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The Influence of Multimedia Learning and Students' Learning Motivation toward Biology Learning Outcomes

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Abstract: This study seeks into the effect of multimedia-based learning on the biology learning outcomes in the excretory system topic and influence of learning motivation on biology learning outcomes in the excretory system topic. This is a pre-experiment design without a control group, involving a sample of 20 students. The research procedure for this one-group pre-test-post-test pre-experiment consists of four stages: (1) preparation or planning, (2) implementation of research/observation, (3) processing and analyzing results and testing research hypotheses, and (4) drawing conclusions from the research findings. There is a significant impact of multimedia-based learning on the biology learning outcomes in the excretory system topic for eighth-grade students at a junior high school in West Sulawesi Province. 2. There is a significant influence of learning motivation on biology learning outcomes in the excretory system topic through the application of multimedia-based learning for eighth-grade students at a junior high school in West Sulawesi Province. The multimedia-based learning has a very significant effect on learning motivation because of understanding and better understanding of the retention of learning materials. Multimedia-based learning also allows students to learn in a more visual, auditory, and kinesthetic way. In this case, multimedia can help facilitate different learning styles in students, so that they can more easily understand and remember learning materials.

Kata Kunci:
Multimedia, Pembelajaran, Motivasi, Hasil Belajar, Teknologi Pendidikan

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Abstrak*: Penelitian ini bertujuan untuk mengetahui pengaruh pembelajaran berbasis multimedia terhadap hasil belajar biologi pada materi sistem ekskresi dan pengaruh motivasi belajar terhadap hasil belajar biologi pada materi sistem ekskresi. Penelitian ini merupakan desain pra eksperimen tanpa kelompok kontrol yang melibatkan sampel sebanyak 20 siswa. Prosedur penelitian pra-eksperimen one-group pre-test-post-test ini terdiri atas empat tahap: (1) persiapan atau perencanaan, (2) pelaksanaan penelitian/observasi, (3) pengolahan dan analisis hasil serta pengujian hipotesis penelitian, dan (4) penarikan kesimpulan dari temuan penelitian. Terdapat pengaruh yang signifikan pembelajaran berbasis multimedia terhadap hasil belajar biologi pada materi sistem ekskresi siswa kelas VIII di salah satu SMP di Provinsi Sulawesi Barat. 2. Terdapat pengaruh yang signifikan antara motivasi belajar terhadap hasil belajar biologi pada materi sistem ekskresi melalui penerapan pembelajaran berbasis multimedia pada siswa kelas VIII di salah satu SMP di Provinsi Sulawesi Barat. Pembelajaran berbasis multimedia berpengaruh sangat signifikan terhadap motivasi belajar karena pemahaman dan pemahaman yang lebih baik terhadap retensi materi pembelajaran. Pembelajaran berbasis multimedia juga memungkinkan siswa belajar secara lebih visual, auditori, dan kinestetik. Dalam hal ini multimedia*

dapat membantu memfasilitasi gaya belajar yang berbeda-beda pada siswa, sehingga mereka lebih mudah memahami dan mengingat materi pembelajaran

INTRODUCTION

The advancement of science and technology has brought changes to all aspects of life, making it necessary to master and enhance knowledge and technology to remain competitive in the global arena (Hidayat et al., 2024). Improving the quality of human resources must be carried out in a planned, focused, intensive, effective, and efficient manner (Ramadhana & Qudratuddarsi, 2024).

Education plays a crucial role in the process of improving human resource quality. The enhancement of education quality is an integrated process closely linked to the improvement of human resources (Zeyer, 2018). The rapid development of science and technology further accelerates the need for innovations in utilizing technological advancements within the learning process (Qudratuddarsi et al., 2022). One such innovation involves shifting from traditional teacher-centered learning, where interaction is one-directional, to student-centered learning, which promotes multidirectional interactions and creates a more interactive learning environment (Septikasari & Frasandy, 2018)

In the context of education, multimedia is utilized as an interactive learning tool. It plays a significant role in enhancing students' motivation, increasing their engagement in learning, and improving their understanding and academic performance. The use of multimedia in education supports better comprehension and retention of the material, as it allows students to learn through various modalities—visual, auditory, and kinesthetic (Haking & Soepriyanto, 2019) By catering to different learning styles, multimedia facilitates a more dynamic and effective learning experience (Ghozali et al., 2024).

