Designing A Project-Based Ecoliteration Learning Trajectory to Improve Students' Ecological Intelligence

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ABSTRACT

The ecological crisis is one problem that has not yet found the right solution. This study intends to provide a solution to solve the ecological crisis by designing a project-based ecoliteracy learning trajectory to improve students' ecological intelligence. This research is a design research which comprises three stages, namely: preliminary design, experimental design, and retrospective analysis. The research subjects were students from the Social Science Education Study Program, Faculty of Education, Institut Agama Islam Negeri Parepare. The data collection instruments used were questionnaires and observation guidelines. The study found that the trajectory of ecoliteracy learning goes through five learning stages, namely: identifying social ecological problems, planning the project design, preparing a schedule, observing social ecological problems to carry out the project, and present a social ecology project. An increase in ecological intelligence can occur because in this learning, students gain learning experiences that bring them closer to their surroundings so that they can grow their empathy for the environment. This learning combines textual and contextual learning. At the beginning, students are invited to gain a lot of knowledge by reading articles related to environmental problems. After that, they made observations in the surrounding environment to identify various environmental problems, their causes, affects, and solutions. The learning trajectories can be used by teachers in the learning process to improve students' ecological intelligence.

Keywords: *Ecoliteracy, Ecological Intelligence, Project-Based Ecoliteration Learning Trajectory*

INTRODUCTION

The environmental crisis is one of the global issues that has caught the attention of both academics and practitioners (Peralta et al., 2015). In Indonesia, environmental crises occurred in several provinces which affected a national and global scale. One problem of the environmental crisis is the quality of land cover, namely there are 6 provinces in Indonesia that are included in the alert category (Kementrian Lingkungan Hidup dan Kehutanan, 2019). This is due to land conversion, which results in reduced vegetation cover and reduced water sources. The ecological crisis that occurs cannot be separated from human intervention. Human domination of nature that is not accompanied by

ecological intelligence makes humans sink into anthropocentrism, which is only oriented to efforts to fulfill needs and ignores the preservation of nature (Zahrawati, 2021). As Chaerina (2016) stated, the ecological crisis that occurred was caused by three factors, namely: the human factor, the natural factor, and the energy-intensive technological factor. It was further stated that the main cause is humans who are selfish, corrupt, less responsible for the environment, and less concerned about the environment. This is the basis for stating that the main cause of environmental damage is because of the low ecological intelligence possessed by the community.

Higher education institutions have a role in solving the problem of the ecological crisis that has occurred. Educational institutions are agents of change that can use the curriculum or applicable ethical principles to instill good values in students (Filho et al., 2018;Ardoin et al., 2020). Lecturers can insert values of loving the environment in the learning process (Derevenskaia, 2014; Simsekli, 2015).

Project-based ecoliteracy learning in several studies has found that it can build students' love for the environment, which ends in efforts to preserve the environment. In addition, project-based learning provides space for students to explore, interpret and synthesize, build a framework of gained knowledge, hone communication skills, and bring students closer to the real environment. Project-based learning is a learning model that integrates various types of problems that encourage students to be active in collecting and implementing new knowledge gained based on experiences in their lives (Pandikar, 2020;Lobczowski et al., 2021; Goyal et al., 2022; Thahir, 2017; Najeeb & Memon, 2022; Zen et al., 2022; Guo et al., 2020).

The main benefit of project-based learning is that it centers the learning experience around the students. This learning model encourages independence, goal-setting, constructive research, collaboration, communication and reflection on the real world (Anggaira, A. S., & Sari, Y. A. 2023; Yusuf, M. 2023; Kalalo, R. R. et al., 2023). This model of education has been experimentally applied and used on all levels, ranging from elementary to college. It is difficult to make generalizations regarding the effectiveness of project-based learning (Aldabbus, 2018a). Various factors have an influence on the success of project-based learning, such as current digital technology, the perfect group, the capacity of teachers to motivate and support students, and the balance between instruction and execution of the project-based learning. Introducing project-based learning to students in the classroom can be done in a variety of ways: educators and schools can make use of pre-existing curricula from external sources or create their own curricula based on this approach (Almulla, 2020). Applying project-based learning as a method of learning is quite challenging (Aldabbus, 2018a). Project-based learning causes a change in the role of educators, from being instructors to facilitators of learning. This lesson mandates teachers must be able to tolerate noise, great numbers of people, and the movement of students in the classroom. Educators must utilize a different teaching format (Efstratia, 2014). Educators must also cultivate their skills in order to provide assistance to students (Roessingh & Chambers, 2011).

