



Analysis of Middle School Students' Learning Styles for Differentiated Learning in Mathematics

Azi Nugraha¹, Erlinda Isulis Marissa^{2*}, Elly Rizeqia Fadilah³

^{1,3} Department of Mathematics Education, STKIP Yasika, Majalengka, Jawa Barat, Indonesia

² Department of Mathematics Education, Universitas Negeri Semarang, Semarang, Jawa Tengah, Indonesia

*Correspondence: eimarissa21@gmail.com

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ABSTRACT

The aim of this research is to obtain a description of students' learning styles in studying mathematics. Learning style questionnaires and in-depth interview methods were used in this qualitative descriptive research design. Thirty class VIII students from one of the middle schools in Majalengka Regency were used as research subjects and 3 of them were chosen to be interview subjects. An interview guide and a Google form-based learning style questionnaire were used as research instruments. The data analysis approach used is data reduction, data presentation, and drawing conclusions. The data from the learning style questionnaire were analyzed based on the type of learning style, then 3 subjects were selected for in-depth interviews. The results of the questionnaire and interviews are then concluded. The results of the research show that the learning styles of class VIII students at a junior high school in Majalengka have a variety of learning styles where the dominant learning style of the students is the visual learning style, followed by the auditory learning style and the least is the kinesthetic learning style. These findings indicate that the visual learning style is the most common type of learning. To develop differentiated learning, teachers and schools must consider the different learning styles and needs of students.

Keywords: learning styles, mathematics lessons, differentiated learning

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Introduction

Education in Indonesia is still being improved, and one of these improvements is curriculum modification. To ensure that the educational model remains current, these changes must be maintained. According to Ki Hajar Dewantara, education in Indonesia is currently intellectual, spiritual, physical and social goals (Himmah & Nugraheni, 2023). In addition, Ki Hadjar Dewantara (Marwah et al., 2018) set the goal of education, namely liberating children's lives and livelihoods by providing advice to ensure their happiness and security. An independent curriculum that prioritizes freedom of learning and humanization of humans is used in this curriculum revision. This is in line with (Latifah, 2023), who states that the idea of independent learning for students is created from the independent curriculum itself. According to (Fitriyah & Wardani, 2022), an independent curriculum is a substitute curriculum that can modify learning objectives to meet world demands while maintaining the basic values of Pancasila.



(Wulandari, 2022) states that the independent curriculum uses a new learning paradigm, which gives teachers the opportunity to adapt learning and evaluation to students' needs and characteristics, and prioritizes student-centered learning.

Curriculum implementation cannot separate teachers' responsibilities in fostering a learning environment. The various functions carried out by teachers in the learning process are strengthened by the introduction of an independent curriculum policy (Daga, 2021). It is important for educators to focus on their understanding of the basic traits of their students. Teachers can identify the needs of each student and develop appropriate learning plans based on these needs to improve learning outcomes by using student needs mapping exercises to reveal the diversity and characteristics of all their students (Rahmawati et al., 2023). Determining the characteristics of each student, taking into account socio cultural background, initial skills, and learning styles is a different matter. Therefore, the profile of student learning styles is the main emphasis in this research.

Learning styles according to (Mayung et al., 2023), is the way individuals formulate their learning approaches and the efforts they make in processing new and challenging information from various points of view. (Ningrat et al., 2018) define learning style as a method of receiving and understanding information that is connected to the learning environment and used as an indication of action. Student learning styles are defined by (Pertiwi et al., 2023) as unique preferences that influence how students absorb, process, and store information. From various expert perspectives, it is concluded that a person's learning style is determined by how well they are able to receive and process information.

According to (Alhafiz, 2022), there are three types of learning styles, namely kinesthetic, auditory and visual. Students who lean toward a visual learning style are adept at processing visual information. They like visual media that helps information processing, such as pictures, graphs, films, posters, animations, concept maps, colors and symbols. Students who lean towards auditory learning are good at processing information through listening. To understand the material, students participate in tutorials and presentations, listen to lectures, and make jokes and anecdotes. Students who tend toward a kinesthetic learning style, on the other hand, are more likely to absorb knowledge that is best understood through hands-on experience.