The use of multimedia in learning activities and its impact on students' motivation aligns with cognitive learning theory, which emphasizes the active role of learners in the learning process (Evans et al., 2024). Incorporating multimedia into teaching provides students with opportunities to engage interactively, such as through simulations, experiments, and interactive activities. Cognitive development is closely related to the ability to think, reason, understand, and recall information about the world. This presents a unique challenge for 21st-century educators, who are expected to design learning strategies that provide high-quality learning experiences while adapting to the evolving demands of modern times (González-Pérez & Ramírez-Montoya, 2022).

The learning motivation of middle school students in various subjects is not always consistent (Miao et al., 2024). This poses a significant challenge for teachers to inspire and enhance academic performance, particularly in science subjects (Ramadhana et al., 2017) Based on observations and initial data collection through field studies and interviews with relevant officials and classroom teachers at a school in West Sulawesi, specifically during the second semester of the 2022/2023 academic year and continuing into the first semester of the 2023/2024 academic year, it was found that numerous obstacles remain concerning both the learning process and student outcomes, particularly in science subjects. The low motivation of students to learn science is evident from the lack of enthusiasm shown by some students during classroom activities. There is a noticeable decrease in student engagement in acquiring knowledge, as well as a general lack of motivation towards participating in learning activities. Such conditions and circumstances are clearly not conducive to an effective learning process, and it is highly likely that the educational objectives will not be optimally achieved. This situation calls for a concerted effort by educators to implement strategies that can reignite student interest and motivation, ensuring a more effective and productive learning environment.

The aforementioned issues significantly impact students' learning outcomes, as every learning process ultimately aims to achieve the desired learning objectives. Therefore, it is essential to employ multimedia learning tools that can create an engaging and enjoyable learning environment while fostering students' motivation to learn (Aldalur & Perez, 2023). This, in turn,

positively influences students' academic performance (Yusuf, 2019). Science, as one of the subjects taught at the middle school level, has distinctive characteristics (Almasri, 2024; Žák & Kolář, 2023). Some of its content emphasizes process skills, while other parts are more abstract and require effective visualization to capture students' interest (Atakan & Akçay, 2024; Qudratuddarsi et al., 2019.) Proper visualization makes the material more tangible and comprehensible, enabling students to better understand the concepts presented. This approach can significantly improve their learning outcomes.

METHOD

This study employed a Pre-Experimental Design without a control group. The effectiveness of the treatment was determined by comparing pre-test and post-test scores after the implementation of multimedia learning. The sample consisted of 20 students. Data collection techniques included a motivation questionnaire with 25 statements and an evaluation test with 40 multiple-choice questions to measure cognitive learning outcomes.

Data analysis methods included both descriptive and inferential statistics. The collected data, consisting of pre-test and post-test scores, were compared to determine if there was a significant difference between the two sets of scores. The comparison involved testing whether there was a significant difference between the mean pre-test and post-test scores using the t-test. Additionally, the study involved prerequisite analysis and hypothesis testing, including normality testing as part of the prerequisite analysis (Hidayat et al., 2021, 2022). The value of learning motivation is categorized into five, as follows:

Table 1. Categorization of Students' Learning Motivation Values

Score	Category
81-100	Very high
61-80	High
41-60	Enough
21-40	Low
0-20	Very Low

The criteria used to determine the categories of learning outcomes in Biology Science refer to the standard categories applied by the National Education Standards Agency (BSNP). These categories are as follows:

Table 2. The category of student's learning outcome

Score	Category
90-100	Very high
80-89	High
70-79	Moderate
60-69	Low
<59	Very Low

RESULTS AND DISCUSSION

The Effect of Multimedia Learning on Student Learning Outcomes

The cognitive learning outcome data was obtained from student assessments, including pretests and posttests, administered after the implementation of the multimedia learning treatment. This data can be analyzed through both descriptive and inferential analyses as follows:

Table 3. Descriptive statistics of students learning outcomes

			Statistic	Std. Error
Pretest	Mean		51.000	1.8970
	95% Confidence Interval for Mean	Lower Bound	47.029	
		Upper Bound	54.971	
	5% Trimmed Mean		51.528	
	Median		52.500	

	Variance			71.974	
	Std. Deviation			8.4837	
	Minimum			30.0	
	Maximum			62.5	
	Range			32.5	
	Interquartile Range			10.0	
	Skewness			-1.173	.512
	Kurtosis			1.412	.992
Postest	Mean			75.875	1.4653
	95% Confidence Interval for Mean		Lower Bound	72.808	
			Upper Bound	78.942	
	5% Trimmed Mean			75.833	
	Median			77.500	
	Variance			42.944	
	Std. Deviation			6.5532	
	Minimum			62.5	
	Maximum			90.0	
	Range			27.5	
	Interquartile Range			7.5	
	Skewness			-.133	.512
	Kurtosis			.406	.992

Table 4. Inferential statistics of Multimedia Learning towards student's learning outcome

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pretest - Postest	-24.875	11.1649	2.4965	-30.1003	-19.6497	-9.964	19	<,001	<,001

From Table 3, it is evident that there is a significant difference between pretest and posttest scores, with an average score increase of 24.875. This notable improvement is attributed to the intervention, specifically the implementation of multimedia learning, which has a significant impact on students' learning outcomes.