The results of observations found that there were still students who disposed of garbage inappropriately, especially when the lecture ended. Some classes had paper waste and food packaging scattered on the classroom floor. This shows the low level of ecological intelligence among students.

Ecological intelligence is intelligence that can be seen from the knowledge, awareness, and life skills of a person who is in harmony with nature. Someone will act by considering the impact on himself, others, and the environment. Someone who has ecological intelligence will think universally. This intelligence is supported by cognitive,

affective, and psychomotor aspects. The desire to preserve the environment comes from knowledge related to the environment, which is further related to affective (social and emotional) aspects. Then it is manifested in the psychomotor aspect, namely the act of preserving the environment and trying to solve the environmental crisis that has occurred (Supriatna, 2016). Ecological intelligence is the aptitude of someone to adjust to their environment through a comprehensive thought process preceding any action (Goleman, 2010). Ecological intelligence comprises three primary components. Initially, ecological intelligence relates to either the cognitive or affective domain. Secondly, ecological intelligence considers the individual differences as they impact the social environment. Thirdly, the primary aim of ecological intelligence is to establish social and environmental obligation (Okur-Berberoglu, 2020). Ecoliteracy is an effort to bring back awareness of the importance of preserving nature. This awareness will become their basis for finding solutions to the environmental crisis that is occurring and making a movement for the importance of protecting the environment (Goleman, 2010). Stone & Barlow (2005) explain that ecoliteracy is a description of a person's ability to understand ecology, social ecology, and various concepts of sustainability. Someone who has good ecoliteracy will have the awareness to protect the environment and try to solve the various ecological crises that occur.

Although there have been several studies that examine project-based ecoliteracy learning, it is only limited to literature studies, application of learning models, and descriptions (Rusmana & Aulia, 2017; Sulistianingsih & Dalu, 2020; Syukron, 2018; Rusmana & Akbar, 2017). These studies have not examined the project-based ecoliteracy learning trajectory that students go through to improve their ecological intelligence. Therefore, this research aims to design a project-based ecoliteracy learning trajectory to increase the ecological intelligence of Tadris IPS students, Faculty of Tarbiyah, Institut Agama Islam Negeri Parepare.

METHOD

This research is design research because it is in accordance with the research objectives to design project-based ecoliteracy learning trajectories to improve ecological intelligence. Design research through three stages, namely: preliminary design stage, design trial stage, and retrospective analysis stage (Akker et al., 2006; Simonson, 2006; Prahmana, 2017). Design research consists of a cyclical procedure which involves thought experiments and instructional experiments leading to implementation (Gravemeijer, 2004). The initial design seeks to devise a Hypothetical Learning Trajectory (HLT) which can be fine-tuned during the design experiment stage (Prahmana, 2017). At this stage, the activities completed include researching ecological crises, understanding ecoliteracy, engaging in project-based learning, and developing ecological intelligence. The findings from the literary analysis can create learning plans and to investigate hypotheses within human language technology. Theory is employed as a framework to enhance each learning activity. During the design evaluation, the learning trajectory that was planned during the beginning of the design process is then implemented within the educational experience (Prahmana, 2017). This implementation investigates and studies students' ecological understanding. This stage contains two cycles. The initial cycle is a trial pilot that will be assessed and enhanced. The second cycle is an educational trial that attempts to employ the educational trajectory that is evaluated and corrected in the pilot experiment in the design experiment phase. Developing ecological intelligence is done through project-based ecoliteracy learning. The last step is to conduct a retrospective evaluation. All information gathered during

the experimental design was reviewed by contrasting the hypothesis and HLT with the outcomes of applying the learning trajectory that had been conducted at the design experiment phase (Gravemeijer & Cobb, 2006). Results of the analysis will be used to provide an overview of project-based ecoliteracy learning trajectories, with the aim to enhance students' ecological intelligence.

