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Aspects of Metacognitive Awareness and Scientific Attitudes Toward Students' Higher-Level Thinking Skills

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Abstrak

Tujuan penelitian ini untuk: Mengetahui besaran kontribusi komponen kesadaran metakognitif terhadap komponen kemampuan berpikir tingkat tinggi siswa kelas X tentang keanekaragaman hayati di SMA N 1 Batang Kuis. Mengetahui besaran kontribusi komponen sikap ilmiah terhadap komponen kemampuan berpikir tingkat tinggi siswa kelas X tentang keanekaragaman hayati di SMA N 1 Batang Kuis. Penelitian ini merupakan jenis penelitian pendekatan deskriptif kuantitatif, yang mempelajari tentang besarnya kontribusi aspek pada kesadaran metakognitif dan sikap ilmiah terhadap kemampuan berpikir tingkat tinggi siswa kelas X. Hail penelitian ini adalah: Aspek komponen kesadaran metakognitif yang paling berkontribusi terhadap kemampuan berpikir tingkat tinggi siswa kelas X tentang keanekaragaman hayati di SMA Negeri 1 Batang Kuis adalah evaluasi (X1.8), strategi perbaikan (X1.7), perencanaan (X1.4), pemantauan komprehensi (X1.6) dan pengetahuan deklaratif (X1.1) dengan kontribusi sebesar 69,8%.Aspek komponen sikap ilmiah yang paling berkontribusi terhadap kemampuan berpikir tingkat tinggi siswa kelas X tentang keanekaragaman hayati di SMA Negeri 1 Batang Kuis adalah adalah aspek ketertarikan memperbanyak waktu belajar sains (X2.6) dan minat karier dalam sains (X2.7) dengan kontribusi sebesar 62,5%.

***Kata Kunci**: Aspek, Metakognitif, Keterampilan Berpikir Tingkat Tinggi.*

Abstract

The purpose of this study is to: Determine the magnitude of the contribution of the metacognitive awareness component to the component of high-order thinking ability of class X students about biodiversity at SMA N 1 Batang Kuis. Determine the magnitude of the contribution of the scientific attitude component to the component of high-order thinking ability of class X students about biodiversity at SMA N 1 Batang Kuis. This research is a type of quantitative descriptive approach research, which studies the magnitude of the contribution of aspects of metacognitive awareness and scientific attitudes to the high-order thinking skills of class X students. The results of this research are: The aspects of metacognitive awareness components that contribute most to the high-order thinking skills of class X students about biodiversity in SMA Negeri 1 Batang Kuis are evaluation (X1.8), improvement strategies (X1.7), planning (X1.4), monitoring comprehension (X1.6) and declarative knowledge (X1.1) with a contribution of 69.8%. The aspects of scientific attitude components that contribute most to the high-order thinking skills of class X students about biodiversity in SMA Negeri 1 Batang Kuis are the aspects of interest in increasing time to study science (X2.6) and career interest in science (X2.7) with a contribution of 62.5%.

***Keywords**: Aspects, Metacognitive, Higher-Order Thinking Skills.*

1. INTRODUCTION

Although biodiversity is simple, students struggle to understand it. Information management and critical thinking require conceptual understanding. Diversity is difficult for students to measure at the gene, species, and ecosystem levels. Sari & Alberida (2022) reviewed biodiversity levels, including domestic and laying cat differences. Ten of 15 students said both are gene-level. Domestic cats and laying cats are species. Despite their morphological distinctions, domestic cats and laying cats are felidae. According to Ilhamdi et al. (2022), pupils had the most misconceptions about biodiversity and conservation (76.47% and 76.47%). Low misunderstandings included Indonesia's flora and fauna distribution, the Wallace Line, and the Weber Line (29.41%). Yunanda & Ghofur (2019) showed that students still fail to distinguish degrees of diversity in genes, species, and ecosystems and develop practical solutions to biodiversity loss. According to interviews with SMAN 1 Batang Kuis teachers, pupils also misunderstand biodiversity conservation activities and biodiversity levels like genes, species, and ecosystems. This may affect biodiversity learning in students.

