Students' Learning Motivation and Metacognitive Awareness in Biology Learning: A Study at Senior High School in Coastal Area

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Abstract. This study aims to analyze students' learning motivation and metacognitive awareness in biology subjects. This type of research is descriptive with a quantitative approach. This research was conducted in April of the 2023/2024 Academic Year, which was conducted at SMA Negeri 4 Tanjungpinang. The population of this study was 685 students of SMA Negeri 4 Tanjungpinang. The sampling technique used was stratified random sampling, and the sample used was 253 students. The instruments used were learning motivation questionnaires and the Metacognitive Awareness Inventory (MAI), which were valid and reliable. The data analysis technique was a quantitative descriptive analysis technique. Based on the results of the study, it can be concluded that the learning motivation of students at SMA Negeri 4 Tanjungpinang in biology subjects is in the moderate category. The metacognitive awareness of students at SMA Negeri 4 Tanjungpinang in biology subjects is in the high category. This can be interpreted as students identifying their strengths and weaknesses in learning and developing good learning strategies.

1 Introduction

In the education world, especially in learning activities, The continuity and success of the process of teaching and learning are not only influenced by intellectual factors but also by other factors that are no less important in determining the academic achievement of students, namely the motivation themselves ability. Motivation is very important in learning activities. Because it will encourage the learning spirit and vice versa; a lack of motivation will weaken the learning spirit [1].

Motivation can be defined as the drive within a person to do certain things to achieve a goal [2]. Learning motivation is the students overall driving force that can give rise to, provide direction, and ensure continuity for activities of learning to achieve the desired goals [3]. Behavior to achieve a goal is drived, directed, and maintained by motivation [4].

In the learning process, motivation functions as an encouragement for students to take action and as a guide to fulfill a need. Motivation as an internal drive that encourages students to act and motivation as a guide to fulfill needs or achieve predetermined goals [5]. Many factors can influence motivation, namely the physical and spiritual condition of students,

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students' ideals, classroom environmental conditions, and the learning ability of each student [6].

Not only learning motivation to realize a learning process that can develop students' potential, but it is also necessary to strengthen the development of thinking and problem-solving skills and make the learning process in class more meaningful; this needs to be emphasized; is what can improve understanding of the learning process [7]. Many students have a low level of understanding of their learning process because they are not yet aware of how they learn. If students can understand their learning process, also known as metacognition, then the information provided during learning can be stored in long-term memory because metacognition is a system that controls information processing [8]. According to [9] metacognitive awareness helps students know what they do not understand and how they can control themselves while learning. Lack of metacognitive awareness makes students appear passive in learning activities, unable to work independently and can fail in learning outcomes [7,10].

Biology is a type of science that studies life and living things from various aspects of problems and levels of organization [11]. Many students consider biology a difficult subject because, during the learning process, there is a lot of use of Latin, difficult pronunciation, and a lot of learning material. Biology lessons cover basic and abstract concepts, so they require broad knowledge [11]. In addition to broad knowledge, motivation is also needed in students, which aims to encourage and increase students' enthusiasm for learning various things in biology lessons [12]. Metacognitive awareness is also no less important to increase effectiveness and improve student focus in biology learning [13]. Learning motivation and metacognition can improve outcomes in biology learning [14].

Based on teacher interviews conducted at SMA Negeri 4 Tanjungpinang regarding student learning motivation, it was found that when the teacher explained the material in front of the class, students were busy talking to their deskmates. And students were still silent when they could not understand the learning process in the classroom. In addition, the metacognitive awareness of students at SMA Negeri 4 Tanjungpinang was also still diverse. Students were not yet able to fully use cognitive strategies in learning, which was indicated by not bringing learning books during the process of learning in class. Based on this description, the researcher is interested in analyzing students' learning motivation and metacognitive awareness in biology subjects.

2 Methods

This study uses a descriptive research type with a quantitative approach, which was conducted in April of the 2023/2024 Academic Year. This research was conducted at SMA Negeri 4 Tanjungpinang. The population in this study were all students of SMA Negeri 4 Tanjungpinang, totaling 685 students. A sampling technique, namely Stratified Random Sampling, was used to obtain a sample of 253 students. The data collection technique used was a questionnaire regarding learning motivation and the Metacognitive Awareness Inventory (MAI).

