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Analysis of Students' Environmental Literacy Skill in Adiwiyata High Schools in Semarang

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Abstract

The PBLHS initiative in schools aims to cultivate individuals with strong environmental literacy skills, which can contribute to reducing environmental issues. The results of the interview suggest that the schools in Adiwiyata have not carried out an assessment of the environmental literacy of their students, despite its critical role in enhancing policies for PBLHS implementation. This study aims to assess the environmental literacy of high school students in Semarang regarding their knowledge, cognitive skills, and attitudes. The research used a descriptive quantitative method, surveying 375 respondents from class XI MIPA in the second semester of 2022/2023 from high schools that were awarded Adiwiyata. The research instrument utilized the environmental literacy assessment framework developed by NAAEE and adapted to high school biology materials. The environmental literacy of Class XI MIPA students at Adiwiyata High School in Semarang City is categorized as moderate in terms of knowledge, cognitive skills, and attitudes, with an average score of 35 for knowledge, 37 for cognitive skills, and 45 for attitudes. Knowledge of ecological systems, the impact of gas pollutants on environmental pollution, and the ability to identify environmental issues are critical areas for improvement. Additionally, students must be responsible for protecting the environment and have a strong sense of self-efficacy. Factors that influence students' environmental literacy skills include individual, school, and family environment, particularly in developing habits that promote environmental protection.

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INTRODUCTION

Environmental literacy is part of 21st century interdisciplinary themes and includes important literacy discussed by AACTE (American Association of Colleges of Teacher Education)(Greenhill, 2010). OECD (Organization for Economic Co-operation and Development) revealed that to create quality human resources and be able to compete and adapt to technology while still paying attention to environmental ethics so that environmental literacy becomes something that should be echoed (Nugraha & Octavianah, 2020). Environmental literacy can be measured based on criteria in the form of environmental literacy domains, including: knowledge, cognitive skills, attitude (environmental affect), and environmentally responsible behavior (Hollweg, *et al.*, 2011). Cognitive Skills include the ability to (1) identify environmental problems, (2) ask questions (3) analyze environmental problems, (4) investigate various environmental problems, (5) evaluate and make personal judgments about environmental problems, (6) utilize knowledge to propose opinions in the form of solutions to solve problems, and (7) evaluate and make solution plans to solve environmental problems. An environmentally literate person has knowledge of: (1) physical and ecological systems; (2) social, cultural, and political systems; (3) issues related to the environment; (4) various solutions to environmental problems; and (5) citizen participation and action strategies in protecting the environment. Attitude is a determinant of environment-related behavior, both good and bad behavior. Learners' attitudes toward the environment are thought to influence their willingness to recognize and choose between value perspectives, as well as their motivation to participate in public deliberations on environmental issues.

When considering that Indonesia is the second largest contributor of plastic waste in the world after China (Wright & Waddell, 2017) one of the largest greenhouse gas emitters in the world (Coca, 2018) and the world's number one country for ignoring weather changes due to global warming (Renaldi, 2019) as well as many activities that do not consider the principle of sustainable resources in Indonesia (Napitupulu *et al.*, 2022), then environmental literacy skills are needed as an effort to prevent and reduce these problems.

The research results of Maknun *et al.*, (2016) that students' environmental literacy is still low due to several factors, one of which is the intention to know and learn about environmental problems. The school factor as an educational environment must help create student awareness that understanding of the environment must be the basis of the attitude to be able to propose solutions to environmental problems by familiarizing students to protect their school environment.

School is a strategic place to improve students' environmental knowledge (Potter, 2010). The government through Kementerian Lingkungan Hidup dan Kehutanan (KLHK) has implemented the Adiwiyata Program since 2006, which in 2019 the implementation of environmental education in schools is carried out with the Environmental Care and Culture Movement in Schools (PBLHS) with an award known as the Adiwiyata award ((Menteri Lingkungan Hidup dan Kehutanan RI, 2019). PBLHS is based on the principle of participatory and sustainable implementation of environmentally friendly behavior which includes aspects of cleanliness, sanitation and drainage functions, waste management, planting and maintenance of trees / plants, water conservation, energy conservation, and innovations related to the application of environmentally friendly behavior. The PBLHS program aims to realize the behavior of school residents who are responsible for preserving environmental functions, and has an impact on improving the quality of the environment at school. It is hoped that the knowledge and habit of protecting the environment at school can be implemented at home and in the community by students so as to reduce environmental problems around them.

In the last 5 years, Semarang City has experienced an increase in the frequency of flood disasters, especially during high rainfall. Based on data from BPBD (*Badan Penanggulangan Bencana Daerah*) Semarang City in early 2023, there were 53 floods with a frequency of 50-250 cm water level (https://pusatkrisis.kemkes.go.id/). According to (*Dinas Lingkungan Hidup*) DLH Semarang City, disasters that occur in Semarang City include floods, landslides, global warming, and pollution due to environmental damage. (https://dlh.semarangkota.go.id/).

Based on the many environmental problems, especially in Semarang City, education plays an important role in relation to environmental conservation and natural resources. Education is done to change the mindset and behavior of students, so environmental education

is done in order to form awareness and environmental awareness from an early age (Herlina *et al.*, 2021).

Evaluation of environmental literacy skills is an important part of education implementation (Farwati *et al.*, 2018). Assessment of environmental literacy needs to be done as a basis for maximizing the potential of environmental education programs. This research was conducted with the aim of analyzing the level of environmental literacy skills of students in Adiwiyata High Schools in Semarang City based on aspects of environmental literacy components in the form of knowledge, cognitive skills, and attitudes and analyzing the factors that influence students' environmental literacy skills so that they can be used in evaluating the achievement of adiwiyata schools in Semarang City. so that the information obtained can be used by policy makers in reducing environmental problems in Semarang City.

