



Impact of environmental change learning experience on high school students' environmental attitudes and reflective thinking skills

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Abstract. This study aims to: (1) determine the level of learning experience of environmental change material of class X students of SMA Negeri 3 Klaten; (2) determine the relationship between learning experience of environmental change material and environmental attitude of class X students of SMA Negeri 3 Klaten; (3) determine the relationship between learning experience of environmental change material and reflective thinking skills of class X students of SMA Negeri 3 Klaten. This study is a correlational study using quantitative methods. This study was conducted at SMA Negeri 3 Klaten, with a sample of 215 class X students obtained through purposive sampling. Data collection was carried out through observation, a Likert-scale questionnaire, an essay test, student interviews, and documentation. The data analysis techniques used were descriptive statistics; prerequisite tests (normality and linearity); hypothesis testing with correlational analysis using the Pearson product-moment correlation; and a coefficient of determination test. The results of this study indicate that: (1) Students' learning experience of environmental change material is in the moderate category (62.33%); (2) There is a significant and positive relationship between the experience of learning environmental change material and students' environmental attitudes with a strong level of relationship ($p = 0.000$; $r = 0.739$); (3) There is a significant and positive relationship between the experience of learning environmental change material and students' reflective thinking skills with a sufficient level of relationship ($p = 0.000$; $r = 0.414$). This research can serve as a guideline or consideration for teachers when implementing environmental change learning.

Keywords: *Environmental attitudes, Environmental changes, Learning experiences, Reflective thinking skills*

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INTRODUCTION

Environmental issues are currently a global concern. This situation is driven by human behavior that lacks concern for the environment, resulting in increasingly worsening environmental problems. The [World Health Organization \(WHO\) \(2021\)](#) noted that 90% of the world's population breathes polluted air, which causes approximately 7 million deaths per year. [Global Forest Watch \(2024\)](#) also reported that human activities, including in Indonesia, caused 96% of tropical deforestation and logging in 2023.

In Indonesia, environmental damage continues due to unsustainable human activities, including floods, landslides, droughts, pollution, and biodiversity loss. The National Disaster Management Agency (BNPB) records that Indonesia experiences more than 1,000 natural disasters annually, dominated by hydrometeorological disasters such as floods and landslides, due to their close link to climate change. In 2024, 1,478 disasters were recorded, a decrease compared to 2023 (5,400 incidents) and 2022 (3,544 incidents) ([DIBI BNPB, 2024](#)).

Entering the 21st century, environmental issues have become a serious challenge, with disasters, pollution, global warming, climate change, and reduced biodiversity all potentially posing global threats. This has led to environmental changes that increasingly threaten the sustainability of ecosystems and human life on Earth ([Daud et al., 2022](#)). The relationship between humans and the environment is interconnected and inseparable. In living their lives, humans are highly dependent on the quality and sustainability of the environment. Good

environmental conditions can support a healthy and prosperous life, while environmental damage can threaten ecosystem balance and reduce human quality of life (Keraf, 2010).

One region in Indonesia that is not immune to increasingly complex environmental problems is Klaten Regency, Central Java. The conversion of rice fields reached 2,155 hectares between 1990 and 2019 and continues to increase (Nurrahma et al., 2024). The Badan Pusat Statistik Kabupaten Klaten (2021) recorded 79 villages affected by water pollution, 12 by soil pollution, and 46 by air pollution. This situation demonstrates the need for serious attention from various parties, including the education sector, to increase public awareness and concern for the environment.

Education plays a crucial role in shaping a generation that cares about and is competent in addressing environmental issues. Young people are positioned as agents of change because they will inherit and protect the environment from an early age (Sianturi et al., 2024). Environmental education aims to build students' awareness, understanding, and ability to respond positively to environmental issues through meaningful learning experiences that influence their perspectives and behaviors toward the environment (Aldawsari et al., 2025). These learning experiences encompass a variety of theoretical and practical activities that enable students to engage directly with environmental issues around them.

In the context of high school education, environmental change is a crucial topic in biology, potentially shaping and enhancing students' environmental awareness. Research shows that students' environmental awareness and concern still need improvement. Research conducted by Baroroh & Roshayanti (2022) revealed that only 13% of students were categorized as very concerned about the environment. The remaining percentages were categorized as moderately concerned (47%), less concerned (23%), and somewhat concerned (17%). Another study by Qodriyanti et al. (2022) reported that students' environmental awareness was in the moderate category, indicating a need for further development.

