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Habits of Mind of Indonesian Students in Kota Kinabalu, Sabah, Malaysia: A Survey Study Through Biology Education

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Abstract

This study examines students' thinking habits in biology learning at the Indonesian School in Kota Kinabalu, Sabah, Malaysia. The novelty of this research lies in its focus on analyzing thinking habits within the context of an Indonesian school abroad, which remains underexplored. The study employed a quantitative descriptive survey design involving 165 students from various grade levels. Data were collected using a questionnaire based on the Thinking Habits framework developed by Arthur L. Costa and Bena Kallick, consisting of 16 items measured on a scale ranging from very weak (0–20), weak (21–40), moderate (41–60), strong (61–80), to very strong (81–100). The collected data were analyzed using descriptive statistical techniques to determine the distribution and average scores of each thinking habit aspect. The results showed that 82.42% of students were categorized as having strong thinking habits, 13.30% as very strong, and 4.24% as moderate. The highest average score was found in the aspect of responding with curiosity and wonderment, while thinking flexibly and metacognition showed relatively lower average scores. These findings provide insights into the profile of students' thinking habits in an international educational context and highlight areas that require further development.

KEYWORDS

biology learning ; habits of mind

Introduction

Learning should be able to develop knowledge, skills, and mindsets in order to produce graduates who possess integrated attitudes, abilities, and knowledge and are equipped with essential life skills, including the ability to solve complex problems intelligently (Adriadi et al., 2022; Erol et al., 2025; Ubaidillah et al., 2022). One way to achieve effective learning outcomes is through the development of habits of mind, as learning success is largely determined by students' habits of mind (Juliastari et al., 2024). Habits of mind are essential abilities that individuals should possess (Hew et al., 2010), as they serve as indicators of academic competence related to learning success (Qadarsih, 2017).

Intelligent individuals generally demonstrate intelligent thinking habits. The concept of intelligent thinking was first introduced by Costa and Kallick in 1985 and later refined by Marzano (Boang Manalu et al., 2024). Thinking habits can be observed through an individual's ability to think quickly, accurately interpret situations, and plan appropriate solutions to problems (Gloria et al., 2018). These habits are reflected in actions carried out efficiently, often without conscious deliberation or reliance on formal theories, as they emerge from established patterns of thinking. Intelligent thinking skills are necessary to enable students to identify solutions to problems and to develop critical thinking abilities (Small, 2020). Possessing strong habits of mind allows individuals to persevere through challenges

and effectively resolve various problems (Gloria et al., 2025).

According to Costa and Kallick (2008), engaging in diverse tasks can foster and strengthen the formation of habits of mind, particularly when such tasks are performed consistently. Therefore, classroom learning habits play a significant role in shaping students' habits of mind (Matsuura et al., 2013; Milburn et al., 2026). The way thinking processes are developed can also influence emotional states, potentially leading to anxiety that affects cognitive performance (I. R. Isfiani & Ekanara, 2022). Consequently, learning tasks and students' emotional conditions during instruction indirectly influence learning outcomes and the development of habits of mind. Habits of mind are considered part of learning outcomes, as supported by previous studies (Gloria et al., 2020). Thus, habits of mind can be defined as mental habits that can be trained and developed through learning activities aimed at enhancing critical and creative thinking skills (Nada et al., n.d.).

Science is a branch of knowledge that includes biology. Science is often perceived merely as a body of knowledge; however, it also encompasses processes. Scientific products consist of knowledge, concepts, principles, and facts, while skills, attitudes, and positive values are developed through scientific processes (Raberger et al., 2026). Biology, in particular, involves direct exploration of nature; therefore, biology learning should not focus solely on mastering facts, concepts, or principles, but also on discovery processes. Biology education emphasizes hands-on experiences that enable students to explore and understand the natural world scientifically (Zhang et al., 2024). In contemporary biology learning, thinking skills are increasingly essential due to the rapid and continuous flow of information, which may influence students positively or negatively (Yuni Pradnyani & I Dewa Putu, 2023).

Learning activities influence the formation of habits of mind because instructional practices and assessment processes encourage the development of specific thinking habits (Gloria et al., 2020). Biology learning incorporates scientific methods, thinking skills, and problem-solving activities through experimentation and observation. In this context, students encounter various problems that require intelligent thinking to resolve (Xie et al., 2026). In line with the demands of 21st-century education, students must develop intelligent thinking abilities, commonly referred to as habits of mind. The application of habits of mind enables students to manage their time effectively, enhances intellectual capacity, supports systematic learning processes, and provides opportunities to acquire meaningful knowledge (R. Isfiani, 2016).

