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Analysis of Students' Interest in Science and Learning Difficulties Regarding the Topic of Inheritance of Traits in Junior High School

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ABSTRACT
Inheritance of traits is a topic in natural sciences that students often find difficult to understand because it involves abstract genetic concepts, scientific terminology, and complex patterns of inheritance. This study aims to analyze students' interest in learning natural sciences and their learning difficulties regarding the topic of inheritance of traits among ninth-grade students at Madani Palu Integrated Model Public Junior High School. This study employed a quantitative descriptive design involving 78 students selected through purposive sampling. Data were collected using questionnaires on students' interest in learning Science and learning difficulties regarding the topic of inheritance of traits. The learning interest questionnaire consisted of 30 items, while the learning difficulties questionnaire consisted of 15 items. Both questionnaires used a five-point Likert scale. The data were analyzed descriptively by calculating response scores and percentages and classifying the results into predetermined categories. The results indicated that students' learning interest was predominantly in the high category, with the highest average score found in attention during the learning process (3.32). However, students' learning difficulties were also high, with teachers' teaching methods receiving the highest average score (4.01). These findings indicate that high learning interest does not always reduce learning difficulties. Therefore, contextual, visual, and interactive science learning strategies are needed to improve students' understanding of the inheritance of traits.d to improve conceptual understanding of inheritance of traits.

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INTRODUCTION

Natural Science (IPA) is one of the subjects that plays an important role in helping students understand natural phenomena and life around them. Natural Science does not only emphasize mastery of concepts, but also trains students to observe, reason, solve problems, and connect scientific concepts with real phenomena. According to Putra in Noorhilmah et al. (2023), Natural Science is a science that studies, describes, and investigates natural phenomena in their various empirical aspects. Therefore, Natural Science learning is expected to develop students' understanding of scientific concepts systematically and meaningfully.

One of the Natural Science topics studied at the junior high school level is heredity. This topic discusses how the traits of living organisms are passed down from parents to their offspring through the concepts of genes, chromosomes, DNA, Mendel's laws, and genetic crosses. The topic of heredity is important to study because it is directly related to everyday life, such as the resemblance between children and their parents, differences in traits among individuals, and the emergence of certain traits within families. However, in practice, heredity remains one of the topics that students find difficult to understand. Hidayati et al. (2022) state that heredity is a subtopic that is difficult for students to understand because of its broad scope and the presence of terms that are relatively difficult for students to comprehend.

Students' difficulty in understanding heredity is partly caused by the large number of new terms and scientific language that are unfamiliar to them. Genetics, particularly heredity, contains terms such as gene, allele, chromosome, genotype, phenotype, dominant, recessive, and DNA. These terms are often regarded as a new language that requires deeper understanding, not merely memorization. Nurwendah and Sari (2025) explain that students with low learning interest experience difficulties in understanding basic genetic concepts such as DNA structure and the laws of inheritance, while students with moderate learning interest have difficulty connecting one concept to another and interpreting genetic cross diagrams.

Genetics is often considered a challenging topic for students because it involves abstract concepts and complex relationships among genetic structures and processes. Students may have difficulty connecting basic concepts, such as genes, DNA, and chromosomes, with the mechanisms underlying the inheritance of traits. Machová and Ehler (2023) found that secondary school students struggled to develop a comprehensive understanding of genetic information and its relationship to heredity, resulting in persistent misconceptions. These findings highlight the importance of helping students understand the connections between genetic concepts and the mechanisms of inheritance rather than learning individual terms in isolation.

The use of learning media is one important effort to help students understand abstract material. Learning media can help stimulate students' thoughts, attention, interest, and readiness to learn. Sukiman in Noorhilmah et al. (2023) states that learning media are media that deliver messages from the sender to the receiver in order to stimulate students' thoughts, feelings, attention, interest, and readiness so that the learning process can achieve its objectives effectively. In heredity material, media such as pictures, videos, animations, genetic cross diagrams, or teaching aids can help students visualize genetic concepts more concretely.

In addition to the difficulty of the material and the learning methods used, students' learning interest also influences the success of Natural Science learning. Learning interest is an encouragement that makes students feel interested, happy, and involved in learning activities. Students with high learning interest tend to be more active, focused, and willing to understand the material, whereas students with low learning interest tend to become bored easily, pay less attention during learning, and have less motivation to understand difficult concepts. Hidayati et al. (2022) state that learning interest plays an important role in encouraging students to achieve academic success and in fostering enjoyment in learning activities.