Developing an environmental attitude aims to enable students to become agents of change in the future through an understanding of the importance of environmental sustainability. Schools play a crucial role in instilling in students an understanding of how human behavior affects the earth and life (Desfandi, 2015). An environmental attitude encompasses actions to prevent and repair environmental damage through innovative solutions. However, developing this attitude is inseparable from mastering reflective thinking skills, which are essential for evaluating thoughts, making decisions, and solving problems (Kenari & Subiantoro, 2023). Through reflective thinking, students can critically analyze various environmental issues, synthesize information, draw on prior experiences, and gain a broader perspective on decision-making.

Based on observations at SMA Negeri 3 Klaten, the environmental awareness of tenth-grade students still needs attention. Understanding of waste management and awareness of reducing plastic use remain low, and irresponsible behavior towards environmental cleanliness is still common. This indicates that environmental awareness has not been optimally formed even though environmental change material has been taught. Interviews with biology teachers also revealed that students' reflective thinking skills in analyzing and solving environmental problems are not optimal, with varying levels of thinking, necessitating further measurement. Based on this, it is important to determine whether the learning carried out by teachers so far has developed students' thinking skills.

Students' learning experiences about environmental change are crucial because they influence their attitudes and mindsets when addressing environmental issues. Meaningful learning experiences enable students to connect the information they gain to real-life situations, fostering environmental awareness and caring attitudes. Research conducted by Sasea et al. (2023) shows that increasing students' environmental knowledge leads to increased

environmental caring attitudes. Research by [Leman et al. \(2026\)](#) also suggests that the higher the level of learning experience, the higher the reflective thinking skills.

Based on the above problems, similar research has never been conducted at SMA Negeri 3 Klaten. The researcher is interested in researching "The Relationship between Learning Experiences on Environmental Change Materials with Environmental Concern Attitudes and Reflective Thinking Skills of Grade X Students of SMA Negeri 3 Klaten". This research is expected to provide a more specific picture of the level of students' learning experiences with environmental change materials, and the relationship between these experiences and environmental concern attitudes and students' reflective thinking skills at the school. This research is important to conduct as an evaluation of the implementation of environmental change learning in schools and as an effort to improve the quality of learning, especially in environmental change materials. Teachers can use the results of this research to design learning materials on environmental change.

METHOD

This research is a correlational study with quantitative methods. The data obtained are numerical and analyzed using SPSS software version 27.0. This research was conducted at SMA Negeri 3 Klaten in April–May of the 2024/2025 academic year in class X semester 2. The research sample comprised 215 students from 6 classes, selected through purposive sampling.

Data collection was conducted through observation, Likert-scale questionnaires, essay tests, interviews, and documentation. The research instruments included: (1) a questionnaire on learning experiences on environmental change material with a scale of 1–4, consisting of 5 aspects, 10 indicators, and 30 statements; (2) an environmental attitude questionnaire with a scale of 1–4, consisting of 20 statements and 7 confirmation questions; and (3) an essay test for reflective thinking skills consisting of 4 questions. The instruments were developed by researchers and validated through expert *judgment*. The results of expert validation indicated that the instruments were in the very valid category. Data analysis included descriptive statistics, normality and linearity tests, *Pearson Product-Moment correlation tests*, and coefficient of determination tests.

Categorization of learning experiences on environmental change material, environmental attitudes, and reflective thinking skills is obtained through the formula listed in Table 1. Furthermore, the results of the correlation test are categorized based on Table 2.

Table 1. Categorization of learning experiences on environmental change material, environmental attitude and reflective thinking skills

No	Interval	Category
1.	$X \geq (M + SD)$	Tall
2.	$(M - SD) \leq X < (M + SD)$	Currently
3.	$X < (M - SD)$	Low

Source: [Azwar \(2012\)](#)

Table 2. Categorization of correlation level and strength of relationship

No	Correlation value (r)	Relationship level
1.	0.00 – 0.199	Very weak
2.	0.20 – 0.399	Weak
3.	0.40 – 0.599	Enough
4.	0.60 – 0.799	Strong
5.	0.80 – 1.000	Very strong

Source: [Siregar \(2017\)](#)

RESULTS AND DISCUSSION

Results

Learning experience of environmental change material for grade X students of SMA Negeri 3 Klaten

The collected data on learning experiences with environmental change material were analyzed using descriptive statistics, yielding an average of 99.79 and a standard deviation of 11.003. The average value and standard deviation were used to determine the category of learning experiences on environmental change material, as shown in Figure 1.