The research subjects were students of the Social Science Education Study Program, Faculty of Education, Institut Agama Islam Negeri Parepare in semester 3 of the 2021-2022 academic year. Students of the Social Sciences Education Study Program are the subject of research because in this study program there is a Social Ecology course that studies ecological crises. In addition, students of the Social Sciences Education Study Program are expected to have sensitivity to social and environmental issues, so that they are selected as research subjects for project-based ecoliteracy learning in growing ecological intelligence. Questionnaire and observation are two data collection techniques used in this study. Based on the research aim, namely to determine the trajectory of project-based learning to improve ecological intelligence, students' ecological intelligence questionnaires and observation guidelines were used to obtain data about the learning process. Besides these two instruments, learning tools, such as learning implementation plans, are also used to support the implementation of learning and research processes. To determine the feasibility of the instrument used in this study, the instruments were validated by experts to obtain advice regarding the feasibility of these instruments. Project-based ecoliteracy learning trajectory data were retrospectively analyzed to get answers to research questions. Then the ecological intelligence data collected through a questionnaire instrument were analyzed descriptively to calculate the size of the data concentration which was then categorized based on Table 1 (Arsyad, 2016).

Table 1. Ecological Intelligence Categorization

Average Score	Category
$1.0 \leq \bar{X} < 1.5$	Very low
$1.5 \leq \bar{X} < 2.5$	Low
$2.5 \leq \bar{X} < 3.5$	Medium
$3.5 \leq \bar{X} < 4.5$	High
$4.5 \leq \bar{X} \leq 5.0$	Very high

RESULT AND DISCUSSION

The activities in this study yconsisted of several stages, namely: preliminary design, experimental design, and retrospective analysis to produce local instruction theory.

Preliminary Design

In the preliminary design stage, the researcher designed a project-based ecoliteracy learning syntax to improve the ecological intelligence of students. Before designing the learning syntax, the researcher reviewed the literature and measured the students' ecological intelligence before implementing project-based ecoliteracy learning.

The project-based ecoliteracy learning syntax design consists of 6 stages, namely: identification of social ecological problems, project design plans, compiling activity schedules, observing social ecological problems and project implementation, project presentations, and evaluation. The six stages of learning were carried out in 4 meetings.

Experimental Design

In the design experiment, the lecturer piloted learning activities that had been

designed at the preliminary design stage, namely activities designed based on project-based ecoliteracy learning syntax to improve students' ecological intelligence. At the beginning of social ecology lectures, learning begins with lecture orientation activities. In this activity, the lecturer conveys the learning activity plan and lecture rules. In addition, students are divided into 5 groups. Each group will be elected a group leader who will coordinate the implementation of social ecology project activities. At this initial meeting, the Lecturer delivered material on the basic concepts of social ecology and portraits of environmental pollution in Indonesia. After that, each group was given identifying social ecological problems in the surrounding environment, making a project design plan, and compiling a schedule of activities. At the second meeting, students and each group presented the social ecological problems that had been identified, the project design plan, and the arrangement of the activity schedule. Furthermore, students are assigned to make observations on social ecological problems that have been chosen by each group. In this observation, each group is tasked with analyzing the causes and solutions to the social ecological problems that occur. The results of the analysis are published in a poster to be presented by each group. Besides posters, each group will display products made by recycling from waste that has been made by each group. At the third and fourth meetings, student project presentations and evaluations were carried out. Each group presented their findings as a poster, while students from other groups gave questions, opinions, and arguments. The lecturer provides suggestions and input related to the findings in the poster. In addition, the lecturer provided additional explanations for student questions and responses. The following is Dialogue 1 from a conversation between lecturers and students regarding the evaluation of group work results.