Biologists use their thoughts to solve issues via active learning. Teaching and learning activities let students explore information, develop knowledge, and apply cognitive abilities to solve problems. The ability is metacognitive awareness. Thinking about thinking is metacognition. Thinking deeply about how students learn and regulate their learning process is essential to learning biology, starting with planning and problem-solving tactics. Students also discuss and track their progress, identify errors, and re-analyze concepts and techniques. Students can understand biology ideas and solve issues using metacognitive awareness. Metacognitive awareness allows pupils to develop their knowledge, pick appropriate learning tactics, and regulate the learning process. According to Erlin et al. (2021), metacognitive awareness students know what they have and have not mastered and what to do when they don't understand Biology lessons, such as learning about the biodiversity of genes, species, and ecosystems. They ask themselves how and what strategies to use to understand the material and improve their Biology scores/grades.

Students can self-regulate their learning via metacognitive awareness. Metacognitive awareness helps students question their weaknesses, create study plans, use appropriate problem-solving skills and strategies, and learn new information more thoroughly, improving student learning outcomes. According to interviews with SMAN 1 Batang tenth-grade teachers during biology examinations, most pupils did not meet the Minimum Competency (KKM) and received remedial sessions. Students also missed biology assignments due to other assignments and late submissions, often surpassing the deadline. Assignments were challenging and time-consuming. Some pupils focused and answered the questions, while others skipped them. Students had trouble comprehending the questions' context, what they needed to know, and how to solve them. Time will feel short for students who never arrange their time to accomplish teacher assignments or tests.
Due to time and materials, teachers rarely reflect at the end of lessons. This limits students' questions and viewpoints in conversations. Other issues pupils face include learning interest, self-confidence, independence, and biological conceptual knowledge. Marhaendra et al. (2023) define low metacognitive awareness as students arriving late to class, not submitting homework, and not listening to peers during discussion/presentation presentations.

Students are engaged with social media or their phones and typically read the class material in PowerPoint instead of learning it. Knowing how pupils meet learning goals and succeed is metacognitive awareness. Therefore, pupils need cognitive skills to learn well. After learning, cognitive skills are acquired. Learning outcome ratings measure learning process success and instructor performance. The learning outcome evaluation system tests students' cognitive ability to determine low, medium, or high. Biology students' cognitive abilities are still at the LOTS (Lower Order Thinking Skills) C1-C3 level, according to SMAN 1 Batang Kuis tenth-grade teachers. Low HOTS (Higher Order Thinking Skills) cognitive level among students. The teacher said the student's test result was below 71, the Minimum Completion Level (KKM). Teachers rarely use HOTS to solve problems. Teachers construct exam instruments for lower-order thinking skills, rarely using and developing higher-order cognitive thinking. Basic biology concepts and theories confuse students. Reading and science interest are poor among 10th graders. Assessing and developing student attitudes in biology uses cognitive capacities. Scientific attitudes are one example.

The affective domain includes students' scientific acts and behaviours, including attitudes. Students with a scientific approach want to learn and solve problems using science. Through scientific labour or practicums, biology is learned through direct experience. Scientific study helps students use evidence and construct theories and laws. Students learn critical, creative, analytical, and divergent thinking (Haslinar et al., 2022). Not only cognitive capacity but also student behaviour toward learning are learning outcomes. A scientific mindset affects pupils' morality. Students have high morals and are smart. According to SMAN 1 Batang Kuis grade 10 teachers, kids are passive, reluctant, fearful, or embarrassed to speak up.

2. RESEARCH METHODS

This development research was validated and evaluated by expert validators (professors) from the This research was conducted at SMA Negeri 1 Batang Kuis, located on Jalan Pendidikan, Paya Gambar Village, Batang Kuis District, Deli Serdang, North Sumatra. The study period was July–September 2024. The population was all 324 tenth-grade students of SMA Negeri 1 Batang Kuis, divided into nine classes. Each class had similar ability characteristics, including high-achieving, average-achieving, and low-achieving students. Class division was not based on grades or rankings.