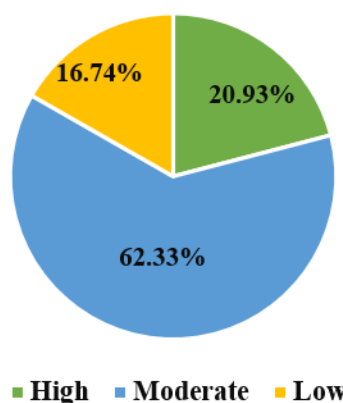


Figure 1. Students' learning experience for environmental change material

Based on Figure 1, the level of student learning experience is dominated by the medium category (62.33%), followed by the high category (20.93%) and the low category (16.74%). This indicates that most students have sufficient learning experience. The level of experience was also analyzed based on five aspects: student interaction in understanding the material, utilization of learning resources, direct experience, vicarious experience, and implementation of learning. The results of the analysis of each aspect are presented in Table 3.

Table 3. Descriptive statistical analysis of learning experience aspects of environmental change material

	Statistics				
	Student interaction in understanding material	Utilization of learning resources by students	Direct student experience	Substitute student experience	Implementation of learning
Number (N)	215	215	215	215	215
Maximum	32	24	20	20	24
Minimum	18	8	11	10	10
Average	27.35	19.64	16.50	16.39	19.91
Standard Deviation	3.32	2.88	2.15	2.40	2.66

The average value and standard deviation for each aspect in Table 3 can be used to determine the category of each aspect of the learning experience of environmental change material, as shown in Figure 2.

Based on Figure 2, the moderate category dominates across the five aspects of student learning experiences, with percentages ranging from 60.47% to 67.91%. This indicates that the majority of students have a fairly good understanding, though it still needs improvement. When sorted by the high category, the order is the aspect of student vicarious experience (21.86%), the aspect of learning implementation (21.40%), the aspect of student direct experience (20.47%), the aspect of student interaction in understanding the material (18.60%), and the aspect of student utilization of learning resources (18.14%). Meanwhile, when sorted by the moderate category, the two aspects with the same highest percentage are the aspect of student

utilization of learning resources and the aspect of student vicarious experience (67.91% each), followed by the aspect of learning implementation (61.86%), the aspect of student direct experience (61.39%), and the aspect of student interaction in understanding the material (60.47%). Meanwhile, if sorted by the low category, the order is the aspect of student interaction in understanding the material (20.93%), the aspect of direct student experience (18.14%), the aspect of learning implementation (16.74%), the aspect of student utilization of learning resources (13.95%), and the aspect of student substitute experience (10.23%).

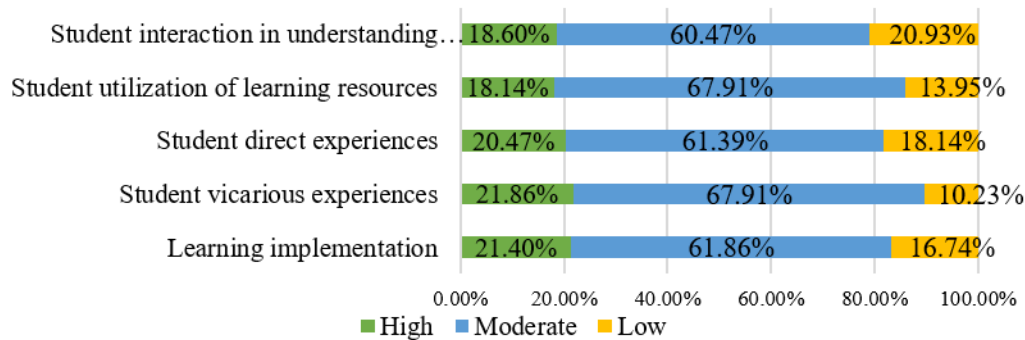


Figure 2. Students' learning experience aspects for environmental change material

Environmental awareness of grade X students of SMA Negeri 3 Klaten

The collected environmental awareness data were analyzed using descriptive statistics, yielding an average value of 68.44 and a standard deviation of 7.497. These average and standard deviation values were used to determine the environmental awareness categories, as shown in Figure 3.