Furthermore, based on the t-test results shown in Table 4, the significance value is less than 0.001, which is below the alpha level of 0.05. This indicates that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a or H_1) is accepted. Therefore, it can be concluded that the application of multimedia learning significantly affects student learning outcomes.

The Effect of Learning Motivation on Student Learning Outcomes

Student motivation towards the learning materials was assessed using a motivation questionnaire administered before and after the intervention. The questionnaire consisted of 25 statements, both positive and negative, to which students provided responses that were scored accordingly. The results tables highlight a notable improvement in student motivation following the implementation of the learning intervention, which in turn positively influences their learning outcomes.

Table 5. Descriptive statistics of student's learning motivation

			Statistic	Std. Error
Pretest Motivasi	Mean		73.30	.880
	95% Confidence Interval for Mean	Lower Bound	71.46	
		Upper Bound	75.14	
	5% Trimmed Mean		73.39	
	Median		74.50	
	Variance		15.484	

	Std. Deviation		3.935	
	Minimum		65	
	Maximum		80	
	Range		15	
	Interquartile Range		6	
	Skewness		-.497	.512
	Kurtosis		-.205	.992
Postest Motivasi	Mean		80.60	.901
	95% Confidence Interval for Mean	Lower Bound	78.71	
		Upper Bound	82.49	
	5% Trimmed Mean		80.94	
	Median		80.00	
	Variance		16.253	
	Std. Deviation		4.031	
	Minimum		70	
	Maximum		85	
	Range		15	
	Interquartile Range		4	
	Skewness		-.998	.512
	Kurtosis		1.026	.992

Table 6. Inferential Statistics of Student Learning Motivation's Effect on Student Learning Outcomes.

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Pretest Motivasi - Postest Motivasi	-7.30	2.716	.607	-8.571	-6.029	-12.018	19	<,001	<,001

From Table 5, it is clear that there is a significant difference between pretest and posttest scores, with an average score increase of 7.300. Further analysis from Table 6 shows a significance value of less than 0.001, which is below the alpha level of 0.05. This indicates that the null hypothesis (H_0) is rejected and the alternative hypothesis (Ha or H_1) is accepted. Therefore, it can be concluded that learning motivation has a significant impact on student learning outcomes.

Discussion

A motivated student will strive to learn diligently and persistently, hoping to achieve positive outcomes (Filgona et al., 2020; Muenks et al., 2018; Sukarno et al., 2024). Conversely, if a student lacks motivation, they will not sustain their learning efforts and can easily become distracted by other activities. This demonstrates the significant influence motivation has on perseverance and persistence in learning (Uno, 2019).

The observed increase in learning motivation among eighth-grade students is largely attributed to the enhancement of student participation, achieved by encouraging students to ask questions and providing equal opportunities for all students to engage in classroom activities. Additionally, the teacher informed students of their exam results and clarified the objectives and benefits of the knowledge gained during the learning process, linking new topics with previously discussed content. According to (Uno, 2019), several motivational techniques can be employed in teaching, including (1) stimulating curiosity, (2) using familiar examples in learning, (3) requiring students to apply previously learned knowledge, (4) clarifying learning objectives, (5) providing feedback on achievements, (6) fostering healthy competition among students, and (7) offering students opportunities to demonstrate their skills publicly.

These findings align with research conducted by the author, in which descriptive analysis of multimedia-based learning implementation showed that multimedia-based learning positively influenced students' academic performance. Inferential analysis through covariance analysis

revealed significant differences and effects on students' learning outcomes in science, specifically in biology, among eighth-grade students at SMP Negeri 6 Satap Pamboang during the study of the excretory system.

The impact of this approach indicates that most students showed increased attention in learning biology, particularly in science lessons that utilized multimedia, such as PowerPoint presentations. The rise in the number of students asking and answering questions reflects their desire to better understand the material and solve problems, demonstrating commendable courage in asking questions. The use of multimedia in teaching has been shown to boost students' learning motivation, which in turn enhances their overall learning activity. When motivation is high, so is student engagement, leading to improved learning outcomes.

