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Effects of Islamic Ecotheology-Based PBL and CTL on Madrasah Students' Learning Outcomes

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Abstract

This study aims to analyze the differences in student learning outcomes after the application of the Problem Based Learning (PBL) and Contextual Teaching and Learning (CTL) models based on Islamic Ecotheological values in the subject of Moral Faith and Adab to the Environment at MIN 2 Bandar Lampung. The research uses a quantitative approach with quasi-experimental methods and nonequivalent control group design. The research sample amounted to 109 students in class VI consisting of 37 students in the Islamic Ecotheology-based PBL group, 36 students in CTL, and 36 students in the control group. Data was obtained through learning outcome tests in the form of 20 multiple-choice questions that had met the validity and reliability tests. Data analysis included descriptive statistics, Shapiro-Wilk normality test, Levene homogeneity test, Paired Samples t-test, One-Way ANOVA, and Post Hoc Tukey HSD. The results showed that the three groups experienced an improvement in learning outcomes. One-Way ANOVA showed a significant difference in the average posttest between groups, and Tukey HSD showed significant differences in each group pair. Descriptively, the PBL group obtained a higher average posttest than the CTL and control groups. The findings showed that there was a difference in learning outcomes between groups, but the improvement could not be fully attributed to the learning model because the class had been formed before and the control group also improved. The specific contribution of Islamic Ecotheological values also cannot be separated from the influence of the learning model. Further research can strengthen the control of early abilities as well as measure affective aspects and ecological behavior.

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INTRODUCTION

Education is one of the important instruments in building human resources that are able to face the ever-evolving demands of life. Learning in the 21st century is not only directed at mastering knowledge, but also at developing critical thinking skills, creativity, communication, collaboration, and character formation of students. (AS et al., 2025; Dede Kurnia Adiputra Nurul Hidayah, 2025; Fikri et al., 2025; Kusuma & Muharom, 2024). These competencies are needed so that students are able to understand information, solve problems, work together, and apply knowledge in various situations. However, educational achievement in Indonesia still faces various challenges. The results of PISA 2022 show that the reading, mathematics, and science skills of Indonesian students are still below the OECD

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average. This condition shows the importance of strengthening the learning process that can increase student engagement while supporting the achievement of learning outcomes.

Learning outcomes problems are also found in learning at MIN 2 Bandar Lampung. Based on initial observations of 30 students, around 43% of students have achieved scores above the Minimum Completeness Criteria (KKM) of 75, while around 57% still receive scores below the completeness standard. The low learning outcomes can be seen from the ability of students to understand concepts, re-explain material, and apply knowledge in daily life. The learning process also tends to take place one-way with the dominance of teachers as a source of information, while students receive more material through the teacher's explanations. This condition limits students' opportunities to ask questions, discuss, express opinions, and explore the material. Therefore, learning that provides more space for students to be actively involved in building understanding and connecting knowledge with real situations is needed. This initial observation condition is the basis for problems in research.

One of the models that is relevant to these needs is Problem Based Learning (PBL). PBL places problems as the starting point of learning so that students are involved in identifying problems, seeking information, analyzing problems, discussing, and formulating solutions. With this character, PBL provides opportunities for students to build understanding through active learning activities. Empirical support for PBL is shown by (Asmiyunda, 2023) through meta-analysis of 14 articles, which resulted in an average effect size of 1.83 and showed a positive influence of PBL on learning outcomes. Meta-analysis research (Orhan, 2025) who analyzed 36 studies also found that PBL had a positive influence on academic achievement. In addition to learning outcomes, meta-analysis (Sisrayanti, Hasan Maksum, Waskito, 2024) Over 20 articles show that PBL has a significant influence on 21st century skills, particularly critical thinking, creativity, collaboration, and communication. Thus, the use of PBL has a strong enough empirical basis to be applied as a more active and problem-solving-oriented learning alternative.

In addition to PBL, Contextual Teaching and Learning (CTL) is relevant because it connects learning materials to students' real-life experiences and situations. Through contextual learning, learners not only learn concepts, but also understand the relationship between the material and the experiences they encounter in everyday life. Some recent research shows that CTL can support concept understanding, learner engagement, and learning outcomes through learning that relates the material to real-life contexts (Kurnia et al., 2026). The implementation of CTL also provides opportunities for students to connect the knowledge learned with situations close to their lives so that learning becomes more meaningful (Rahmawati & Saad, 2024). In learning Akidah Akhlak, these characteristics are relevant because the material not only needs to be understood conceptually, but can also be related to students' behavior and experiences in daily life. Thus, PBL and CTL have different characteristics but both provide space for students to be actively involved. PBL emphasizes the process of problem solving, while CTL emphasizes the relationship of the material to the context of life. In this study, both were used as two different learning treatments in experimental classes.