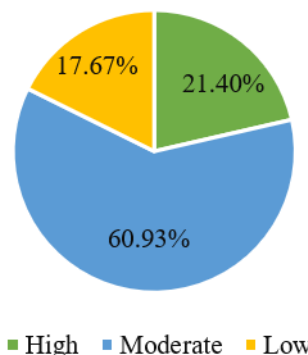


Figure 3. Student environmental attitudes

Based on Figure 3, the majority of students (60.93%) are in the moderate category for environmental awareness, indicating that student awareness is quite good, though not optimal. As many as 21.40% of students are in the high category, and 17.67% are in the low category. This indicates the need for more intensive environmental education so that more students reach the high category and reduce those in the low category. Students' environmental awareness attitudes are further analyzed through two aspects: efforts to prevent and repair environmental damage, as shown in Table 4.

The average value and standard deviation for each aspect in Table 4 can be used to determine the category of each aspect of environmental concern attitude, as shown in Figure 4. Based on Figure 4, the most dominant category in both aspects is the medium category, namely 60.93% for the prevention aspect and 68.37% for repairing environmental damage. This indicates that the majority of students have a fairly good environmental awareness, although not optimal. In the high category, the prevention aspect has a higher percentage (21.86%) than

the repair aspect (20%). This is because preventive measures are easier to carry out independently. Conversely, repairing environmental damage usually requires cooperation and support, so the percentage is slightly lower. Meanwhile, the low category is still observed in both aspects: 17.21% for prevention and 11.63% for repair. This means that some students still lack concern, which could be due to limited involvement, a lack of role models, or low awareness of the impact of environmental damage.

Table 4. Descriptive statistical analysis of environmental attitude aspects

	Statistics	
	Efforts to prevent environmental damage	Efforts to repair environmental damage
Number (N)	215	215
Maximum	64	16
Minimum	40	8
Average	54.84	13.60
Standard Deviation	5.97	1.90

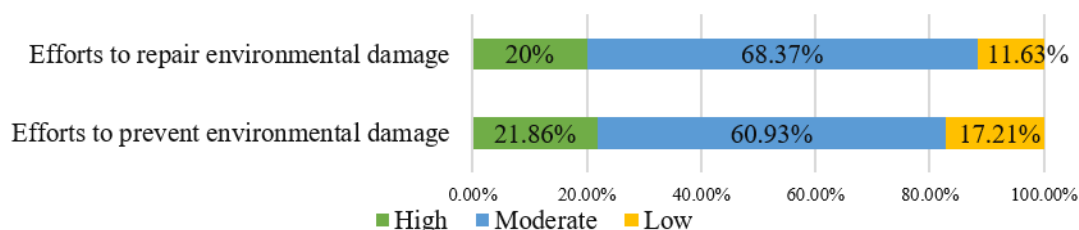


Figure 4. Student environmental attitude in each aspect

The relationship between learning experiences on environmental change material and the environmental awareness attitude of class X students of SMA Negeri 3 Klaten

Based on the prerequisite tests, namely the normality test (Sig 0.200 > 0.05) and the linearity test (Sig 0.617 > 0.05), the data on learning experience of environmental change material and environmental attitude data are normally distributed and have a linear relationship; the hypothesis test can be carried out with a parametric test using the Pearson Product Moment correlation test, which utilizes the help of SPSS software version 27.0. The results of the correlation test between the learning experience of environmental change material and environmental attitude are shown in Table 5.

Table 5. Results of the correlation test between learning experience and environmental concern

		Correlations	
		Learning experience	Environmental attitude
Learning Experience	Pearson Correlation	1	.739 **
	Sig. (2-tailed)		.000
	N	215	215
Environmental Attitude	Pearson Correlation	.739 **	1
	Sig. (2-tailed)	.000	
	N	215	215

Based on Table 5, the significance values for both dataset sets are 0.000. In accordance with the decision-making basis for the Pearson Product Moment correlation test, as stated by Siregar (2017), if the significance value (Sig.) < 0.05, then there is a relationship between the learning experience of environmental change material and students' environmental attitudes.

The results of the correlation test show a correlation coefficient of 0.739, indicating a strong relationship. The level of relationship between the two variables is then tested using the coefficient of determination, obtained from the R Square value, to assess how much the learning experience of environmental change material variable contributes to the environmental attitudes variable. The results of the coefficient of determination test are shown in Table 6.