The importance of assessing student learning styles can help educators develop more effective learning plans. Teachers can apply appropriate strategies, including using visual or auditory aids or involving students in kinesthetic activities related to lesson content, by knowing students' preferred learning methods (Apipah & Kartono, 2017). As a result, they will be more involved in the learning process and understand the material better. There is a lot of literature on learning style analysis due to the fact that it is very important for determining learning strategies, media, and teaching modules.



Problems in the field show that the learning methods implemented are not optimal in accommodating the diverse learning styles of students. Apart from that, based on the findings of observations and interviews conducted by researchers at one of the secondary schools in Majalengka Regency, because they have not carried out diagnostic tests based on learning styles, teachers also lack information about their students' learning styles. Because they have not carried out diagnostic tests based on learning styles, teachers also lack information about their students' learning styles. The interview results show that although the teacher has formed diverse groups for discussion activities and knows most of the students' characteristics, the teacher has not grouped students based on their preferred learning styles, nor has they utilized this information to improve the learning process. This results in monotonous teaching in class. Teachers should provide learning models that are in line with current student-centered educational ideas, not the ideal conception of teacher-centered learning, as presented by Alhafiz's research (2022).

The diverse learning styles of students need to be adapted to various types of learning. Differentiated learning is a learning strategy that is suitable for teachers to use during the learning process because it is impossible to generalize children's learning styles. Differentiated learning was described by (Faiz et al., 2020) as a series of intentional actions taken by educators with the goal of planning successful learning, developing a supportive learning environment, and meeting each student's unique learning needs. Differentiated learning allows the identification of students according to their characteristics. In accordance with (Herwina, 2021) statement that because differentiated learning is individual, students can obtain the best learning outcomes, products and methods are designed taking their needs into account.

Both teachers and students can benefit from differentiated teaching. Because students are in the learning process based on their needs, teachers can analyze and evaluate learning in an appropriate way without requiring any engineering. According to the view of (Himmah & Nugraheni, 2023), providing accommodation for creativity and a low perspective on failure encourages students to adapt their learning to their own talents and as a result influences changes in behavior in students. Teachers apply differentiated learning to avoid generalizing to each student. Because every student is different from birth, learning style is an important factor in the educational process.

According to (Subhan, 2022), the initial assessment is the beginning of the differentiated learning phase. After the evaluation, teachers can create learning plans based on the results of diagnostic tests, learning styles, and other intelligence tests. This research focuses on class VIII junior high school students in ensuring students' learning readiness, interests and learning profiles, and to help teachers determine appropriate learning to apply to children based on their developmental stage.

Based on the description above, A basic investigation was carried out to describe students' learning



styles at a secondary school in Majalengka Regency. The findings of this analysis will be useful information for classroom teaching, because learning differentiated must be able to take into account variations in the unique characteristics of each student according to their learning preferences. The availability of this data will facilitate the application of differentiated learning across subjects, thereby enabling the optimization of learning strategies to produce optimal student learning outcomes and an effective and efficient learning environment.

Methods

Qualitative research using a descriptive approach is the research method used. The descriptive approach in qualitative research is a method that characterizes and interprets an object as it really is (Zelllatiifanny & Mudjiyanto, 2018). Because purposive sampling was used in this research, the research subjects were 30 class VIII students from one of the middle schools in Majalengka Regency and 3 of them were chosen to be interview subjects. The research instruments used were learning style questionnaire sheets to determine student learning style tendencies and interview guides to determine student responses from the results of the learning style questionnaire. The data collection technique used was a questionnaire technique to determine student learning styles and in-depth interviews. The research procedure applied in this research has three stages, namely the planning stage, implementation stage and completion stage. The data analysis technique from Miles and Huberman (Sugiyono, 2019) was used in this research with the stages of data reduction, data presentation, and conclusion verification. Data analysis begins with obtaining data from filling out a learning style questionnaire and in-depth interviews which are then sorted according to research needs, then the data is presented in percentages of student learning styles and descriptions of learning styles through interview results and the final stage is drawing conclusions from the presentation of the data carried out. Source triangulation ensures the validity of the data that researchers use in this research.