Students' learning difficulties in Natural Science can also be influenced by internal and external factors. Internal factors include students' interest, motivation, attitude, physical health, and mental readiness, while external factors may come from family, school, the learning environment, learning methods, and facilities and infrastructure. Ndruru (2023) states that students' learning difficulties are influenced by factors originating from themselves, their family, school, and the community environment. Thus, low learning interest and inappropriate learning strategies may cause students to experience difficulties in understanding Natural Science material, including heredity.

This research was conducted at SMP Negeri Model Terpadu Madani Palu. SMP Negeri Model Terpadu Madani Palu is one of the public schools in Palu City that is often used as a research site and a place for educational development activities. Idrus et al.

(2024) conducted research at SMPN Model Terpadu Madani Palu involving eighth-grade students, with a population of 147 students divided into five classes. The study showed that this school has an active Natural Science learning environment for research, particularly in developing students' problem-solving abilities through the guided inquiry learning model.

In addition, Yunidar et al. (2024) also noted that the Junior High School Indonesian Language Subject Teacher Forum (MGMP) activity in Palu City was held at SMP Negeri Model Terpadu Madani Palu, with 50 participants. This indicates that SMP Negeri Model Terpadu Madani Palu is not only a place where learning takes place, but also one of the venues for educational activities in Palu City.

This is further supported by the research of Ferdiawan et al. (2026), which selected SMP Negeri Model Terpadu Madani Palu as one of the research locations related to the implementation of a multimodal text approach to improve the teaching skills of Indonesian language teachers in Palu City. In that study, SMP Negeri Model Terpadu Madani Palu was selected along with several other public junior high schools, such as SMP Negeri 3 Palu, SMP Negeri 13 Palu, and SMP Negeri 19 Palu, based on the schools' willingness to participate, the relevant background of the teachers, and the availability of supporting facilities for the implementation of technology-based learning. The study also involved the principal of SMP Negeri Model Terpadu Madani Palu as an informant because the principal plays an important role as a school policymaker.

Based on these articles, SMP Negeri Model Terpadu Madani Palu can be viewed as one of the leading schools in Palu City. This school is known as one of the schools that is highly favored and sought after by new students who wish to continue their education at the junior high school level. The high level of public interest in this school indicates that SMP Negeri Model Terpadu Madani Palu has its own appeal in the implementation of education. Therefore, an analysis of students' interest in learning Natural Science and their learning difficulties in heredity material at this school is important to conduct, because the results of the study can provide an overview of the condition of Natural Science learning in one of the schools that holds a strategic position in junior high school education in Palu City.

Based on the explanation above, it is important to conduct an analysis of students' interest in learning Natural Science and their learning difficulties in heredity material at SMP Negeri Model Terpadu Madani Palu. This analysis is needed to determine the extent of students' interest in Natural Science learning, the forms of difficulties experienced by students, and the factors that cause students to have difficulty understanding heredity. The results of this analysis can serve as a basis for teachers to design learning that better suits students' needs, for example through more detailed explanations, the use of interesting learning media, the provision of real examples from everyday life, and the active involvement of students in learning activities. Therefore, research on the analysis of students' interest in learning Natural Science and their learning difficulties in heredity material at SMP Negeri Model Terpadu Madani Palu is important as an effort to improve the quality of Natural Science learning and to help students understand heredity more easily, concretely, and meaningfully.

METHOD

This study employed a quantitative descriptive research design aimed at describing students' interest in learning Science and their learning difficulties regarding the topic of inheritance of traits. The research was conducted at SMP Negeri Terpadu Madani, involving ninth-grade students, during the second semester of the 2025/2026 academic year. Data were collected on April 16, 2026, using questionnaires on students' interest in learning Science and learning difficulties regarding the topic of inheritance of traits. The population of this study consisted of all ninth-grade students, totaling 78 students, and the sample also consisted of 78 students who completed the research questionnaires. The sampling technique used was purposive sampling because the respondents were selected based on specific considerations, namely ninth-grade students who had studied the topic of inheritance of traits in Natural Science learning and were willing to complete the research questionnaires.