Table 6. Results of the test of the determination coefficient of learning experience with environmental concern attitude

Coefficient of determination	
R	.739 ^a
R Square	.547
Adjusted R Square	.544
Standard Error of the Estimate	5,060

Based on Table 6, the R-square value is 0.547 (54.7%). This value indicates that the contribution of learning experiences on environmental change material to students' environmental awareness attitudes is 54.7%, with the remaining 45.3% coming from other factors not tested in the study.

Reflective thinking skills of grade X students of SMA Negeri 3 Klaten

The collected reflective thinking skills data were analyzed using descriptive statistics, yielding an average of 77.15 and a standard deviation of 15.80. These average and standard deviation values were used to determine the categories of reflective thinking skills, as shown in Figure 5.

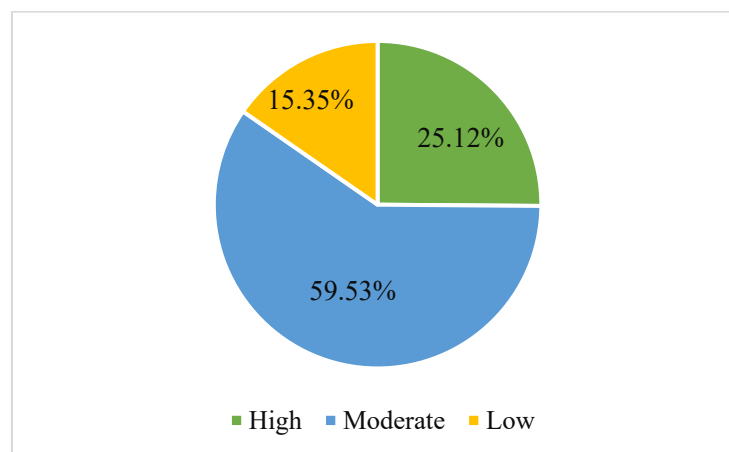


Figure 5. Students' reflective thinking skills

Based on Figure 5, the most dominant category of reflective thinking skills was moderate (59.53%), indicating that most students had sufficient, although not optimal, reflective abilities. They were able to reflect on experiences or problems, but not in depth. A total of 25.12% of students were in the high category, indicating more critical and comprehensive analytical and reflective abilities. Meanwhile, 15.35% of students were in the low category, indicating that they still had difficulty evaluating experiences in depth. These students' reflective thinking skills were categorized according to their level of reflective thinking, which included habitual action, understanding, reflection, and critical reflection, as shown in Figure 6.

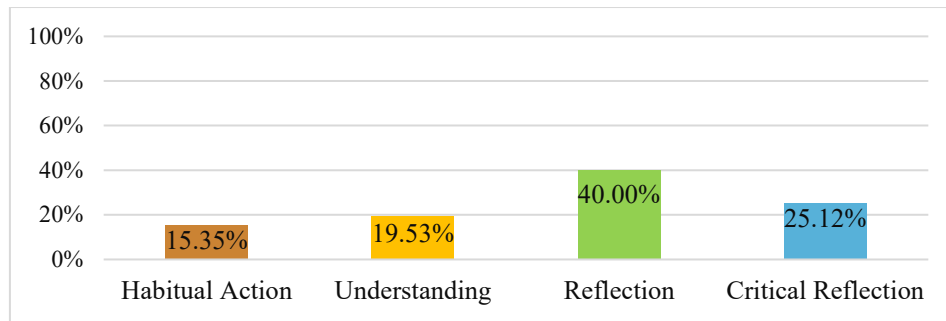


Figure 6. Reflective Thinking Skill Level Diagram

Figure 6 shows that the reflection level is the most dominant, at 40.00%, demonstrating students' ability to analyze situations, consider alternatives, and evaluate consequences. The critical reflection level ranks second (25.12%) and reflects more complex critical thinking. Furthermore, the understanding level (19.53%) indicates that students are beginning to understand the problem but have not yet engaged in in-depth reflection. Meanwhile, the habitual action level is the lowest (15.35%), with students solving problems on autopilot without adequate contextual analysis.

The relationship between learning experiences on environmental change material and reflective thinking skills of class X students of SMA Negeri 3 Klaten

Based on the prerequisite tests, namely the normality test (Sig. 0.076 > 0.05) and the linearity test (Sig. 0.915 > 0.05), the data on learning experience of environmental change material and reflective thinking skills are normally distributed and have a linear relationship. The hypothesis test can be carried out using a parametric test, the Pearson Product-Moment correlation test, in SPSS version 27.0. The results of the correlation test between the learning experience of environmental change material and reflective thinking skills are shown in Table 7.

