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Local Wisdom-Based Ecopedagogy in Sociology Learning: Enhancing Critical Consciousness and Environmental Behavior

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Abstract: Local wisdom-based ecopedagogy learning approach plays a strategic role in growing critical consciousness and environmental care behavior among students. This research aims to explore the effect of local wisdom-based ecopedagogy learning approach on students' critical consciousness and environmental care behavior in the context of Sociology learning in Senior High School Sequential mixed method approach is used by collecting quantitative data through online questionnaire distributed to 644 students coming from many provinces in Indonesia and qualitative data through in-depth interview with Sociology teachers. The result of research shows a positive significant correlation between students' critical consciousness and environmental care behavior ($b = 0.869$, $p < 0.05$), where 61.3% of behavior variability is explained by the students' critical consciousness level ($R^2 = 0.613$). Qualitative data supports the quantitative finding indicating that teachers applied some learning strategies: environmental project, case study, activity out of classroom, and interactive discussion to give meaningful experience encouraging the students to think critically and to take real action to care for the environmental problem. This research also identifies the challenges faced by teachers in the implementation of local wisdom-based ecopedagogy learning approach including limited module as learning reference, limited practical training for the teachers, and limited time because the curriculum is not flexible. This study contributes theoretically to expanding the literature about ecopedagogy and likewise offers practical recommendation to improve the facilitation of training for teachers and the development of local value-based teaching module for Sociology subject.

Keywords: Ecopedagogy; Local wisdom; Sociology learning; Critical consciousness; Environmental care behavior

1 Introduction

Environmental degradation is a serious challenge damaging ecosystem sustainability and human health at global and local levels. Intergovernmental Panel on Climate Change (IPCC) reports that climate change due to human activity has exerted significant impact on the increasing frequency and intensity of natural disasters such as flood, drought, and storm directly having implication to environmental conservation and people's welfare broadly [1]. Environmental degradation is globally also worsened by the problems of deforestation, soil pollution, water and air, and the intense and excessive exploitation of natural resources leading to the threat of global biodiversity extinction [2]. Burning fossil fuel can result in greenhouse gas emission, consequently contributing to global warming phenomenon, severely extreme weather event, and global climate change [3]. Environmental degradation impacts adversely human health, biodiversity, and tourism sector, and needs substantial financial resource to recover [4].

Indonesia is one of countries with the second highest mega biodiversity wealth potency in the world with unique flora fauna wealth throughout archipelago [5]. However, this potency results in vulnerable to various complex environmental damages. Land conversion, river pollution, and illegal logging are several basic problems the

intensity of which increases continuously. In 2021, the Ministry of Living Environment and Forestry (Indonesian: *Kementerian Lingkungan Hidup dan Kehutanan* or KLHK) reported that deforestation has reduced over 480,000 hectares of forest in Indonesia annually. This has an impact on the indigenous people dependent on forest and losing their access to sustainable natural resource [6]. Forest fire, particularly in Bromo tourism region, has a very big impact on environment. This disaster destroyed over 50 hectares of land and emitted hazardous pollutants including carbon dioxide and particles, leading to the degraded quality of air [7]. Land conversion, particularly related to the project of expanding infrastructures and farm land, has resulted in severe forest fragmentation, disrupted habitat, and endangered biodiversity [8].

Environmental degradation issue is closely related to the poor awareness of environmental conservation among people, particularly young generation Study found that majority of students have neither adequate environmental knowledge nor positive attitude toward environmental conservation [9]. In Belize, the students show low environmental consciousness and irresponsible behavior toward environment [10]. Similarly, a study conducted on 15 year-age children in 53 countries found that the environmental consciousness level relatively tends not to change between 2006 and 2015 [11]. In social media domain, the participation of Y-generation in social media related to campaign and care for environmental sustainability indicates the lowest participation level [12]. The students' low consciousness of environmental issue, particularly related to soil and vegetation conservation indicates the need for the improved environmental education [13]. In Indonesia, the Junior High School students' environmental consciousness in Bogor shows very low score in cognitive skill and environmental behavior [14]. Therefore, education plays a strategic role in developing critical consciousness and environment-friendly behavior among young generations. In this context, the local wisdom-based ecopedagogy learning is a relevant approach to deal with the challenge.

In last decades, ecopedagogy arises as an alternative to critical education paradigm offering solution to the challenge of global environmental sustainability. Ecopedagogy rooted in Paulo Freire's critical education theory emphasizing the importance of liberating and contextual education [15]. This paradigm invites the students to think critically of their social reality and environment. This paradigm is not only oriented toward the improvement of environmental knowledge but also involves real action to empower the students as an agent of environmental change within society [16–18]. A variety of researches on the effectiveness of ecopedagogy implementation have been conducted by previous researchers. Ecopedagogy has an impact on the students' improved consciousness and sensibility to ecological education social justice issue in the term of comprehension, attitude, and commitment [19]. Ecopedagogy can encourage students' critical thinking and cultural competency by connecting local and global environmental issues. Ecopedagogy empowers the students to participate directly in the meaningful activities growing the sense of responsibility for this earth [20, 21]. The implementation of ecopedagogy through outing class effectively improves environment- and biodiversity-consciousness and gives the students direct experience that strengthens their learning [22].