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The instruments used in this study consisted of a questionnaire on students' interest in learning Science and a questionnaire on students' learning difficulties regarding the topic of inheritance of traits. The indicators of learning interest included feeling of enjoyment, interest in the material, attention during the learning process, and learning motivation, using a four-point Likert scale with the response options Strongly Agree, Agree, Disagree, and Strongly Disagree. Meanwhile, the indicators of learning difficulties included learning concentration, learning motivation, self-confidence, and the teacher's teaching method, using a five-point Likert scale with the response options Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. The data obtained were analyzed using quantitative descriptive analysis by calculating students' response scores, determining the percentages, and classifying the results into specific categories to describe the level of students' interest in learning Science and their learning difficulties regarding the topic of inheritance of traits.

RESULTS AND DISCUSSION

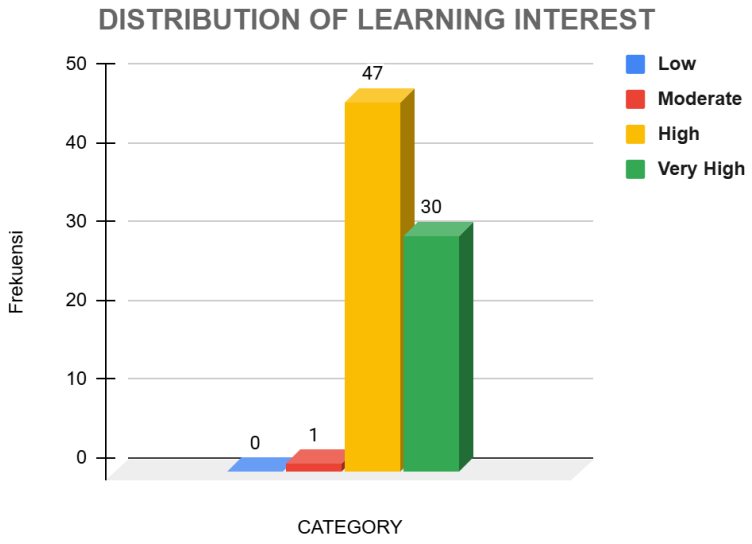


Figure 1. Distribution of Learning Interest

Based on Figure 1, the distribution of students' learning interest shows that no students were in the low category, 1 student was in the moderate category, 47 students were in the high category, and 30 students were in the very high category. The highest frequency was found in the high category, with 47 students. This indicates that most students had a high level of interest in learning Science. In addition, the number of students in the very high category was also considerable, with 30 students. Therefore, it can be concluded that the learning interest of ninth-grade students at SMP Negeri Terpadu Madani was generally categorized as high.

The high level of students' learning interest found in this study indicates that Science learning, particularly the topic of inheritance of traits, was able to attract students' attention and encourage their willingness to participate in the learning process. This finding is supported by Hidayati, Sudarti, and Handayani (2022), who found that scientific literacy had a significant effect on students' learning interest in the topic of inheritance of traits among junior high school students. Their study showed that students' interest in learning inheritance of traits was closely related to their ability to understand scientific information and connect it with learning activities. These findings are also in line with Asrianti, Mellisa, anda Fauziah (2023), who identified that learning difficulties in biology are closely associated with student engagement and motivation levels, suggesting that a supportive learning environment is key to sustaining students' interest. Similarly, Kharismayani et al.

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(2023) found that junior high school students' interest in science learning is shaped by multiple factors including teacher quality, family support, and classroom learning experiences, reinforcing the multidimensional nature of science learning interest. Therefore, the high level of learning interest in the present study may be associated with the relevance of inheritance material to students' daily lives, such as similarities between children and parents, inherited characteristics, and differences among individuals.

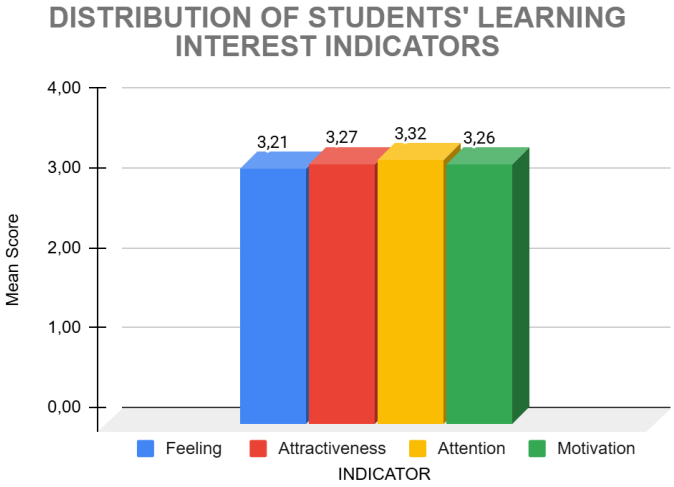


Figure 2. Distribution of Students' Learning Interest Indicators in Science Learning