The sample was drawn using a cluster random sampling technique. The sample size was determined by drawing lots. This resulted in a total sample of 104 students. This study, a descriptive quantitative approach, examined the contribution of metacognitive awareness and scientific attitudes to higher-order thinking skills in tenth-grade students. After describing the data, the contribution between variables was analyzed (Ermin, 2021).

3. RESULTS AND DISCUSSION

Contribution of Metacognitive Awareness Aspects to Students' Higher-Order Thinking Skills

To determine the contribution of each measured aspect of metacognitive awareness to students' higher-order thinking skills, a multiple linear regression test was conducted using the stepwise method. The simple linear regression equation can be written as follows: $\hat{Y} = 185.3a - 2.6X1.8 - 1.3X1.7 - 2.4X1.4 - 1.4X1.6 - 1.1X1.1 = 69.8\%$. This means that the metacognitive awareness aspects collectively contribute 69.8% to students' higher-order thinking skills. The remaining 30.2% is influenced by other factors, with the regression coefficient being negative.

Metacognitive awareness (X1) consists of eight aspects of cognitive knowledge components: declarative knowledge, procedural knowledge, and conditional knowledge. The regulatory aspect of cognition includes planning, information management strategies, comprehension monitoring, improvement strategies, and evaluation. Five of the eight metacognitive awareness components contributed: evaluation (X1.8), improvement strategies (X1.7), planning (X1.4), comprehension monitoring (X1.6), and declarative knowledge (X1.1). The contribution of metacognitive awareness components to the higher-order thinking skills of tenth-grade students at SMA Negeri 1 Batang Kuis on biodiversity can be seen through the regression equation in Appendix 7.

Contribution of Scientific Attitude Aspects to Students' Higher-Order Thinking Skills
To determine the contribution of each measured aspect of scientific attitude components to students' higher-order thinking skills, a multiple linear regression test was conducted using the stepwise method. The simple linear regression equation can be written as follows: $\hat{Y} = 198.9a – 3.3X2.6 – 1.9X2.7 =$ 62.5%. This means that the scientific attitude aspects collectively influence students' higher-order thinking skills by 62.5%. Meanwhile, the remaining 37.5% is influenced by other factors. The regression coefficient is negative.

Scientific attitude (X2) consists of seven components: the social implications of science, the normality of scientists, attitudes toward scientific inquiry, the application of scientific attitudes, enjoyment of science lessons, interest in increasing time studying science, and career interest in science. Of the seven components of scientific attitude, the two that contribute to students' higher-order thinking skills are interest in increasing time studying science (X2.6) and career interest in science (X2.7).

DISCUSSION

Metacognitive Awareness and Higher-Order Thinking
Shows that five metacognitive awareness components best support biodiversity-related higher-order thinking in SMA Negeri 1 Batang Kuis tenth-graders. Evaluation (X1.8), improvement techniques (X1.7), planning (X1.4), comprehension monitoring (X1.6), and declarative knowledge (X1). Evaluation involves lesson re-evaluation and progress assessment. Following the lesson, 55 students (53%) took notes, according to the student questionnaire. This matches the learning model and student behaviour. 58 students (55%) considered simpler biology assignments. After completing the biology assignment, 58 students (56%) believed they learnt enough.
The teacher asked pupils about their biodiversity knowledge following the class. Students said they understood. The lesson ended. Teachers examine pupils' comprehension daily. For pupils who score below the Minimum Competency Minimum (KKM), teachers offer remedial or enrichment lessons. Teachers admit to infrequently reflecting with students. Keliat et al. (2021) found that junior and senior high school learning has not optimally empowered higher-order thinking and metacognitive awareness, and teachers struggle to construct learning models. School technology includes infocus and poor internet connectivity. Thus, traditional, teacher-dominated classroom learning prevails. According to Listiana et al. (2019), traditional learning is still common and dominated by teachers. Students are less engaged in learning and rely more on getting knowledge than seeking, listening, and writing down that information from the teacher.

