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Analysis of the Dimensions of Students' Motivation to Learn Biology in 3T Areas (A Study at SMA Negeri 1 Lahewa)

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Abstract: Student motivation in biology classes is often assumed to be consistently high, even though this ideal condition has not yet been fully achieved, particularly in schools in island regions with limited resources and support for independent study at home, as is the case at SMA Negeri 1 Lahewa in North Nias Regency. This study aims to analyze the levels of learning motivation among 10th and 11th-grade students in Biology classes at that school, examined from the dimensions of internal and external motivation. The study employed a quantitative descriptive design involving 66 students selected through purposive sampling from a population of 586 students. Data were collected via a Guttman-scaled questionnaire containing 20 statements, distributed online through Google Forms. The data were analyzed descriptively by categorizing respondents' total scores into five levels of motivation. The results indicate that students' learning motivation generally falls into the high category, with very high scores in perseverance, discipline, and the desire to achieve, but still low scores in the habit of independent learning at home and the initiative to seek additional learning resources. These findings indicate that students' motivation is supported more by school structure and supervision than by internalized independent learning; therefore, strengthening independent learning at home is a key priority for the development of future biology learning strategies.

Keywords: Motivation to learn, Biology education, Self-regulation, 3T regions, Guttman scale.

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Introduction

Education is one of the main pillars of quality human resource development and plays a central role in preparing a generation capable of facing the challenges of the times. The success of the educational process is not only determined by the quality of teachers, the curriculum, or learning resources, but is also greatly influenced by the students' own motivation to learn (Sardiman, 2011). Learning motivation is understood as the totality of psychological driving forces within students that initiate, sustain, and direct learning activities so that learning objectives can be achieved, whether these forces stem from internal or external sources (Uno, 2014; Ryan & Deci, 2020). Without adequate motivation, the learning process tends to be passive and fails to produce optimal academic achievement, no matter how comprehensive the available learning facilities may be (Hamalik, 2011).

Biology, as one of the science subjects taught in high school (SMA), has distinctive characteristics: it involves abstract and complex concepts that are rich in scientific terminology, yet at the same time is closely related to students' daily lives. Learning biology requires students not only to memorize facts but also to understand processes, analyze natural phenomena, and continuously develop scientific thinking skills all of which are heavily influenced by students' interest in learning science (Harefa et al., 2023). These characteristics make learning motivation a crucial factor, as students who lack strong motivation will struggle to maintain consistency in understanding the relatively complex material in Biology (Suciani et al., 2022). Ideally, every student is expected to have a high level of learning motivation in biology, characterized by interest, attention, perseverance, and consistent initiative for independent learning (Sardiman, 2011; Amazihono & Sarumaha, 2024).

In reality, these ideal conditions have not yet been fully realized, as students' motivation to learn biology varies across schools and remains uneven (Anggo et al., 2023). The results of a study by Harefa et al., (2022) revealed that students' motivation to learn Biology tends to fall into the moderate category, especially when the teaching methods used lack variety and are not relevant to students' real-life contexts. A similar finding was reported by Emda (2018), who emphasized that low student motivation is largely influenced by monotonous teaching methods, which result in students being less actively engaged in the classroom learning process. The gap between the ideal expectation of high

learning motivation and the reality on the ground which shows learning motivation in the moderate to low range is a critical issue that warrants in-depth analysis.

This issue becomes even more relevant when considered in the context of SMA Negeri 1 Lahewa, one of the schools located in the island region of North Nias Regency, North Sumatra Province. The school's geographic location in an archipelago, limited learning support facilities and infrastructure, and the socioeconomic conditions of most students are believed to influence students' motivation levels in biology, as is commonly observed in educational institutions in remote island regions (Rahmadi, 2020). Differences in students' family backgrounds and learning environments also have the potential to create significant gaps in motivation between students, both in terms of internal and external drives (Rifa'i & Anni, 2012; Zebua et al., 2024). These unique conditions present both challenges and opportunities in efforts to understand and enhance students' motivation to learn Biology at this school (Lase & Telaumbanua, 2025).

Learning motivation plays a fundamental role in determining the quality and success of the learning process, serving as a driver, guide, and catalyst for students' learning behavior (Hamalik, 2011; Herpratiwi & Tohir, 2022). The results of a study by Andriani and Rasto (2019) demonstrate that learning motivation has a positive and significant effect on student learning outcomes, with a contribution of 38.8%. These findings are supported by studies by Palittin et al. (2019) and Sapitri and Fauziah (2022), which show that the higher students' learning motivation, the higher their academic achievement, including in biology. These two findings confirm that learning motivation is not merely a supplementary factor but a core component that makes a tangible contribution to learning success (Hulu & Telaumbanua, 2023).