However, Research on habits of mind has been widely conducted in domestic Indonesian school contexts; however, studies in overseas Indonesian schools remain limited. This gap is theoretically and educationally significant, as students' thinking habits are shaped not only by instructional practices but also by sociocultural environments. From sociocultural and constructivist perspectives, learning is influenced by cultural interaction, language use, and contextual experience, all of which may differ substantially in international school settings. Previous studies in Indonesia have generally examined habits of mind within relatively homogeneous environments, providing limited insight into how these cognitive dispositions develop in more diverse and cross-cultural contexts. Indonesian schools abroad, such as the Indonesian School in Kota Kinabalu, Sabah, Malaysia, represent a unique educational ecology characterized by multicultural interaction, multilingual practices, and curriculum adaptation. Investigating habits of mind in this context therefore goes beyond simple contextual replication, as it enables a deeper understanding of how varied learning environments shape students' cognitive dispositions. Furthermore, prior research tends to assess habits of mind without explicitly linking them to specific learning contexts. In contrast, this study examines students' habits of mind within the context of biology learning, considering its emphasis on inquiry, observation, and problem-solving. Accordingly, this study aims to analyze students' habits of mind within the context of biology learning in an international school setting. This study contributes to the literature by extending existing findings on habits of mind into a cross-cultural educational context and by highlighting the relevance of subject-specific contexts in understanding students' cognitive dispositions.

Methods

This study employed a quantitative descriptive survey design to examine students' Habits of Mind in the context of biology learning. A survey approach was appropriate because the study aimed to describe and map students' cognitive dispositions without manipulating variables or applying experimental treatments. The participants consisted of 165 students from various grade levels at the Indonesian School in Kota Kinabalu, Sabah, Malaysia. Data were collected using a questionnaire based on the Habits of Mind framework developed by Costa and Kallick (2008), consisting of 16 categories. The instrument results were interpreted using scale criteria adapted from Riduwan (2008), classified as very weak (0–20), weak (21–40), moderate (41–60), strong (61–80), and very strong (81–100). Data were analyzed using descriptive statistical techniques to determine the level and distribution of students' Habits of Mind in biology learning.

Population and Sample/Informants

The population of this study consisted of all students at the Indonesian School in Kota Kinabalu, Sabah, Malaysia. A total of 165 students from elementary, junior high, and senior high school levels participated in this study. Total sampling was used because the entire accessible population within the school was involved, allowing a complete representation of students' Habits of Mind in biology learning without excluding any available respondents. However, the number of students across grade levels was uneven, with each educational level contributing different proportions of participants. Therefore, the findings are interpreted as a general description of students' Habits of Mind across grade levels, and caution is needed when comparing or generalizing results across elementary, junior high, and senior high school groups, particularly for the smaller subsample at the elementary level.

The participants were students from Sekolah Indonesia Kota Kinabalu, comprising a total sample of 165 male and female students across the elementary, junior high, and senior high school levels. Detailed participant characteristics are presented in Table 1.

Research Location

The study was conducted was conducted from May to June 2024 at Indonesian School in Kota Kinabalu, Sabah, Malaysia. This school provides education based on the Indonesian national curriculum for Indonesian students

living abroad. The diverse cultural and educational environment offers a unique context for examining students' Habits of Mind in biology learning. The reason for selecting students from the Indonesian School in Kota Kinabalu, Malaysia, is that Indonesian students attending school in Kota Kinabalu exhibit distinctive characteristics, namely a high capacity for adaptation. This ability is cultivated as they live and study in an environment with a culture and tradition distinct from their native culture in Indonesia

Table 1. Sampel amount data

Level	Female	Male	Amount
SD	5	6	11
SMP	48	37	85
SMA	50	19	69
Total Amount			165

Instrumentation or Tools

The study employed a Habits of Mind questionnaire as the main research instrument to measure students' thinking habits in biology learning. The instrument was developed based on the 16 Habits of Mind proposed by Arthur L. Costa and Bena Kallick (2008), which include persistence, managing impulsivity, listening with understanding and empathy, thinking flexibly, metacognition, striving for accuracy, questioning and posing problems, applying past knowledge, communicating with clarity and precision, gathering data through senses, creating and innovating, responding with wonderment, taking responsible risks, finding humor, thinking interdependently, and remaining open to continuous learning. The questionnaire was adapted into a student-friendly format and translated into Indonesian to ensure clarity and appropriateness for the local educational context. Content validity was evaluated through expert judgment in science education to ensure the relevance of each item to the construct of habits of mind. The instrument was also tested for reliability, resulting in a satisfactory Cronbach's Alpha coefficient indicating acceptable internal consistency. Prior to the main study, a pilot test was conducted on a small group of students to ensure clarity and readability of the items. The final instrument used a Likert scale to measure students' responses and determine the level of habits of mind in biology learning.

