The Influence of the Guided Inquiry Learning Model on Students' Ecoliteracy Attitudes on Waste Recycling Materials

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Abstract: Ecoliteracy is the concept of a comprehensive understanding of ecosystems and their environment. The low ecological intelligence or ecoliteracy of students is the background of this study. This study aims to test whether the guided inquiry learning model affects students' ecoliteracy attitudes and how students' ecoliteracy attitudes through guided inquiry learning models on waste recycling materials. The research method used is an experiment with a quantitative approach. The population in this study was the entire class X MIPA SMA Negeri 1 Stabat, which amounted to 216 students. The sample used was random sampling, namely class X MIPA-1 students as an experimental class and class X MIPA-3 as a control class with 72 students. The research only focuses on attitudinal aspects of ecoliteracy competence. Research data were collected through the distribution of questionnaire sheets and observations. The results showed that the average ecoliteracy attitude of students taught using the guided inquiry learning model reached 87.2% in the good category. Meanwhile, the average ecoliteracy attitude of students taught with conventional learning models is 62.7% with sufficient categories. Hypothesis testing is done manually. Experimental class students have a higher percentage of ecoliteracy than control class students. Guided inquiry learning in waste recycling materials is more efficiently used to determine the improvement of students' ecoliteracy attitudes.

Keywords: Guided Inquiry Learning Model; Student Ecoliteracy Attitude; Waste Recycling Material

Introduction

National education has an important role in developing and shaping the character and civilization of a civilized nation, with the main aim of educating the nation's life. Education aims to develop the potential of students to become individuals who believe and fear God Almighty, have noble morals, good health, skills, creativity, and independence, and become democratic and responsible citizens [1]. The main purpose of education is not only limited to improving aspects of knowledge but also incorporating elements of good attitude in the learning process. In Biology Education, the importance of sustainability between living things and nature is a major factor in efforts to preserve the environment. One of the aspects studied is ecoliteracy, such as ecological intelligence or ecoliteracy. The term comes from the Greek "oikos" meaning habitat, and "logos" meaning knowledge. This ecological intelligence has a complex nature [2]. Ecoliteracy is the human capacity to adapt to the environment. Ecological intelligence must be possessed by students and applied in everyday life in response to environmental situations [3].

Responsibility and concern for one's environment can be formed, one of which is through education. Education makes students sensitive and concerned about the environment [4]. However, environmental problems are also often found in the school environment. Schools have become one of the places to produce waste, both organic and inorganic waste [5]. School residents' average complex activity often ignores the conditions of the surrounding environment. Students who like to litter and are apathetic towards plants are some clear examples of students' lack of concern for the environment. It can be seen that there is still often a dirty school environment, student participation in environmental activities is still lacking, students have low awareness of shaping environmental care behavior, and students have an indifferent attitude towards the environment [6].

Environmental problems are a lack of understanding of concern for the environment or student ecoliteracy. Ecoliteracy is the ability of humans to adapt to the ecological environment [3]. Someone with ecoliteracy can understand well the impact of his behavior on fellow humans and his environment. Ecoliteracy is a condition where someone has understood the principles of ecology and lives by these ecological principles in organizing and building a life with mankind on this earth in realizing a sustainable society. Ecoliteracy aims to enable every human being to live in harmony with nature without damaging the existing natural order [7]. In order to mitigate environmental issues, it is imperative to cultivate ecoliteracy among students, enabling them to become ecologically knowledgeable persons. The Center For Ecoliteracy has developed a set of ecoliteracy competencies. Ecoliteracy competencies, according to the Center For Ecoliteracy, include aspects of head (cognitive) competencies, heart (emotional) competencies, and hands (active) competencies [8].

Instilling a caring mentality in students is essential for the sustainability of the school environment. An eco-mindset will highlight ecological concepts, especially human-environment interaction [9]. Knowledge of the environment that students have can make students friendly to the environment so that they can find effective solutions to environmental problems encountered [10]. Ecoliteracy is important to develop in the learning process because students have a role as agents who develop knowledge, insights, attitudes, and sustainable behavior in society (agents of change), agents who have an awareness of their natural conditions, and agents who can apply ecoliteracy in life [11]. However, without the realization of concrete actions as an effort to protect the environment, environmental knowledge only becomes knowledge whose application is not sustainable [12].