Although previous studies have made important contributions, there are still a number of research gaps that need to be addressed through further study. The study by Harefa et al. (2022) focused more on the effect of blended learning on learning motivation, whereas the studies by Andriani and Rasto (2019), Palittin et al. (2019), and Hulu and Telaumbanua (2022) emphasized the correlational relationship between motivation or interest and learning outcomes without detailing the levels of learning motivation themselves. Furthermore, the study by Emda (2018) was limited to a literature review (library research) without being supported by empirical field data, and thus was unable to describe the actual state of students' learning motivation within the context of a specific school. These limitations whether in terms of research objectives, the methods used, or the lack of specificity in the instruments used to categorize levels of motivation indicate that purely descriptive and measurable studies on the levels of student learning motivation in biology, particularly in schools located in island regions such as SMA Negeri 1 Lahewa, remain very limited.

Based on this discussion of theoretical and empirical gaps, the key question that needs to be answered is: What is the actual level of learning motivation among students at Lahewa State High School 1 in their Biology classes when viewed comprehensively from the dimensions of internal and external motivation? It is increasingly important to answer this question empirically and measurably, given that an understanding of the challenges and opportunities regarding student learning motivation can serve as a foundation for teachers and schools in designing more targeted Biology learning strategies. Therefore, this study aims to analyze the levels of learning motivation among students at Lahewa State High School 1 in Biology learning through a quantitative descriptive approach using a Guttman Scale questionnaire developed based on indicators by Uno (2014) and Sardiman (2011), and categorized according to Riduwan's (2019) score interpretation criteria. This study is expected to provide a realistic picture of students' learning motivation while also serving as an empirical reference for the development of more varied and contextual Biology learning strategies capable of addressing challenges and capitalizing on opportunities at schools with archipelagic geographical characteristics.

Methods

Research design

This study was designed as a descriptive study using a quantitative approach (Sugiyono, 2019). This approach was chosen because the purpose of the study was to describe the state of students' learning motivation as it is, without intending to test causal relationships between variables. The data collected consisted of numerical scores obtained through a structured questionnaire, which were then analyzed using descriptive statistics so that students' levels of learning motivation could be systematically classified and interpreted (Arikunto, 2019). A similar procedure has been applied in previous studies on motivation to learn biology, which also used questionnaires as the primary data collection instrument (Anggo et al., 2023; Sapitri & Fauziah, 2022); thus, this design can be considered a standard procedure that has been tested in similar contexts.

Research location, time, and sample

The study was conducted at Lahewa State High School No. 1, located on Arah Ono Zalukhu Street, Afia Village, Lahewa Subdistrict, North Nias Regency, North Sumatra Province. Data collection took place over a single day, on April 29, 2026, during the 2025–2026 school year. The population was defined as all 10th- and 11th-grade students actively enrolled in Biology classes during that academic year, with 306 students in 10th grade and 280 students in 11th grade, for a total population of 586 students. Twelfth-grade students were not included because, at the time of the study, they had already completed their entire course of study and final assessments. The sample was determined using purposive sampling, in which one class from each grade level was selected as a representative sample, resulting in 66 students as respondents comprising 33 10th-grade students and 33 11th-grade students (Sugiyono, 2019). Sample selection was based on several criteria: students must be enrolled and actively attending classes during the 2025/2026 academic year; actively participating in Biology classes throughout the current semester; having access to a smartphone and the internet; and being willing to participate as respondents.

Data collection instruments and techniques

Data were collected using a questionnaire designed based on two dimensions of learning motivation internal and external motivation adapted from Uno's (2014) theoretical framework. The internal dimension was broken down into three indicators: interest and curiosity, attention and concentration, and perseverance and a "never-give-up" attitude, which were measured through twelve statement items. The external dimension is broken down into three indicators: discipline and responsibility; independence and learning initiative; and aspirations for achievement, which are measured through eight items. The instrument consists of 20 closed-ended statements on a Guttman scale that yield dichotomous "Yes" or "No" responses (Riduwan, 2019); the use of a standardized questionnaire to measure learning motivation has also been observed in previous similar studies (Herpratiwi & Tohir, 2022). "Yes" responses were scored as 1 and "No" as 0 for positive statements (items 1–6 and 8–20), while for the single negative statement (item 7), the score was reversed, so that the total score each respondent could achieve ranged from 0 to 20.