Dialogue 1

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Lecturer	:	After reading, observing in the field, interviewing with related parties, analyzing and discussing various environmental problems, what do you think is the root cause of the current environmental crisis?
Student 1	:	Humans who think materialistically.
Lecturer	:	Good. Any other opinion?
Student 2	:	Industrial acceleration and capitalization. The rapid development of science and technology is accompanied by the development of human ability to change nature or to be more precise exploit nature. As with the problem of environmental exploitation, we observe humans are sometimes only oriented towards achieving as much profit as possible, then ignore the preservation of nature. They clear land to build housing, without thinking about whether the absorbed land suffices to prevent flooding.
Lecturer	:	What a great opinion. Any other opinion? The lecturer asked again.
Student 3	:	Development that is not based on regional or environmental characteristics. Sometimes because they want to be advanced and look cool, they carry out development without thinking about the safety of nature and humans.
Lecturer	:	Okay, nice opinion. Any more different opinions?
Student 4	:	The low spirituality of humans, so they forget that nature is God's creation that must be maintained.
Lecturer	:	Nice opinion. There are more?

Student 5	:	The low ecoliteracy of the community makes them insensitive to the environment because they don't know because they don't read enough.
Lecturer	:	All the opinions expressed are excellent. So, what are the keywords causing the environmental crisis?
Student	:	Humans who do not have an awareness of the importance of protecting the environment.

From Dialogue 1 between the lecturer and the students, it can be concluded that through the project-based ecoliteracy learning process, students are awakened by an awareness of the importance of protecting the environment. In addition, students know that the root of this ecological problem cannot be separated from the role of humans, so that to get out of these problems, human roles are needed both on a small scale in everyday life, especially on a large scale in social life.

Retrospective Analysis

It was concluded that project-based ecoliteracy learning can improve the ecological intelligence of students which can be seen from students' knowledge of various environmental problems in their lives, students' knowledge about the causes of these environmental problems, students' knowledge about the impact of environmental problems, students' knowledge about predictions of environmental problems in the future, students' knowledge about solutions or alternatives in solving environmental problems, as well as students' understanding of human and environmental relations in both local and global contexts. The following is Figure 1 of students' ecological intelligence which can be seen in each indicator.

Figure 1. Improving Student Ecological Intelligence
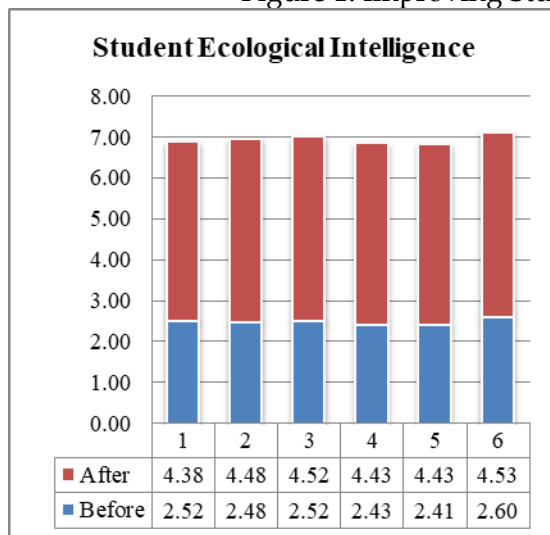
Explanation:

1. Knowledge of various environmental problems in daily life
2. Knowledge of the causes of environmental problems
3. Knowledge of the impact of environmental problems
4. Knowledge of predicting future environmental problems
5. Knowledge of solutions or alternatives to solve environmental problems
6. Understanding of human and environmental relations in both local and global contexts

	1	2	3	4	5	6
After	4.38	4.48	4.52	4.43	4.43	4.53
Before	2.52	2.48	2.52	2.43	2.41	2.60