Table 7. Results of the correlation test of learning experience with reflective thinking skills

Correlations			
		Learning experience	Reflective thinking skills
Learning Experience	Pearson Correlation	1	.414 **
	Sig. (2-tailed)		.000
	N	215	215
Reflective Thinking Skills	Pearson Correlation	.414 **	1
	Sig. (2-tailed)	.000	
	N	215	215

Based on Table 7, the significance values for both data sets are 0.000. In accordance with the basis for making decisions on the Pearson Product Moment correlation test, according to [Siregar \(2017\)](#), if the significance value (Sig.) < 0.05, then there is a relationship between learning experiences on environmental change material and reflective thinking skills. The results of the correlation test show a correlation coefficient of 0.414, indicating a moderate, close relationship. The relationship between the two variables is then assessed using the coefficient of determination (R Square), indicating how much the learning experience variable contributes to the reflective thinking skills variable. The results of the coefficient of determination test are shown in Table 8. Based on Table 8, the *R-squared coefficient* is 0.171 (17.1%). This value indicates that learning experience accounts for 17.1% of reflective thinking skills, with the remaining 82.9% attributable to other factors not tested in the study.

Table 8. Results of the determination coefficient test of learning experience with reflective thinking skills

Coefficient of determination	
R	.414 ^a
R Square	.171
Adjusted R Square	.167
Standard Error of the Estimate	14,424

Discussion

Learning Experience of environmental change material for grade X students of Sma Negeri 3 Klaten

Learning experiences result from the learning process and from students' interactions with the material and learning activities. The higher the quality of the learning experience, the higher the students' conceptual understanding (Widyastuty, 2024). At SMA Negeri 3 Klaten, the majority of 10th-grade students are in the moderate learning experience category (62.33%), followed by high (20.93%) and low (16.74%). This indicates that students have had a fairly good learning experience and participate in every learning activity the teacher designs, but there is still room for improvement.

Five main aspects influence students' learning experiences. The aspect of student interaction in understanding the material shows that 60.47% of students are in the medium category, 20.93% in the low category, and only 18.60% in the high category. Interaction in learning, such as group discussions where students can share their understanding, can enrich their learning experience. Many students are still passive in learning, reluctant to ask the teacher questions, and rarely discuss with peers. The teacher-centered learning culture also causes students to become accustomed to being passive recipients of information rather than active interactors (Iswardhany, 2016).

The utilization of students' learning resources shows that 67.91% are in the medium category, 18.14% in the high category, and 13.95% in the low category. Learning resources are very important for effective and efficient learning because they are a major factor in success and the foundation for improving the quality of learning in education and enriching students' learning experiences. Fransiska et al. (2024) stated that the use of diverse learning resources can increase learning effectiveness and enrich students' insights. Most students rely on only one main textbook, LKS, and the teacher's explanations, without seeking additional references. Sapriyah (2019) explained that using varied learning resources can increase motivation and help students better understand the material.

The students' direct experience shows that 61.39% are in the medium category, 20.47% in the high category, and 18.14% in the low category. Direct experience is important because it allows students to connect theory with real practice, making it more meaningful. Environmental learning based on direct experience can also increase students' awareness of environmental issues (Nurdiah et al., 2024). Students with high experience tend to be active in environmental activities and care about their surroundings. In contrast, students with low experience tend to understand theory only and show little real concern. This is in line with Bruner's theory, as discussed by Panjaitan (2023), which emphasizes the effectiveness of learning by doing in fostering deep understanding.

The students' vicarious experiences indicate that 67.91% are in the medium category, 21.86% in the high category, and only 10.23% in the low category. Edgar Dale's Cone of Experience theory identifies media experiences, such as images, videos, and verbal symbols, as forms of experience that can enrich students' understanding, even though they are not direct real experiences (Sari, 2019). Mayer (2020) states that students who actively use various media and information sources for learning have a better understanding than those who are passive.

These results show a positive pattern, as the high percentages in the medium and high categories indicate that most students can effectively utilize vicarious experiences.

