92–7.
4. Lauri MA. WASP (Write a Scientific Paper): Collecting qualitative data using focus groups. Early Hum Dev. 2019;133:65–8.
5. O.Nyumba T, Wilson K, Derrick CJ, Mukherjee N. The use of focus group discussion methodology: Insights from two decades of application in conservation. Methods Ecol Evol. 2018;9(1):20–32.
6. Singh K, Bharatha A, Sa B, Adams OP, Majumder MAA. Teaching anatomy using an active and engaging learning strategy. BMC Med Educ. 2019;19(1):149.
7. Santos Espino JM, Afonso Suárez MD, González-Henríquez JJ. Video for teaching: classroom use, instructor self-production and teachers' preferences in presentation format. Technology, Pedagogy and Education. 2020;29(2):147–62.
8. Craig RJ, Amernic JH. PowerPoint presentation technology and the dynamics of teaching. Innovative Higher Education. 2006;31:147–60.
9. Adams C, Adams C. PowerPoint, Habits of Mind, and Classroom Culture. Journal of Curriculum Studies. 2006;38(4):389–411.

10. Adams C. PowerPoint and the Pedagogy of Digital Media Technologies [Internet]. 2012 [Cited 2025 Jan 14]. pp.139–54. Available from: https://www.researchgate.net/publication/302245790_PowerPoint_and_the_Pedagogy_of_Digital_Media_Technologies.
11. Baker JP, Goodboy AK, Bowman ND, Wright AA. Does teaching with PowerPoint increase students' learning? A meta-analysis. Comput Educ. 2018;126:376–87.
12. Mcloughlin C. The implications of the research literature on learning styles for the design of instructional material. Australian Journal of Educational Technology. 1999;15(3):1.
13. Balakrishnan V, Gan CL. Students' learning styles and their effects on the use of social media technology for learning. Telematics and Informatics. 2016;33(3):808–21.
14. Eichler JF, Peeples J. Flipped classroom modules for large enrollment general chemistry courses: A low barrier approach to increase active learning and improve student grades. Chemistry Education Research and Practice. 2016;17(1):197–208.
15. Long T, Logan J, Waugh M. Students' Perceptions of the Value of Using Videos as a Pre-class Learning Experience in the Flipped Classroom. TechTrends. 2016;60(3):245–52.
16. Ariyandi A. Interview Guide [Internet]. 2024 [Cited 3 March 2024]. Available from: https://figshare.com/.