Sociology as a discipline studying the relation between individual, group, and community plays a strategic role in building the students' critical consciousness of social and environmental issues. The Sociology subject at senior high school level enables the students to comprehend social-cultural dynamics in their surrounding environment, including how local wisdom values can be an alternative solution in dealing with the challenge of environmental damage. Through local value-based learning approach, Sociology plays strategic role in integrating the concepts of environmental sustainability and responsibility through exploring local wisdom relevant to the students' life. The integration of local wisdom values into Sociology learning is relevant to ecopedagogy paradigm. This paradigm emphasizes the relation between education, sustainability, and cultural context. Ecopedagogy rooting in Freire's critical educational theory encourages the students to think critically of environmental problem and to take action collectively to deal with it [23]. In Sociology learning, this concept can be embodied through using local values as the source of contextual teaching material to improve the students' consciousness of the importance of maintaining harmonious relation between human beings and nature. For example, gotong royong (mutual cooperation) tradition in Java, Subak tradition in Bali or Sasi system in Maluku can be used as concrete models reflecting the sustainable environmental management in the local community's daily life [24–27].

However, the research on the implementation of ecopedagogy based local wisdom in Sociology learning is still conducted rarely, particularly at Senior High School level. Previous studies on Sociology learning tended to focus on developing learning media and model as an attempt of improving the learning effectiveness [28–31]. Although these researches' findings gave important contribution, this approach has not directly integrated yet environmental issues and local wisdom values into Sociology learning. This research aims to fill in the gap by exploring how the local wisdom value-based ecopedagogy transformation is integrated into Sociology learning to improve the Senior High School students' critical consciousness and environmental care behavior. This research not only evaluates how effective this approach is in developing the students' critical thinking of sustainable environmental issue, but also offers a learning model connecting local values to the challenge of global sustainability. Mixed method-research approach is used to explore the relationship between ecopedagogy implementation and two main variables: students' critical consciousness and environmental care behavior. In addition, this research also explores in depth how the

teachers' experience is in implementing local value-based ecopedagogy in the Sociology learning.

2 Literature Review

2.1 Ecopedagogy as an Environment-Based Educational Approach

Ecopedagogy is a movement departing from real problem and based on life perspective [17, 32]. This movement is a reaction to modern paradigm giving human beings power and domination over the earth or called anthropocentrism. Educational practice departing from modern positivist philosophical view, makes the students separated not only from their cultural root but also from their residence environment [23]. Modern educational practice is viewed having distanced the students from their homeland and socio-cultural environment. Ecopedagogy gives emphasis on sustainability issue. Sustainability in this context is interpreted as the reverse of various forms of imbalance, conflict, greed, individualism, destruction, domination, and excessive control of material [16]. Ecopedagogy is an educational approach integrating ecological principles into critical pedagogy aiming to develop ecological literacy comprehension and to grow critical consciousness among students. This approach roots in Freirean critical theory paradigm emphasizing the integration of global ecological problem into local interest and promoting environmental social justice for the people [18].

2.2 Local Wisdom in Living Environment Conservation

Local wisdom plays a strategic role in living environment conservation, particularly in the context of people having lived close to the nature for many years. Local wisdom involves inherited knowledge and practice based on in-depth comprehension on local ecosystem situation and condition and how to maintain the natural balance naturally [33]. Local wisdom serves as the mechanism of environmental conservation and sustainable resource management. The knowledge is acquired through a long trial and error process and is evidently effective in maintaining ecological balance and social harmony. Local wisdom can develop daily behavior toward human being and nature, essentially aimed at sustainable living environment protection and management [34, 35]. This knowledge is often expressed in various forms such as customs, rite and traditional practices governing the sustainably utilization of natural resources such as water, soil (land), and forest. Emphasizes the positive impact of the internalization of local wisdom values on the attempt of conserving environment by ensuring the recognition of local indigenous people's rights and authorities [25]. This perspective emphasizes the importance of ascertaining the legitimacy of community and respecting the role of knowledge and traditional practice of local people in the attempt of conserving environment. These results indicate the potency of local intelligence to contribute to the sustainable environmental conservation practice.

2.3 Students' Critical Consciousness and Environmental Care Behavior

Previous studies showed that the students generally tend to have high levels of consciousness, interest, and knowledge on environment [36, 37]. However, the concept of attitude to environment is likely different between one discipline and another [37]. The presence of on-target environmental education program in school can significantly improve the students' level of consciousness, attitude, norm, self-efficacy, and environmental behavior [38]. Such factors as providing activities or practices involving the students directly in an experimental experience or project-based activity and routine documentation over environment-friendly action also contribute to strengthening environmental standard and performance [38]. Furthermore, there is a positive correlation between ecological consciousness and motivation to do environment-friendly consuming activity [39]. This motivation, in turn, affects further ecological behavior [39]. Higher education institution plays an important role in growing environmental attitude and behavior among students because they are the prospective nation leader contributing to decision making in the future [36]. Understanding the students' perception on the environment-friendly marketing mechanism and the factors affecting their environmental behavior is very important to encourage the sustainable behavior [39]. Teachers' learning based on local environmental contextual problem tends to strengthen the students' ecological literacy. This also contributes to improving the students' ability of identifying, analyzing, and planning real action to deal with local and global environmental problems [40, 41]. Freirean dialogue can facilitate the students to understand the dynamics of power [42, 43].

3 Method

3.1 Research Design

This research used mixed method approach with explanatory sequential design. explanatory sequential design is a research approach combining quantitative and qualitative analyses sequentially [44, 45]. In the beginning stage, quantitative data was collected through online questionnaire distributed to the students coming from various regions in Indonesia to identify the relation between local wisdom-based ecopedagogy by teachers in Sociology learning and the students' critical consciousness and environmental care behavior. Furthermore, qualitative data

was used to deepen the findings of quantitative result by exploring a number of teachers' experience in several schools with the specified criteria in integrating the local wisdom value-based ecopedagogy into Sociology learning. This approach can give more comprehensive understanding on the phenomenon studied that is relevant to answer the research problem statement proposed by the author, how are the transformation of teachers' understanding on ecopedagogy, the its implementation practice in the learning and its impact on the students' critical consciousness and environmental care behavior?