The environment plays an important role in realizing the attitude and responsibility of caring for the environment. This is because, through education, students are regulated in speaking, behaving, or behaving in a way that shows good character [13]. Based on observations at SMA Negeri 1 Stabat and interviews with teachers of Biology subjects, it is known that the teaching methods used are still less varied and only focused on cognitive aspects. As a result, students become passive in learning and exhibit low levels of waste-related ecoliteracy. The attitude of indifference of students to the school environment is reflected in the behavior of littering, with much garbage scattered outside the classroom, especially on the school grounds. When some students found out about the garbage, they were reluctant to clean it up. This is the impact of several problems, one of which is the lack of support from instructors in developing new ways of teaching that can improve students' environmental literacy. Passive students are not motivated in the learning process, so they do not understand the material taught [14]. Alternative and innovative learning methodologies are needed to engage students and improve their ecoliteracy through guided questions. One approach that can be used to achieve this is the guided inquiry learning model, where students are encouraged to be central in learning [15]. The paradigm of guided inquiry learning is that students are encouraged to identify facts about their environment actively. This approach helps create a student-focused learning paradigm and provides opportunities to better understand the environment and ecological issues in greater depth [16]. For this reason, the authors felt interested in researching the role of students in understanding the environment as an alternative to learning that can improve ecoliteracy attitudes.

Some previous studies relevant to this research topic include research conducted by Pratiwi et al. (2022) entitled The Effect of the Guided Inquiry Learning Model on the Ecoliteracy of Elementary School Students. The results showed that guided inquiry learning is more effective than conventional learning models in increasing student ecoliteracy [15]. Another study was also conducted by Karlina et al. (2017), and the results showed that learning with an out-of-study-based group investigation methodology can help students improve ecoliteracy in waste management activities [17]. According to the findings of previous relevant studies, both discoveries have

the same goal: improving students' ecoliteracy with learning models. Ecoliteracy or ecological awareness of students can be improved through creative learning that requires them to act and observe immediately in response to what they find [15].

Based on the description above, this study aims to determine the influence of the guided inquiry learning model on student ecoliteracy attitudes and find out how student ecoliteracy attitudes through the guided inquiry learning model at SMA Negeri 1 Stabat. This research also only focuses on aspects of ecoliteracy attitudes in biology learning. This is what makes this study different from previous research. Students' ecoliteracy attitudes are an asset in improving the overall ecological level. Attitude is the main goal in applying ecoliteracy in addition to knowledge and skills [18]. An attitude of caring for the environment must also be developed in education [19]. Senior high school is one of the formal institutions that has an important role in maintaining attitudes on the development of student education [20].

Research Methods

This research will be conducted at SMA Negeri 1 Stabat in JL. Proclamation No.3 Abadijaya, Kwala Bingai, Kec. Stabat, Kab. Langkat, North Sumatra, with zip code 20811. This research was carried out in the even semester, from April 15 to May 26, 2022/2023. This study used a quasi-experimental method with a quantitative approach [21]. For sampling techniques, a simple random sampling method is used. In this study, posttest refers to questionnaire sheets and observation sheets. The study design involved two classes: the experimental class that received treatment and the control class that did not. Both classes will take the final test using the same test instrument. In this study, the sample consisted of class X MIPA-1 with 36 students as an experimental class and class X MIPA-3 with 36 students as a control class. The research instrument consists of questionnaire sheets and observation sheets that refer to indicators of students' ecoliteracy attitudes [4]. The research procedure used in this study consists of three stages, which are as follows:
1. Planning Phase
   The planning stage is the first step in research to compile and prepare everything needed.
2. Implementation Phase
   The implementation stage is the core of the research, where the application of pre-planned treatments or actions is carried out.
3. Data Processing Stage
   The last stage is data processing, where after the implementation is carried out, the data obtained is analyzed and processed according to the plan made before.
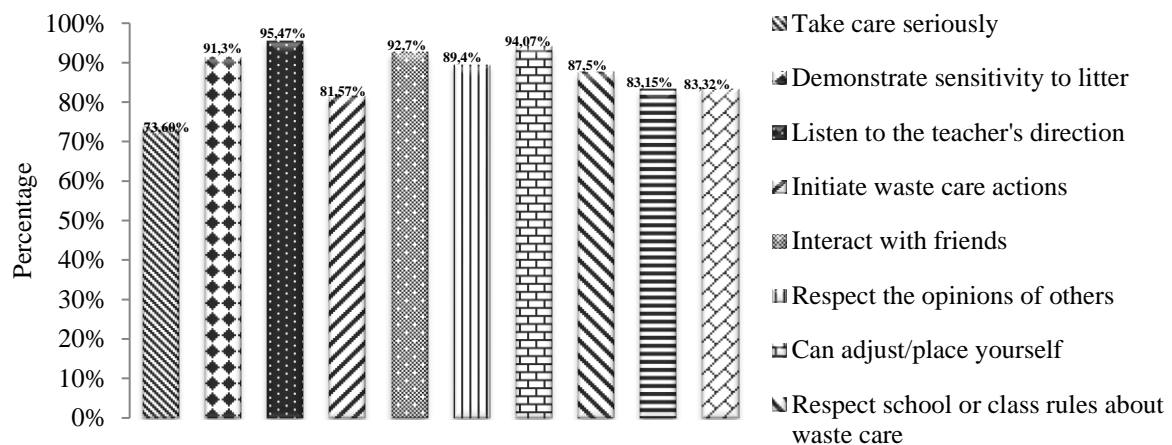
The data analysis carried out tests the validity of the instrument and analyzed the results of the instrument. The prerequisite tests are normality, homogeneity, and hypothesis tests.

