Learning Motivation and Biology Achievement Among 11th-Grade Students: An Analysis of Strengths and Weaknesses at SMA Negeri 1 Idanogawo

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Abstract: The low level of active student engagement in biology learning and suboptimal learning outcomes are issues that need to be examined empirically. This study aims to describe the level of learning motivation and perceptions of biology learning outcomes, as well as to identify indicators of weaknesses among 11th-grade students at Idanogawo State High School 1. The study employed a descriptive quantitative approach using a 14-item Yes/No questionnaire distributed via Google Forms to 23 valid respondents in May 2026. The data were analyzed using descriptive statistics, including the mean, median, mode, standard deviation, and the percentage of responses per item. The results showed that the average learning motivation score was 5.48 out of a maximum of 6 (91.3%), while the average learning achievement score was 6.78 out of a maximum of 8 (84.8%). A total of 52.2% of students fell into the moderate category and 21.7% into the high category. The strongest motivational factors were found in the awareness of the importance of biology and the earnestness in completing assignments (100%), while the greatest weaknesses were found in independent learning outside of class hours (69.6%) and the willingness to ask questions when unsure (43.5%). Descriptively, there was a consistent pattern between motivation scores and perceptions of learning outcomes, confirming that learning motivation is positively correlated with students' biology learning outcomes.

Keywords: motivation to learn; biology learning outcomes; educational psychology; active learning

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Introduction

Education is the cornerstone of developing competent human resources with strong character. Law No. 20 of 2003 on the National Education System emphasizes that the national education system serves to develop abilities and shape the character and civilization of a dignified nation in order to enrich the nation's life (National Education System Law, 2003). Success in the formal education process at school is not solely determined by the quality of the curriculum and teacher competence, but also by the students' own internal psychological factors. One psychological component that significantly determines the quality of the learning process and outcomes is learning motivation (Sardiman, 2016).

The biology curriculum at the Senior High School (SMA) level is a discipline that studies all phenomena of life, from the molecular level to ecosystems. The nature of biology—rich in concepts, scientific terms, and interconnections among biological phenomena—requires students to engage in deep and sustained cognitive processing (Dahar, 2011). However, real-world evidence shows that students' learning outcomes in biology at various schools do not always meet expected standards. This situation is generally attributed to students' low intrinsic motivation to explore biology material independently (Nurhayati, 2021).

Learning motivation is defined as the totality of internal driving forces within a student that initiate learning activities, ensure their continuity, and provide direction so that the student's desired goals can be achieved (Sardiman, 2016). Uno (2017) distinguishes motivation into two main dimensions: intrinsic motivation, which stems from self-awareness and personal desire, and extrinsic motivation, which is triggered by external factors such as grades, rewards, and social demands. Students with strong intrinsic motivation have been shown to demonstrate deeper engagement, greater perseverance, and, ultimately, achieve more optimal learning outcomes (Deci & Ryan, 2000).

Ideal conditions for learning biology require students who are not only physically present in the classroom but also actively ask questions, are willing to explore learning resources independently, and engage in scientific discussions. Self-Determination Theory (SDT), developed by Deci and Ryan (2000), asserts that high-quality learning motivation will only develop when students' basic needs for competence, autonomy, and relatedness are met in their learning environment. However, various studies indicate that teaching practices in schools are still often one-sided and do not provide sufficient space for the development of students' learning autonomy (Hia et al., 2025; Pratama & Suryadi, 2022).

Various studies have confirmed a strong positive relationship between learning motivation and biology achievement. Nurhayati (2021) found a correlation coefficient of r = 0.688 between learning motivation and biology

achievement among high school students in North Sumatra, while Handayani and Prasetyo (2020) reported a correlation coefficient of 0.74 in a similar population in South Sumatra. Pratama and Suryadi (2022) even found that learning motivation accounted for 48.7% of the variation in biology learning outcomes. These findings confirm that interventions to enhance learning motivation are among the most effective strategies for improving the quality of biology learning outcomes.

However, there are several gaps in previous studies that warrant attention. Most prior research measured learning motivation using relatively long Likert scales that required complex inferential analysis, making them impractical to apply in the context of small-scale studies in high schools with limited resources. Furthermore, previous studies rarely specifically identified the weakest and strongest indicator items in a particular school context, resulting in recommendations that were not specific or actionable enough for teachers and school administrators (Handayani & Prasetyo, 2020; Zebua, 2024).

