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LEARNING STYLES ON ELEMENTARY STUDENTS' LEARNING OUTCOMES IN THE HUMAN RESPIRATORY SYSTEM USING CONVENTIONAL TEACHING METHODS

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Abstract
Students are less interested in the complicated content on the human respiratory system that is taught using traditional methods. Students' learning outcomes are impacted by traditional instruction that ignores learning style. This research aims to analyze the influence of learning styles on the learning outcomes of fifth-grade elementary school students on the topic of the human respiratory system. The method used in this study is an analytical design with a cross-sectional approach. This study involved 34 fifth-grade students from SDN X and SDN Y in Bulukerto District. The researcher identified learning styles through a modified questionnaire and learning outcomes through optional evaluation questions according to the learning styles. There are 12 people with a visual learning style, 13 people with an auditory learning style, and 9 people with a kinesthetic learning style. The audio learning style having the highest average at 73.46, the kinesthetic learning style at 68.33, and the visual learning style at 67.5. There is no statistically significant difference in the average scores of the three learning styles (p-value=0.391). The findings of this research indicate that conventional learning is more effective for auditory learning styles and can still be used for visual learning. To facilitate all learning styles, the development of interactive multimedia for the human respiratory system material is necessary. Future research should increase the sample size using experimental research and control external factors.
Keywords: *Learnng Styles; Learning Outcomes; Elementary Student; Human Respiratory System*

Abstrak
Materi pembelajaran sistem pernapasan manusia yang kompleks dan diajarkan dengan metode konvensional kurang diminati oleh siswa. Pembelajaran konvensional tanpa memperhatikan gaya belajar berpengaruh terhadap hasil belajar siswa. Penelitian ini bertujuan untuk menganalisis pengaruh gaya belajar terhadap hasil belajar peserta didik kelas lima tingkat sekolah dasar pada materi sistem pernapasan manusia. Metode yang digunakan dalam penelitian ini yaitu desain analitik dengan pendekatan cross sectional. Penelitian ini melibatkan 34 peserta didik kelas V SDN X dan SDN Y Kecamatan Bulukerto. Peneliti mengidentifikasi gaya belajar melalui kuesioner yang telah dimodifikasi dan hasil belajar melalui soal evaluasi secara optional sesuai dengan gaya belajar. Terdapat 12 orang dengan gaya belajar visual, 13 orang dengan gaya belajar audio, dan 9 orang dengan gaya belajar kinestetik. Gaya belajar audio memiliki rata-rata paling tinggi yaitu 73,46, gaya belajar kinestetik yaitu 68,33, dan gaya belajar visual yaitu 67,5. Tidak terdapat perbedaan nilai rata-rata dari ketiga gaya belajar secara statistic (p value=0,391). Temuan penelitian ini yaitu pembelajaran konvensional lebih efektif untuk gaya belajar auditori dan masih dapat digunakan untuk visual. Untuk memfasilitasi seluruh gaya belajar, perlu pengembangan multimedia interaktif untuk materi sistem pernafasan manusia. Penelitian selanjutnya sebaiknya meningkatkan jumlah sampel menggunakan penelitian eksperimen dan mengendalikan faktor eksternal.
Kata Kunci: Gaya Belajar; Hasil Belajar; Sekolah Dasar; Sistem Pernapasan Manusia

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Introduction

Teachers play a significant role in achieving learning objectives that will impact students' learning outcomes (Putri et al., 2020). Learning outcomes are the level of achievement of students' success in certain subject matter that can be expressed in scores from test results (Irawati et al., 2021). Good learning outcomes are indicators of success in learning (Irawati et al., 2021; Isnanto, 2022; Yuniarsih & Kamaludin, 2021). Therefore, teachers must possess the ability to teach using engaging and effective learning methods. Learning outcomes can be influenced by internal factors such as intelligence, health, students' learning styles, interests, and motivation, as well as external factors such as family, school, and community (Isnanto, 2022; Yuniarsih & Kamaludin, 2021).