Data Collection Procedures

Data were collected using a Habits of Mind analysis questionnaire. The questionnaire, developed by Costa and Kallick (2008), consists of 31 items covering 16 categories: (1) persisting, (2) managing impulsivity, (3) listening with understanding and empathy, (4) thinking flexibly, (5) metacognition, (6) striving for accuracy, (7) questioning and posing problems, (8) applying past knowledge to new situations, (9) thinking and communicating with clarity and precision, (10) gathering data through all senses, (11) creating, imagining, and innovating, (12) responding with wonderment and awe, (13) taking responsible risks, (14) finding humor, (15) thinking interdependently, and (16) remaining open to continuous learning.

Data Analysis

The research data were collected using a four-point Likert scale consisting of Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Each response was assigned a score of 4, 3, 2, and 1, respectively. The total score for each respondent was calculated by summing all item scores, then converted into a percentage score using the formula: (obtained score / maximum score) × 100. The resulting percentage scores were interpreted using criteria adapted from Riduwan (2008), classified as very weak (0–20), weak (21–40), moderate (41–60), strong (61–80), and very strong (81–100). Data were analyzed using descriptive statistical techniques to describe the distribution of students' Habits of Mind without any manipulation of variables, in accordance with the descriptive research design (McMillan & Schumacher, 2001).

Result and Discussion

Students' habits of mind in biology learning were predominantly categorized as strong. The analysis showed that most students demonstrated a high level of habits of mind across the 16 categories developed by Costa and Kallick. Overall, 82.42% of students were classified in the strong category, 13.30% in the very strong category, and 4.24% in the moderate category. These results indicate that students generally exhibit well-developed thinking habits in biology learning, with variation across specific aspects.

The results of the habits of mind assessment were classified into five levels: very weak, weak, sufficient, strong, and very strong. The number of students in each category was then calculated as a percentage. Detailed results are presented in Figure 1, which illustrates the percentage distribution of students according to the Habits of Mind score criteria.

Figure 1 shows that the largest proportion of students (82.42%) fall into the strong Habits of Mind category. The second largest group is classified as having very strong Habits of Mind, accounting for 13.30% of the students. In numerical terms, 136 out of 165 participants demonstrated strong Habits of Mind, while 22 students were categorized as having very strong Habits of Mind.

Habits of Mind level of 16 categories

From the results of the study, the value of habits of mind from 16 categories obtained in each aspect varies. More clearly can be seen in Table 2. which displays the value and criteria of habits of mind from 16 aspects with the average HoM value of all students with various levels, namely Elementary, Junior High, And High School. To find out overall how habits of mind are formed at all levels, namely Elementary School, Junior High School and High School for Indonesian school students in Kota Kinabalu, it can be seen from the average value of habits of mind for each aspect for the whole, more details can be seen in Figure 2. Among the 16 Habits of Mind indicators, the highest average score was observed in the aspect of responding with wonderment and awe, whereas the lowest average scores were found in the aspects of thinking flexibly and metacognition.

Table 2 shows that elementary school students achieved the highest Habits of Mind score (89), which falls into the very strong category, in the aspect of responding with wonderment and awe. In contrast, the lowest Habits of Mind score among elementary school students was 66, classified as sufficient, and was observed in the aspect of metacognition

Among junior high school students, the highest Habits of Mind score was 88, categorized as very strong, also in the aspect of responding with wonderment and awe. The lowest score was 69, classified as sufficient, and occurred in two aspects, namely thinking flexibly and metacognition.