Based on initial observations at Idanogawo State High School 1 in May 2026, striking variations were found in the engagement and enthusiasm for learning biology among 11th-grade students. This phenomenon raises an important question: What are the actual profiles of these students' motivation to learn and their perceptions of their biology learning outcomes, and in which indicators do their main weaknesses lie? This study is expected to provide a concrete empirical picture that can serve as a basis for teachers and school administrators to design more targeted pedagogical interventions to improve students' motivation and learning outcomes in biology.

Method

Type and Research Approach

This study is a descriptive quantitative study. A quantitative approach was used because the data collected consists of numerical values that can be statistically analyzed, while a descriptive approach was chosen because this study aims to describe the current state of students' motivation and learning outcomes in biology without applying any special interventions (Sugiyono, 2019). Quantitative descriptive research is considered appropriate for mapping the factual conditions of a psychological variable in a specific population at a specific point in time (cross-sectional).

Research Location and Time

The research was conducted at Idanogawo State Senior High School 1, Idanogawo Subdistrict, Nias Regency, North Sumatra Province. Data collection took place on May 8–10, 2026, through an online survey using Google Forms administered to 11th-grade students.

Population and Sample

The population in this study consists of all 11th-grade students at Idanogawo State High School 1 for the 2025/2026 academic year. The research sample was determined using purposive sampling, specifically students who responded to the online questionnaire and provided data that could be analyzed. Of the 28 responses submitted via Google Forms, a deduplication process was conducted to retain the most recent data from each individual who submitted more than one response, resulting in 23 unique, valid respondents as the units of analysis for this study.

Data Collection Instrument

The instrument used was a questionnaire consisting of 14 dichotomous (Yes/No) items, which was distributed online via Google Forms. The questionnaire was designed to measure two dimensions: (1) motivation to learn biology (Items 1–6) and (2) perceptions of biology learning outcomes (Items 7–14). Scoring was performed by assigning a value of 1 to positive responses that supported the indicators and 0 to negative responses, except for Item 6, which was negative in nature and therefore scored in reverse. The instrument's scoring rubric is presented in Table 1.

Table 1. Research Questionnaire Instrument Outline (14 Items)

No.	Dimension	Indicators / Questions	No. Item	Characteristics
1	Motivation to Learn (X)	Awareness of the Importance of Biology for the Future	1	Positive
2		Studying biology without any homework	2	Positive
3		The desire to get good grades	3	Positive
4		Diligence in completing biology assignments	4	Positive
5		Perseverance in understanding difficult material	5	Positive
6		Studying only when exams are coming up	6	Negative

No.	Dimension	Indicators / Questions	No. Item	Characteristics
7	Learning Outcomes (Y)	Actively asking questions when something isn't understood	7	Positive
8		Grades always meet the minimum passing score	8	Positive
9		Often getting good grades	9	Positive
10		Understanding the material during exams	10	Positive
11		Rarely has difficulty with Biology problems	11	Positive
12		Satisfactory test scores	12	Positive
13		Confident when answering Biology questions	13	Positive
14		Able to complete assignments/exercises well	14	Positive

Data Analysis Techniques

The collected data were analyzed using descriptive statistics, including: (1) calculation of each respondent's total score; (2) calculation of descriptive statistics—mean, median, mode, standard deviation, minimum, and maximum—separately for the dimensions of learning motivation and learning outcomes; (3) categorization of total scores into three categories (high, moderate, low) based on the formula M ± SD; and (4) calculation of the percentage of positive responses per item to identify indicators of strengths and weaknesses in each dimension. The entire process of data processing and presentation was conducted descriptively without using inferential analysis.

Results

This study successfully collected data from 23 valid respondents, all 11th-grade students at Idanogawo State High School 1. The respondents consisted of 15 female students and 8 male students. Descriptive statistical analysis was conducted separately for the learning motivation dimension (Items 1–6, maximum score of 6) and the biology learning outcomes dimension (Items 7–14, maximum score of 8).

Table 2. Descriptive Statistics for the Learning Motivation Dimension (Items 1–6, Max Score = 6)

Statistics	Scores
N	23
Maximum Possible Score	6
Mean	5.48
Median	5
Mode	5
Standard Deviation	0.51
Minimum	5
Maksimum	6

The average student learning motivation score was 5.48 out of a maximum of 6, equivalent to 91.3%. The standard deviation of 0.51 reflects relatively little variation among students on this dimension, indicating that most students have relatively uniform levels of learning motivation at a fairly high level.