In this era of digitalization, students are accustomed to digital tools, especially gadgets. Technology presents dynamic and rapid information with a combination of images, videos, text, and sound, making learners accustomed to audiovisual learning methods (Szymkowiak et al., 2021). This shows that in the digital era, elementary schools are also affected in terms of teaching methods shifting from traditional to technology-based (Sumardi et al., 2020; Tuma, 2021). the era of digitalization can influence students' learning styles. Individual differences also have different learning styles that can affect learning outcomes. Learning styles are approaches to how students learn, focusing on the process of understanding difficulties in receiving new information through different individual perceptions to achieve learning outcomes (Ezzeddine et al., 2023; Gayef et al., 2023; Irawati et al., 2021; Putri et al., 2020; Rashad Sayed et al., 2024; Wu & Wang, 2025). According to (Deporter & Hernacki, 2016), learning styles consist of auditory, visual, and kinesthetic. The auditory learning style relies more on the sense of hearing to obtain information, the visual learning style emphasizes sight, and the kinesthetic learning style emphasizes touch, movement, and experience. Previous research states that a single teaching method is not suitable when applied to a classroom group with diverse learning styles (Halim et al., 2021; Wu & Wang, 2025). Therefore, teachers need to pay attention to students' learning styles, which should be adjusted according to the type of material to be taught.

According to previous research, learning style can affect learning outcomes. A study by (Halim et al., 2021) states that there is a positive and significant relationship between learning styles and students' learning outcomes in physics subjects. Similar research by (Irawati et al., 2021), found that there is a significant influence between learning styles and the learning outcomes of elementary school students in natural sciences. The influence of learning styles on learning outcomes is also mentioned by (Kusumasari & Nugraheni, 2023), where there are differences in learning outcomes among visual, auditory, and kinesthetic styles in the subject of fractions in mathematics. Based on several studies, the characteristics of the material also need to be considered in relation to students' learning styles.

One of the subjects that requires attention to the learning objectives to be achieved is IPAS on the human respiratory system material. The material on the human respiratory system includes content about natural and social sciences that involve many organs with abstract and complex information (Han & Kim, 2019; Irawati et al., 2021; Napitupulu et al., 2019). Therefore, due to this complexity, a teaching method that can accommodate all learning styles of students is needed. However, currently, teachers still use conventional teaching methods. To analyze in depth the influence of learning styles on learning outcomes in conventional teaching methods, the researcher used a sample of two public elementary schools in Bulukerto District with accreditation characteristics and a number of students meeting the differential statistical test criteria.

Science education in elementary schools today still largely uses the lecture method. Research by (Nisa'i et al., 2022), tates that science subjects in both upper and lower grades of elementary school are delivered using the lecture method, whereas science subjects require students to understand how a natural event can occur, so teachers must have the skills to enhance learning motivation so that students do not become passive. The lecture method is also used in Ciporos Cilacap elementary school, the researcher mentioned that teachers have not yet utilized creative media due to the numerous administrative task demands (Nurlaeli, 2021). he same applies to the two elementary schools that are the subjects of this research, in the fifth-grade human respiratory system material, still use the lecture method with books as the media. The students' learning outcomes show that the average score on the human respiratory system material test is 66,33. This indicates that the students have not yet achieved the expected level of competence. An initial study of the two elementary schools found that there are three types of learning styles: visual, auditory, and kinesthetic. Through conventional teaching, the teacher has not yet been able to facilitate those three learning styles.

According to the teachers, they have been participating in continuous professional development training, but have not yet been able to implement it in their teaching. This is due to the lack of school commitment and support in terms of facilities and infrastructure, such as adequate equipment and internet access, to help innovate the use of learning media that can accommodate all students' learning styles.

Apart of the limited studies for analyzing student learning outcomes based on learning styles in the human respiratory system material, this study also uses evaluation questions tailored to each individual's learning style. Visual learning style uses optional questions, audio learning style uses questions narrated in the form of sound, and kinesthetic learning style uses questions in the form of games. Several previous studies assessed learning outcomes using indicators in the form of students' Semester Final Assessment results (Isnanto, 2022). This research aims to analyze the influence of learning styles on the learning outcomes of fifth-grade elementary school students on the topic of the human respiratory system. Learning styles in this study are categorized into auditory, visual, and kinesthetic. Based on the objectives, the problem statement is obtained: does learning style significantly affect the learning outcomes of fifth-grade elementary school students on the topic of the human respiratory system? Through this research, it is hoped to support several previous studies on the importance of considering learning styles as well as innovations in teaching methods and media that can accommodate all learning styles of students to achieve optimal learning outcomes.