The learning implementation aspect shows that 61.86% of students are in the medium category, 21.40% in the high category, and 16.74% in the low category. This aspect measures the extent to which students follow the teacher's learning activities. An effective learning process should actively involve students in systematically designed learning stages, from observation to the presentation of discussion results (Aji et al., 2024). The teacher uses the Discovery Learning (DL) and Problem-Based Learning (PBL) learning models with systematic scientific learning stages. Some students show signs of being unprepared to learn, such as not focusing on the teacher, distracting friends, looking around, and being sleepy, which can hinder the learning process.

Environmental attitude of class X students of SMA Negeri 3 Klaten

Environmental awareness is reflected in behavioral changes driven by feelings, understanding, and a tendency to apply environmental knowledge through actions that positively impact environmental sustainability (Adlika, 2020). Environmental awareness cannot be directly known, but is reflected in a person's behavior or actions. Research at SMA Negeri 3 Klaten in grade X showed that environmental awareness was dominated by the moderate category (60.93%), followed by the high category (21.40%), and the low category (17.67%). The dominance of the moderate category indicates that students have a fairly good level of environmental awareness, but it is not yet optimal. Widiawati et al. (2022) explained that environmental education plays an important role in shaping students' understanding, awareness, and attitudes towards the environment. Students with high environmental awareness are influenced by a high level of environmental literacy (Pratama et al., 2020), while students with low attitudes are generally due to a lack of understanding of the impact of environmental damage (Widiawati et al., 2022).

Students' environmental awareness was analyzed through two main aspects. Efforts to repair environmental damage were dominated by the medium category (68.37%), followed by the high category (20%), and the low category (11.63%). Istiqomah, as cited in Daud et al. (2022), explains that environmental awareness should be demonstrated through concrete actions to effectively and beneficially improve and manage the environment. Students in the high category demonstrated a strong commitment to actively participate in environmental improvement efforts, such as tree planting and reusing used goods (Aprilianti & Suratsih, 2023). Students in the low category exhibited limited environmental knowledge and had minimal access to information about environmental issues (Daud et al., 2022).

The aspect of efforts to prevent environmental damage shows dominance of the medium category (60.93%), followed by the high category (21.86%) and the low category (17.21%). The percentage in the high category for this aspect is slightly higher than for the improvement aspect because students tend to understand and implement preventive measures more easily. Students in the high category actively implement environmentally friendly practices such as environmental care, reducing plastic use, waste management, and energy conservation. Fransisky et al. (2024) explained that students demonstrate environmental damage prevention behavior because they understand the significant impact it has on life. Prevention efforts are easier to implement because they do not require specialized tools, incur high costs, or involve other parties, whereas improvement efforts require support from specific facilities and activities. This is in line with Pratama et al. (2020), who state that environmental prevention behavior is easier to understand because the cause-and-effect relationship is clearer and can be implemented in daily activities.

The relationship between learning experiences on environmental change material and the environmental awareness attitude of class X students of SMA Negeri 3 Klaten

Based on the results of the hypothesis test using Pearson Product-Moment correlation analysis, there is a significant relationship between learning experiences and environmental awareness attitudes among class X students at SMA Negeri 3 Klaten ($p = 0.000 < 0.05$). The correlation coefficient of 0.739 indicates a strong positive relationship, meaning that the higher the level of learning experience on environmental change material, the higher the students' environmental awareness attitudes (Siregar, 2017). These results are consistent with research by Herlina et al. (2025), which found a positive and significant relationship between environmental learning experiences and environmental awareness attitudes.

Good learning experiences help students understand the consequences of environmentally damaging actions, thus fostering a more caring attitude. Dewi & Anggraini (2022) state that knowledge gained through the learning process is the primary foundation for attitude formation, as it shapes perceptions, emotions, and tendencies to act. Environmental awareness needs to be instilled through early learning, particularly through contextual and applied activities such as discussions, field observations, and case studies (Agustin & Meisyaroh, 2020).

The coefficient of determination analysis indicates that learning experiences about environmental change accounted for 54.7% of the variation in students' environmental awareness. In comparison, the remaining 45.3% was attributable to other factors. This is in accordance with Azwar's (2016) view that attitudes are shaped by various factors, including culture, personal experience, the influence of important people, mass media, educational and religious institutions, and an individual's emotional state.