Evaluation involves assessing learning phases, summarizing material, and assessing assignments. Evaluation involves analyzing, collecting, and presenting valuable data for teacher decision-making and program growth. Learning evaluation frequently involves introspection. Evaluation and planning are linked, according to Fauziah et al. (2018). Planning their learning process yields learning objectives. This helps them plan how to assess their learning goals. It's important to evaluate and reflect on learning tactics to help absorb and remember new information (Anwar, 2022).

Evaluation pushes pupils to study harder and longer. It also improves learning processes, facilities, and student learning. Kuswara et al. (2024) emphasized that teachers must reflect before ending a lesson to enable students to self-reflect on their learning and boost metacognition. Students can assess their learning performance by reflecting on their strategies (Listiana et al., 2019).

Debugging corrects comprehension and errors. various students have various learning styles. 44 pupils (42%) stopped and reread when perplexed, according to the student questionnaire. Confusion caused 50 students (48%) to re-evaluate biology. After taking the biodiversity higher-order thinking skills test, students bypassed difficult questions and focused on easier ones. Student halted and reviewed questions. Rereading and consulting a friend or teacher helped students understand the topic. Ask questions in group discussions if you don't grasp biology. Good remedial tactics made students aware of what they were doing when they didn't understand concepts or theories (Erlin et al., 2021; Listiana, 2019). Students took notes while the teacher explained biodiversity.

Based on the results of the higher-order thinking skills test on biodiversity, many students still gave incorrect answers. Students were confused when answering these questions. This was because they did not organize their biology learning and create a study schedule. Keliat et al. (2021) explained that the reason students did not create a study schedule and manage their study time was because the material was perceived as difficult, uninteresting, and not of interest to them. According to Angraini et al. (2021), students who lacked proper study planning resulted in poor learning outcomes. According to Marhaendra et al. (2023), time management is beneficial for students because it allows them to learn more efficiently and with quality, accompanied by careful planning. This includes reviewing lessons, making plans before and after studying, and elaborating on acquired knowledge (Adiansyah et al., 2023).

Planning using appropriate strategies will impact students' cognitive abilities, specifically higher-order thinking skills. The planning process involves devising a solution appropriate to the problem at hand (Keliat et al., 2021; Fauziah et al., 2018). Planning explains what needs to be done with full attention (Keliat et al., 2021). Erlin et al. (2021) added that determining objectives and analytical tasks helps students initiate significant knowledge, making it easier for them to organize, expand their knowledge, remember, and understand the subject matter. The aspect of comprehension monitoring is students' ability to assess their cognitive abilities and the effectiveness of strategies implemented during the learning process. Students consciously assess the extent of their own understanding. Based on the results of the metacognitive awareness questionnaire, 31 (30%) students were hesitant to use concept maps to help them understand biology material. This is because teachers have not yet implemented a concept map-based learning model. Lectures are the learning model that often dominates teaching and learning activities. Based on the results of the higher-order thinking skills test on biodiversity, students were not yet fully able to differentiate between levels of biodiversity at the gene, species, and ecosystem levels. In question 13, students were asked to define and analyze biodiversity at the gene, species, and ecosystem levels using the example presented. Some students still made errors in determining the gene, species, and ecosystem levels. The student answered that mangoes are an example of species diversity and tigers are an example of genetic diversity (Figure 4.1). The student who answered correctly said that mangoes are an example of genetic diversity and tigers are an example of species diversity, but did not provide an analysis.

4. CONCLUSION

Based on the problem formulation presented, the following conclusions can be drawn: The metacognitive awareness components that contribute most to the higher-order thinking skills of tenth-grade students regarding biodiversity at SMA Negeri 1 Batang Kuis are evaluation (X1.8), improvement strategies (X1.7), planning (X1.4), comprehension monitoring (X1.6), and declarative

knowledge (X1.1), with a contribution of 69.8%. The scientific attitude components that contribute most to the higher-order thinking skills of tenth-grade students regarding biodiversity at SMA Negeri 1 Batang Kuis are interest in increasing time studying science (X2.6) and career interest in science (X2.7), with a contribution of 62.5%.

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