RESEARCH METHOD

The study used descriptive quantitative method with survey technique. The population in this study were all Class XI students from high schools that have received the Adiwiyata award in Semarang City. Based on data from the Central Java Environment and Forestry Agency, there are 11 high schools in Semarang City that have received the Adiwiyata award.

Sampling is based on consideration of the representation of the overall picture of high school adiwiyata categories, namely Adiwiyata Mandiri, National Adiwiyata, Provincial Adiwiyata, and City Adiwiyata. The sampling technique used a purposive sampling technique based on considerations related to some biology material that corresponds to the environmental literacy domain. XI MIPA class students were chosen as a representative sample because these students had taken material related to the diversity of living things and their roles, ecosystem components and interactions between components, and environmental changes. In accordance with Decree No. 008/H/KR/2022 issued by the Head of the Education Standards, Curriculum and Assessment Agency of the Ministry of Education, Culture, Research and Technology regarding the learning outcomes of education in the independent curriculum, one of the objectives of the biology subject is that students are able to use their understanding in evaluating the relationship between biological systems and changes due to the impact of human activities so that they can propose solutions to problems in personal, local and global contexts (litbang.kemdikbud.go.id).

Sample with a known population was determined using the Isaac and Michael formula (Sugiyono, 2019).

$$S = \frac{\lambda^2.N.P.Q}{d^2(N-1)+\lambda^2.P.Q}$$

Information:

S = Sample size
λ^2 = Chi Square which is affected by degrees of freedom and error rate
N = Population size
d = Degrees of freedom
P = Correct probability
Q = Wrung chance

The sample size for a population of 3,756 with a sampling error rate of 5% and a confidence level of 95% is 375. The research was conducted in high schools in Semarang City that have received the Adiwiyata award. The research was conducted in the even semester of the 2022/2023 academic year. This research was carried out through stages including validating research instruments, observations and surveys to measure students' environmental literacy skills with test instruments, tabulating data and calculating percentages, analyzing data from student response questionnaires, concluding research results.

The environmental literacy test used was a multiple choice question and a Likert scale questionnaire. The test instrument was used as a measuring tool for students' environmental literacy in biology material. The assessment instrument is in the form of 25 multiple choice questions consisting of 15 items to measure the knowledge aspect and 10 items to measure the cognitive skills aspect and 15 items of Likert scale attitude assessment questionnaire. Based on

the instrument validity test, 15 items on the Knowledge Aspect and 10 items on the cognitive skills aspect used for research data collection can be seen in Table 1.

Table 1. Lattice of Questions used for Research Data Collection

Environmental Literacy Domains	PISA's Environmental Literacy Indicators	Activities	Question number
Knoledge	1. Systems and physical components of ecology	Categorize types of ecosystem components	1, 2
		Understand ecological systems	3,5
		Understand the types of interactions of living things in their environment and the things that are caused by these interactions.	6,7
	2. Environmental Issues	Understand the terms used in environmental conservation	8
		Understand the impact of gaseous pollutants on environmental pollution	10,11
	3. Socio-political system of environmental regulation	Understand conservation regulations and activities	12,14
		Understand the types of ways to conserve nature in Indonesia	15,16
	4. Strategies to address or prevent environmental problems	Propose steps that can be taken to prevent environmental damage	17, 18
Cognitive skills	1. Identify environmental issues.	Identify environmental problems in their surroundings	19,21
	2. Analyze environmental issues	Evaluate the causes of environmental change issues, and their impacts	22, 25, 26
	3. Evaluate potential solutions to environmental problems	Evaluate and propose efforts that can be made to overcome environmental problems.	27,28
	4. Propose and justify actions that address environmental issues	Propose and justify actions that address environmental issues	30
		Propose citizen participation measures and environmental action strategies	31,32
Total			25

Table 2. Attitude Assessment Questionnaire Grid

	Assessment Indicators	Item number	Items used
1.	Interest in the environment	1,2,3,4	1,2,4
2.	Sensitivity and concern for the environment	5,6,7,8	6,7,8
3.	Self efficiacy	9,10,11,12	9,10,11
4.	Responsibility for the environment	13,14,15,16	13,14,15
5.	Motivation and intention to act in protecting the environment	17,18,19,20	17,18,20

The validity and reliability test of the attitude assessment tool was performed on 33 participants and analyzed using the SPSS software. Analysis of 20 items revealed that 15 items had moderate to high validity scores. In the reliability test, the 15 items had a score of 0.871, which falls in the high category. Therefore, these 15 items are considered reliable for use as research tools.

The questions were distributed using google form. The instrument that has been prepared is then validated by experts and then tested constructively in the form of validity, reliability, difficulty level, and differential power tests which aim to determine the feasibility level of the environmental literacy evaluation tool developed by researchers. In the data collection process, the researcher shared the google form link directly with students by visiting the school and entering each class. This opportunity to interact with students directly was utilized by the researcher to identify the classroom and school environment and gather supporting information from students.

Technique for Data Analysis

The data processing technique utilized in the student assessment of environmental literacy is grounded in the science literacy test data and augmented by observations and questionnaires filled out by students. Environmental literacy assessment weights are adapted from the NAAEE framework and translated into NELA scores.