3.2 Research Location and Respondent

This research was carried out in several Senior High Schools in Central Java, East Java, and West Java areas selected purposively based on certain criteria. The criteria were: School having environmental care program where there are Sociology teachers integrating local wisdom aspect of respective region into environment in their learning.

Table 1. Profile of senior high school student respondents

Category	Sub Category	Number	Percentage
Sex	Male	209	32.45%
	Female	435	67.55%
Grade	X (Tenth)	210	32.61%
	XI (Eleventh)	187	29.04%
	XII (Twelfth)	247	38.36%
Age	15 years	202	31.37%
	16 years	198	30.75%
	17 years	344	53.42%

Table 1 shows that subject of research in quantitative stage consisted of the 10th, 11th, and 12th graders in 10 schools receiving Sociology learning, with a total of 644 students including 209 male and 435 female students in the 10th, 11th, and 12th grades of Senior High School selected using stratified random sampling technique [46]. This technique was used to ascertain the representation of respondents based on the different characteristics of schools. Meanwhile, in qualitative stage, the main informants consisted of 10 Sociology teachers coming from several schools specified based on certain criteria. In addition, the informants are Sociology teachers having experience in integrating environment-based local wisdom values in the learning carried out. Supporting documents like RPP (Learning Implementation Plan), teaching material, and students' activity report were also used as the material of analysis to confirm the data resulting from observation and interview.

This research applied stratified sampling technique based on the existence of environment conservation-oriented school programs, such as Adiwiyata and similar initiative. This criterion was selected recalling an assumption that the schools have had supporting infrastructures, institutional culture, and adequate pedagogic preparedness to adopt the environment-based learning approach optimally. Thus, the schools become a relevant context to explore the implementation of ecopedagogy in the more applicative framework in Sociology learning in particular.

The selection of research site limited to provinces in Java Island, i.e. Central Java, East Java, and West Java was carried out based on a number of strategic considerations. Java has high population density, is the center of national education institution constellation, and has diverse environmental programs at school level. For that reason, this region is considered capable of representing the general dynamics of education and ecopedagogy implementation in Indonesia.

Nevertheless, the research's limited geographic area remains to leave the potential biased representation, particularly in reaching different social-ecological context beyond Java Island. Therefore, the generalization of findings needs to be made carefully to Eastern Indonesian area or regions with different ecological traditional background. Future research with broader and more diverse area coverage needs to be carried out to get a more comprehensive representative understanding on ecopedagogic practice in educational framework in Indonesia.

3.3 Research Instrument

This research used an instrument designed to evaluate the students' critical consciousness of environment and environmental care behavior in the context of local wisdom-based ecopedagogic application in Sociology subject. This quantitative instrument was developed using 5-point Likert scale modified based on the instrument suggested by previous studies [47, 48] in order to be more compatible to this study's context (see Table 2).

Table 2. Variable of students' critical environmental consciousness

Dimension	Definition	Example of Questionnaire Items
Cognitive	Student's understanding on the impact of human activity on environment.	I realize that such activities as forest fire contribute to climate change. I know that excessive plastic use can pollute and harm ecosystem.
Affective	Students' attitude and emotional concern with environmental issue.	I feel concerned seeing rubbishes scattered around me. I feel responsible for taking care of environmental conservation for the sake of next generation's future.
Psychomotor (Behavior)	Students' readiness and involvement in real action to take care of environment.	I participate actively in reforestation and tree planting activity at school. I always dispose rubbish in its place and sort it by type.

Variable Operationalization

The variable of students' critical environmental consciousness was analyzed using three main dimensions, with the following example of questionnaire items:

Meanwhile, the variable of environmental care behavior measures concrete action the students commit to take care of environment, with the following item examples (see Table 3):

Table 3. Variable of environmental care behavior measures

Dimension	Definition	Example of Questionnaire Items
Environmental care behavior	Students' readiness and involvement in real action to take care of environment.	I bring my own drinking bottle to reduce the use of disposable plastic I always turn off the light and the electronic appliances when they are not used to save energy

Validity and Reliability Tests on the Instrument

To ensure the quality of measurement, validity and reliability tests were carried out using Corrected Item-Total Correlation and Cronbach's Alpha methods [46]. The result of validity test shows that the total item correlation ranges between 0.63 and 0.88, higher than the threshold of 0.6; thus, it can be concluded that all items in these instruments validly measures the construct studied. Reliability test using Cronbach's Alpha reaches score of 0.96, indicating that each of questionnaire items has strong correlation in measuring the same concept.

Result of Exploratory Factor Analysis (EFA)

To explore the structure of factor in this instrument, the EFA [46] was carried out. The result shows that there are two main factors that can explain the variance pattern in the data: The first factor has variance score of 6.86, reflecting 32.66% of total variance. This factor particularly includes the items relating to the students' critical environmental consciousness in cognitive, affective, and psychomotor aspects. The second factor contains item related to the environmental care behavior, reflecting the students' concrete action in taking care of environmental conservation. These two factors explain 61.90% of total variance cumulatively, indicating that this instrument captures fairly representatively the data studied.