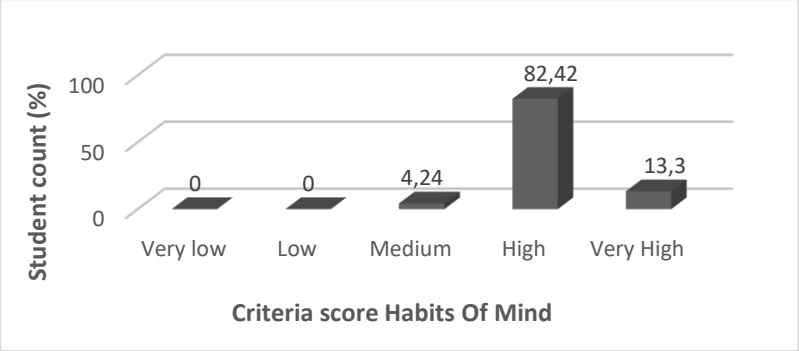

Figure 1. Percentage of Habits of Mind Score Criteria

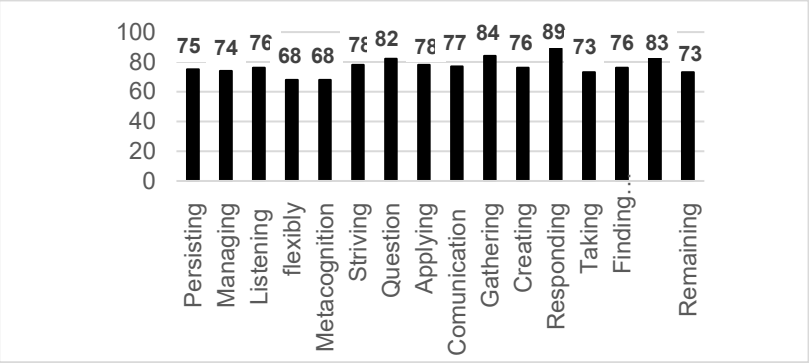

Figure 2. Average Habits of mind score of students

Table 2. Habits of Mind scores and criteria from 16 categories

No	Aspect HOM	Level			Average	Score criteria
		SD	SMP	SMA		
1	Peristing	70	75	81	75	High
2	Managing impulsivity	73	78	71	74	High
3	Listening with understanding and empaty	71	77	80	76	High
4	Thingking flexibly	73	69	63	68	High
5	Metacognition	66	69	68	68	High
6	Striving for accuracy	84	76	74	78	High
7	Question and posing problem	84	78	80	82	Very High
8	Applying New Knowledge to new situation	75	78	80	78	High
9	Thinking And Comunication with Clarity and Precision	77	74	76	77	High
10	Gathering Data Through all Sense	82	86	84	84	Very High
11	Creating, imagining and innovating	75	78	75	76	High
12	Responding with wonderment and awe	89	88	91	89	Very High
13	Taking responsible risk	77	72	69	73	High
14	Finding humour	77	77	74	76	High
15	Thingking interdependently	77	84	88	83	Very High
16	Remaining open to continuous learning	73	70	74	73	High
Average		76	77	77	77	High

For senior high school students, the highest Habits of Mind score was recorded in the aspect of responding with wonderment and awe, with a score of 91, which falls into the very strong category. Meanwhile, the lowest score was found in the aspect of thinking flexibly, with a value of 63, categorized as sufficient.

Based on Table 2, the average Habits of Mind score for elementary school students was 76, which is categorized as strong. Junior high school and senior high school students also obtained similar average scores of 77, which fall within the strong category. These results describe the distribution of Habits of Mind scores across grade levels without implying causal effects.

Habits of Mind represent intelligent ways of approaching problem-solving in various situations and are considered important in supporting students' learning processes. Habits of Mind include integrity, perseverance, curiosity for new ideas, imagination, and the embodiment of essential human values in scientific activities (Erol et al., 2025). The findings of this study show that students' Habits of Mind in biology learning are generally categorized as strong. This profile suggests that students demonstrate positive thinking habits when engaging with biological concepts and phenomena. In this context, biology learning provides a relevant setting in which students are required to observe phenomena, apply prior knowledge, and consider possible solutions in learning activities. Consistent with Yang et al., (2025), Habits of Mind are reflected in students' ability to recall and connect prior knowledge when responding to learning tasks. However, in this study, these findings are interpreted as a description of students' cognitive profiles within biology learning rather than

evidence of instructional effectiveness. Biology learning, as noted by Slaby, (2025), involves problem-oriented activities that are aligned with the development of thinking habits, but the present study does not examine causal relationships between instruction and outcomes.