On the other hand, educational challenges are not only related to academic achievements, but also to the formation of students' concern for the environment. Various environmental issues show the importance of education that not only provides knowledge about the environment, but also builds awareness and responsibility to protect it. In the context of Islamic education, concern for the environment has a religious foundation because humans are seen as caliphs who have the mandate to protect the earth. This perspective can be developed through Islamic Ecotheology which connects Islamic values with ecological responsibility. (Rohman et al., 2024) shows that Islamic eco-theology can be

integrated into the curriculum of Islamic Religious Education and Ethics to strengthen environmental education in Indonesia. The research places Islamic eco-theology as a foundation for connecting religious education with environmental education.

Research (Taufikin, 2025) also shows that the integration of ecotheology in Islamic education can strengthen students' understanding of the relationship between Islamic teachings and ecological responsibility. The study specifically uses the principles of khilāfah, amānah, and mīzān as the basis of ecological education and finds that the integration of these values can support students' awareness and practice of environmental concern. In line with that, (Teguh Aryanto, Na'imah, Sigit Prasetyo, 2025) found that the integration of ecotheology with participatory learning can be a means to internalize ecological values in Islamic education. Studies (Syafaruddin, 2025) It also emphasizes that ecotheology in Islamic education requires the integration of the foundation of values, curriculum, learning methods, and the role of educators so that environmental education does not stop at knowledge, but can be part of the learning experience of students.

In this study, the value of Islamic Ecotheology is used as the basis for learning content in the material Adab towards the Environment in the subject of Moral Faith. The values emphasized include humans as caliphs, the environment as a mandate, and the prohibition of doing facades or damage to the earth. The integration provides an Islamic context to the learning process so that environmental problems are not only understood as problems of daily life, but are also associated with human responsibilities based on Islamic teachings. Thus, PBL based on Islamic Ecotheology provides opportunities for students to learn and solve environmental problems through Islamic values, while CTL based on Islamic Ecology connects learning materials with environmental conditions that are close to students' lives.

A number of previous studies have shown the contribution of each research component. Research on PBL shows a positive influence on students' learning outcomes and skills, while research on CTL shows that learning that links material to real life can support engagement and learning outcomes. Research on ecotheology in Islamic education also shows that Islamic values can be integrated with environmental education to build ecological awareness. These findings provide the basis that active learning models, contextual learning, and Islamic ecological values have relevance in learning. However, previous research used in this study still examines PBL, CTL, and Islamic Ecotheology separately.

Based on this study, there is still limited research that specifically tests PBL based on Islamic Ecology and CTL based on Islamic Ecology as two different learning treatments, then compares the results with conventional learning in Madrasah Ibtidaiyah students. Therefore, the novelty of this research lies in the empirical testing of the two learning models in the learning of Moral Faith of Adab material on the Environment with Islamic Ecotheology values as the basis of learning content. This study uses two experimental classes, namely the class that obtained PBL based on Islamic Ecotheology and the class that obtained CTL based on Islamic Ecology, and one control class that obtained conventional learning. With this design, the research can provide an overview of the differences in students' learning outcomes after receiving the three learning treatments.

Based on this description, this study was conducted to analyze the influence of Problem Based Learning based on Islamic Ecotheology and Contextual Teaching and Learning based on Islamic Ecotheology on the learning outcomes of students at MIN 2 Bandar Lampung. This research is expected to provide empirical evidence regarding the application of both learning models in improving learning outcomes while providing context for Islamic values in learning Adab to the Environment.

METHOD

This study uses a quantitative approach with quasi-experimental methods and nonequivalent control group design. The research involved three groups, namely experimental group I which obtained the Problem Based Learning (PBL) model based on Islamic Ecotheology values, experimental group II which obtained the Contextual Teaching and Learning (CTL) model based on Islamic Ecotheology values, and the control group that obtained conventional learning. The research population was class VI students of MIN 2 Bandar Lampung. The sample consisted of three classes that had been available, namely 36 students in the PBL group, 37 students in the CTL group, and 36 students in the control group, with a total of 109 students. The determination of the group was carried out based on the classes that were available in the madrasah without randomizing students individually. The three groups were given a pretest before learning and a posttest after treatment.

The research was carried out in the odd semester of the 2026/2027 school year. The pretest was carried out on July 16, 2026, then each group received three treatments with a time allocation of 5 × 40 minutes at each meeting, and the posttest was carried out on August 11, 2026. In the PBL group, learning was carried out through identification, analysis, and problem-solving activities related to the environment. In the CTL group, learning was carried out by connecting the material with environmental experiences and conditions that were close to the students' lives. The second treatment integrated the values of Islamic Ecotheology in the form of caliphate and mandate in maintaining and preserving the environment. The control group obtained conventional learning on the same material. Adab material on the Environment, learning objectives, time allocation, teachers teaching Moral Faith subjects, and evaluation instruments were equalized in all three groups, while the difference in treatment lay in the learning model used. The implementation of each treatment followed the learning tools that had been prepared according to the characteristics of each model.