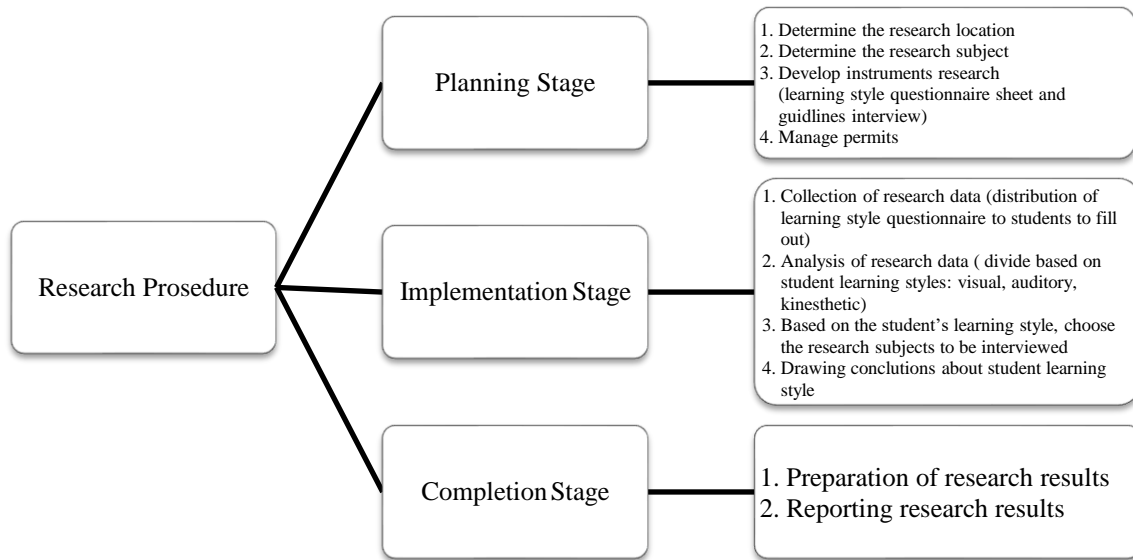


Figure 1. Research Procedure

Results and Discussion

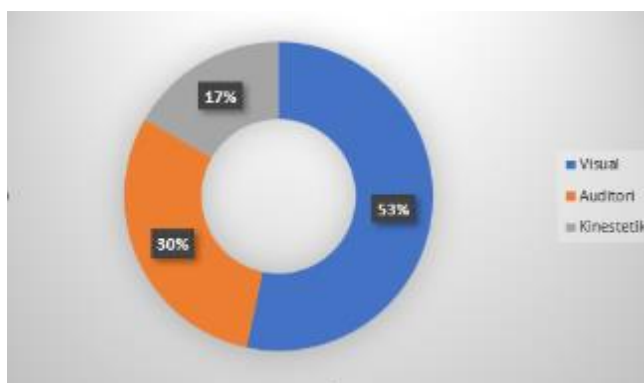
Results

This research examines several different aspects of students, namely learning styles including visual, auditory and kinesthetic. Based on research from Bobbi De Potter and Mike Hernacki (in Alhafiz, 2022), which groups learning styles into three categories, namely visual, auditory and kinesthetic, in this case it is used as a reference in grouping learning styles in this research. The development of learning style indicators is based on the characteristics of learning styles proposed by (Amin & Suardiman, 2016), the characteristics of auditory learning styles as follows: 1) easily disturbed by noise; 2) learn information faster through listening and remembering; 3) like detailed explanations of difficulties related to images as well as questions and answers; 4) enjoy exchanging opinions, asking questions, and explaining in detail. The following characteristics determine the visual learning style: 1) thorough and specific; 2) difficulty understand verbal instructions; 3) it is easier to retain information from what is observed; 4) find it harder to focus. One can identify a kinesthetic learner as someone who: 1) predominantly moves; 2) using body gestures; 3) learn best through practice or simulation; and 4) approach other people more closely.