Tabel 3. Scoring of Environmental Literacy Test Instrument

Aspect	The number of questions	Max points	Multiplier Factor	Max Score
Knowledge	15	15	4.00	60
Congnitive skills	10	10	6.00	60
Attitude	15	60	1.00	60
Total				180

Table 4. Description of Score Range and Category for Each Component

Aspects	Range	Category		
		Low	Moderate	High
Knowledge	0-60	0-20	21-40	41-60
Cognitive skills	0-60	0-20	21-40	41-60
Attitude	15-60	15-30	31-45	46-60

RESULTS AND DISCUSSION

Based on the interviews conducted, it is evident that 9 out of 11 high schools, which have received Adiwiyata awards in Semarang City, have not measured the environmental literacy skills of their students with the guidelines of the environmental literacy assessment framework. The evaluation-monitoring activity of the Adiwiyata program is conducted at the end of each school year. However, it focuses only on evaluating the implementation, obstacles, and physical products produced. It is vital to examine the influence of the adiwiyata program on students' competencies, attitudes, and behavior to enhance and advance the program at school. Maknun *et al*., (2016) suggest that information regarding students' environmental literacy achievements in knowledge, cognitive skills, attitudes, and behavior is essential to promote the quality of learning in schools. Hanafi *et al*., (2021) reported that environmental literacy is a viable solution to address environmental issues.

Environmental literacy of 11th grade students at Adiwiyata High School, Semarang City, during the second semester of 2022/2023 was investigated. The results were categorized based on the respondents' scores and are shown in Table 5 for student categories in knowledge, cognitive skills, and attitudes.

Table 5. Environmental literacy skills in each aspect

Aspect	Mean	Category
Knoledge	35	Moderate
Cognitive skills	37	Moderate
Attitudes	45	Moderate

Students' Environmental Literacy Skills in the Knowledge

In this study, researchers identified the indicators that require attention and need improvement to determine students' abilities across various aspects. Graph 1 displays students' capacity to answer questions for each indicator of environmental literacy in the knowledge aspect.

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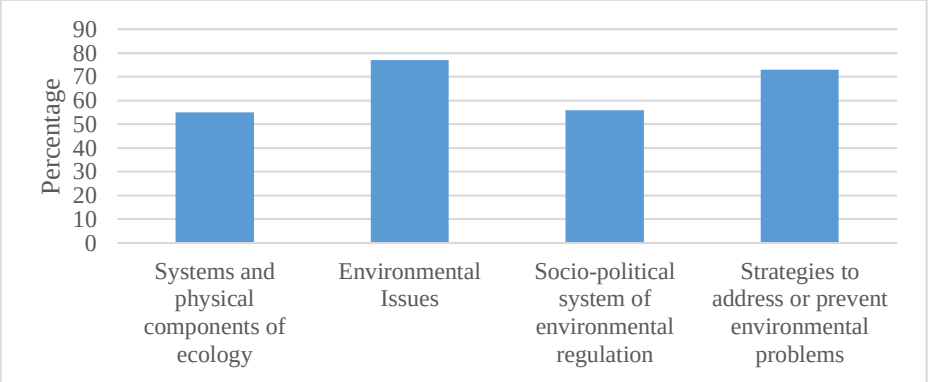
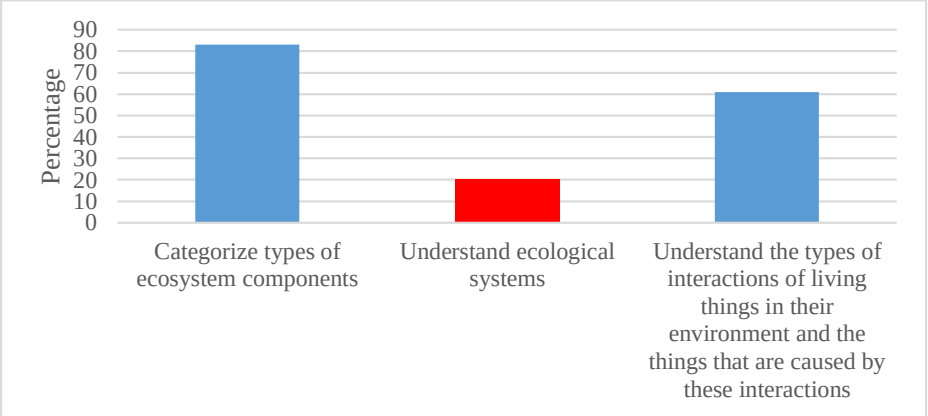
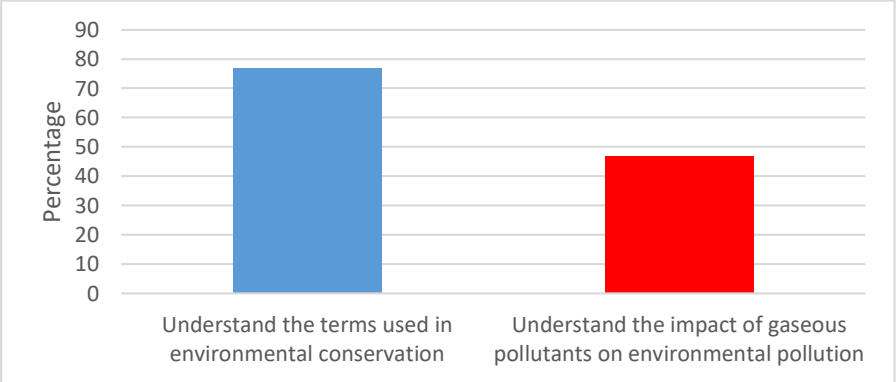