The findings indicate that students' Habits of Mind across elementary, middle, and high school levels are generally categorized as strong. Out of the 16 categories, 12 were in the strong category, while four categories—questioning and posing problems, gathering data through all senses, responding with admiration and wonder, and thinking interdependently were categorized as very strong. These results describe students' cognitive profiles within the context of biology learning at Sekolah Indonesia Kota Kinabalu, Sabah, Malaysia. The relatively higher scores in several Habits of Mind categories may be understood in relation to the learning context in which students engage in biology activities such as laboratory work, observation, and collaborative tasks. Such learning environments align with Costa and Kallick (2008), who emphasize that Habits of Mind emerge when individuals are engaged in meaningful problem situations that require thoughtful responses rather than automatic reactions. In addition, classroom activities that involve observation and inquiry may provide opportunities for students to interact with learning materials through multiple senses, which is reflected in the relatively higher score of "gathering data through all senses." However, these interpretations describe possible contextual alignment and should not be understood as evidence of instructional effectiveness.

The highest category, responding with admiration and wonder, may be associated with learning situations that stimulate curiosity and encourage students to engage with biological phenomena. This aligns with Costa and Kallick (2008), who highlight curiosity and wonder as important dispositions in developing intellectual engagement. Meanwhile, thinking interdependently is reflected in collaborative learning activities, which is consistent with the view that social interaction supports thinking processes in learning environments (Westgaard & Winkel, 1996). However, these relationships are interpretive and based on literature rather than causal evidence from this study.

Conversely, flexible thinking and metacognition showed relatively lower scores. Flexible thinking may appear less developed when learning activities rely heavily on structured or textbook-based approaches, limiting opportunities for exploring alternative perspectives. Similarly, metacognitive awareness may be less visible when students are not consistently engaged in reflective learning practices. These interpretations are consistent with Costa and Kallick (2008) and Marzano (1998), who emphasize the importance of reflection and adaptability in developing higher-order thinking habits. Overall, the results provide a descriptive profile of students' Habits of Mind in biology learning. While previous literature (Costa & Kallick, 2009; Marzano, 1998; Prawirohartono & Hidayati, 2007) suggests that meaningful, reflective, and supportive learning environments are associated with the development of thinking habits, this study does not test causal relationships. Therefore, any implications for teaching practice should be interpreted as contextual reflections rather than evidence of instructional effectiveness.

Biology education implemented before the survey likely trained students' habits of mind at the elementary, middle, and high school levels. When such learning experiences are applied consistently and continuously, the development of students' Habits of Mind becomes increasingly robust. The highest average score observed in responding with admiration and wonder was influenced by teaching practices that foster enthusiasm in answering questions and appreciating peer responses. Conversely, flexible thinking and metacognition were identified as categories with the lowest scores. Flexible thinking is underdeveloped when classroom discussions heavily rely on textbook references, limiting opportunities for students to explore alternative perspectives. Similarly, metacognitive skills remain low when students follow instructional materials without engaging in deep reflection or self-regulation processes. These findings underscore the need for diverse teaching methods and strategies that actively promote flexible thinking and metacognitive awareness.

The biology education applied before the survey allowed for the creation of an adequate learning environment and provided meaningful learning experiences. This aligns with research (Elsayed et al., 2025) that a comfortable and enjoyable learning environment has been proven to enhance metacognitive skills and encourage meaningful learning. Costa and Kallick (2008) emphasize that an individual's problem-solving ability depends on mental habits that regulate responses to stimuli. Similarly, Westgaard and Winkel (1996) suggest that active learning influences self-reinforcement by integrating operant conditioning with learning attitudes. To cultivate productive thinking habits, students should regularly engage in reflective learning processes, while teachers should consistently reinforce thinking skills throughout instruction (İnönü et al., 2025; Thornton, 2025). An effective learning environment allows students to adapt to various situations using their thinking skills and develop positive habits that support discipline and intellectual growth (Alfiyana et al., 2026; Moreira-Almeida, 2025).

Although the overall results are strong, the findings indicate that students' habits of mind still require improvement, especially in aspects categorized as adequate. Various teaching strategies and pedagogical approaches are needed to elevate these aspects from adequate to strong or very strong. Enhancing students' Habits of Mind is essential, as they are a crucial dimension of meaningful learning. Costa and Kallick (2008), along with Marzano (1998), emphasize that Habits of Mind are not merely mastery of concepts, attitudes, or skills but an integration of these components that contribute to the development of personality and intellectual maturity. Biology education needs to be conducted with more active and creative learning models.