After 30 class VIII students from one of the junior high schools in Majalengka Regency filled out a questionnaire using "Google Form" based on the learning style indicators, 10 questions were created using the Guttman scale based on each type of learning style. These questions consist of statements with the options "yes" or "no". The findings of the learning style analysis are shown in Table 1 and Figure 1 below.

Table 1. Trends in Student Learning Styles

No	Learning Styles	Frequency
1	Visual	16
2	Auditory	9
3	Kinesthetic	5
	Total	30

*Figure 2. Percentage Diagram of Student Learning Styles*

From Table 1, it can be seen that there are 16 students who learn best visually, 9 people who learn best auditorily, and 5 people who learn best kinesthetically. Meanwhile, Figure 1 displays the proportion of students' learning preferences, 53% of students have a visual learning preference, 30% have an auditory preference, and 17% have a kinesthetic preference. These findings show that visual learning is the most popular learning style, followed by learning that relies on hearing and kinesthetics. This shows that reading or looking at pictures helps to a large extent students more easily understand the lesson material. Additionally, (Jampel, 2016) noted that physical, psychological, fatigue, family, and school problems all influence students' tendencies to use visual learning methods. A learner who has access to a variety of reading materials and is familiar with reading learning models will most likely prefer learning through pictures. To optimize the learning process, it is necessary to pay attention to variations in learning styles.

From the interview results, it is known that students with a visual learning style can understand the questions by reading them themselves. Students with a visual learning style also study reference books and conduct online searches to prepare for class. Mathematics learning can be understood by visual learning style students by looking and taking notes. Apart from recording the contents written on the board and other related information on powerpoint, the teacher also takes notes during class explanations. Students can also learn mathematics by listening and taking notes during class discussions. This statement is also in line with the indicators contained in the learning style questionnaire distributed to students, which shows that students prefer to read, take notes easily, read quickly, are not easily distracted by noise, answer questions with "yes/no", fast speaking method, knows how to follow clear instructions and is a

good long-term planner, and can communicate directly by reading facial expressions. Favorite activity is making things, and art is preferred over music.

Mathematics learning is better understood by students with an auditory learning style when they are involved in peer discussions, watching learning films, and listening to music. When there is a commotion in class and the teacher's delivery of material is not understood, they become very uncomfortable. They added that they would write more meaningful things after hearing the teacher's explanation. Students with an auditory learning style prefer questions asked by the teacher to help them understand. By telling stories and explaining them to teachers, they can also present the results of their work. This statement is in line with the learning style questionnaire indicators given: auditory learning style, learning while listening, difficulty recording or writing down ideas, reading aloud, and easily remembering information discussed or explained rather than observing, often distracted by noise, often giving takes long responses to questions, speaks clearly and rhythmically, can imitate voice inflections when speaking, is adept at communication, enjoys talking on the telephone, and finds conversation and conversation more enjoyable than artistic media.

When faced with new material and information, students with a kinesthetic learning style seek clarification from teachers or acquaintances because they believe that this will help them understand the lesson better. In addition, they enjoy learning through discussions because they believe it will be fun to do it with their friends. Additionally, they claim that prolonged silence hinders their ability to concentrate while studying. This statement is also in line with the distribution of learning style questionnaire indicators which shows that students with a kinesthetic learning style prefer to learn by doing, read with a finger as a pointer, remember information that has been written many times, find it difficult to sit still. for long periods of time, and often answer questions accompanied by.

Students who have a kinesthetic learning style understand a mathematics lesson by approaching a teacher or friend with the reason that it will make them clearer in receiving material and information. They also like learning by discussing because they think it will be fun when they are with friends. They also said that they could not study with focus when just sitting quietly for a long time. This statement is also in accordance with the indicators when distributing the learning style questionnaire, where the kinesthetic learning style of students prefers to learn with a practical model, reads using a finger as a pointer, remembers by writing information many times, cannot sit still for a long time and often answers questions followed by body gestures.