Graph 1 Students' environmental literacy in the knowledge aspect

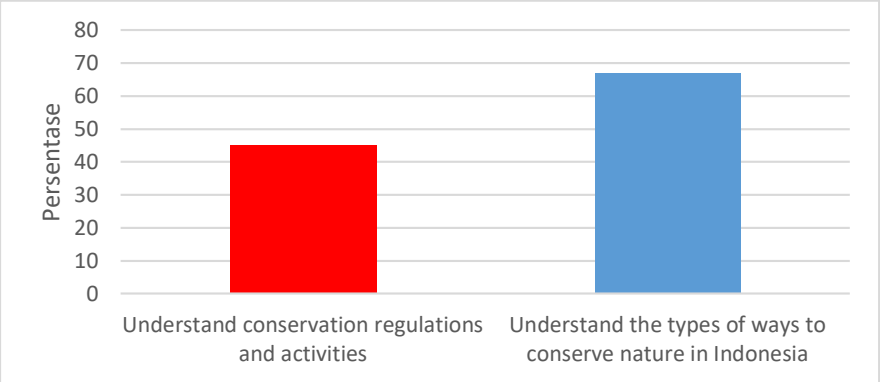
The ability of students to answer questions involving environmental literacy in the knowledge aspect of each indicator can be seen in graphs 2 to 5. In the research results presented, the red graph shows the indicator that has the lowest percentage among other indicators, so it deserves attention for improvement.



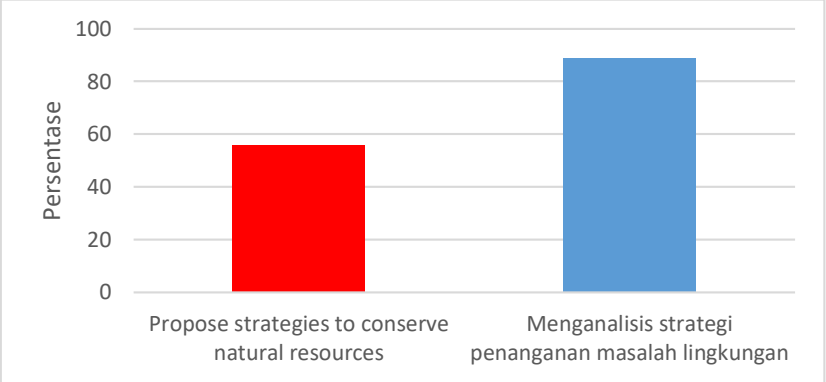
Graph 2. Knowledge of Ecological Systems and Physical Components



Graph 3. Knowledge of Environmental Issues



Graph 4. Knowledge related to the socio-political system of environmental regulation



Graph 5. Knowledge of environmental response and prevention strategies

Based on the results of the study on environmental literacy skills in Semarang City's Adiwiyata schools, it is evident that the lowest achievement among the five indicators is in the ecological systems and physical components, as well as the socio-political systems associated with environmental regulation. Based graph 2 out of all the respondents, only 20% demonstrated the ability to accurately answer questions related to the ecological system.

Ecology is the examination of the interactions among organisms and between organisms and their environment (Mastur & Mas'ud, 2018). It is plausible that students' comprehension of ecological systems may suffer due to insufficient instruction that incorporates direct environmental engagement. After reviewing the Adiwiyata school environment, it is evident that various parks providing educational opportunities, such as toga gardens, vegetable gardens, mini forests, and fish farms, are not adequately cared for. According to the interviews conducted with biology teachers, the COVID-19 pandemic has led to the neglect of the parks that were meant to serve as educational resources, particularly for the study of ecological systems. These parks have not been maintained or utilized for learning purposes.

(a) (b)

Figure 1. (a) Condition of the Toga Garden Before the Covid-19 Pandemic (Source: Biology teacher documentation SMAN 7 Semarang). (b) The condition of the toga garden at SMAN 7 Semarang after the Covid-19 pandemic (Source: Researcher documentation)

Environmental conditions play a critical role in the success of an educational activity. Education is a learning process that takes place in the family environment, school environment, and is implemented in the community environment (Permana & Ulfatin, 2018). Improving students' understanding of the ecological system is essential to enhance their knowledge of the physical components of ecology.

Based on Graph 3, students demonstrate good understanding of terms related to environmental conservation. However, their knowledge about the impact of gas pollutants on the environment is lacking. Out of 375 respondents, only 47% answered questions correctly. The results of the survey showed that many students are not interested in reading articles and books about the environment. Students' low interest in reading is a contributing factor to their lack of knowledge, despite the fact that reading activities and skills can expand knowledge. Ruslan & Wibayanti, (2019) stated that low student interest in reading contributes to low student knowledge. Moreover, students' comprehension ability significantly affects their knowledge acquisition from reading materials.

Graph 4. indicates the need for improvement in students' understanding of the socio-political system related to environmental regulations. As noted by Mastur & Mas'ud (2018), despite the Semarang City Government's issuance of Semarang City Regional Regulation Number 13 of 2006 concerning Environmental Control, guided by Law Number 32 of 2009 concerning Environmental Protection, frequent occurrences of environmental pollution problems persist in Semarang City.