Based on Figure 2, the analysis of students' learning interest indicators shows that all indicators obtained mean scores above 3.00. The attention during the learning process indicator obtained the highest mean score, at 3.32. This was followed by interest in the material with a mean score of 3.27, learning motivation with a mean score of 3.26, and feeling of enjoyment with a mean score of 3.21. These results indicate that students' attention during the learning process was the most dominant aspect of their interest in learning Science, while feeling of enjoyment obtained the lowest mean score compared to the other indicators. Nevertheless, all indicators showed high scores, indicating that students' interest in learning Science can be categorized as good/high.

When viewed based on the learning interest indicators, all indicators obtained an average score above 3.00. The attention indicator obtained the highest score, namely 3.32, followed by interest at 3.27, motivation at 3.26, and feelings of pleasure at 3.21. The high attention indicator indicates that students are able to concentrate and follow the learning process well. This finding is in line with the research of Rahmajati and Dewi (2024) who used indicators of feelings of pleasure, interest, attention, and student involvement in analyzing science learning interest. The research shows that science learning designed contextually can increase students' learning interest from the category of sufficient to good. This is further supported by Toli & Kallery (2021), who demonstrated that hands-on and inquiry-based science learning activities designed to enhance student interest significantly improved both learning outcomes and engagement among junior high school students, reinforcing the importance of contextual and interactive approaches in science education.

The attention indicator that obtained the highest score also indicated that students tended to focus on the material being studied. In science learning, attention is a crucial aspect because science material, including inheritance, requires conceptual understanding, observation, and active student involvement. This is supported by research by Mai et al. (2023) on student motivation and engagement in science learning, which showed that student motivation and engagement play a role in supporting satisfaction and achievement in science learning. Therefore, the high level of student attention and motivation in this study can be an important asset in supporting successful science learning.

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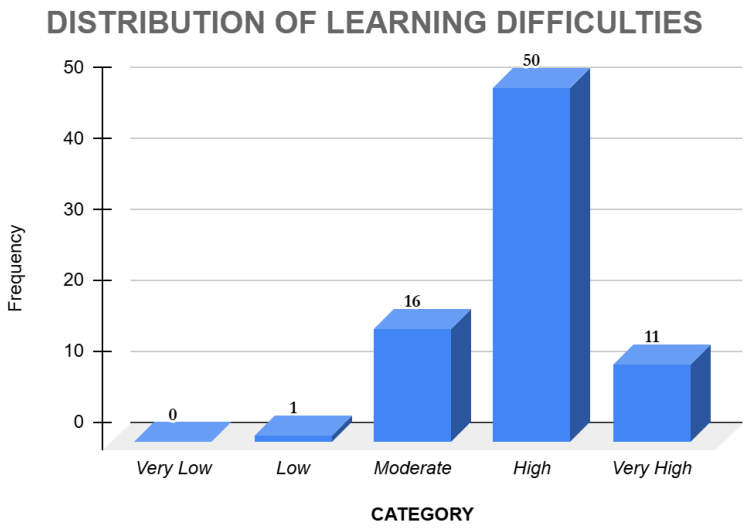


Figure 3. Distribution of Students' Learning Difficulties Regarding the Topic of Inheritance of Traits

Based on Figure 3, students' learning difficulties regarding the topic of inheritance of traits were distributed into five categories. There were no students in the very low category, 1 student in the low category, 16 students in the moderate category, 50 students in the high category, and 11 students in the very high category. The highest frequency was found in the high category, indicating that most students experienced a high level of learning difficulties in understanding the topic of inheritance of traits. Therefore, it can be concluded that the learning difficulties of ninth-grade students at SMP Negeri Terpadu Madani were generally categorized as high.