In addition, Bartlett's Test of Sphericity results in significant chi-square value ($p < 0.001$), implying that the inter-variable correlation is strong enough to carry out factor analysis. The Kaiser-Meyer-Olkin (KMO) score of 0.93 shows that the sample size used is very adequate for factor analysis. Considering this, the construct in research can be categorized into two main dimensions: students' critical environmental consciousness and environmental care behavior. Thus, the instrument developed can not only identify the students' response pattern more accurately but can also be used as a basis for further research or developing a more comprehensive measuring instrument.

In qualitative stage, data collection was carried out using semi-structured interview, observation, and focus group discussion. Interview guide is designed to explore teachers' understanding of local wisdom-based ecopedagogy, learning strategy applied and challenge faced. Observation was carried out during the learning process to record directly the learning practice reflecting the implementation of ecopedagogy including learning method, students' participation, and integration of local wisdom values into learning material. Observation data was recorded on observation sheet containing some indicators: students' participation in discussion on environmental issue and the relationship of material to local wisdom values. Focus group discussion (FGD) involved Sociology teachers coming from several schools specified based on the criteria to explore the collective perspective on the implementation of local wisdom-based ecopedagogy in Sociology learning. FGD was carried out in small group to ensure that all participants can contribute to discussion.

3.4 Procedure of Collecting Data

The procedure of collecting data was carried out in some stages in accordance with explanatory sequential design. In the first stage, questionnaire was distributed online to the students in some schools in East Java, Central Java, and West Java, Indonesia through link: https://forms.gle/KnozDNwbQxJJMoxW9 to collect quantitative data related to the variables of students' critical consciousness and students' environmental care behavior. This process lasted for a month with Sociology teachers' help in each of schools. After the quantitative data was analyzed, interview with teachers, observation in the classroom, and FGD were carried out continuously to comprehend deeply the finding data quantitatively and to confirm the patterns found.

In this research context, the constraint related to digital access commonly associated with rural area is not identified significantly. All participants can access and fill in the online instrument form by utilizing internet devices and network available in their school environment. Thus, potential bias due to digital exclusion can be minimized as much as possible.

3.5 Data Analysis

Data analysis method was adjusted with the type of data collected in this research. Quantitative data was analyzed using descriptive statistics to describe the students' critical environmental consciousness and environmental care behavior. In addition, linear regression analysis is applied to explore the correlation between ecopedagogic application and both variables, at significance level or $p < 0.05$.

Although the data collected from various schools were clustered in general, the choice of simple linear regression in this research was based on some basic reasons. Firstly, the schools being the sample of research have relatively uniform characteristics, viewed from curriculum, teaching method, and students' demographic profile so that inter-school variation can be minimized. Secondly, the sample size has not been large enough to support the application of Multilevel Modeling (MLM) without sacrificing model stability. Therefore, linear regression is viewed as an appropriate approach to get meaningful understanding related to the inter-variable relation studied.

Meanwhile, qualitative data was analyzed using thematic analysis method [46], including the stages of transcription, coding, and main theme identification. To improve the validity of finding, data triangulation was carried out by comparing the result of interview with supporting document. In the last stage, the integration of quantitative and qualitative data was carried out to get a more comprehensive understanding on the phenomenon studied.

4 Result

This research aims to answer the problem statement "How can the transformation of local wisdom value-based ecopedagogy into Sociology learning improve the senior high school students' critical consciousness and environmental care behaviour?" Quantitative data was collected to measure two main variables: students' critical consciousness and students' environmental care behaviour. Meanwhile, qualitative data was used to explore in depth the strategy integrating local wisdom values into Sociology learning carried by the teachers. This section presents the findings of quantitative and qualitative data from Sociology teachers.

4.1 Descriptive Statistics

The result of descriptive statistical analysis on the data collected provides general description on the senior high school students' critical consciousness and environmental care behaviour, and shows that most students have high score.

Table 4. Descriptive statistics of students' critical consciousness and environmental care variables

Variable	Mean	Standard Deviation	Minimum Score	Maximum Score
Students' critical consciousness	4.148	0.537	1	5
Students' environmental care behavior	4.154	0.596	1	5

From Table 4, it can be seen that the variable of students' critical consciousness shows minimum score of 4.148 (5 scale) and standard deviation of 0.537 and has the same range of scores: 1.0 (minimum) and 5.0 (maximum). The data indicates that the two variables show very good mean score (more than 4 out of 5 scale) with almost identical scores: 4.148 and 4.154. This data indicates that generally, the students have high level of critical consciousness and environmental care behaviour. Meanwhile, in standard deviation, the variable of environmental care behaviour has higher standard deviation (0.596) compared with the critical consciousness variable (0.537). This data implies that the variation of environmental care behaviour shown by students is more diverse than their critical consciousness.

Seeing the chart above, the box plot in Figure 1 shows that data distribution tends to be symmetric for both variables: students' critical consciousness and students' environmental care behaviour. The chart above indicates the presence of several outliers on the bottom representing the presence of minority students with much lower

score than the score of majority students. In addition, the visualization of histogram shows the negative skew data distribution indicating that majority students have high score. The high mean scores of both variables indicate teachers' successfulness in building critical consciousness and environmental care behaviour among students. The presence of outlier on the bottom represents the need for teachers to pay special attention to identify and to deal with the constraints related to poor understanding and environmental care behaviour in a small group of students with lower score. In addition, the similarity of mean scores between two variables indicates the consistency of students' critical consciousness and its implementation in the students' environmental care behaviour.