The instrument used to measure learning motivation was taken from research [15], which is valid and reliable with a coefficient value of 0.547 (moderate category). The instrument grid is presented in Table 1.

Table 1. Grid of Learning Motivation Instruments

No	Indicators	Question Number	
		Favorable	Unfavorable
1	Independent in learning biology	-	1
2	Students like challenges in biology learning activities	2	3
3	Interested in learning biology	-	4
4	Can defend their opinions	5, 6	-
5	Enjoy solving problems in learning	7	-

The instrument used to measure metacognitive awareness was developed by [15] and adopted by [16]. It has been tested for validity and reliability with a coefficient of 0.879 (high category). The metacognitive awareness instrument grid is presented in Table 2 below.

Table 2. Metacognitive Awareness Instrument Grid

No	Aspects	Indicators	Question Number
1	Cognitive Knowledge	Declarative Knowledge	7, 9, 13, 14, 17, 29, 41
		Procedural Knowledge	3, 11, 24, 30
		Conditional Knowledge	12, 15, 23, 26, 32
2	Cognitive Regulation	Planning	4, 6, 19, 20, 40
		Information Management Strategies	10, 27, 28, 34, 35, 37, 38, 42
		Monitoring of Understanding	1, 2, 8, 18, 25, 31, 43
		Improvement Strategies	22, 36, 39, 45
		Evaluation	5, 16, 21, 33, 44

In this study, descriptive statistics are used to analyze data. Descriptive statistics can describe, summarize, and summarize data so that it is easier to read and use the data [17]. The scoring used for each student's answer uses a Likert scale. The student learning motivation questionnaire scores can be seen in Table 3 below.

Table 3. Learning Motivation Questionnaire Scores

Description	Favorable	Unfavorable
Strongly Agree	4	1
Agree	3	2
Disagree	2	3
Strongly Disagree	1	4

Source: [18]

The scores used for each student's answer on the metacognitive awareness questionnaire can be seen in Table 4 below.

Table 4. Metacognitive Awareness Questionnaire Scores

No	Description	Score
1	Often	4
2	Sometimes	3
3	Seldom	2
4	Never	1

Source: [16]

The scores obtained by students in filling out the learning motivation and metacognitive awareness questionnaires are processed into a value on a scale of 100, with the following calculation..

$$\text{Score percentages} = \frac{\text{obtained score}}{\text{maximum score}} \times 100\%$$

Score percentages are grouped according to the categories of learning motivation and metacognitive awareness, which are presented in Tables 5 and 6.

Table 5. Score Categories for Measuring Learning Motivation

No	Score percentages (%)	Category
1	86-100	Very High (VH)
2	76-85	High (H)
3	60-75	Moderate (M)
4	55-59	Low (L)
5	<55	Very Low (VL)

Modified from [19]

Table 6. Score Categories for Measuring Metacognitive Awareness

No	Score percentages (%)	Category
1	81.26 - 100	Very High (VH)
2	68.76 – 81.25	High (H)
3	56.26 – 68.75	Moderate (M)
4	43.76 – 56.25	Low (L)
5	25 – 43.75	Very Low (VL)

Source: [20]

3 Results and Discussion

3.1 Descriptive Analysis of Learning Motivation

Students' learning motivation was measured through a questionnaire and given to 253 students. There are 5 indicators to represent questions on the learning motivation questionnaire. The assessment scores are given according to Table 3, and calculations are made for each student's answer. The results of the analysis of students' learning motivation data for each indicator can be seen in Table 7.

Table 7. Student Learning Motivation for Each Indicator

No	Aspek Indikator	Achievement Score (%)	Kategori
1	Independent in learning biology	70.95	M
2	Students like challenges in biology learning activities	65.22	M
3	Interested in learning biology	67.79	M
4	Can defend their opinions	72.73	M
5	Enjoy solving problems in learning	64.82	M
Average		68.30	M

Based on Table 7, it can be seen that the average student learning motivation for each indicator reaches a figure of 68.30% in the moderate category. In the independent indicator in learning biology, the results are 70.95% in the moderate category. This is in accordance with research [21] that showed students' learning independence was in the moderate category, students tried to learn more actively without having to be told by teachers or parents, but they admitted that they often delayed time and gave up quickly when experiencing difficulties.