Research Methods

This study uses an analytical design with a cross-sectional approach, because this study aims to analyze the influence without concluding a cause-and-effect relationship (Maier et al., 2023). The researcher collected data on learning style identification and learning outcomes within a single period in December 2024. This study used 34 fifth-grade students from two elementary schools, SDN X and SDN Y in the Bulukerto District of Wonogiri Regency. Total sampling was used to determine the sample size, because of the small population (Suriani et al., 2023). The sample in this study consists of students aged 11-12 years old, students who participate in learning about the human respiratory system, do not have health issues that could affect learning outcomes, and have obtained parental permission to participate in the research. Both schools have not yet used media on the human respiratory system material except for lectures and textbooks. The researchers chose schools with an A accreditation to control for the

external factor of school quality. This study uses the human respiratory system material in the IPAS subject.

The researcher identified students' learning styles using a questionnaire modified from Bobbi Deporter and Mike Hernacki in their book Quantum Learning (Deporter & Hernacki, 2016). The measurement of learning outcomes uses evaluation question instruments designed according to the student's learning styles. Visual learning style uses optional question sheets, audio learning style uses questions narrated with sound, and kinesthetic learning style uses game-based questions. All of these instruments have undergone feasibility testing by experts (expert judgment), both subject matter experts and evaluation experts, to ensure the validity of the questions. Here are the guidelines for the students' learning styles:

Table 1. Blueprint of the Learning Style Questionnaire

No.	Learning Style	Component	Indicator	Question Number	Number of Question
1.	Visual	Appearance	1.1 Neat and orderly	1, 3	2
		Speaking	2.1 Speaking quickly	2, 9	2
		Reading	3.1 Prefer reading alone quickly and diligently	4, 10	2
		Understanding	4.2 More likely to remember what is seen than what is heard	6, 7	2
		Hobby	5.1 Preferring art over music	5, 8	2
			Jumlah	**10**	
2.	Kinesthetic	Appearance	1.1 Can't sit still for a long time	11, 12	2
		Speaking	2.1 Stand close together when speaking softly	13,14	2
		Reading	3.1 Using fingers or mirroring actions in reading	15, 16	2
		Understanding	4.1 Learning through practice and group work	17, 18	2
		Hobby	5.1 Taking time to exercise and engage in other physical activities	19, 20	2
			Jumlah	**10**	
3.	Auditorial	Appearance	1.1 Easy to get along with	22, 25	2
		Speaking	2.1 A good and fluent speaker	21, 27	2
		Reading	3.1 Reading aloud, moving lips/pronouncing words	23, 24	2
		Understanding	4.1 Learning by listening and discussing	26, 28	2
		Hobby	5.1 Prefer music over painting	29, 30	2
			Total	**10**	
			Number of Questionnaire Items	**30**	

The learning style questionnaire consists of 30 questions that include inquiries for three types of learning styles: 10 questions for visual learning, 10 questions for auditory learning, and 10 questions for kinesthetic learning. The type of learning style is determined by the highest total score among the three learning styles. Here are the learning outcome guidelines:

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Table 2. Question Framework for Learning Outcome Evaluation

Material Indicator	Question Indicator
Identifying the human respiratory organs	Presented with an image of the human respiratory system, students are able to accurately analyze the human respiratory organs. Presented with a narrative about one of the human respiratory organs, students are able to analyze the respiratory organ. Presented with a narrative about one of the human respiratory organs, students are able to analyze the human respiratory organ accurately. Presented with a narrative of one of the human respiratory organs, students are able to analyze the human respiratory organ accurately. Presented with an image of the human respiratory system, students are able to accurately analyze the human respiratory organs.
Analyzing the respiratory process in humans	Presented with an image of the human respiratory inspiration process, the students are able to explain the human inspiration process in a systematic manner. Presented with a list of human respiratory organs, the students are able to accurately detail the sequence of human respiratory organs. Presented with a narrative about the process of human respiration, students are able to accurately analyze the human respiratory process. Presented with the types of changes that occur in human respiration, students are able to accurately analyze the process of air changes that take place. Presented with a narrative about daily human activities, the students are able to accurately correlate the causes of shortness of breath. Presented with a text about events occurring in human respiration, students are able to accurately analyze the events happening in one of the human respiratory organs.
Analyzing the function of the respiratory system in humans	Presented with a picture of the nose, the students are able to accurately analyze the function of the human respiratory organs. Presented with an image of the human respiratory organs, students can analyze the function of the human respiratory system. Presented with a description of the human respiratory organs, the students are able to accurately distinguish the function of one of the respiratory organs. Presented with an image of the human respiratory organs, the students are able to accurately determine the function of one of the human respiratory organs. Presented with a narrative about the dangers of a certain gas, students are able to accurately conclude the dangers of that type of gas to human respiration.
Identifying various disorders of the human respiratory system	Presented with a narrative about respiratory system disorders, students are able to accurately diagnose the type of disease related to the human respiratory organs based on its symptoms. Presented with a narrative about respiratory system disorders, students are able to accurately identify the types of human respiratory organs that are affected. Presented with a narrative about respiratory system disorders, students are able to accurately diagnose the symptoms shown when experiencing respiratory disturbances. Presented with a brief narrative, students are able to correlate respiratory disorders with appropriate ways to address them.