The high level of students' learning difficulties regarding the topic of inheritance of traits shows that this material remains challenging for junior high school students. Although students showed high learning interest, they still experienced difficulties because inheritance of traits involves abstract concepts, scientific terminology, and logical relationships among concepts. Students are required to understand genes, chromosomes, genotypes, phenotypes, dominant traits, recessive traits, and inheritance patterns. In this regard, Mead, Hejmadi, and Hurst (2017) emphasized that the sequence and method of teaching genetics significantly influences students' conceptual understanding, noting that a well-structured approach to genetics instruction can substantially improve comprehension of related biological concepts. This finding is supported by Ningrum et al. (2024), who stated that inheritance of traits is often difficult for ninth-grade junior high school students to understand and may cause misconceptions. Their study found that students commonly experienced misconceptions in basic genetic concepts, such as dominant and recessive traits, complex inheritance patterns, and the relationship between genotype and phenotype.

Similar findings were also reported by Fajri et al. (2022), who identified students' misconceptions in heredity material using a two-tier diagnostic test. Their study showed that 34% of students experienced misconceptions, 54% understood the concepts, and 12% did not understand the concepts. The highest misconception occurred in the indicator of inheritance according to Mendel's law, followed by Mendel's first law. This supports the present finding that students still experience learning difficulties in inheritance of traits, particularly because the topic requires conceptual understanding and the ability to apply genetic concepts in problem-solving activities.

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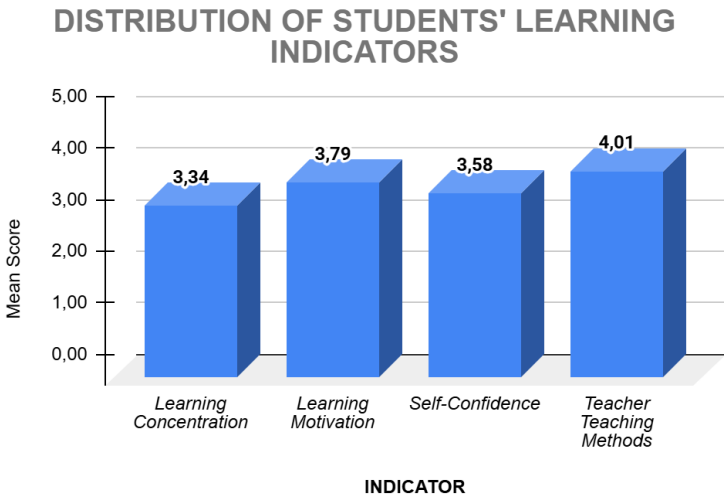


Figure 4. Distribution of Students' Learning Difficulty Indicators Regarding the Topic of Inheritance of Traits

Based on Figure 4, the analysis of student learning indicators shows that all indicators received an average score above 3.00. The teacher's teaching method indicator received the highest average score, at 4.01. Next, the learning motivation indicator received an average score of 3.79, followed by self-confidence with an average score of 3.58, and learning concentration with an average score of 3.34. These results indicate that the teacher's teaching methods are the most dominant aspect in supporting the students' learning process, while learning concentration received the lowest average score compared to the other indicators. Nevertheless, all indicators showed high scores as they were above 3.00. Thus, the student learning indicators can be categorized as good/high.

These findings are consistent with research on internal and external factors contributing to learning difficulties, which indicates that such difficulties are influenced not only by students' psychological aspects and motivation but also by the learning strategies, media, and methods employed by teachers. The study also found that motivation is one of the dominant internal factors influencing learning difficulties, while learning methods and learning media are external factors that contribute to students' learning barriers. Thus, the results of this study reinforce the view that learning difficulties need to be comprehensively understood through the interaction between students' internal factors and external learning factor (Nanda & Handayani, 2025)**.**

These research findings are also supported by the findings of Mustofa et al. (2023) who state that concentration is a key factor in the learning process. Good concentration helps students absorb and retain information, whereas poor concentration can cause students to struggle to follow lessons, lower academic performance, and increase boredom. The study also found that improved concentration is influenced by teacher motivation, the learning environment, facilities, teaching methods, and peer influence. This is relevant to the results of this study, as the learning concentration indicator received the lowest average score compared to other indicators, suggesting it may be one of the reasons for the persistently high levels of learning difficulties among students.