Students who have independence in learning will make students become responsible people and can be confident and can solve their problems by themselves [22].

Furthermore, in terms of the indicator aspect, students like challenges in learning biology, it is in the moderate category with a percentage of achievement of 65.22%. In terms of the indicator aspect of interest in learning biology, it is in the moderate category with a result of 67.79%. Student learning interest is influenced by the student's factors; student behavior in following the biology learning process can indicate interest in the learning process [23]. If they do not have an interest in learning biology, then their interest in learning will decrease. The interest in learning obtained in the medium category showed that no matter how good the teaching methods and techniques used by teachers are if students' interest in learning is low, the teaching and learning process between students and teachers will not be achieved according to the goals that have been set [24]. Therefore, interest in learning is very necessary in the learning process.

Next, the indicator can defend their opinion on the aspect of learning motivation, which obtained a percentage of 72.73% with a moderate category. High confidence in each of their opinions must be possessed by each student so that friends do not easily influence them, because students who have minimal knowledge will find it difficult to defend their different opinions compared to students who have extensive knowledge and are creative. Therefore, each student must be able to defend their own opinion in the teaching and learning process [11].

In the last indicator, the pleasure of solving problems in learning is in the moderate category, with a percentage of 64.82%. Students who enjoy solving problems in learning show that they are highly creative [25]. In the learning process, high motivation is needed, and it will make it easier for students to solve problems in learning. Conversely, if students' learning motivation is low, it will affect students' ability to solve problems in learning [25]. The level of student learning motivation, when measured in general, can be seen in Figure 1.

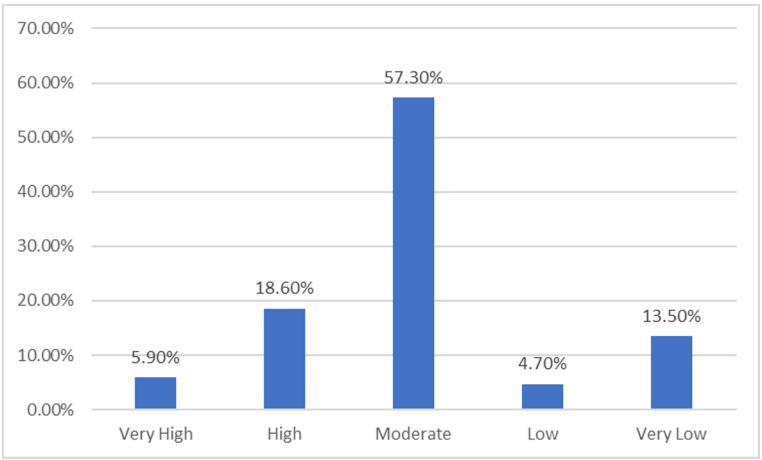

Fig. 1. Frequency Distribution of Students in Each Learning Motivation Category

Based on the image shown in Figure 1 above, it can be seen that most students, namely 145 students (57.3%), have learning motivation in the medium category and 47 students (18.6%) in the high category. Then, a small portion of students, namely 34 students (13.5%), have learning motivation in the very low category. 15 students (5.9%) are in the very high category and 12 students (4.7%) have learning motivation in the low category. Therefore, it can be concluded that the learning motivation of students at SMA Negeri 4 Tanjungpinang is in the medium category.

3.2 Descriptive Analysis of Metacognitive Awareness

Students' Metacognitive Awareness was measured through a closed questionnaire. There are 8 indicators to represent questions on the metacognitive awareness questionnaire. The assessment scores are given according to Table 4, and calculations are made for each student's answer. The results of the analysis of students' metacognitive awareness data for each indicator can be seen in Table 8.