Results And Discussion

Environmental problems that occur today in education are a tangible form of students' lack of attitude about environmental understanding/ecological literacy, with a learning model that only focuses on cognitive aspects so that students become passive or less active, especially regarding ecoliteracy. This understanding is referred to as ecoliteracy or ecological literacy [4]. Researchers have collected data through questionnaires and observation sheets where students' ecoliteracy attitudes use ecoliteracy assessment rubrics in attitude aspects. The attitude aspect consists of 3 indicators that the researcher has operationalized according to the activities carried out in the experimental and control classes and is further divided into 10 sub-indicators as follows.

Table 1. Ecoliteracy competence of attitude aspects

Indicators	Sub Indicators
1. Feeling caring, empathy, and respect for others and living beings	Take care seriously Demonstrate sensitivity to litter Listen to the teacher's direction
2. Work together and value others with different backgrounds, motivations, and intentions. Observe deeply and appreciate multiple	Initiate waste care actions. Interact with friends Respect the opinions of others Can adjust/place yourself Respect school or class rules about waste care
3. Committed to equality, justice, inclusivity and respect for all people.	Take action in the form of rewarding waste care activities Willing to sacrifice based on caring for the environment

perspectives.

The following data from the distribution of questionnaires and observation sheets carried out by researchers in the experimental and control classes are as follows figure 1.

Figure 1 shows that the value of the student ecoliteracy attitude assessment rubric consists of 10 (ten) sub-indicators filled in by students and assessed by two observers during the learning process using a guided inquiry learning model. The highest average percentage in the sub-indicator of listening to teacher direction was an average of 95.47% with the category "very good." this happened because when the teacher provided motivation, perception, presented problems, and also designed observations in terms of guiding, the students seemed focused during the delivery. This process will later be accompanied by creativity and student participation in determining the appropriate steps in the learning process, namely recycling waste very well. This aligns with Pratiwi et al. (2022) research that learning with a guided inquiry model is a teaching model where teachers guide students through an activity by asking questions and discussing. With student involvement, students must identify concepts by following the teacher's instructions to actively participate in defining problems and solution processes [15].

Figure 1. The assessment percentage data is based on sub-indicators of students' ecoliteracy attitudes in the experimental class.

Table 2. Assessment of students' ecolietration attitudes classically in experimental classes.

Number of students	The Value of Student Ecoliteracy Attitudes	Category
36	87.2%	Good

Table 2 shows the results of questionnaire sheets and observations made by students and observers on students when applying the guided inquiry learning model. The results showed that the average score of students' overall ecoliteracy attitude in the experimental class reached 87.2%, which was in the "good" category.
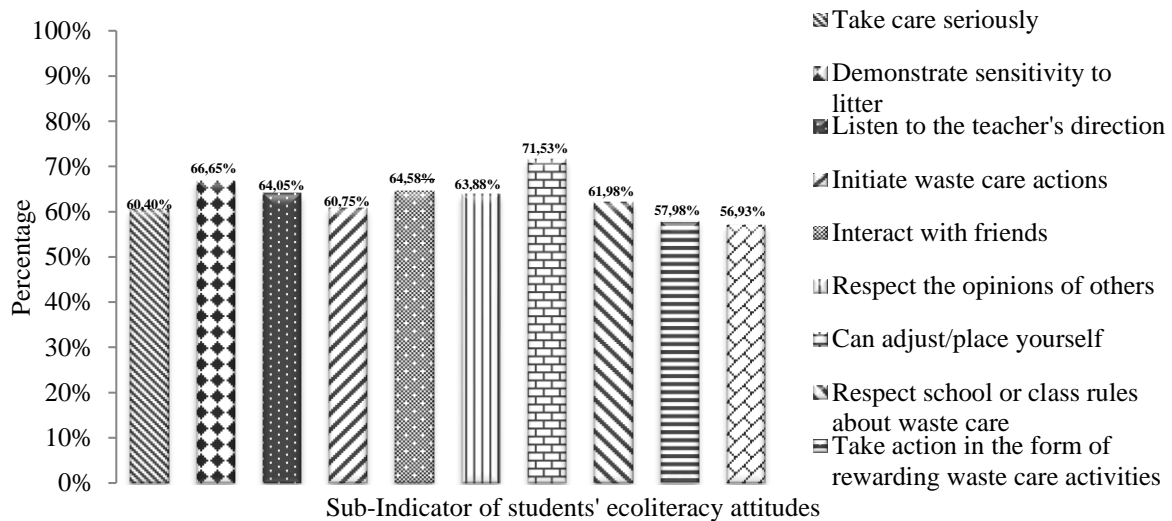
Figure 2. The assessment percentage data is based on sub-indicators of students' ecoliteracy attitudes in the control class.