From these data, it can be concluded that there is an increase in student ecological intelligence after project-based ecoliteracy learning. Student knowledge about various environmental problems in everyday life has increased. Before project-based ecoliteracy learning was applied, the average value of student ecological intelligence was 2.52 to 4.38. Likewise, student knowledge about the causes of environmental problems has also increased, namely before project-based ecoliteracy learning was applied, the average value of student ecological intelligence was 2.48 to 4.48. Student knowledge about the impact of environmental problems has increased from 2.52 to 4.52 after going through
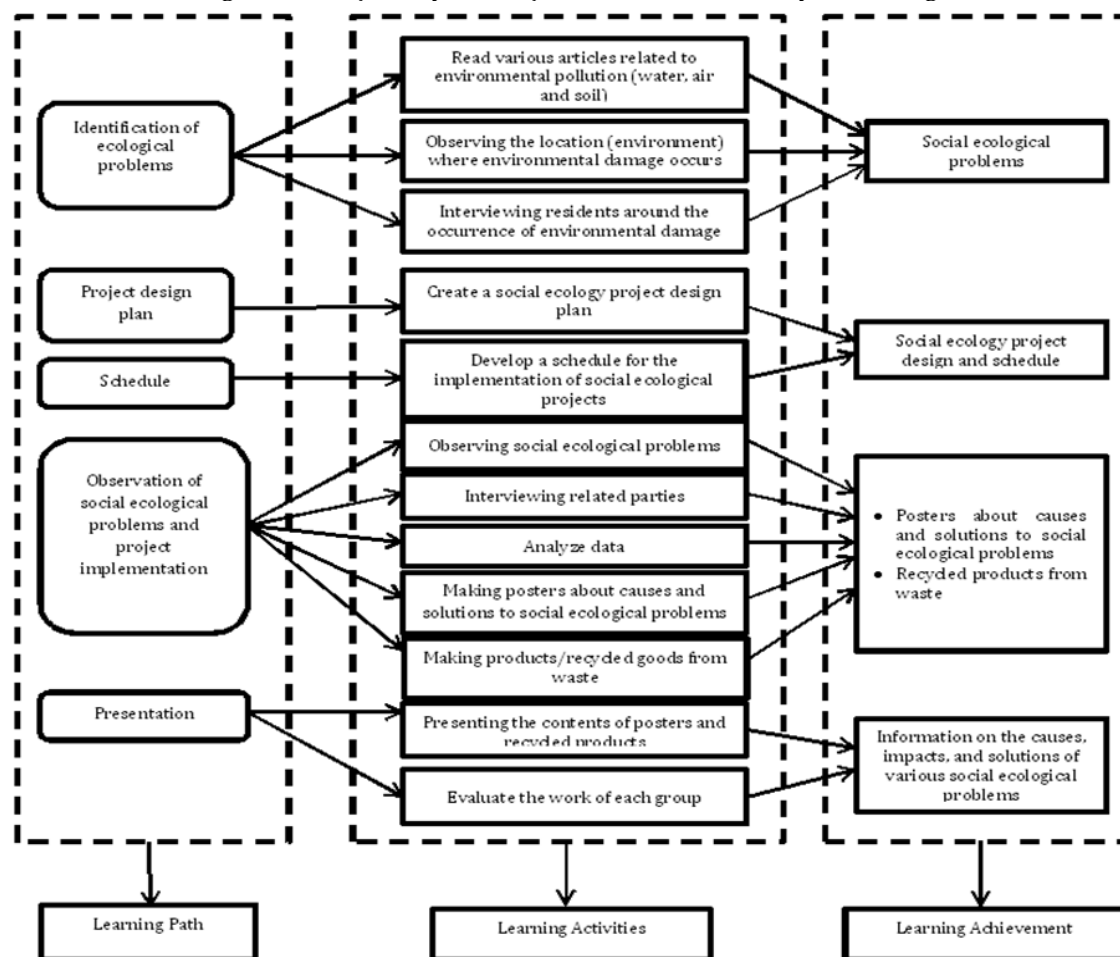
the project-based ecoliteracy learning stages.