Before distribution, the instrument was validated through expert judgment by the course instructor to ensure content validity; a similar validation procedure using expert judgment has also been used in other studies on learning motivation before the instrument was distributed in the field (Suciani et al., 2022). This process was conducted to ensure that each item accurately and proportionally represented the dimensions and indicators of learning motivation.

Data collection was conducted online using Google Forms, with the link shared via WhatsApp on April 29, 2026. The procedure was carried out in five stages: (1) the questionnaire was created in Google Forms, including instructions for completion, respondent identification, and 20 statements; (2) the link was distributed to the 10th- and 11th-grade class presidents via their class WhatsApp groups, then forwarded to all respondents; (3) respondents accessed the link via their smartphones, read the instructions, and then selected either "Yes" or "No"; (4) responses were automatically saved to a Google Sheets spreadsheet linked to the Google Form; and (5) after all data was collected, it was downloaded in .xlsx format for further analysis. The choice of Google Forms and WhatsApp was based on considerations of practicality and efficiency, given that all respondents have access to smartphones as their primary means of daily communication, as also reported in another study on motivation to learn biology that utilized similar digital media for data collection (Sapitri & Fauziah, 2022).

Data analysis techniques

The data were analyzed using descriptive statistical techniques, which are used to describe the data as they are without intending to generalize the results to a broader population (Sugiyono, 2019). The analysis was conducted in five stages. First, all respondents' answers were tabulated in a spreadsheet; each item was scored according to predetermined criteria, and then each respondent's scores were summed to obtain a total score. Second, the total scores were converted into percentages using the formula P = (Total Score / Maximum Score) × 100%, with the maximum score set at 20. Third, the percentage values were categorized into five levels of learning motivation: very high (81–100%), high (61–80%), moderate (41–60%), low (21–40%), and very low (0–20%), based on score interpretation criteria adapted from Riduwan (2019). Fourth, the frequency distribution and percentages were calculated for each category—both overall and separately for the 10th-grade and 11th-grade groups using the formula % Category = (f/n) × 100%, where f is the frequency of students in a specific category and n is the total number of respondents. Fifth, the results of the distribution were interpreted narratively to address the research questions, taking into account the dominant categories that emerged and comparing the patterns of learning motivation distribution between the 10th-grade and 11th-grade groups as part of a comparative descriptive analysis. All

Results

The study respondents consisted of 66 students from Lahewa State High School 1, comprising 33 10th-grade students and 33 11th-grade students (a 50:50 ratio), with 62.1% male and 37.9% female. Based on the results of the learning motivation questionnaire, which consisted of 20 statements, it was found that students' motivation to learn biology was generally in the high category, with varying levels across each indicator, as summarized in Table 1.

Table 1. Summary of the Level of Learning Motivation Among Students at Lahewa State High School 1 in Biology Classes

No	Indcator	Key Achievements	Category
1	Interest and curiosity	86.4% are interested in studying biology; however, only 39.4% prioritize it over other subjects	High
2	Attention and concentration	93.9% pay attention to the teacher; however, only 62.1% are able to stay focused from the beginning to the end of the lesson	High
3	Perseverance and a refusal to give up easily	90.9% continue to try to understand difficult material; however, only 66.7% are in the habit of reviewing material they have not yet understood	Very High
4	Discipline and responsibility	95.5% arrive on time and are disciplined at school; however, only 48.5% study regularly at home	Very High
5	Independence and a desire to excel	93.9% want to get high grades; however, only 56.1% actively seek out additional learning resources on their own	Very High

Source: Researchers, 2026

The pattern in Table 1 shows a consistent gap across all indicators: high achievement is evident in aspects driven by the school environment and external supervision (attendance, attention in class, motivation to excel), while lower achievement was found in aspects requiring students' independent initiative outside of direct teacher supervision (studying at home, seeking additional resources, maintaining focus, and prioritizing biology). This pattern is illustrated in Figure 1.