In figure 2, it can be seen that the average of the student ecoliteracy attitude assessment rubric consists of 10 (ten) sub-indicators that students and two observers have assessed during the conventional learning process. The highest average percentage in the sub-indicator can adjust/place themselves, obtaining an average of 71.53% with the "good" category. This happens because students carry out learning only in class based on explanations from the teacher. Students tend to only focus at the beginning and then be indifferent to learning until the end, but they do not leave the class or lessons on waste recycling materials.

Table 3. Assessment of students' ecolietration attitudes classically in the control class.

Number of students	The Value of Student Ecoliteracy Attitudes	Category
36	62.7%	Enough

Table 3 displays the results of questionnaire sheets and observations that students and observers have made of students during conventional learning. The results showed that the average score of students' overall ecoliteracy attitude reached 62.7%, included in the "sufficient" category.

The results of the study using a guided inquiry learning model on waste recycling materials in class X MIPA-1 SMA N 1 Stabat, researchers found that ecoliteracy attitudes can increase in students. The experimental class had a greater average percentage of all sub-indicators (87.21%) than the control class (62.88%), for which the experimental class that learned by guided inquiry learning increased statistically significantly.

Normality Test

The normality test used in this study aims to evaluate whether or not the data obtained from research at SMA N 1 Stabat has a normal distribution. The normality test is performed manually using the Liliefors method with the help of the Microsoft Excel program [22]. The following data were obtained based on the results of

calculations by the Liliefors method. Since $L_{counts} < L_{tables}$, it can be concluded that the data is normally distributed.
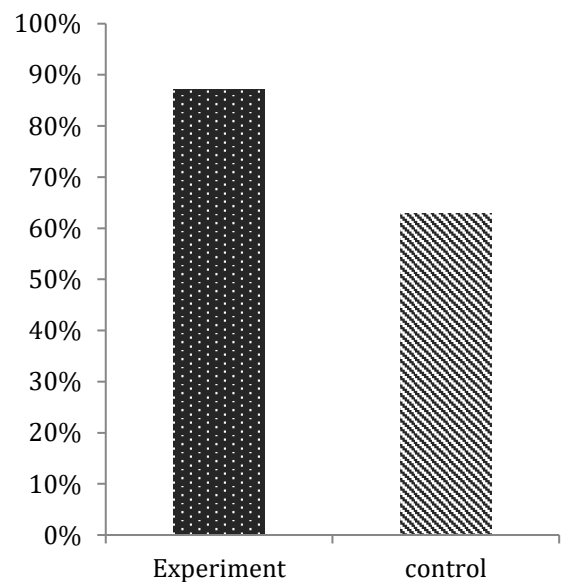

Figure 3. The average difference in percentage of all sub-indicators.

Table 4. Normality test results.

Questionnaire and Observer	Normality Value	Decision
Experimental class	$0.0864 < 0.1476$	Usual
Control class	$0.1199 < 0.1476$	Usual

Homogeneity Test

A homogeneity test is performed to determine if the sample taken is from a population with uniform variance. The homogeneity test aims to check whether the data from both groups have homogeneous variance [23]. It can be concluded that both data are homogeneous because $F_{count} < F_{table}$.

Table 5. Homogeneity test results.

Questionnaire and Observer	Value of homogeneity	Decision
Experimental and control classes	1.036 < 1.76	Homogeneous

Test the hypothesis

The hypothesis test used in this study uses a two-part test (t-test) using the following formula.

$$t = \frac{\bar{X}1 - \bar{X}2}{\sqrt{\frac{S1^2}{n_1} + \frac{S2^2}{n_2}}} \qquad [24]$$

Table 6. Hypothesis test results

Research Hypothesis	The average score of students' ecoliteracy attitudes on questionnaire sheets and observations of waste recycling material in the experimental class was greater than that of students in the control class.
Research Results	$t_{count} = 35.676$
Interpretation Criteria	$t_{table} = 1.994$ (taraf signifikan 5%)
Interpretation	H_0 rejected, and H_a accepted
Conclusion	There is an influence of learning using a guided inquiry learning model on students' ecoliteracy attitudes.