Table 8. Students Metacognitive Awareness of Each Indicator

No	Indicators	Achievement Score (%)	Category
1	Declarative Knowledge	77.17	H
2	Procedural Knowledge	74.33	H
3	Conditional Knowledge	78.66	H
4	Planning	78.77	H
5	Information Management Strategies	71.21	H
6	Monitoring of Understanding	76.47	H
7	Improvement Strategies	80.68	H
8	Evaluation	73.42	H
Average		76.33	H

Based on Table 8, it can be seen that all achievement values on each metacognitive awareness indicator are in the high category. The average obtained on the metacognitive awareness indicator is 76.33%. On the indicators of declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, monitoring information understanding, and evaluation, the achievement values are around 70. However, on the debugging strategy indicator (improvement strategy), the achievement value is 80.68%.

The declarative knowledge indicator is already in the high category of achievement; this shows that the knowledge of various things from students is good. Good declarative knowledge indicates that students understand their strengths and weaknesses in learning and know how they can overcome these weaknesses [26]. High declarative knowledge can identify students' strengths and weaknesses [27]. That way, students can anticipate their failures by preparing themselves better.

In addition, the procedural knowledge indicator is in the high category of achievement. This shows that students can understand the strategies used in learning so that learning becomes useful. Students can be said to have procedural knowledge if they are able to choose and apply appropriate procedures when they solve a problem [28]. The conditional knowledge indicator is also in the high category, with an achievement value of 78.66%. This shows that their knowledge of how, when, and why to do something or implement the learning strategy is right for them [29].

Meanwhile, the planning indicator is also in the high category. This shows that students are able to plan several ways to solve a problem in learning. In accordance with the statement from [26]. Students who have good planning skills will have a way to solve problems and will be able to allocate time to achieve their learning goals. The information management strategy indicator also shows an achievement value of 71.21% in the high category. When the information management strategy is running well, students will be aware pay close attention and focus their goals on important information [30].

In addition, the monitoring indicators for understanding and improvement strategies are also in the high category. This shows that students are right to be able to use the learning objectives they want to achieve, have managed strategies well, and monitor information related to their learning [15]. The evaluation indicator is also in the high category; this indicates that students are able to understand how to evaluate the results of their learning,

namely by evaluating the learning objectives that have been targeted before the learning process begins. In the evaluation process, students reflect on the extent of their abilities after completing the learning process [26].

The general level of students' metacognitive awareness can be seen in Figure 2 below.

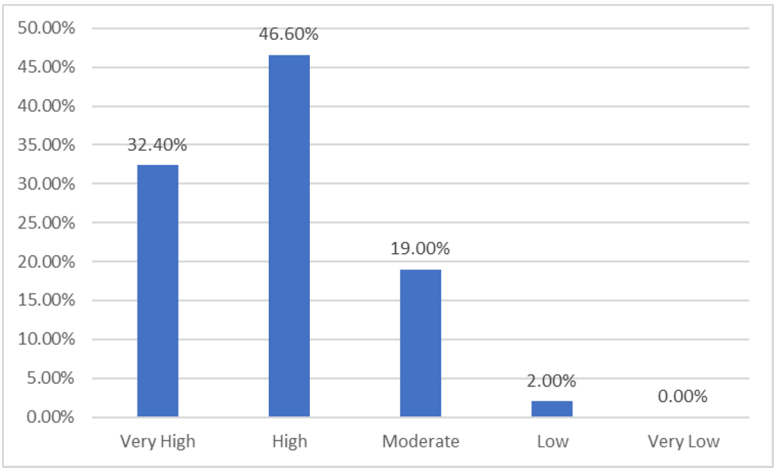

Fig. 2. Frequency Distribution of Students in Each Category of Metacognitive Awareness

Based on the data displayed in Figure 2, it is known that most students, namely 118 students (46.6%), have metacognitive awareness in the high category and 82 students (32.4%) in the very high category. Then a small number of students, namely 48 students (19%), are in the moderate category and 5 students (2%) are in the low category. So it can be concluded that the metacognitive awareness of students at SMA Negeri 4 Tanjungpinang is in the high category.

4 Conclusion

Based on the results of the research analysis, it can be concluded that the learning motivation of students at SMA Negeri 4 Tanjungpinang in the Biology subject is in the moderate category. The results of this study also show that the metacognitive awareness of students at SMA Negeri 4 Tanjungpinang in the Biology subject is in the high category.

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