Analyzing various ways to prevent respiratory diseases	Presented with a narrative about the characteristics of respiratory disorders, students are able to take the right steps to prevent the transmission of respiratory diseases accurately. Presented with statements about behaviors related to the respiratory system, students are able to accurately analyze the appropriate behaviors. Presented with statements about behaviors related to the respiratory system, students are able to accurately analyze the appropriate behaviors. Presented with images of behaviors that maintain the respiratory system, students are able to accurately select the appropriate behaviors. Presented with a narrative about lung diseases, students are able to accurately select efforts to prevent respiratory tract infections.

The evaluation questions for visual learning styles consist of 25 questions, the assessment for auditory learning styles consists of 25 questions, and the assessment for kinesthetic learning styles consists of 25 questions. All learning outcome questions have the same material and level of difficulty. The assessment of learning outcomes uses the total score on each learning outcome question according to the learning style. The researchers conducted validity test of the learning outcomes questionnaire and realiability test with a Cronbach's alpha result of 0,79. Data analysis used a one-way ANOVA test to compare the average learning outcomes based on students' learning styles. To protect the rights of the respondents, the researcher used Informed consent as proof of willingness to participate in the study.

Result and Discussion

Based on the learning style questionnaire filled out by the respondents, the results are as follows:

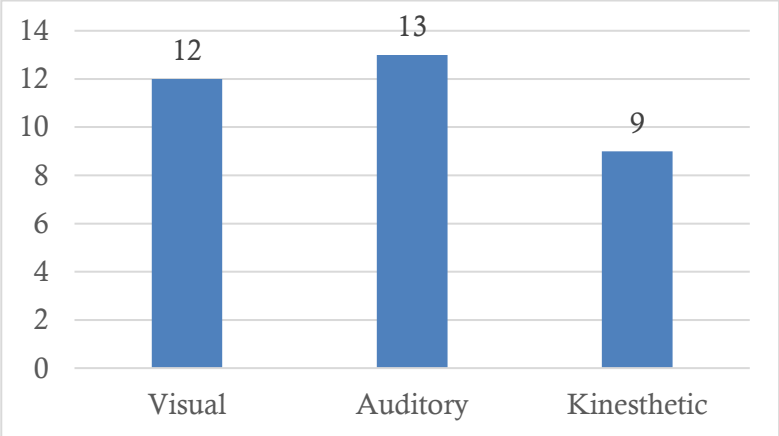

Figure 1. Distribution of Students' Learning Styles

Based on the image above, out of 34 students, there are 12 with a visual learning style, 13 with an auditory learning style, and 9 with a kinesthetic learning style. Therefore, auditory, visual, and kinesthetic learning styles are almost evenly distributed among the fifth-grade students. This needs to be a concern for teachers as an internal factor of students that can affect learning outcomes. Because if teachers teach with the same subject matter, methods, and assessments, students do not have the same opportunity to achieve optimal learning outcomes (Halim et al., 2021; Yuniarsih & Kamaludin, 2021). This is also because students individually

have different learning styles. Students who receive instruction through methods that do not align with their learning styles will not be interested and will easily become bored (Halim et al., 2021).