The paired t-test results show that t_{count} (35.676) > t_{table} (1.994). The findings showed that $t_{count} > t_{table}$. Thus, there was a significant increase in ecoliteracy between the experimental class, which received guided inquiry learning, and the control class, which received conventional learning. According to this study, guided inquiry learning suits biology learning, especially in improving students' ecoliteracy attitudes. The last thought has been shown that guided inquiry learning is more successful than conventional learning in improving student ecoliteracy attitudes in SMA N 1 Stabat students.

From the results of the study, it was found that the average percentage of all sub-indicators of student ecoliteracy attitudes in the experimental class was in a good category, with an average of 87.21%, and the control class was in the sufficient category with an average of 62.88%. This happened because of the ten sub-indicators of student ecoliteracy attitudes used by researchers to see student ecoliteracy attitudes, only four sub-indicators occupied the "very good" category in the experimental class, namely the indicators showing sensitivity to waste, listening to teacher directions, interacting with friends, and being able to adjust/place themselves. This shows that the attitude aspect of experimental class students has been very good and becomes capital in improving the overall ecological level as McBride et al. argues (in Setiawan) that attitude is the main goal in the application of ecoliteracy in addition to knowledge, motivational skills and commitment in making the earth better [18]. An attitude of caring for the environment must also be developed in education. Therefore, schools are the most effective medium for building environmental awareness and awareness [19].

In these ten sub-indicators, students can go through habituation activities at school, have a high sense of empathy and care for the environment, and respect the environment and everything (including other living things). Not only that, some students were also seen reminding each other of their themes to maintain the environment at school. A person's ecoliteracy is obtained from knowledge of ecological principles and sensitivity and concern for the environment to make a real contribution to the environment [25].

The research results in the control class showed that no sub-indicators reached the "very good" category. This happened because some students were still confused about determining a fair attitude and did not take the rights of others for personal gain. When observed, it is closely related to knowledge of what ecoliteracy is. Students should understand their rights and the rights of other living things in the environment, including what actions violate the rights of other living things and harm the environment. This shows that a person's attitude does not necessarily arise without the stimulus of attitude knowledge first. As stated by Nugraha and Hartono, the main purpose of education is so that students can become intelligent individuals in their attitudes and behaviors. That knowledge through learning must be conveyed so that students can determine the attitudes and actions taken [26-27].

Based on the results of the calculation of student ecoliteracy attitudes, namely in the hypothesis test of student ecoliteracy attitude values that $t_{count} > t_{table}$ or $35.676 > 1.994$ means reject H_0, the guided inquiry learning model has a positive effect on students' ecoliteracy attitudes on waste recycling materials. This aligns with Pratiwi's opinion that guided inquiry learning can improve students' ecological intelligence (ecoliteracy) [15]. There is a significant difference between students who undergo learning with a guided inquiry model and students who learn with a conventional model. The problem-based learning model has proven to be very effective for the ecological literacy ability of grade X high school students [28]. Researchers found that group learning can improve student ecoliteracy, which means researchers use the guided inquiry learning paradigm in small groups.

The percentage of increased awareness or attitude can be considered as an indication of progress, such as research that has been conducted by researchers, namely in the experimental class produced an average percentage obtained from the student ecoliteracy attitude assessment rubric, which was 87.21% and the average percentage result obtained from the student ecoliteracy attitude assessment rubric in the control class was 62.88%. So, the average difference in percentage obtained is 24.33%. There was an increase in the average ecoliteracy attitude of 24.33%, so the conclusion was that there was a significant influence on the use of the guided inquiry

learning model. Guided inquiry learning allows students to participate actively in selecting and using research-based learning materials. This positively impacts student learning outcomes regarding attitude [29].

Conclusion

Based on the results of research and discussions that researchers have carried out, the following conclusions are obtained the guided inquiry learning model affects the ecoliteracy attitude of SMA Negeri 1 Stabat student. The hypothesis test results are $t_{count} > t_{table}$ or (35.676 >1.994). The ecoliteracy attitude of SMA Negeri 1 Stabat student in the experimental class was 87.2%, including the good category. The guided inquiry model can be used to make students actively participate in selecting and using research-based biology learning materials.

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