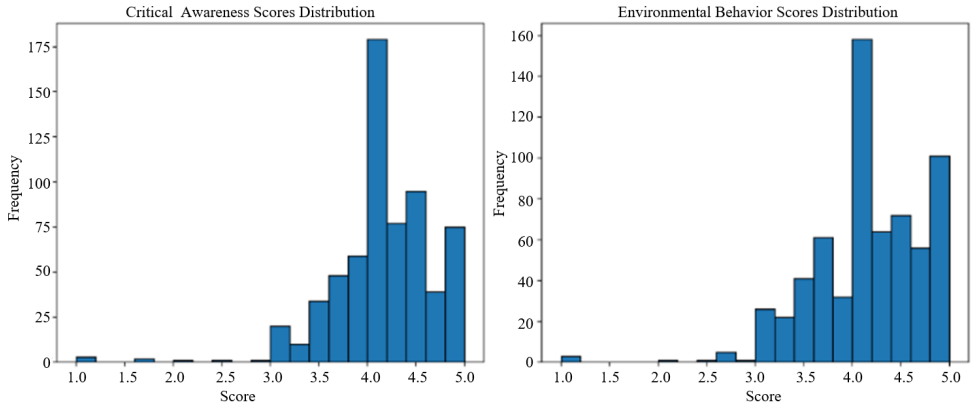

Figure 1. Box plot of students' critical consciousness and environmental care behaviour

4.2 Regression Analysis

The relation between students' critical consciousness and environmental care behaviour was analysed using a simple linear regression. The result of linear regression analysis shows a significant positive correlation between students' critical consciousness and their environmental care behaviour (see Table 5). Regression model produced is y = 0.55 + 0.869x, where y represents the score of students' environmental care behaviour, while x represents the score of students' critical consciousness. Slope coefficient (β = 0.869) represents that each 1-point increase in the score of critical consciousness is followed with the increase by 0.869 in the students' environmental care behaviour. Meanwhile, intercept (α = 0.55) describes the initial score of environmental care behaviour if critical consciousness scores zero.

Table 5. Result of simple linear regression analysis

Parameter	Coefficient (β)	Standard Error	t-Value	p-Value
Intercept (α)	0.5496	0.1139	4.8248	0.0000
Critical consciousness	0.8688	0.0272	31.9038	0.0000

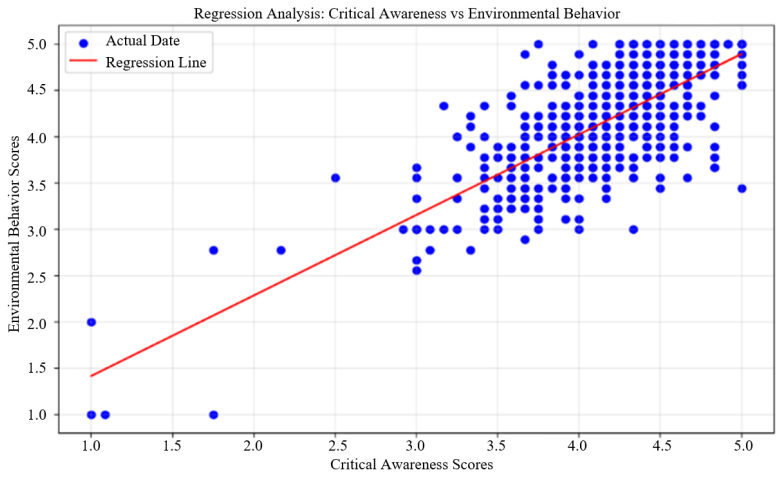

Figure 2. Scatter plot of students' critical consciousness and environmental care behaviour

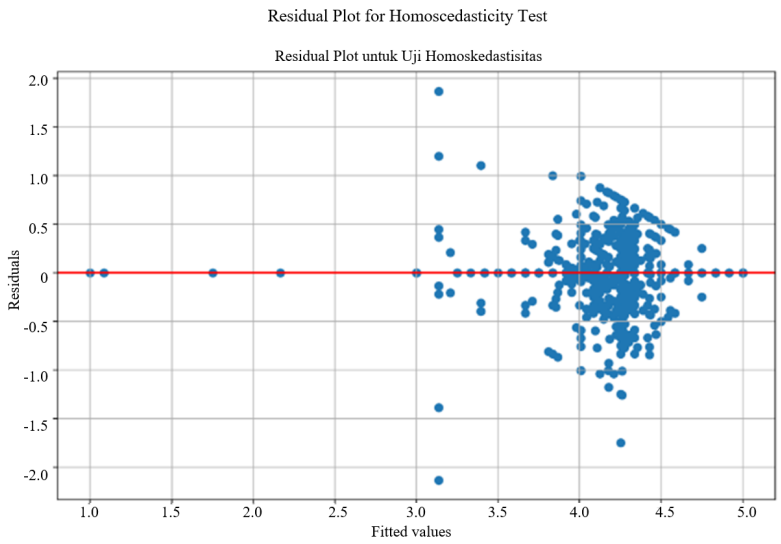

Figure 3. Residual plot for homoscedasticity test

Coefficient of determinacy score ($R^2 = 0.613$) shows that 61.3% of score variation for the students' environmental care behaviour can be explained by their critical consciousness. Meanwhile, the rest of 38.7% is affected by other variables excluded from this regression model. Additionally, scatter plot presented in Figure 2 shows a positive obvious correlation between two variables, with most data point lying close to regression line. This indicates the strong linear relation pattern, despite some outliers that can affect the accuracy of model.

To ensure the validity of model used in this research, a classical assumption test, including homoskedasticity test through residual plot display (Figure 3) and Breusch-Pagan test. The result of analysis shows that p value obtained is substantial (($p \approx 0.98$ in F test), indicating that the model does not encounter heteroskedasticity problem. Thus, it can be concluded that residual variance remains to be constant in all predicted values so that the regression model used in this research can be interpreted as valid and has good reliability.