Here are the learning outcomes (average scores) of students based on their learning styles:

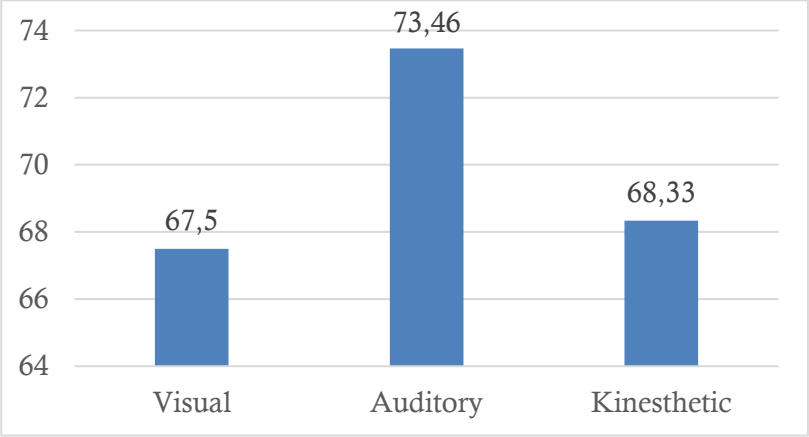

Figure 2. Average Student Learning Based on Learning Styles in Conventional Learning Methods

Figure 2 presents the role of learning styles on students' learning outcomes with the conventional teaching method. Based on the above image 2, the audio learning style has the highest average at 73.46, followed by the kinesthetic learning style with an average score of 68.33, and the visual learning style with an average score of 67.5. Here are the results of the statistical test to determine the differences in average scores among the three learning styles:

Table 3. Results of the One-Way ANOVA Statistical Test

Learning Style	N	Mean	Std. Deviation	Minimum	Maximum	Significance
Visual	12	67.50	8.919	55	85	0,391
Auditory	13	73.46	12.972	50	90	
Kinesthetic	9	68.33	12.247	50	85	
Total	34	70.00	11.481	50	90	

Table 3 above shows that each learning style has almost the same minimum and maximum values. In the visual learning style, the minimum score is 55 and the maximum score is 85. In the auditory learning style, the minimum score is 50 and the maximum score is 90. In the kinesthetic learning style, the minimum score is 50 and the maximum score is 85. The significance level indicates that pvalue=0.391 or pvalue > 0.05, which means there is no significant difference in the average values of the three learning styles. This indicates that there are external factors beyond learning styles that may play a role in determining students' learning outcomes. Therefore, further research is needed on other factors that influence learning outcomes. Several factors that can influence learning outcomes include personal factors, teacher and student motivation, student engagement and interactivity, teacher quality, teaching methods, and parental background (Gerhard et al., 2023; Tran et al., 2025; Wekerle et al., 2020). Penelitian oleh (Adhani et al., 2022), memperoleh hasil bahwa gaya belajar mempengaruhi sebanyak 36,6% terhadap hasil belajar siswa dan 63,4% dipengaruhi oleh faktor lain seperti motivasi belajar, pola asuh orang tua, dan lingkungan belajar.

The limitation of this study is the small sample size of 34 students, which cannot represent the entire population. Previous research by (Halim et al., 2021) used 120 students and research by (Irawati et al., 2021) with 70 students obtained results indicating a significant influence between learning styles and learning outcomes. Furthermore, the researchers did not control for most factors that might influence students' learning outcomes. In order to obtain cause-and-effect evidence, researchers can subsequently use an experimental research design with a control group and a larger sample size.

Based on Figure 2, the average score of the human respiratory system material among students is highest for the auditory learning style. This result is consistent with previous research (Sayed et al., 2025), which states that conventional or traditional learning methods are usually conducted statically or based on predetermined rules. This conventional method is easy and effective in the early stages, but learners cannot dynamically adapt to changes in student behavior or learning environments. The conventional learning method is very suitable for auditory learning styles, can be used for visual learning styles, and is not suitable for kinesthetic learning styles. This is also in line with Skinner's behaviorism theory, which emphasizes the stimulus-response mechanism to achieve learning outcomes (Muis et al., 2024). The stimuli referred to are sound for auditory learning styles and text or images for visual learning styles.

In this study, students with a kinesthetic learning style had slightly higher average scores compared to students with a visual learning style. Based on the researcher's observations during the learning process, students with a visual learning style were slow in copying the learning material written on the board, and some students were reluctant to take notes. Through conventional learning, teachers should summarize and create learning outlines to accommodate students with visual learning styles (Halim et al., 2021). Nevertheless, previous research states that the lecture method is economical, flexible, and supports critical thinking (Ssemugenyi, 2023). The lecture method can teach highly structured fact-based content within a limited timeframe, but its drawback is that it cannot engage students in direct factual learning.