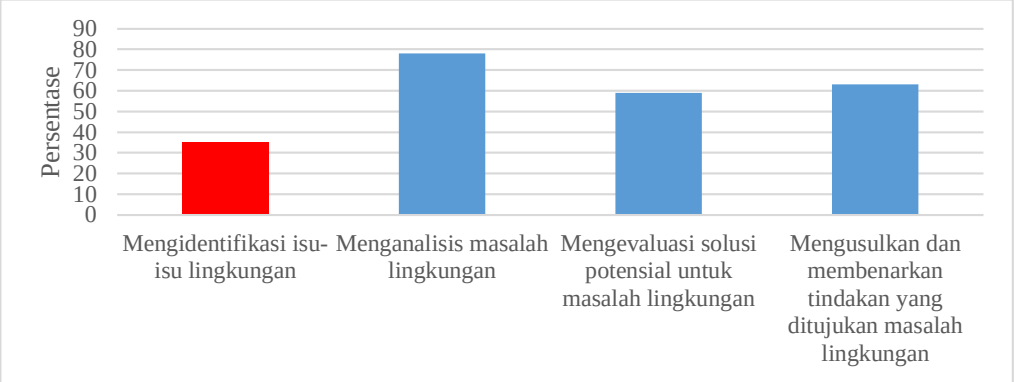
Law enforcement efforts and government policies require participation from various parties. Active community involvement in policy-making is essential for achieving sustainable environmental development in the political system. Therefore, increasing public awareness and concern for the socio-political system related to environmental regulation is necessary. One way to promote environmental awareness is through the school-based Adiwiyata program, which includes an environmental education component. While schools are only accountable for addressing environmental challenges on school grounds through the Adiwiyata program, the goal is for students to gain an understanding of environmental policies and regulations through educational instruction. Individuals knowledgeable about environmental policies and regulations can participate in advocacy efforts aimed at preserving the environment.

Graph 5. shows that students are able to analyze strategies for dealing with environmental problems around them. However, they lack the ability to propose strategies that preserve natural resources. This is due to an imbalance in students' knowledge of formulating steps to prevent environmental damage and solutions to environmental problems, which has yet to be balanced with responsible environmental behavior to have a significant positive impact on the surrounding environment. In line Roswita's (2016) suggestion of improving environmental literacy, efforts can be made to increase students' knowledge of their environment. Such knowledge increase not only contributes to environmental literacy but also helps in the development of students' character (Desfandi *et al.*, 2015).

Students' Environmental Literacy Skills in the Cognitive skills

The assessment of cognitive skills includes four indicators: (1) identification of environmental issues, (2) analysis of environmental problems, (3) evaluation of potential solutions to

environmental problems, and (4) proposal and justification of actions aimed at solving environmental problems.



Graph 6. Respondents' Ability to Answer Questions on Cognitive Skills Aspects for Each Indicator

Graph 6. provides information that the indicator with the lowest achievement is in the skill of identifying environmental issues. This is known based on the number of students who can answer questions correctly only 35% of the total respondents. Students' cognitive skills in identifying environmental issues are influenced by students' knowledge and attention to environmental problems around them so that learning and Adiwiyata programs carried out need to be designed to increase students' attention to the environment. Identifying environmental issues includes the ability to describe and provide evidence of truth related to a problem (Hollweg *et al.*, 2011).

According to graph 6, it is known that students' ability to evaluate potential solutions to environmental problems around them is not good, as only 50% of the respondents can answer correctly. This could result from a deficiency in their critical thinking skills. Hollweg *et al.*, (2011) propose that the essence of this competency is reliant on students' aptitude in critical thinking. Given that the learning objectives are aimed towards equipping students with the ability to think creatively and logically, problem solving skills, and decision-making skills to survive in the real world (Andriyani & Suniasih, 2021; Halidjah & Pranata, 2021).

The adiwiyata program implementation needs to integrate with school learning. However, based on observations, many teachers still employ the lecture method as it conveys a lot of material with limited time. It has been confirmed by biology instructors and Adiwiyata program managers that lesson plans have been developed to promote the success of the Adiywata program. However, due to the many administrative duties of instructors and lack of preparedness in infrastructure, learning often deviates from the plan. In line with Setianingsih *et al.*, (2019) which suggests that the critical thinking skills of students are low because the learning model used has not explored the potential of students to think critically about a problem.

Students can enhance their ability to recognize environmental issues by utilizing the PBL (Problem Based Learning) learning model and contextualizing environmental problems. In line with the results of research by Sumarni et al., (2019) which improves cognitive skills through problem-based learning. This aligns with the research conducted by Windari & Yanti, (2021) which indicates that integrating critical thinking skills - including analysis, synthesis, problem-solving, conclusion-making, and evaluation - into steps taken during problem-based learning improves students' critical thinking abilities.

Cognitive skills can be enhanced not only through problem-based learning approaches but also through contextual learning. In line with Sholehah, (2022) Contextual STAD (Student Teams Achievement Divisions) learning can also enhance students' cognitive skills, which is one of the scientific thinking skills.

Students' Environmental Literacy Skills in the Attitude

Students' environmental literacy skills in the attitude aspect are evaluated using 5 indicators: (1) interest in the environment, (2) sensitivity or concern for the environment, (3) self-efficacy, (4) responsibility for environmental balance, and (5) motivation and intention to protect the environment.

Interest in the environment can foster students' sensitivity and concern for ecological issues. The lack of interest in environmental issues among students can be attributed to their limited exposure to nature. According to Rakhmawati *et al.*, (2018) environmental literacy refers to an individual's ability to comprehend environmental processes, recognize the extent of the environment, and understand its formation. This is supported by Anggraini & Nazip, (2022) who suggest that the learning process should involve students in direct learning experiences outside of the classroom, where they can observe environmental problems and behaviors that have a positive impact on the environment. However, results from direct questioning of respondents indicate that biology learning outside of the classroom is uncommon and has never been undertaken.

Based on the results of the student response questionnaire, individual sensitivity to the environment is influenced by environmental knowledge (Darmawan & Fadjarajani, 2016). Therefore, the Adiwiyata program fosters an attitude of environmental care in schools. Nevertheless, attitudes are also developed through family habits. To support the achievement of the goals of the adiwiyata program at school, parents are expected to provide exemplary care for the environment at home. Objective and balanced language is used, and the text adheres to conventions of logical structure, formality, and precise word choice.