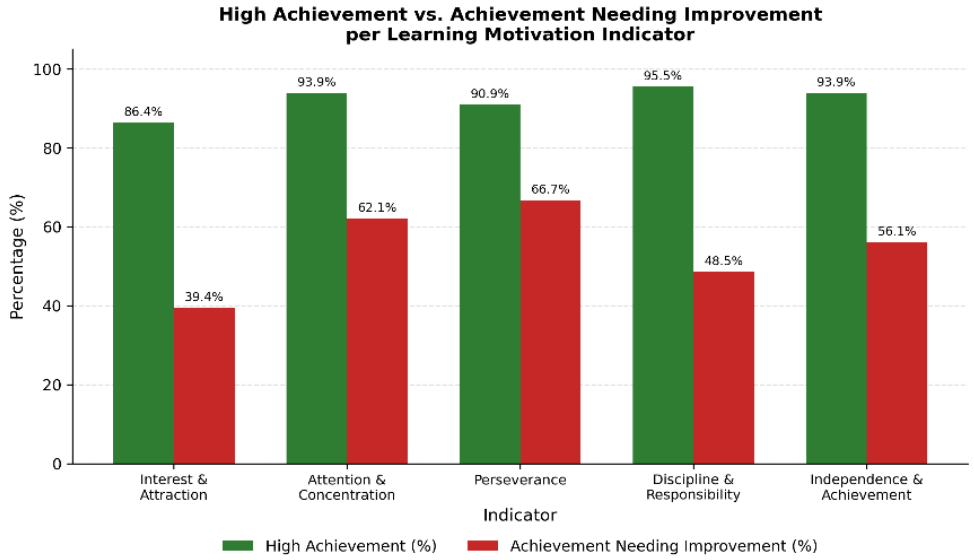

Figure 1. Comparison of Each Indicator of Student Learning Motivation

Overall, out of 66 respondents, students' motivation to learn biology was categorized as high, with the main strengths being perseverance in the face of difficult material (90.9%), discipline in the school environment (95.5%), and the desire to excel (93.9%). Conversely, the three aspects identified as still requiring further attention are consistency in independent study at home (48.5%), the initiative to seek additional learning resources (56.1%), and prioritizing Biology over other subjects (39.4%).

Discussion

The main findings of this study indicate that the learning motivation of students at Lahewa State High School 1 in Biology classes is generally in the high category, but with a consistent pattern: very high achievement is evident in

indicators under the direct supervision of the school environment (discipline, perseverance, and the desire to excel), while lower levels of achievement consistently appear in indicators that require independent initiative beyond that supervision (studying at home, seeking additional resources, and maintaining focus). This pattern directly addresses the study's objective of uncovering the levels of students' learning motivation, while also providing an initial answer to the research question regarding the extent to which internal and external motivators work in balance within the context of an island school.

Theoretically, students' high desire to achieve (93.9%) can be understood through two classical frameworks. Maslow (1954) explains the desire to achieve as a manifestation of the need for esteem that arises after students' need for security in a disciplined school environment is met, while McClelland (1961) more specifically explains that individuals with a high need for achievement demonstrate a strong drive to reach certain standards of success, as reflected in students' desire to earn high grades. The high level of student discipline at school can also be interpreted through Vroom's (1964) expectancy theory: the presence of teachers and school rules creates clear expectations and instrumentality regarding learning efforts, whereas these expectations weaken when students study independently without direct supervision at home an interpretation consistent with the role of motivation as a driver, guide, and catalyst for learning behavior, as proposed by Hamalik (2011) and Sardiman (2011). The consistent gap between academic performance at school and at home is better explained by self-determination theory, which distinguishes between autonomous and controlled motivation (Ryan & Deci, 2020). A recent meta-analysis of 144 studies and more than 79,000 students by Bureau et al., (2022) reinforces this explanation by finding that teachers' support for autonomy predicts students' self-determined motivation more strongly than support from.

This explanation is consistent with the findings of Li (2024) among 1,126 rural high school students in Henan Province, China, which showed that self-regulated learning is strongly influenced by resilience and academic delay of gratification two capacities that typically develop through consistent environmental support, including family support. In line with this, Suud et al., (2024), in a study of 606 Indonesian students, found that family social support plays a crucial role in shaping students' self-regulated learning. Given the geographical context of SMA Negeri 1 Lahewa, which is located in an archipelagic region with limited resources (Rahmadi, 2020; Zebua et al., 2024), the low prevalence of independent study habits at home observed in this study is most likely not solely due to a lack of students' internal motivation but also to the limited structural support at home that could foster such autonomous learning habits.