Teachers need to pay attention to the characteristics of learning materials and students' learning styles in order to design an effective educational curriculum through the appropriate learning styles (Gayef et al., 2023). This becomes an important component to enhance students' analytical abilities through a conducive and positive learning environment. The mismatch between teaching methods and students' learning styles results in students losing interest in the material, feeling hopeless, and performing poorly in exams (Ezzeddine et al., 2023). An optimal and varied learning method, aligned with the identification of individual or group or class learning styles, can optimize students' learning outcomes (Ezzeddine et al., 2023; Gayef et al., 2023; Halim et al., 2021; Rasmitadila & Dewi, 2019; Wu & Wang, 2025).

One of the efforts to accommodate all learning styles of students is through the use of interactive learning multimedia. Interactive learning multimedia combine images, videos, texts, audio, and animations packaged in digital files to deliver learning materials to students according to the teacher's needs and tailored to the students' learning styles (Geni et al., 2020; Munawaroh et al., 2022). Research by (Gunawan et al., 2016) through a quasi-experiment with interactive multimedia also states that mastery of material concepts is influenced by interactive learning multimedia and there are differences in learning outcomes with different learning styles. This is an effort to facilitate students who are becoming overly dependent on technology in all aspects of daily life so that in the learning process, they are more interested in virtual simulations and educational videos. According to (Ezzeddine et al., 2023), age and generation are one of the factors that need to be considered in determining the learning method.

Interactive learning media has been widely used for STEM, including the human respiratory system material. This is because STEM is a complex subject that requires teamwork, assessment, and the capacity to solve the problem in daily life (Hu et al., 2024; Raisal et al., 2024). Research by (Khairani et al., 2023), also state that the use of interactive learning media in STEM can increase the attention and motivation of elementary school students.Interactive learning multimedia also greatly supports learning on the topic of the human respiratory system.

Research by (Alyusfitri et al., 2024), shows that the use of interactive multimedia based on e-modules for science subjects, namely outer space and mathematics, has a significantly positive effect on the learning outcomes of elementary school students. Interactive multimedia in the form of Gamified Learning, such as Kahoot, can also enhance understanding of scientific concepts and principles as well as increase active participation among elementary school students (Rayan & Watted, 2024). Research that demonstrating the effectiveness of interactive multimedia on elementary school students using virtual reality games was also conducted by (Lai, 2024), through experimental research, it was shown that fourth-grade students utilizing virtual reality had higher cognitive skills as well as better depth, accuracy, and application of scientific concepts. Through experimental research, (Lin et al., 2024) found that the group receiving the intervention in the form of Alternative Reality Game (AGM) utilization had a deeper understanding of the consept, with higher participation and emotional engagement compared to the control group.

Although in theory learning styles are a factor that influences learning outcomes, previous research through a systematic literature review revealed that 2 out of 3 analyzed articles mentioned that there is no correlation between learning styles and learning outcomes (Asbari et al., 2020). The author states that the learning style theory classifies people nominally, where students tend to have a preference for only one learning style. In fact, it is very likely that a student experiences a development of perception based on the experiences felt during their educational journey. That reflection can give rise to new perceptions and change old behaviors, leading to the adoption of new behaviors. So students can change and develop their preferences along with the maturity of their souls, changing their learning styles, as found by (Mahasneh et al., 2021) in their research study. Therefore, learning styles are contextual and depend on teaching styles, learning facilities, and other supporting environments such as technology.

Conclusion

The learning styles of the students in the fifth grade are almost evenly distributed, consisting of 12 people with a visual learning style, 13 people with an auditory learning style, and 9 people with a kinesthetic learning style. The audio learning style has the highest average at 73.46, followed by the kinesthetic learning style with an average score of 68.33, and the visual learning style with an average score of 67.5. Statistically, there is no significant difference in the average scores of the three learning styles. The conventional learning method with lectures and books is effective for the auditory learning style. Teachers need to pay attention to the variation in students' learning styles to determine effective teaching methods especially in instructional design. One of the efforts that can be made is by utilizing interactive learning multimedia that can present material in a combination of images, text, audio, and animation. Interactive learning media can be utilized according to the needs of teachers and students. The implications of the research for curriculum design are the need for differentiated learning and the development of teaching materials that take into account students' learning styles. Future research should be able to control and analyze external factors that may influence learning outcomes using experimental methods and a broader sample, and exploring whether blended

learning can enhance student engagement and learning outcomes across different learning styles.

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