A student's learning profile, as defined by Tomlinson (Hockett, 2018), is their preferred learning method, which is influenced by factors such as learning style, IQ, background, gender, and culture. Students become more aware of their learning needs and strengths when they are given ongoing



opportunities to reflect on and discuss how they learn best. Teachers also become more responsive to the unique characteristics of their students.

Furthermore, the results of the description of learning styles that have been found are taken into consideration by teachers in choosing and using learning methods, one of which is using differentiated learning according to students' learning styles. Teachers use differentiated learning as a strategy or effort to meet the needs and expectations of their students. Students will be assisted in their learning process through various learning activities appropriate to their level of expertise through the use of differentiated learning. Apart from providing attention and providing scaffolding (*scaffolding*) for students who experience learning setbacks, teachers also try to encourage the development of students who are already advanced. This approach is an effort to improve the teaching and learning process so that students become independent learners who have positive attitudes and problem-solving abilities (Nurhayati, 2017). As a result, teachers can modify how differentiation is implemented to ensure that learning occurs efficiently. It has been proven that differentiated teaching increases student motivation and achievement (Suwartiningsih, 2021).

In addition, flexible group formation will be used in differentiated learning classrooms, allowing students with certain skills to collaborate with their peers. Students who excel in one subject may not necessarily excel in other subjects as well. For example, students may excel at reading comprehension rather than writing, be able to spell and write sentences accurately, or even struggle with math. Teachers in these adaptable groups will be aware that some students may work on new activities slowly. Groups in differentiated learning always experience changes in response to student needs and experiences. To give students insight into the entire solution space, differentiated learning also makes the assumption that their internal and external situations are always changing (Gray, 2020).

(Iskandar, 2021) emphasized that students' sentiments of joy, enthusiasm and motivation are influenced by internal and external factors, and can be used to measure improvements in learning outcomes through diversification of learning. Teachers must continue to foster and build appropriate learning as an external element to improve student performance and learning outcomes. This will also increase interest and motivation to learn. This is in accordance with Marlina's (2019) statement that differentiation classes are different from classes in general, namely that teachers in differentiation classes recognize multiple intelligences more because learning is focused on students' learning profiles, preparation and interests.

The following activities can be used to implement differentiated teaching based on learning styles.

1. Before studying, perform a diagnostic evaluation and study the results. There are two types of diagnostic tests: cognitive and non-cognitive. To ascertain whether students have achieved

understanding of the content presented, cognitive diagnostic tests are administered. Teachers will be able to develop learning objectives that align with students' learning readiness by using the learning readiness data that the results will provide. Teachers will also be able to ascertain the level at which students will learn.

The next assessment is a non-cognitive diagnostic evaluation which can be carried out using various techniques, including questionnaires, observations and interviews. With the help of these evaluations, teachers hope to learn more about their students' learning styles and backgrounds, which will help them adapt lessons and activities in the classroom. This assessment can be used to determine learning styles. Teachers can use this data to develop learning by first observing their students' learning habits. Parents or teachers in previous sessions can also be sources of information collected, apart from the students themselves. The teacher then assesses the student's learning style and categorizes them into visual, auditory or kinesthetic learning styles because learning is differentiated based on learning styles.