One thing that honestly surprised the author was the difference in the categories of learning motivation compared to the study by Harefa et al. (2022), which was conducted in a relatively similar geographical and cultural context in the Nias Islands but concluded that the categories were moderate. The author initially assumed that similar island conditions would yield similar motivation categories as well, so the finding of a "high" category in this study was not entirely expected. This discrepancy sparks further curiosity; it likely arises because the study by Harefa et al. (2022) focused on the effectiveness of a specific blended learning approach, whereas this study is purely descriptive without any methodological intervention, meaning that the two studies actually measure somewhat different things despite sharing the same theme. It is important to remain open to this possibility, rather than imposing a single conclusion that generalizes student motivation across the entire Nias region.

On the other hand, these findings are consistent with several other relevant studies. The "high–very high" category in this study aligns with the findings of Anggo et al. (2023) at Luwuk State High School 1, which also reported a "very high" category. The positive relationship between motivation and academic achievement found by Andriani and Rasto (2019), Palittin et al. (2019), and Sapitri and Fauziah (2022) further strengthen the assumption that high motivation in this study has the potential to positively contribute to students' biology learning outcomes, although this study itself did not directly measure learning outcomes; therefore, this relationship cannot yet be empirically confirmed in the context of State Senior High School 1 Lahewa. Students' high interest in material related to daily life (84.8%) is also consistent with Emda's (2018) argument that the relevance of the material plays a crucial role in maintaining learning motivation, even when teaching methods are not always varied.

In terms of scope and generalizability, these findings should be understood as a descriptive snapshot of a single point in time and a single school, rather than a representation of motivation to learn biology in general throughout North Nias or Indonesia. With a population of 586 and a sample of 66 students selected through purposive sampling at a single school, these results are more appropriately positioned as baseline data that enrich the literature on motivation to learn biology in the context of remote island schools a context that has rarely been specifically studied (Rahmadi, 2020) and cannot yet be statistically generalized without further replication.

This study has several limitations. First, the descriptive cross-sectional design using a dichotomous Guttman scale captures conditions at a single point in time and does not explain why the school-home gap occurs. Second, the comparison between 10th and 11th grades—which was planned during the data analysis phase has not been presented separately in the results section. Third, this study did not incorporate qualitative data that could provide a deeper explanation of the factors behind the low levels of independent study habits at home. Given these limitations, future research is recommended to: (1) explicitly present a comparison of motivation between 10th and 11th grades; (2) use a

mixed-methods approach with interviews of students and parents to explore factors related to family support (Suud et al., 2024); and (3) design and test interventions based on self-determination theory such as autonomy-support training for teachers to bridge the gap between controlled and autonomous motivation among students in island regions (Bureau et al., 2022). Despite these limitations, this study makes an initial contribution by providing the latest empirical data on motivation to learn biology in schools in the North Nias archipelago, while also serving as a foundation for teachers and schools to design strategies to strengthen students' independent learning outside of school hours.

Conclusion

This study concludes that the learning motivation of students at Lahewa State High School 1 in biology classes falls into the high category, characterized by strong motivation when supported by school structure and supervision, but has not yet been fully internalized into independent learning initiatives outside of school—a pattern relevant not only to Lahewa State High School 1 but also to other schools in island regions with similar geographic and social characteristics. These findings underscore that future efforts to enhance motivation for learning Biology must go beyond merely strengthening school rules and supervision; they must also foster students' autonomy and self-confidence to learn independently. There are three key takeaways for readers of this article: first, student learning motivation is multifaceted and varies across indicators, so educational interventions must be tailored to address specific areas of weakness rather than applied uniformly; second, a school's geographic and social context shapes students' motivation patterns, so nationally standardized educational policies need to be adapted at the school level; and third, strengthening independent learning at home represents the most urgent and promising area for intervention to be explored in future educational research and practice.

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AI declaration guidelines

The authors state that Artificial Intelligence (AI) tools were used in the drafting of this manuscript. Specifically, Claude (Anthropic) was used for language refinement, analysis of writing structure, and assistance with manuscript formatting. All results generated by AI have been critically reviewed, examined, and validated by the authors to ensure accuracy, originality, and consistency with the research findings. The authors bear full responsibility for the entire content of this manuscript, including the validity of the data, the accuracy of the interpretations, and the originality of the work. AI tools were not used to generate research data, results, or core academic interpretations in this manuscript.

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