Cherdymova *et al.*, (2018) explained that environmental awareness and care are formed from the environmental training process. Students who have knowledge about the environment develop a positive attitude towards the environment and care more about the surrounding environment. (Anggraini & Nazip, 2022). In addition to habituation for environmental protection, environmental education can include socialization and workshops that encourage students to take concrete actions and campaign for environmental care. Nurkolis *et al.*, (2020) support the idea that workshop activities can increase environmental awareness and promote environmental literacy.

According to the results of interviews with biology teachers and adiwiyata managers at school, it is known that the covid 19 pandemic has a significant effect on the implementation of the adiwiyata program. Online learning makes teachers unable to supervise the implementation of the adiwiyata program. During the covid 19 pandemic, students carry out the adiwiyata program independently at their respective homes.

During the observation conducted at SMA 14, an Adiwiyata Mandiri school, the researcher participated in a 15-minute cleanup activity, which included singing, picking up and sorting waste materials, and movement to dispose of garbage. In addition, schools employ various activities to reduce waste, such as implementing "Clean Environment Fridays" and similar clean-up events, promoting the use of refillable containers in classrooms, waste sorting habits, and repurposing used items as "*hasta karya*." Through these activities, the Adiwiyata program takes real action in cultivating students' concern for the environment, beginning with the cleanliness and waste management of their school surroundings. This aligns with Hidayati *et al.*, (2013) assertion that students' environmental awareness and responsibility can be fostered through the practice of maintaining cleanliness in their school environment.

Teachers' involvement in environmental action serves as a role model for students. The teacher's objective attitude towards the environment sets an example of behavior that students can imitate. This is consistent with Maulana & Harmanto (2014) findings that a teacher's caring attitude towards the environment motivates students and cultivates their environmental awareness and responsibility. Environmental education should be incorporated into the education curriculum and taught throughout various subjects, especially science, which includes biology. One way for teachers to enhance environmental awareness is through designing conservation-oriented learning. Hal ini didukung oleh penelitian Susilo *et al.*, (2016) conducted research that highlights the significant impact of incorporating a conservation vision into science learning on environmental care attitudes.

According to the results of interviews conducted with the adiwiyata manager at SMAN 14, the waste problem at school is that kitchen waste has not been managed and utilized properly. Composting activities are carried out to manage the organic waste but not yet optimal.

In another school, SMAN 16 conducts waste management by making ecobricks that are utilized as benches in addition to composting to manage organic waste at the school. According Arfani & Lestari, (2021) an effort that can be an alternative to organic waste management is to utilize maggot.

Self-efficacy refers to an individual's belief in their ability to successfully complete a task or action. According to the response results, students already possess the belief that their actions toward the environment will have an impact on themselves and those around them. Additionally, students believe that recent natural disasters are the consequence of human actions that do not prioritize nature. The high confidence in these two indicators yields positive outcomes. However, 76% of respondents did not believe that the garbage accumulating in the landfill is solely the responsibility of the Environmental Agency. Rather, the entire population shares the responsibility for this pile of garbage. Students with strong self-efficacy are more likely to adapt to environmental issues and confidently take action to address problems, demonstrating a sense of individual responsibility. In accordance with Mahsunal *et al*., (2023) that Self Efficacy significantly affects self-confidence so that they tend not to try to overcome problems in their environment.

Based on the results of the study, students were willing to invite others to participate in environmental protection and often threw garbage into the trash can. However, the activity of sorting waste and processing waste for recycling is still low. Although the waste is disposed according to its place, if the waste is not sorted and processed, it will end up in the landfill and only delay the environmental problems. Based on the research of Rarasandy *et al*., (2020) that between attitude and behavior has a significant relationship. One of the requirements for responsible behavior is an understanding of environmental challenges and various activities that can be carried out to overcome them (Anggraini & Nazip, 2022). The issue of environmental crises from local to global level is not only the responsibility of the government but also of the community (Parker, 2018) o the responsibility related to this issue needs to be fostered in students.

Based on the results of the study, it is known that students have the willingness to preserve the environment and dare to reprimand friends or other people if they take actions that can damage environmental sustainability, so the motivation and intention to invite others to protect the environment is quite good. In addition, students' awareness of the importance of preserving the environment starting from small things is quite good. Schools need to increase students' motivation to engage in environmental activities by convincing them that what they do to the environment will affect their present and future lives. Students' attitude towards environmental protection is also influenced by their own motivation. Motivation and intention to act in protecting the environment are verbal willingness and commitment to act based on beliefs or attitudes (Hollweg *et al.*, 2011).

Factors that influence students' environmental literacy

The factor of student habituation at school and the school's commitment in managing the adiwiyata program considering that the school's process towards the national and independent levels is the result of the school's commitment in implementing PBLHS. As stated by Septian & Wibisono, (2021) that attitude which is the result of student learning can be influenced by friends, school rules, and teachers. But not only that, the family environment and place of residence also affect students' attitudes and habits, especially in environmental protection behavior. As stated by Azhar et al., (2015) that personal experience, other people who are considered important, mass media, educational institutions or institutions, and religious institutions as well as emotional factors within themselves are among the factors that influence attitude formation.In the post-pandemic period, the implementation of the adiwiyata program at Adiwiyata High School in Semarang City will be reviewed and it is hoped that it can return to running like before the Covid 19 pandemic. Schools must work hard to reorganize adiwiyata policies and programs and carry out planning so that the program can continue to run comprehensively. Given the implementation of the adiwiyata program, which began to be rarely carried out during the pandemic, making good habits before the pandemic began to fade. Some teachers began to neglect the integration of the adiwiyata program in subjects. However, in the 2023/2024 school year, the adiwiyata program managers in schools will begin to echo the adiwiyata program in schools.