This is in line with students' knowledge about predicting environmental problems in the future, which also experienced an increase in the average score from 2.43 to 4.43. Student knowledge regarding solutions or alternatives to solving environmental problems increased from 2.41 to 4.43. Finally, regarding students' understanding of human and environmental relations in both local and global contexts, it increased from 2.60 to 4.53. Increased ecological intelligence of students due to project-based ecoliteracy learning provides opportunities for students to be closer to the environment. Thus, students can see the reality that exists in their environment regarding environmental problems, causes, affects, and predictions of environmental conditions in the future. This will build their sensitivity to environmental issues.

Learning Trajectory

After a retrospective analysis of the data got during the teaching experiment, a project-based ecoliteracy learning trajectory was got in increasing student ecological intelligence.

Figure 2. Trajectory of Project-Based Ecoliteracy Learning

The use of project-based ecoliteracy learning models in social ecology learning has an important role in growing students' ecological intelligence. During the learning process, the use of project-based ecoliteracy learning model syntax is able to provide a memorable learning experience for students.

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The resulting learning trajectory is a learning trajectory passed by students starting from identifying social ecological problems, project design plans, preparing activity schedules, observing social ecology problems and project implementation, project presentations, and evaluation. After the project-based ecoliteracy learning model was applied, then measurements were made on the students' ecological intelligence and information was got that the ecological intelligence achieved was different for each student based on six indicators, namely: student knowledge about various environmental problems in their lives, student knowledge about the causes of environmental problems, student knowledge about the impact of environmental problems, students' knowledge of predicting future environmental problems, students' knowledge of solutions or alternatives in solving environmental problems, and students' understanding of human and environmental relations in both local and global contexts. The use of project-based ecoliteracy learning models in social ecology learning has an important role in growing students' ecological intelligence. During the learning process, the use of project-based ecoliteracy learning model syntax is able to provide a memorable learning experience for students.

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The main finding of this research is that project-based learning can increase students' ecological intelligence. The learning trajectory is: identifying social ecological problems, planning project designs, preparing activity schedules, observing projects implementing social ecological problems, and presenting social ecological projects.

DISCUSSION

Project-based ecoliteracy learning activities can improve students' ecological intelligence which includes; knowledge of various environmental problems in everyday life, knowledge of causes of environmental problems, knowledge of the impact of environmental problems, knowledge of predictions of future environmental problems, knowledge of solutions or alternatives to solve environmental problems, as well as an understanding of human and environmental relations in both local and global contexts.

The first stage of project-based ecoliteracy learning is for students to identify social ecological problems through the learning stages by reading articles about environmental pollution, making observations on site, and interviewing with related parties. This activity can improve the ability to read, observe, and listen to students. Reading journal articles can motivate students to read more, allows them to understand the main ideas and important details of their chosen to read material, and allows them to think critically because reading journal articles allows them to learn new vocabulary, increases reading speed, allows them to concentrate , and help them when they have difficulty understanding the contents of the reading. Reading journal articles serves as a learning

strategy for students who develop their self-efficacy to be motivated to read more (Aliponga, 2013).

Then the second stage, namely the project design plan. At this stage, students in groups make a project design plan. Then enter the third stage, namely preparing a schedule of activities. At this stage, students in groups develop a schedule for implementing the social ecology project. This activity trains students to think and behave independently and be responsible for their planning. Planning is the process of pre-determining a pattern of action to realize an overall policy with the shortest possible articulation of means. This implies that planning is identifying means and ends. Planning helps us to understand our targets and allows us to chart strategies to achieve those targets. Effective planning provides more rational, efficient and timely information needed to influence knowledge and assist student coordination. Planning equally provides optimal means for realizing long-term goals. It also provides direction and a sense of purpose to the learning process (Innocent, 2021).