Table 3. Descriptive Statistics for the Biology Learning Outcomes Dimension (Items 7–14, Max Score = 8)

Statistics	Scores
N	23
Maximum Possible Score	8
Mean	6.78
Median	7
Mode	7
Standard Deviation	1.04
Minimum	5
Maksimum	8

The average score for students' biology learning outcomes was 6.78 out of a maximum of 8, equivalent to 84.8%. The standard deviation of 1.04 shows greater variation compared to the motivation dimension, indicating that students' perceptions of their learning outcomes vary more widely.

Table 4. Categorization of Total Scores (Motivation + Learning Outcomes, Max = 14; M = 12.26, SD = 1.25)

No.	Category	Score Range (out of 14)	Frequency	Percentage (%)
1	High	≥ 13.5 (≈ 14)	5	21.7%
2	Medium	11.0 – 13.5	12	52.2%
3	Low	< 11.0	6	26.1%
Total			23	100%

A total of 5 students (21.7%) fell into the high category, 12 students (52.2%) into the moderate category, and 6 students (26.1%) into the low category. This distribution pattern indicates that, overall, students' motivation and perceptions of their biology learning outcomes are quite good, although there is still significant room for improvement.

Table 5. Percentage of Positive Responses per Item – Learning Motivation Dimension

Item	Question	Yes (n)	No (n)	% Positive
1	Do you think biology is important for your future?	23	0	100.0%
2	Do you study biology even when you don't have homework?	16	7	69.6%
3	Do you want to get good grades in biology?	23	0	100.0%
4	Do you work diligently on your biology homework?	23	0	100.0%
5	Do you try to understand difficult biology concepts?	18	5	78.3%
6	Do you only study biology right before exams? (score: No=1)	0	23	100.0%

The results of the item-by-item analysis of the learning motivation dimension showed the highest scores for Item 1 (awareness of the importance of biology, 100%), Item 3 (desire to get good grades, 100%), and Item 4 (diligence in completing assignments, 100%). Meanwhile, the greatest weakness was found in Item 2 (studying biology without assignments), with only 69.6%—or 16 out of 23 students—responding positively.

Table 6. Percentage of Positive Responses per Item – Biology Learning Outcomes Dimension

Item	Question	Yes (n)	No (n)	% Positive
7	Do you actively ask questions when you don't understand a biology lesson?	10	13	43.5%
8	Do your biology grades always meet the minimum passing score?	20	3	87.0%
9	Do you often get good grades in biology?	22	1	95.7%
10	Do you understand the biology material during exams?	22	1	95.7%
11	Do you rarely have trouble answering biology questions?	18	5	78.3%
12	Are your biology test scores satisfactory?	22	1	95.7%
13	Are you able to answer biology questions with confidence?	21	2	91.3%
14	Can you complete biology assignments and exercises well?	21	2	91.3%

In terms of learning outcomes, the strongest indicators were Item 9 (frequently receiving good grades, 95.7%), Item 10 (understanding the material during exams, 95.7%), and Item 12 (satisfactory test scores, 95.7%). The most notable finding is the low percentage of positive responses for Item 7 (actively asking questions when unsure), which reached only 43.5%, far below the other indicators.

Discussion

Overview of Students' Learning Motivation

The research results indicate that the learning motivation in biology among 11th-grade students at Idanogawo State High School 1 generally falls into the moderate to high category, with an average score of 5.48 out of a maximum of 6 (91.3%). This finding aligns with Nurhayati's (2021) study, which found that high school students' motivation to learn biology in North Sumatra falls into the high category. The fact that 100% of students acknowledge the importance of biology for their future constitutes a highly valuable psychological asset, as confirmed by Uno's (2017) theory that hopes and future orientation are the strongest drivers of intrinsic motivation in adolescents.

However, there is a striking disparity between the high level of awareness regarding the importance of biology (100%) and the low level of independent learning outside of class time (69.6%). This indicates that the motivation of most students remains predominantly extrinsic—that is, they are driven to study only when faced with external obligations such as assignments or exams. This finding is consistent with the research by Pratama and Suryadi (2022), which found that extrinsic motivation still dominates the learning patterns of high school students in Indonesia. Djamarah (2011) explains that true intrinsic motivation is characterized by a willingness to learn that arises spontaneously without the need for external encouragement; if independent learning remains low, then intrinsic motivation has not yet fully developed.