4.3 Teachers' Understanding of Local Wisdom-Based Ecopedagogy

Qualitative data from the result of research shows that majority of Sociology teachers do not know the term ecopedagogy formally. However, teachers understand that the learning relevant to students' life and local cultural values can help the students have higher consciousness of environmental issues occurring around them. Although teachers are not aware that the learning method is relevant to ecopedagogy principle approach, several teachers connect their learning practices by introducing the students to environmental issue and strengthening the relation between students and local values. Teacher also views that the local value-based learning can enrich the Sociology learning material for Senior High School even without mentioning theoretical concept of ecopedagogy. This is as suggested by informants WP and AR, as follows:

"This term is new to me, but I have likely ever applied the concept, particularly when I invited the students to discuss plastic waste problem in their village" (WP, a teacher of Sociology).

"However, generally I discussed the impact of oil palm plantations on the damaged environment. Therefore, I used the material concerning globalization and its effect on environment and local wisdom to discuss the impact of oil palm plantation, particularly the impact of green open space or forest clearance. Thus, I hope that local wisdom value can help the students understand environmental issues around them" (AR, a teacher of Sociology).

Table 6. Main theme of teachers' understanding on ecopedagogy

Theme	Research Finding
Not familiar with the term Ecopedagogy	Majority of teachers do not know the term "ecopedagogy" formally.
Intuitive Understanding	Teachers have intuitive understanding on the importance of integrating local values and ecological education into Sociology learning.
Relevance of local value	Teachers believe that local values can be effective learning media and teaching material source to get the students closer to environmental issues in their surroundings.

Table 6 shows that majority of teachers have not had formal knowledge on ecopedagogy through academic training or reading sources. However, this does not completely inhibit them from applying an approach in line

with ecopedagogy principle. Teachers understand that the implementation of local wisdom values can be a medium facilitating the teachers to grow consciousness of environmental issues around the students. This finding underlines the importance for school or local office of educational affairs to provide formal training and adequate supporting resources to the teachers to bridge intuitive understanding and understanding on ecopedagogy theoretical concept.

4.4 Teachers' Strategy in Implementing Local Wisdom-based Ecopedagogy in Sociology Learning

Teachers have applied a variety of learning strategies to integrate local wisdom values into sociology learning. Although they are not aware that the strategy they have applied is the part of ecopedagogy approach. The strategy used by teachers involves using local tradition as case study teaching material, project-based learning implementation, and interactive discussion on environmental issues relevant to the context of local culture. Teachers also applied the learning out of classroom (outing class) to give the students in-person experience related to environmental and social issues. This outing class learning not only contributes to enriching the learning material but also potentially can build directly the students' consciousness of the importance of the attempt of conserving local cultural values and environment. This is as suggested by informants AY, SD and YD, as follows.

"In the material of environmental damage, I trust the students to arrange a program in group to make the school community aware of the importance of environmental conservation. The project started with observation, reporting finding, discussing program plan, implementation, and uploading video of activities in social media, and ended with evaluation. The program packaging was designed so attractive that the students not only arrange but also can do so joyfully. One of the programs was REKAB (resik kalen bebarengan or cleaning the gutter together)" (AY, a teacher of Sociology).

"Ever. On jumat sehat (healthy Friday) occasion we, as the teachers, invited the students to sort plastic wastes from decomposable wastes and put them into different places. The plastic waste would be collected to be recycled later" (SD, a teacher of Sociology).

"Establishing school's waste bank, developing recycling system, producing organic fertilizer made of wastes, campaigning for reduce, reuse, recycle, healthy canteen and accustoming students with bringing health food supply in accordance with the principle "isi piringku (fill in my plate)" (YD, a teacher of Sociology).

The implementation of ecopedagogy-based learning approach by integrating local wisdom values evidently contributes positively to the change of students' behaviour in treating ecological issue around them and in taking care of school environment collectively. Teachers report that after the learning implemented through project, case study or discussion, the students began to be able to show the change of attitude leading to the attempts of conserving environment, for example the students not only became more aware of the importance of disposing waste correctly but also actively reduced disposable plastic use. This is as suggested by informants KA, YS and FI, as follows.

"Some of students' habits change gradually, one of which is that they more sensitively turn off the light in the afternoon, close the water tap that is not closed tightly, and minimize plastic waste by bringing their own eating and drinking utensils" (KA, a teacher of Sociology).

"Yeah. Several times I saw some students beginning to be aware of disposing bottle waste in the place provided by the school, while previously they disposed it in regular waste basket" (YS, a teacher of Sociology).

"After the learning I have carried out, the students' care indeed improves. They understand better the importance of taking care of environmental conservation" (FI, a teacher of Sociology).

Table 7. Main theme of teachers' strategy in implementing local wisdom-based ecopedagogy

Sub-Theme	Strategy
A case study on environmental conservation based on local wisdom	Using local traditions such as sambatan (Java), sadranan (Java), merti desa (Java), sasi (Maluku), subak (Bali), awig-awig (Bali), tana ulen (Sulawesi), pranata mangsa (Java), Tembawang (Kalimantan Barat), Tanah Ulayat (Kalimantan Barat), Sialang (Riau), Mbaru Niang (Nusa Tenggara Timur), aluk to dolo (Sulaswesi Selatan), Lubuk Larangan (Riau), Dewi Sri (Java), huma betang (Lampung), panglima laot (Aceh) and mutual cooperation (gotong royong) to explain sustainability issue.
Environmental project	Involving the students in such activities as school greening or campaign for waste management.
Interactive discussion	Discussing local issues such as plastic wastes, resource management, and environmental damage.
Outing class	Conducting direct observation on local site or surrounding environment to learn from real experience.