Furthermore, these findings are consistent with research emphasizing the importance of teacher support in learning. Xu (2024) found that teacher support has a direct effect on academic achievement, and that this effect is mediated by students' academic self-efficacy and academic emotions. This means that teachers do not merely serve as conveyors of content but also as psychological supporters who can boost students' self-confidence and create a more positive learning experience. These findings support the results of this study, namely that teachers' teaching methods are the most significant indicator in the student learning process.

Teacher-related factors, such as teacher support, teacher-student relationships, teaching practices, teaching styles, and instructional behaviors, influence students' academic motivation. In that review, teacher support was even cited as one of the most influential factors on academic motivation. Thus, the high scores for teachers' teaching methods and students' learning motivation in this study can be understood as two interrelated aspects, as effective teaching strategies tend to encourage students to be more motivated in their learning (Asadpour et al., 2025).

Thus, the results of this study indicate that students' learning difficulties remain in the high category, even though several indicators such as teaching methods, motivation, self-confidence, and concentration are already in the fairly good category. This indicates that learning difficulties cannot be explained by a single factor alone but arise from the interaction between various internal factors such as motivation, concentration ability, and self-confidence and external factors, such as teaching methods, the learning environment, learning aids, and learning resources. Therefore, to address learning difficulties, efforts are needed to implement more diverse learning strategies, boost motivation, strengthen self-confidence, and create a comfortable and supportive learning environment.

Overall, the findings of this study indicate that ninth-grade students at SMP Negeri Model Terpadu Madani Palu had a high level of interest in learning Science, particularly regarding the topic of inheritance of traits. This can be seen from the dominance of students in the high and very high categories, as well as the high mean scores obtained in all learning interest indicators. The highest score was found in the attention during the learning process indicator, indicating that students were able to focus on the learning activities and showed positive responses toward the material. This condition suggests that inheritance of traits is a topic that can attract students' interest because it is closely related to daily life, such as similarities between children and parents, inherited characteristics, and differences among individuals.

However, the results also show that students' learning difficulties regarding the topic of inheritance of traits were categorized as high. This means that students' high interest in learning Science did not automatically eliminate their difficulties in understanding the material. Although students were interested and attentive during the learning process, they still faced challenges in understanding abstract genetic concepts, scientific terms, and genetic cross patterns. Concepts such as genes, chromosomes, genotypes, phenotypes, dominant traits, recessive traits, and Mendelian inheritance require logical reasoning, conceptual understanding, and continuous practice.

These findings are in line with Hidayati, Sudarti, and Handayani (2022), who found that inheritance of traits can support students' learning interest when connected with scientific literacy and meaningful learning activities. However, the findings are also supported by Ningrum and Utomo (2024) and Fajri, Roviati, and Anugrah (2022), who reported that students often experience difficulties and misconceptions in heredity material, especially in concepts related to genotype, phenotype, dominant and recessive traits, inheritance patterns, and Mendel's law. Therefore, learning difficulties in inheritance of traits should not only be viewed as a result of low interest, but also as a consequence of the abstract and complex nature of the material.

Based on these findings, Science learning on inheritance of traits needs to be designed in a more concrete, contextual, and interactive way. Teachers need to maintain students' learning interest while also helping them overcome learning difficulties through the use of visual media, contextual examples, guided exercises, genetic cross practice, and interactive discussions. Herman and Saleh (2023), in a meta-analysis found that innovative learning approaches such as blended learning consistently improved biology learning outcomes among high school students, suggesting that varied and technology-supported instructional methods can be effective in addressing learning difficulties. These strategies are expected to help students understand abstract genetic concepts more easily and improve the quality of Science learning.

CONCLUSION

This study found that ninth-grade students at SMP Negeri Terpadu Madani Palu had a high level of interest in learning Natural Science, particularly in the topic of inheritance of traits. However, their learning difficulties were also categorized as high. Attention during the learning process was the most dominant indicator of learning interest, while teaching methods were the most prominent indicator of learning difficulties. These findings indicate that high learning interest does not necessarily correspond to fewer learning difficulties.

Further research is recommended to investigate the factors contributing to students' learning difficulties and to examine the effectiveness of contextual, visual, and interactive learning strategies in improving students' understanding of inheritance of traits.

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AI DISCLOSURE STATEMENT

The authors used ChatGPT solely for language editing and grammatical improvement. No generative AI tools were used to create, analyze, interpret, or write the scientific content of this manuscript.

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