Active engagement is the primary driver of the learning process. To effectively manage and process learning materials, students must be physically, intellectually, and emotionally active. According to (Sardiman, 2020), while students are engaged in activity, thinking processes occur simultaneously. To train students to think independently, they must be given the opportunity to take action. Verbal thinking arises only after students engage in action-based thinking. The connection between verbal and action-based thinking leads to optimal learning activity, which in turn improves learning outcomes.

The high learning outcomes observed in this study are likely due to the use of multimedia, specifically PowerPoint-based presentations, which made learning more engaging for students. The animated presentations helped direct students' attention to key concepts and brought static ideas to life, transforming abstract concepts into tangible images. This ability to make abstract ideas more concrete through multimedia improved students' imagination and understanding.

Utilizing multimedia in teaching science, particularly biology, is crucial, given the abstract nature of much of the content, which students often find challenging to comprehend. (Sardiman, 2020) asserts that the appropriate and varied use of educational media can help overcome student passivity. In this context, educational media serve to: a) stimulate students' enthusiasm for learning, b) facilitate more direct interaction between students and their environment, and c) allow students to learn independently according to their abilities and motivations.

The improvement in learning outcomes is evident from the increased average scores of the students. As students progress through the learning process, their achievements rise accordingly. This improvement is also visible in daily classroom activities, where students exhibit greater enthusiasm, active participation, and growing knowledge. The positive effect of multimedia-based learning, particularly PowerPoint, becomes clear when comparing the progress made during these lessons to that of traditional lessons without multimedia (Abdulrahaman et al., 2020). Atmaja (2021) supports this finding, stating that the factors influencing learning outcomessukarnofall into two categories: (1) internal factors, including motivation, aspiration for success, intelligence, and prior knowledge, and (2) external factors, including the design and management of motivation and learning activities (Utami & Amaliyah, 2022; Yu, 2022)

Although motivation and the aspiration to succeed, as well as the management of these factors, do not directly affect learning outcomes, they influence the effort students exert to achieve those outcomes. Effort is an indicator of motivation, and learning outcomes are affected by the extent of the effort students invest (Lundgren & Eklöf, 2020; van Gog et al., 2020). Therefore, the greater the motivation and desire for success, the more effort students will put into achieving better learning outcomes (Amida et al., 2021; Safitri et al., 2023; Mubarok, 2019).

This study distinguishes itself by its focus on integrating multimedia-based learning tools, specifically PowerPoint presentations with animations, to address the abstract and often challenging nature of biological concepts in secondary education. While prior studies have demonstrated the general efficacy of multimedia in improving academic performance, this research delves deeper into its specific impact on student motivation and engagement in the context of science education, particularly in studying the excretory system. The novelty lies in its exploration of how multimedia transforms abstract ideas into visually stimulating and

comprehensible forms, fostering a more interactive and student-centered learning environment. By linking students' prior knowledge with new concepts through multimedia, the study underscores the potential of technology to bridge cognitive gaps, a dimension not extensively covered in earlier research.

Moreover, the study innovatively combines motivational techniques, such as fostering curiosity, providing timely feedback, and promoting active participation, with multimedia-based teaching strategies to amplify learning outcomes. Unlike traditional methods, where motivational strategies and teaching tools are often employed in isolation, this research integrates these approaches seamlessly, demonstrating their synergistic effect on students' academic performance and engagement. The comprehensive approach to examining both intrinsic (motivation and curiosity) and extrinsic (multimedia tools and structured activities) factors provides a holistic understanding of how tailored instructional strategies can significantly enhance learning in science education. This dual focus on cognitive and emotional dimensions of learning represents a significant contribution to the field of educational research.

CONCLUSION

This study demonstrates a significant impact of multimedia-based learning on the biology learning outcomes of eighth-grade students in the excretory system topic at a junior high school in West Sulawesi Province. Furthermore, it highlights the critical role of learning motivation in enhancing biology learning outcomes when multimedia-based learning is implemented. These findings provide valuable insights for educators in designing and implementing effective teaching strategies that integrate multimedia to enrich classroom experiences. Beyond offering practical guidance for teachers in selecting instructional media, this study serves as a meaningful reference for researchers aiming to explore innovative pedagogical approaches and advance the field of education.

The uniqueness of this study lies in its investigation of how multimedia can convert abstract concepts into visually engaging and easily understandable formats, creating a more interactive and student-focused learning experience. By integrating students' prior knowledge with new material through multimedia, the research highlights the capability of technology to close cognitive gaps, an aspect that has not been thoroughly explored in previous studies. Additionally, the study creatively merges motivational strategies—such as sparking curiosity, delivering prompt feedback, and encouraging active participation—with multimedia-driven teaching methods to enhance learning outcomes effectively.

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