Table 7 shows that the application of ecopedagogy approach integrated into local wisdom values contributes significantly to improving the students' critical consciousness and environmental care behaviour. In this case, Subak

system is utilized as a concrete example in the learning to facilitate the process of critically thinking of the reciprocal relation between human activity and ecological sustainability (see Figure 4). This case study-based approach not only strengthens the students' conceptual understanding on local ecological principles but also supports the reinforcement of cognitive and affective aspects in their environmental consciousness.

Meanwhile, mutual cooperation (gotong royong) values play an important role beyond the material delivery (see Figure 4). These values are not only presented in narrative or illustration of case study but are also actualized in the students' participation in collective activities such as the actions of cleaning off school environment and surrounding people' activities. This direct participation in some activities strengthens the students' behaviour dimension so that they not only find out the importance of taking care of environment, but are also encouraged to take part in real actions. Thus, local values such as Subak and mutual cooperation act as a cultural mediator to strengthen the effectiveness of ecopedagogy in creating the students' consciousness and environmental action contextually and meaningfully.

The result of interview conducted shows that teachers face several challenges in implementing the local wisdom-based ecopedagogy learning approach. These challenges include inadequate supporting resource from the office of educational affairs and the schools, the limited formal education on ecopedagogy, the limited time to implement ecopedagogy due to dense curriculum and the students' low participation in several environmental activities. Teachers think that the constraints potentially restrict the effective implementation of ecopedagogy learning strategy planned.

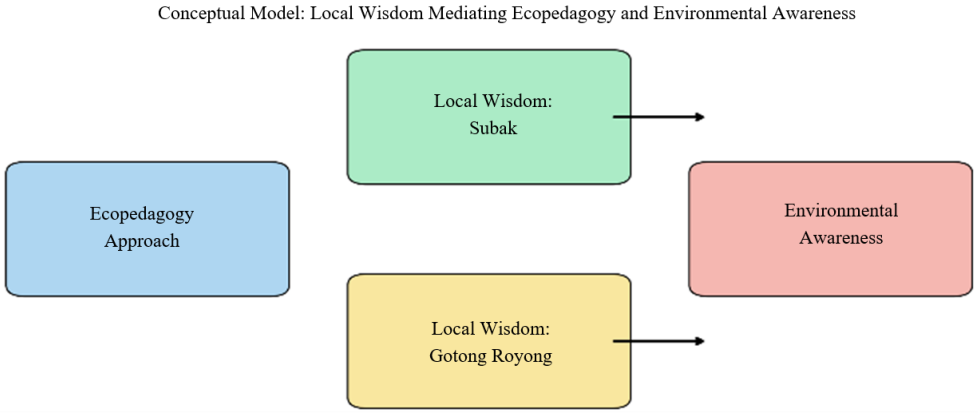

Figure 4. Conceptual model local wisdom mediating ecopedagogy and environmental awareness

5 Discussion

The result of research shows that there is a significant positive correlation between students' critical consciousness and environmental care behavior, with regression coefficient value (β) of 0.869 and $p < 0.05$. In addition, the coefficient of determinacy ($R^2 = 0.613$) shows that 61.3% of variability in the students' environmental care behavior can be explained by their critical consciousness level. This finding is in line with previous studies revealing that an in-depth understanding on environmental issue contributes to creating behavior more responsible for environmental conservation [21, 49].

The result of qualitative data analysis also supports this result. The teachers interviewed stated that the students participating actively in class discussion related to local value-based environmental issue tend to have better understanding of the impact of human activities on environment and the importance of conservation action in their community. This result confirms the findings of previous studies indicating that the experience- and local value-based learning approach can improve the correlation between critical consciousness and real behavior in taking care of environment. The learning method integrating contextual issue of surrounding environment is known to improve the students' ecological literacy so that they can more readily identify, analyze, and design solution to environmental issues, at both local and global levels [40, 41].

In addition, the result of regression analysis shows that a simple linear regression effectively describes the correlation between critical consciousness and environmental care behavior. To ensure the compatibility of model, Intraclass Correlation Coefficient (ICC) test was carried out, indicating that the inter-school variability in this research belongs to low category so that the clustering effect does not exert significant impact on the model. The result of ICC test for critical consciousness reaches score of 0.341, belonging to poor reliability category as it is below the threshold of 0.40. Therefore, the use of simple linear regression remains to be considered valid and giving meaningful interpretation in this research context.

In Sociology learning process with local wisdom-based ecopedagogy approach, the teachers apply various learning strategies such as case study, environmental project, interactive discussion and outing class. These learning strategies is evidently effective in improving the students' critical consciousness as shown with the mean score of critical consciousness (Mean = 4.148). Qualitative data reveals that the local value-based environmental projects, like school greening, REKAB (cleaning the gutter together) and mutual cooperation-based waste management, can evidently give the students an in-person real experience to understand their action's impact on environmental conservation. This learning strategy supports critical pedagogy principles explaining that dialogic [15], contextual learning model emphasizing student empowerment encourages the students' critical consciousness of environmental issues. This finding is also in line with studies [42, 43] explaining that Freirean dialogue can facilitate the students to understand the dynamics of power, deal with social gap, and promote inclusive practice in education. In addition, study found that such factors as providing activity or training involving the students' direct engagement in an experimental experience or project-based activity and routine documentation over the environment-friendly actions contribute to strengthening environmental standard and performance [38].