Reflective thinking skills of grade X students of SMA Negeri 3 Klaten

Reflective thinking skills need to be developed to help students adapt to the rapid pace of global development (Hayati et al., 2023). Ariyanto et al. (2022) explain that reflective thinking is an activity that helps students connect knowledge to solve new problems, while Fuady (2016) states that this process involves connecting prior knowledge with new information to analyze problems and determine the best solution. The results of research at SMA Negeri 3 Klaten showed that most grade 10 students had reflective thinking skills in the medium category (59.53%), followed by the high category (25.12%) and the low category (15.35%). This indicates that students have a sufficient skill base but are not yet at an optimal level. Interviews with students showed that teachers have attempted to develop these skills through a reflection program at the end of the lesson, but it has not been implemented optimally due to time constraints. However, according to Setiawan (2018), reflecting on written experiences can positively impact students' memory.

Based on the four levels of reflective thinking according to Kember (in Kenari & Subiantoro, 2023), namely habitual action, understanding, reflection, and critical reflection, the results of the study showed that the reflection level was the most dominant (40.00%), followed by critical reflection (25.12%), understanding (19.53%), and habitual action (15.35%). A high percentage of reflection indicates students' ability to analyze situations in depth and evaluate the consequences of actions (Peltier et al., 2005). A high level of critical reflection indicates students' higher-order thinking abilities (Aulia et al., 2025).

To improve reflective thinking skills, problem-based learning can be implemented to emphasize real-life problem-solving (Yuni et al., 2021). Furthermore, cultivating self-reflection through learning journals and end-of-lesson reflection activities is also effective. Consistent training in reflective thinking has been shown to develop these skills, including the ability to present logical arguments using relevant sources (Rosmiati et al., 2020).

The relationship between learning experiences on environmental change material and reflective thinking skills of class X students of SMA Negeri 3 Klaten

Based on the results of the hypothesis test using Pearson Product-Moment correlation analysis, there is a significant relationship between the learning experience with environmental change material and the reflective thinking skills of class X students at SMA Negeri 3 Klaten ($p = 0.000 < 0.05$). The correlation coefficient of 0.414 indicates a positive relationship with a sufficient degree of closeness, meaning that the greater the learning experience with environmental change material, the higher the students' reflective thinking skills (Siregar, 2017). This result is consistent with research by Leman et al. (2026), which found a positive and significant relationship between biology learning experiences and students' reflective thinking skills.

Good learning experiences in biology, especially those involving real-world problems such as environmental change, contribute to the development of higher-order thinking skills, including critical, logical, reflective, metacognitive, and creative thinking (Tendrita et al., 2016). Kenari & Subianto (2023) showed that learning experiences linked to contextual issues can significantly improve reflective thinking skills, especially at the levels of reflection and critical reflection. Rodgers (2002) explained that reflective thinking skills involve combining new information with prior experience to make better decisions.

The complex and contextual nature of environmental change requires students not only to memorize concepts but also to analyze impacts, evaluate causes, and consider solutions to real-world problems. Ariyanto et al. (2022) state that reflective thinking is a higher-order thinking skill that develops through active, sustained, and meaningful learning experiences. Prisila et al. (2021) suggest that cognitively challenging learning experiences encourage students to think more deeply.

The coefficient of determination analysis indicates that learning experiences account for 17.1% of the variance in students' reflective thinking skills. In comparison, the remaining 82.9% is influenced by other factors, including school facilities and infrastructure, student motivation, family background (Ningrum & Fauziah, 2021), learning styles (Maulida et al., 2024), and teacher learning models and methods (Elpita & Irwandi, 2019). Although not dominant, these contributions still demonstrate a significant role in developing students' reflective thinking skills.

CONCLUSION

This study aims to analyze the level of learning experience in environmental change material and its relationship to environmental attitudes and reflective thinking skills among class X students at SMA Negeri 3 Klaten. Based on the research that has been conducted, the following conclusions were obtained: (1) the learning experience of environmental change material of class X students of SMA Negeri 3 Klaten is in the moderate category (62.33%); (2) there is a significant and positive relationship between the learning experience of environmental change material and students' environmental attitudes with a strong level of relationship ($p = 0.000$; $r = 0.739$); (3) there is a significant and positive relationship between the learning experience of environmental change material and students' reflective thinking skills with a sufficient level of relationship ($p = 0.000$; $r = 0.414$). Teachers can use these findings as evaluation guidelines in designing more meaningful learning. Suggestions for further research include exploring other external factors (such as learning styles, motivation, and infrastructure) that were not tested in this study but also contribute to students' reflective attitudes and skills.

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