Several factors can hinder the development of habits of mind. Internal factors include students' discomfort and reluctance to express opinions in front of peers (Damanik, 2026; Siswati et al., 2026). External factors encompass teachers' instructional strategies, the use of engaging learning media, the availability of learning resources, as well as the provision of motivation and rewards, all of which play a significant role in encouraging students' Habits of Mind (Harefa et al., 2022). Therefore, it is hoped that teachers can create a supportive learning environment that encourages active participation and provides positive reinforcement to strengthen students' habits of mind.

Interpretation of Key Findings

The findings show that students in this sample generally displayed strong Habits of Mind profiles in the context of biology learning. Most students were categorized at the strong level, while a smaller proportion were in the very strong and moderate categories. Among the 16 Habits of Mind indicators developed by Arthur L. Costa and Bena Kallick, the highest score was observed in responding with wonder and awe, indicating relatively high levels of curiosity and appreciation toward natural phenomena in this sample. In contrast, flexible thinking and metacognition showed

lower scores, reflecting variation in Habits of Mind profiles across different cognitive aspects within the student group.

Comparison with Previous Studies

The results of this study are consistent with previous research on Habits of Mind, which indicates that science learning environments can effectively foster positive thinking dispositions among students. Studies have shown that inquiry-based and practicum-oriented science learning tends to strengthen students' curiosity, persistence, and engagement with scientific concepts. Similarly, biology learning activities that involve observation, experimentation, and exploration of natural phenomena can encourage students to develop habits such as responding with wonderment and awe. However, similar to findings in earlier studies, aspects related to higher-order thinking such as flexible thinking and metacognition often require more structured instructional strategies to develop optimally.

Limitations and Cautions

Despite providing important insights, this study has several limitations. First, the research was conducted in a single educational context, namely the Indonesian School in Kota Kinabalu, which may limit the generalizability of the findings to other Indonesian schools abroad or within Indonesia. Second, the data were collected using a self-report questionnaire, which may be influenced by students' perceptions and response bias. Therefore, the results should be interpreted cautiously, as they represent students' perceived Habits of Mind rather than direct observations of their thinking behaviors.

Recommendations for Future Research

Future studies are recommended to explore the development of Habits of Mind using more diverse research approaches, such as mixed methods that combine quantitative surveys with classroom observations or interviews. Researchers may also examine the impact of specific instructional models, such as project-based learning or inquiry-based learning, on the improvement of thinking flexibly and metacognition. In addition, expanding the research to different Indonesian schools abroad or other educational contexts would provide a broader understanding of how biology learning supports the development of students' Habits of Mind.

Conclusion

This study investigates students' Thinking Habits in biology education and describes the level of Thinking Habits among students at the Indonesian School in Kota Kinabalu, Sabah, Malaysia. The findings indicate that most students exhibit strong Thinking Habits, with 13.30% categorized as very strong, 82.42% as strong, and 4.24% as adequate, reflecting a generally positive profile of thinking dispositions within this sample. Among the 16 indicators, responding with wonder and awe showed the highest average score, suggesting relatively high curiosity and appreciation toward natural phenomena in the biology learning context. In contrast, flexible thinking and metacognition showed lower scores, indicating variation in Thinking Habits across different cognitive aspects. Overall, these results provide a descriptive overview of students' Thinking Habits and suggest preliminary implications for instructional attention toward flexible thinking and metacognitive skills. However, as this study employs a descriptive survey design, it does not establish causal relationships between biology learning activities and the development of specific thinking dispositions.

Although this study provides valuable insights into students' Thinking Habits in the context of an Indonesian international school, several limitations should be noted, such as the use of a single research location and reliance on self-reported questionnaire data. Future research should focus on expanding studies to different educational contexts and employing diverse research methods, such as mixed approaches, which could potentially enhance our understanding of students' cognitive dispositions in science learning and inform more effective biology teaching practices and educational strategies.

Author contributions

Egina Bumiarti conducted the research, including data collection, data analysis, and manuscript preparation. Ria Yulia Gloria acted as the corresponding author and supervised the research process, providing guidance in conceptualization, methodology, and manuscript revision. Deka Andriani contributed to the data collection process and provided support as a biology teacher at the Indonesian School in Kota Kinabalu, Sabah, Malaysia.

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