This research reveals that the integration of local wisdom values into ecopedagogic approach plays a significant role in creating the students' environmental consciousness comprehensively. In contrast to conventional environmental education often delivering ecological issues in abstract form and separated from local context, the local wisdom instead offers a contextual meaningful learning experience based on the local community's culture. In this research, local elements such as Subak and mutual cooperation (gotong royong) not only function as learning material but are also implemented as ecopedagogic method representing ecological values through living real practice and undertaken in the community's daily activities. This approach encourages critical reflection, affective involvement, and active participation among students in the actions supporting environmental consciousness and sustainability. This finding is in line with Misiaszek's [17] thinking of decolonial ecopedagogy, emphasizing the importance of local context-based environmental learning to empower the students as the agent of change in their social and cultural reality. When the students learn from their own environment and cultural identity, their involvement in ecological issues tends to be deeper and their commitment tends to be more sustainable.

The implementation of Sociology with local wisdom-based ecopedagogy approach also contributes to the positive change in the students' environmental care behavior. The mean score of students' environmental care behavior gained is high (Mean = 4.154). Teachers explain that the students begin to shows positive behavior and habit related to environment, for example they more sensitively turn off the light in the afternoon, close the water tap that is not closed tightly, minimize plastic waste by bringing their own eating and drinking utensils, and dispose wastes in accordance with the waste categories specified by the school. This finding is also in line with previous studies stating that the local context-based learning affects significantly the change of student behavior. The integration of local wisdom as the content of character education can help building the expected student behavior through dialectic externalization, objectivation, and internalization processes [50]. This finding is also in line with study [51] explaining that local wisdom-based Social Science learning enables the students to have better understanding to know, to comprehend and to practice it directly in social life within society. Science learning explained that the context-based science learning can evidently improve students' intrinsic motivation and learning intrinsic in science education [52].

Although the finding of research shows positive impact on students' critical consciousness and environmental care behavior, teachers face various challenges in implementing Sociology learning with local wisdom-based ecopedagogy approach. The main constraints the teachers encounter are inadequate teaching material module used as the source of references, limited training on local wisdom-based ecopedagogy approach, and limited time due to the demand of dense material for Sociology curriculum in Senior High School. These challenges can also be seen in the variability of score for the students' environmental care behavior (Range = 1–5), representing that a number of students have not shown the changing behavior yet through this learning approach. This finding is in line with study [53] revealing that in Finland rural areas, teachers found difficulty in integrating the learning into local context because of inadequate local knowledge and gap between urban- and rural-oriented policies.

This research contributes importantly to strengthening [15] ecopedagogic theory by confirming that integrating local values into the learning can improve the students' critical consciousness and environmental care behavior. This finding expands literature concerning the relation between environmental education and local wisdom values, and highlights how the local context can be used as learning media or teaching material to strengthen the relevance of learning and its impact on the change of students' understanding and behavior. Practically, this research can give recommendation to educational policy makers and teachers as practitioners to have the skill in designing Sociology learning module integrating local wisdom values in order to be relevant to the syllabus of curriculum existing. In addition, it is important for the office or the school to facilitate the provision of practical training on local wisdom-based ecopedagogy learning approach. Equally important is that the impulse for the schools to establish cooperation between school and local community can enrich the students' learning experience. This is intended to make the students connected not only to lesson materials but also to their environment and local culture.

This research has a number of limitations needing attention. One of them is the potential rise of Hawthorne

effect, in which the participants likely change their behavior unconsciously because they realize that they were being observed in the research. This condition can result in the provisional improvement in environmental care behavior but unsurely reflects the sustainable long-term change. In addition, this research has not been able to measure the long-term impact of the implementation of local ecopedagogy-based learning on the students' environmental care behavior. Recalling that the change of behavior takes time, further research with longitudinal design and longer observation period is very desirable. The study using this approach will be able to provide more in-depth understanding on the effectiveness of ecopedagogy in inculcating the environmental care behavior sustainably.

Another limitation lies in the data analysis approach, the use of simple linear regression likely capturing the hierarchic (clustered) effect less optimally in the school context. Although this method was selected due to its sample's relatively homogeneous characteristic and limited number of data, the more complex approach like Multilevel Modeling (MLM) can be used in the future research to explore more in-depth the effect of school factor on the inter-variable correlation. Using this approach, the future research is expected to provide richer insight into the dynamics of relation between students' critical consciousness and environmental care behavior in various school contexts.

6 Conclusion

This research shows that Sociology learning with local wisdom-based ecopedagogy approach can improve the students' critical consciousness and environmental care behavior. Quantitative data shows the significant correlation between students' critical consciousness and environmental care behavior, with 61.3% of student behavior being explained by their critical consciousness level. Qualitative data supports this finding, in which teachers apply learning strategies like environmental project, case study, outing class and interactive discussion to help the students understand the importance of taking care environment through environmental care real action. To support learning success and effectiveness, the schools need to support practical training for teachers, to develop Sociology teaching module based on local wisdom and to support the environmental care project activity involving the students' active participation. This result of research either increases experience with the importance of local wisdom in environmental education or confirms the previous literatures on contextual learning that can encourage the positive change in the students' behavior. The future researches are led to research and development of Sociology learning model with local wisdom-based ecopedagogy approach. Sociology learning with local wisdom-based ecopedagogy approach can be an integral part of educational curriculum to create a generation concerned more with local cultural values and surrounding environment.

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Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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