Overview of Students' Biology Learning Outcomes

The average score for students' biology learning outcomes was 6.78 out of a maximum of 8 (84.8%), indicating a fairly positive perception of learning outcomes. The majority of students (87%) stated that their biology grades always met the minimum passing standard, and 95.7% reported frequently receiving good grades. These figures are consistent with the findings of Handayani and Prasetyo (2020), who reported that high school students with moderate-to-high motivation tend to exceed the minimum passing standard. Sudjana (2016) emphasized that meeting the minimum passing standard provides empirical evidence that students have mastered the established core competencies (Halawa et al., 2025).

The most surprising finding in this study was the extremely low level of student questioning; only 10 students (43.5%) reported actively asking questions when they did not understand the lesson. This is a clear indication that the learning process remains passive and lacks dialogue. This finding really caught the researchers' attention because, on the one hand, students reported a good understanding of the material during exams (95.7%), but on the other hand, they were reluctant to ask questions when they were confused. This may indicate the presence of psychological barriers, such as a fear of being judged negatively or a classroom culture that does not encourage critical questioning. According to Sudjana (2016), students' active engagement in asking questions reflects the depth of their thinking process and the true quality of their conceptual understanding.

The Relationship Between Learning Motivation and Learning Outcomes

Although this study did not employ inferential statistical correlation analysis, the descriptive analysis of individual items provides a fairly clear picture of the relationship between motivation and learning outcomes. Students with high total scores generally exhibited positive response patterns on nearly all items across both dimensions simultaneously, while students with low scores exhibited interrelated weaknesses on both dimensions. This pattern is consistent with the findings of previous studies: Nurhayati (2021) found $r = 0.688$, and Pratama & Suryadi (2022) found that motivation contributed 48.7% to biology learning outcomes.

These findings can be explained through Sardiman's (2016) theoretical framework, which states that motivation functions as a driver, guide, and determinant of learning behavior. Deci and Ryan (2000), through Self-Determination Theory (SDT), also confirmed that high intrinsic motivation leads to deeper engagement and better academic achievement. A generalizable conclusion that can be drawn from this study is that increased learning motivation—particularly intrinsic motivation—is a key prerequisite for achieving optimal biology learning outcomes in high school.

Recommendations Based on the Study's Limitations and Contributions

This study used a simple Yes/No questionnaire without incorporating official report card grades or inferential correlation analysis; therefore, the strength of the relationships between variables could not be precisely quantified. For future research, it is recommended to use a Likert scale with instruments that have been formally tested for validity and reliability; to include national exam scores or end-of-semester assessment data as more objective measures of learning outcomes; to expand the sample to include several classes or schools in Nias Regency; and to use multiple regression analysis to identify more comprehensive predictors of learning outcomes. The contribution of this study lies in the presentation of school-specific profiles of motivation and biology learning outcomes, which can be directly used by teachers and the principal of SMA Negeri 1 Idanogawo as a basis for developing measurable and targeted intervention programs.

Conclusion

This study successfully provided a descriptive, data-driven snapshot of the learning motivation profiles and perceptions of learning outcomes in biology among 11th-grade students at Idanogawo State High School 1. The key findings to note are: (1) overall learning motivation falls into the moderate-to-high category, with strengths in awareness and dedication to learning, but weaknesses in independent learning outside of class hours; (2) perceptions of learning outcomes were fairly positive, but students' willingness to ask questions remained very low and requires immediate attention; and (3) there was a descriptive correlation between high motivation and high perceptions of learning outcomes, confirming the theoretical and empirical relevance of the relationship between these two variables. Interventions focused on strengthening intrinsic motivation and creating a classroom climate that encourages active dialogue are strategic steps that biology teachers and school administrators need to prioritize.

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AI Usage Statement

The authors declare that an artificial intelligence (AI)-based tool, namely Claude AI (Anthropic), was used in the preparation of this manuscript, specifically to assist with language editing and refining the writing structure to conform to the GEN BIONIX journal template. The entire process of data collection, conducting observations, administering questionnaires, analyzing data, and interpreting findings was carried out entirely by the author team directly in the field. All authors take full responsibility for the entire content of this manuscript and have critically reviewed and validated all content based on research data obtained directly in the field.

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