After that, the fourth learning stage, namely observing the problems of social ecology and project implementation. At this stage, students must go through five stages of learning, namely; students in groups make observations of social ecological problems, students in groups interview with related parties to obtain information about social ecological issues, students and their respective groups analyze the results of observations and interviews, students and groups make posters about the causes and solutions to the social ecological problems found, and students in groups make products/recycled goods from waste. This learning stage can improve students' ecological intelligence. Observation of environmental problems is one stage in learning with a scientific approach. Implementing a scientific approach to learning has a beneficial effect on educators and students because of the focus on scientific thinking that promotes systematic and comprehensive thinking. Looking at learning as a source of knowledge, forming connections between knowledge and process skills, delving deeper into topics, and providing teachers with the ability to assess student knowledge based on their abilities and needs are all integral components (Liando & Maru, 2019; Liando & Maru, 2019). The fifth learning stage, namely project presentation. At this stage, students in groups presented the contents of the posters and recycled products. Presentation-based learning provides opportunities for students to be actively involved in their learning process. In addition, this learning trains students to become more independent learners and increases their confidence to speak and take part in class forums. However, it should be emphasized that presentation-based learning is more structured and accountable, which will make the learning process more effective (Sugeng & Suryani, 2018). Then the last stage, namely evaluation. At this learning stage, the lecturer evaluates the work of each group by providing suggestions and input regarding the findings in the posters, as well as providing additional explanations for student questions and responses. Evaluating is a very important part of the teaching and learning process. It assists educators and students in improving instruction and understanding. Evaluation is an ongoing process with regular training. Through the teacher's evaluation process, the students will be able to gain a thorough understanding of the material discussed (Ifeoma, 2022).

The findings of this research are in line with Li et al., (2015) who stated that project-based learning has a positive influence on students' environmental attitudes. Students defined the use of project-based learning in environmental education as a beneficial approach, enhancing creativity, encouraging research and providing permanent learning. Students believe that this practice helps them define environmental problems

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more clearly and take a more active role in the process of solving them.

Likewise, Aldabbus, (2018b); Condliffe et al., (2017); Maros et al., (2023); Najeeb & Memon, (2022b); Solomon, (2008); Valeria Vincent et al., (2022) found the same thing that project-based learning contributed positively to learning. The real-world focus of project-based learning activities is at the heart of the process (Elvianasti et al., 2022; Roisatin et al., 2022). When students comprehend that their labor is of real value, as it is a problem that must be solved or a project that could impact others, they will be driven to ply. Besides providing essential knowledge and increasing awareness, project-based learning teaches students how to analyze worldwide issues and develop specific local action plans (Akkuzu, 2016).

Increasing ecological intelligence through project-based ecoliteracy learning can occur because in this learning, students gain learning experiences that bring them closer to their surroundings so that this can foster their empathy for the environment. This learning combines textual and contextual learning. At the beginning of learning, students are invited to gain a lot of knowledge by reading articles related to environmental problems. After that, they made observations in the surrounding environment to identify various environmental problems, their causes, affects, and solutions. The cognitive ability to identify, understand, and solve problems that are interrelated between human activities and nature is an important aspect of ecological intelligence because ecological intelligence must bring together cognitive skills with empathy for all life (Bouley, 2012).

The attitude of caring for the environment does not just appear, but an introduction to the environment is needed so that awareness of the importance of protecting the environment can grow in students. Because humans are not naturally born environmentalists and have poor perceptions and awareness of nature, it must be clear that ecologically intelligent abilities must be gained through learning (Zhang et al., 2002). Furthermore, the capability of humans to adjust to their surrounding environment is known as ecological intelligence. The capacity to respond to the circumstances of one's environment and to apply them in day-to-day life is known as ecological intelligence. Someone with strong ecological intelligence will possess the knowledge to comprehend natural occurrences, be cognizant of ecological matters, and display awareness for natural elements. An individual can cultivate ecological intelligence through the process of learning.