CONCLUSION

Environmental literacy skills of grade XI students in the 2022/2023 academic year at high schools in Semarang City that have received Adiwiyata awards have a medium score category in the knowledge aspect. Students already have knowledge of environmental issues and strategies to overcome and prevent environmental problems, but there is a need to increase students' knowledge of ecological systems and the impact of gas pollutants on environmental pollution. Students' environmental literacy in the aspect of cognitive skills is categorized as moderate. Students' skills in analyzing environmental problems, evaluating potential solutions to environmental problems, and proposing and justifying actions aimed at environmental problems are quite good but need to be improved, especially in the skill of identifying environmental issues. In the attitude aspect, the category is moderate. Students have enough interest, concern, responsibility for the environment and have the motivation and intention to act in protecting the environment but lack in terms of self-efficiacy. various factors that can affect students' environmental literacy skills include school commitment to the implementation of the PBLHS Movement, the involvement of teachers and school residents in complying with school policies related to PBLHS, the use of the environment as a medium and learning resource, contextual and problem-based learning that must be emphasized.

REFERENCES

Andriyani, N. L., & Suniasih, N. W. (2021). Development of Learning Videos Based on Problem-Solving Characteristics of Animals and Their Habitats Contain in Ipa Subjects on 6th-Grade. *Journal of Education Technology*, *5*(1), 37.

Anggraini, N., & Nazip, K. (2022). Kemampuan Literasi Lingkungan Mahasiswa Pendidikan Biologi Menggunakan Skor Nela. *Journal of Education Action Research*, *6*(4), 552–557.

Azhar, Basyir, D., & Alfitri. (2015). Hubungan Pengetahuan dan Etika Lingkungan dengan Sikap dan Perilaku Menjaga Kelestarian Lingkungan. *Jurnal Ilmu Lingkungan*, *13*(1), 36–41.

Cherdymova, E. I., Afanasjeva, S. A., Parkhomenko, A. G., Ponyavin, M. B., Yulova, E. S., Nesmeianova, I. A. A., & Skutelnik, O. (2018). Student ecological consciousness as determining component of ecological-oriented activity. *Eurasian Journal of Biosciences*, *12*, 67–174.

Coca, N. (2018). *The most important country for the global climate no one is talking about*. Retrieved from https://www.vox.com/energy-and-environment/2018/12/5/18126145/indonesia-climate-change-deforestation

Darmawan, D., & Fadjarajani, S. (2016). Hubungan Antara Pengetahuan dan Sikap Pelestarian Lingkungan dengan Perilaku Wisatawan dalam Menjaga Kebersihan Lingkungan (Studi di Kawasan Objek Wisata Alam Gunung Galunggung Desa Linggajati Kecamatan Sukaratu Kabupaten Tasikmalaya). *Jurnal Geografi*, *4*(1), 37–49.

Farwati, R., Permanasari, A., Firman, H., & Suhery, T. (2018). Pengembangan dan Validasi Instrumen Evaluasi Literasi Lingkungan. *Jurnal Penelitian Pendidikan Kimia: Kajian Hasil Penelitian Pendidikan Kimia*, *5*(1), 38–43.

Greenhill, V. (2010). *21st Century Knowledge and Skills in Educator Preparation*. Retrieved from https://eric.ed.gov/?id=ED519336

Halidjah, S., & Pranata, R. (2021). *Development of Indonesian Language Teaching Materials Based on Google Classroom in Primary Schools*. *5*(2), 298–306.

Hanafi, Y., Aprilia, N., Nurusman, A. A., Purwanto, A., Nadiroh, N., & Budi, S. (2021). Analisis Kebutuhan Pengembangan Instrumen Literasi Lingkungan Untuk Mahasiswa Pendidikan Biologi FKIP Universitas Ahmad Dahlan. *Jurnal Eksakta Pendidikan (Jep)*, *5*(2), 174–180.

Herlina, N., Suprapto, P. K., & Chaidir, D. M. (2021). Studi Komparatif Literasi Lingkungan Dan Sikap Peduli Lingkungan Siswa Sekolah Adiwiyata Dengan Non Adiwiyata. *Quagga: Jurnal Pendidikan Dan Biologi*, *13*(2), 17–23.

Hidayati, N., Taruna, T., & Purnaweni, H. (2013). Perilaku Warga Sekolah Dalam Program Adiwiyata di SMK Negeri 2 Semarang. *Prosiding Seminar Nasional Pengelolaan Sumberdaya*

Alam Dan Lingkungan, 149–154.

Hollweg, K. S., Taylor, Bybee, J. R., Marcinkowski, R. W., Mcbeth, T. J., & Zoido, W. C. (2011). Developing a Framework for Assessing Environmental Literacy (Full Document). *North American Association for Environmental Education*. Retrieved from https://cdn.naaee.org/sites/default/files/devframewkassessenvlitonlineed.pdf

Hollweg, K. S., Taylor, J., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). Developing a Framework for Assessing Environmental Literacy: Executive Summary. In *North American Association for Environmental Education*. Retrieved from http://www.naaee.net/framework

Mahsunal, A., Musbikhin, & Hasanah, M. (2023). Pengaruh Self Efficacy terhadap Kepercayaan Diri pada Siswa. *Al-Ihath: Jurnal Bimbingan Dan Konseling Islam*, *3*(1), 32–46.