2. Group learning styles to create lesson plans and teaching materials. Based on learning styles, teachers may develop lesson plans and resources after obtaining and analyzing data. At this point it is necessary to think about the differentiation strategy that will be used. Differentiation can be achieved, depending on the factors, through the materials, procedures, and final products developed during the learning process. By conveying different types of information or material according to different learning styles, such as material presented through pictures, videos, instructional songs, practices, or observations, content differentiation is achieved. Additionally, process differentiation can be achieved by assigning students to visual, auditory, or kinesthetic learning groups based on their preferred learning style. Differentiation can also be done by displaying various learning materials, such as mind maps, posters, observation reports, and so forth. It is known that the differentiating factors developed can be modified according to the type of topic, students, and teaching hours; they are not required to combine all three.
3. Practice differentiated teaching. Implementing learning based on differentiated learning planning is the next stage. A variety of interesting text and graphics will make learning fun for students who learn best visually. They also like easy-to-read and colorful writing. Learning through listening is preferred by auditory learners, who may encounter this method in podcasts, films, or teacher explanations. In addition, you can invite them to learn through instructional songs whose lyrics are changed based on the subject matter being studied. Practice and direct observation will be more attractive to kinesthetic learners, who prefer learning patterns with a lot of movement.
4. Preparation of monitoring and evaluation plans. Of course, the actions taken cannot be separated from the evaluation and monitoring components. Reflecting on the consequences of implementing



learning, including whether or not you agree with the implementation of differentiated learning and its components, how students respond and their learning outcomes, etc., is how evaluation activities are formed. Once the assessment is reviewed, strengths and areas for improvement are identified. Using a monitoring plan, educators continue positive practices already in place and address areas that need improvement.

Discussion

Analysis of the learning styles of 30 class VIII students in one of the junior high schools in Majalengka Regency found that 16 students or 53% had a visual learning style, 9 people or 30% for the auditory learning style and 17% or 5 people for the kinesthetic learning style.

It is important to offer visual-based learning resources, such as graphs, diagrams, and pictures, to students who are predisposed to a visual learning style. Information can be conveyed efficiently using digital media, whiteboards and visual presentations. Encouraging students to create mindmaps or take notes can help them understand concepts better. In line with (Zagoto, 2019), through video playback, making maximum use of visuals, and using written materials are all necessary to support students' visual learning styles in meeting their learning needs.

Learning strategies based on oral presentations, conferences, or group discussions can be especially beneficial for students who lean towards an auditory learning style. Podcasts, audio recordings, and audiobooks are additional resources as tools for learning. Utilizing sound-based learning strategies can help students with their learning styles. In line with (Azizah et al., 2023), that to facilitate students' auditory learning styles, educators actively participate in group discussions and ask students to read aloud.

Students who prefer the kinesthetic learning style can learn by focusing on physical movement. In addition, involving students in role plays, simulations, or experiments can help their understanding of the subject matter. Giving each student the opportunity to participate in practical tasks such as demonstrations and real projects is important as well. Agree with (Nafisah et al., 2023), that through direct practical learning and demonstrative learning is the best way to improve students' kinesthetic learning styles.

This learning style analysis was carried out because of the variety of learning styles that students have. Therefore, it must be accommodated well through the application of appropriate learning methods, one of which is using differentiated learning. It is important to provide a variety of teaching methods and strategies that address different learning styles in differentiated learning modules. In line with the opinion of (Dewi, 2023), differentiated learning is learning that has been adjusted to students' learning profiles, interests and readiness to improve student learning outcomes. Learning can be made more efficient and provide greater opportunities for each student to understand and become an expert in the subject matter by paying attention to their learning style tendencies. Another limitation is that the researcher cannot



control how honest the students are in answering the learning style questionnaire, therefore the researcher assumes that all students act honestly.

Conclusion

It can be concluded that students have diverse learning styles based on research on student learning styles conducted in class VIII of one of the middle schools in Majalengka Regency. The learning style is 53% visual, 3% auditory, and 17% kinesthetic.

Discovering students' learning styles can be the first step in evaluating a teacher's ability to design materials that suit students' skill levels. To prevent students from becoming disinterested or overwhelmed during the learning process, differentiated learning adapts to each student's individual learning needs based on their readiness.

This learning is one way to implement the new learning paradigm promoted by the independent curriculum. Teachers should use differentiated learning in implementing learning by paying attention to students' learning styles and characteristics because there are various learning styles among students. The aim of this learning process is to help students achieve predetermined learning goals and gain a deeper understanding of the subject matter.

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