Investigating the relationships between objects in the context they are in, examining the motives for their being and their beneficiaries, is part of ecological intelligence. Ecological intelligence is an appreciation of what is beneficial, an appreciation of diversity, and a requirement for creativity, innovation, and morality. This topic necessitates inquiries into the consumer-focused culture of globalisation and an appreciation and comprehension of how people are situated within culture and how culture is situated within natural systems (Shumba, 2011).

Ecological awareness does not come from single persons, but from collective understanding. It is necessary to take a relational approach in order to comprehend the complexities of systems, along with the connections between the natural and man-made environments. This intelligence is not solely derived from one's own thought processes, but is developed through learning from experiences within a particular cultural and environmental atmosphere. Ecological intelligence is an idea that is strongly linked to culture and which causes considering human-nature relationships with definitive ethical and moral guidelines. The way individuals interact with one another is determined by these relationships, which can range from social to ecological. This leads to an

appreciation for diversity and interdependence (Goleman, 2009).

Each ecological issue may have varying impacts on different people in various locations. They can alter the ecological teaching principles to different and variable circumstances. The primary aim of ecological intelligence is to cultivate social and environmental accountability. In relation to ecoliteracy, that framework for ecoliteracy includes affective, knowledge, cognitive skills, and behavioral components. However, what ecoliteracy places the most emphasis on is sustainability, introducing spiritual and holistic components. A person who has a good ecoliteracy will be an effective member of a sustainable society with a comprehensive capacity of mind, heart, hands and spirit comprising an organic understanding of the world and participatory action in and with the environment (McBride et al., 2013).

Systematic reasoning, ecological philosophy, comprehensive perspectives, shared ways of life and cultural resemblances are all components of ecological intelligence. It is challenging to precisely characterize the essence of ecological intelligence and its traits, as it is a multifaceted notion. Ecological intelligence also produces cognitive and affective effects, such as the inception of social and environmental accountability and consciousness (Okur-Berberoglu, 2020). Ecological intelligence, which is a new conscience, is defined as the ecological awareness and sensitivity of modern humans to negative natural mutations on a global scale and the ability to react to these changes. Individuals need perceptual abilities that allow them to think about how their activities affect ecosystems. This is only possible if the individual develops a certain level of ecological intelligence. In order for individuals to develop such intelligence, it is necessary, first, to explore the kinds of intelligence they potentially contain (Akkuzu, 2016).

This research found a project-based Eco literacy learning trajectory which could be one of the learning model choices for teachers to apply in the classroom with indications of problems of students having low ecological intelligence. Apart from that, the findings of this research can be used as reading material for those who focus on social ecological studies.

This research was applied to research subjects with a social science background who were accustomed to studying environmental issues. Therefore, it is recommended for further research to apply the project-based Eco literacy learning model to subjects with backgrounds in arts or other sciences that rarely study environmental issues. Besides that, for future researchers they can carry out project-based ecoliteracy learning research with experimental research types in classes where students are indicated to have low ecological intelligence.

CONCLUSION

The research concluded that the project-based ecoliteracy learning trajectory comprises five stages, namely: identifying social ecology problems, planning project designs, preparing activity schedules, observing social ecology problems-implementing projects, and presenting social ecology projects. In addition, this study found that project-based ecoliteracy learning can improve students' ecological intelligence, as seen from the average value of ecological intelligence before and after project-based ecoliteracy learning. This learning trajectory is effective in increasing students' ecological intelligence because this learning combines textual and contextual learning. Through this learning trajectory, students gain learning experiences that bring them closer to their surroundings so that they can develop their empathy for the environment. From the findings of this study, there are several suggestions, namely: educators are advised to

use project-based ecoliteracy learning trajectories in implementing learning to improve students' ecological intelligence.

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AUTHOR CONTRIBUTION STATEMENT

FZB: Conceptualization, design, data analysis, and writing. AA: Data acquisition and analysis. SS: Reviewing, supervision, and final approval. JJ: Proofreading and critical revision of manuscript. CN: Critical revision and technical or material support.

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