Maknun, J., Barliana, M. S., & Cahyani, D. (2016). The Level of Environmental Literacy toward Vocational High School Students in West Java Province. *Innovation of Vocational Technology Education*, *12*(2), 181–195.

Mastur, & Mas'ud, M. (2018). Peran Dinas Lingkungan Hidup Kota Semarang Terhadap Pelaksanaan Pembangunan Berwawasan Lingkungan. *Jurnal Ilmiah Ilmu HUkum Q1STIE*, *11*(2), 209–225.

Maulana, G. S., & Harmanto. (2014). Peran Keteladanan Guru dalam Upaya Membentuk Karakter Peserta Didik Di SMA Negeri 12 Surabaya. *Kajian Moral Dan Kewarganegaraan*, *3*(2), 1189–1204.

Menteri Lingkungan Hidup dan Kehutanan RI. (2019). Peraturan Menteri Lingkungan Hidup dan Kehutanan RI Nomor 52 Tahun 2019 tentang Gerakan PBLHS. In *Jdih* (pp. 1–18).

Napitupulu, L., Tanaya Sitanggang, S., Ayostina, I., Andesta, I., Fitriana, R., Ayunda, D., Tussadiah, A., Ervita, K., Makhas, K., Firmansyah, R., & Haryanto, R. (2022). Trends in Marine Resources and Fisheries Management in Indonesia: A Review. In *World Resources Institute*.

Nugraha, D., & Octavianah, D. (2020). DISKURSUS LITERASI ABAD 21 DI INDONESIA. *JPE (Jurnal Pendidikan Edutama)*, *7*(1), 107.

Nurkolis, Setyaningsih, R., & Roshyanti, F. (2020). Manajemen Sekolah Berbasis Literasi Lingkungan untuk Meningkatkan Kesadaran Siswa terhadap Lingkungan Sekolah. *Jurnal Administrastrasi Pendidikan*, *27*(1), 11–23.

Parker, L. (2018). Environmentalism and education for sustainability in Indonesia. *Indonesia and the Malay World*, *46*(136).

Permana, B. I., & Ulfatin, N. (2018). Budaya Sekolah Berwawasan Lingkungan pada Sekolah Adiwiyata Mandiri. *Ilmu Pendidikan: Jurnal Kajian Teori Dan Praktik Kependidikan*, *3*(1), 11–21.

Potter, G. (2010). Environmental Education for the 21st Century: Where Do We Go Now? *The Journal of Environmental Education*, *41*(1).

Rakhmawati, D., Prasetyo, A. P. B., & Ngabekti, S. (2018). Peran Program Adiwiyata dalam Pengembangan Karakter Peduli Lingkungan Siswa: Studi Kasus Di SMK Negeri 2 Semarang. *USEJ: Unnes Science Education Journal*, *5*(1), 1148–1154.

Rarasandy, L., Priyono, A., Prasetyo, B., & Ngabekti, S. (2020). Student's Conservation Attitudes and Behavior After Conservation and Environment-Courses. *Journal of Innovative Science Education*, *9*(2).

Renaldi, A. (2019). *Indonesia Is Home to the Most Climate Change Deniers in the World*. Retrieved from https://www.vice.com/en/article/a3x3m8/indonesia-climate-change-deniers-yougov-poll

Ruslan & Wibayanti. (2019). Pentingnya Meningkatkan Minat Baca Siswa. *Prosiding Seminar Nasional Pendidikan Program Pascasarjana Universitas Pgri Palembang*, 767–775.

S.R, T. A., & Lestari, H. (2021). Efektivitas Pengelolaan Sampah dalam Mewujudkan Kota Semarang Bersih (Studi Kasus : Pengelolaan Sampah di TPA Jatibarang). *Journal of Public Policy and Management Review, 10*(3), 491–499.

Septian, N., & Wibisono, A. (2021). Review Faktor Pembentuk Perilaku Belajar Siswa Generasi Z Dalam Ruang Kelas. *Research*https://doi.org/10.30998/rdje.v7i2.9434

Setianingsih, R., Marianti, A., & Ngabekti, S. (2019). Analysis of Critical Thinking Skills High School Students in the District of Semarang Material Environmental Change Curriculum 2013. *Journal of Biology Education*, *8*(3), 315–321.

Sholehah, N. (2022). Lesson Study: Penerapan STAD Kontekstual untuk Meningkatkan Hasil Belajar dan keterampilan Proses Sains. *Journal of Classroom Action Research*, *4*(1).

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (1st ed.). ALFABETA CV.

Sumarni, W., Wijayati, N., & Supanti, S. (2019). Analysis Kemampuan Kognitif dan Berfikir Kreatif Siswa Melalui Pembelajaran Berbasis Proyek Berpendekatan STEM [The Analysis of Cognitive and Creative Thinking Skill Through The Use of STEM Project Based Learning Model]. *Jurnal Pembelajaran Kimia OJS*, *4*(1), 18–30.

Susilo, H., Prasetyo, A. P. ., & Ngabekti, S. (2016). Pengembangan Desain Pembelajaran IPA Bervisi Konservasi Untuk Membentuk Sikap Peduli Lingkungan. *USEJ - Unnes Science Education Journal*, *5*(1), 1065–1069.

Windari, C. O., & Yanti, F. A. (2021). Penerapan model problem based learning untuk meningkatkan keterampilan berpikir kritis pesera didik. *Edu Sains Jurnal Pendidikan Sains & Matematika*, *9*(1), 61–70.

Wright, T., & Waddell, S. (2017). How can Indonesia win against plastic pollution? *Theconversation*. Retrieved from https://theconversation.com/how-can-indonesia-win-against-plastic-pollution-80966