The independent variables in this study are PBL based on Islamic Ecotheology values and CTL based on Islamic Ecotheology values, while the bound variable is the learning outcomes of students in the subject of Moral Faith and Adab on the Environment. Islamic Ecotheological values are used as the basis for learning content in both experimental groups, especially the values of caliph and trust. Data was collected using a learning outcome test in the form of 20 multiple-choice questions with four answer choices. The results of the validity test showed that all 20 questions were declared valid with an r-table of 0.195. The reliability test using Cronbach's Alpha obtained a value of 0.802 so that the instrument was declared reliable.

Data analysis was carried out with the help of SPSS version 27 through descriptive and inferential analysis. Descriptive analysis was used to determine the average and standard deviation of pretest and posttest results in each group. Prerequisite tests included normality tests using Shapiro-Wilk and homogeneity tests using Levene's Test. Changes in learning outcomes between pretest and posttest in each group were analyzed using Paired Samples t-test because both measurements came from the same student. Furthermore, the difference in posttest results between PBL, CTL, and control groups was analyzed using One-Way ANOVA. If the ANOVA results showed significant differences, the analysis was continued with Post Hoc Tukey HSD to find out the group pairs that had differences. The significance level used was 0.05.

The research was carried out after obtaining official permission from MIN 2 Bandar Lampung through a research recommendation letter dated July 15, 2026. The implementation of the research was carried out in accordance with the permits and

provisions of the madrasah. To maintain the suitability of treatment, learning in each group was carried out based on learning tools that had been prepared in accordance with the established model, while student data was used for research purposes and presented in aggregate.

RESULTS AND DISCUSSION

Research Results

This study aims to analyze the effect of the application of the Problem Based Learning (PBL) and Contextual Teaching and Learning (CTL) models based on Islamic Ecotheology values on the learning outcomes of students at MIN 2 Bandar Lampung. The research uses a quantitative approach with a quasi-experimental design through Nonequivalent Control Group Design. The research involved three groups, namely experimental group I which obtained learning with the PBL model based on Islamic Ecotheological values as many as 37 students, experimental group II which obtained learning with the CTL model based on Islamic Ecotheology values as many as 36 students, and the control group that obtained conventional learning as many as 36 students. Thus, the total number of students involved in the study was 109 people.

The validity test of the instrument is carried out to determine the ability of each question item to measure the aspect that is the target of the research. The test is carried out by comparing the r-count value of each item with the r-table at the predetermined significance level.

Table 1. Instrument Validity Test Results

Item	r count	r Table	Verdict
1	0,305	0,195	Valid
2	0,258	0,195	Valid
3	0,249	0,195	Valid
4	0,401	0,195	Valid
5	0,241	0,195	Valid
6	0,230	0,195	Valid
7	0,521	0,195	Valid
8	0,447	0,195	Valid
9	0,396	0,195	Valid
10	0,488	0,195	Valid
11	0,277	0,195	Valid
12	0,197	0,195	Valid
13	0,294	0,195	Valid
14	0,366	0,195	Valid
15	0,573	0,195	Valid
16	0,325	0,195	Valid
17	0,484	0,195	Valid
18	0,427	0,195	Valid
19	0,392	0,195	Valid
20	0,302	0,195	Valid

Based on the validity test results presented in Table 1, all 20 question items have an r-count value greater than the r-table value of 0.195, indicating that all items are valid. The lowest r-count value is found in question item 12, which is 0.197, while the highest value is found in question item 15, which is 0.573. Thus, all 20 question items are declared valid and suitable for use as research instruments. Furthermore, the reliability test of the learning

outcome test instrument is carried out to determine the level of consistency and reliability of the instrument in measuring student learning outcomes. The instrument is said to be reliable if it is able to provide relatively consistent measurement results when used under the same conditions. The reliability test in this study was carried out using Cronbach's Alpha with the help of the SPSS program. The results of the reliability test of the learning outcome test instrument are presented in Table 2.

Table 2. Results of Reliability Test Instruments Learning Outcomes Test

Cronbach's Alpha	N of Items
0.802	20

As presented in Table 2, the reliability test conducted using SPSS version 27 yielded a Cronbach's Alpha value of 0.802 for 20 question items. This value exceeds the threshold of 0.60 and falls within the high reliability category, indicating that the learning outcomes test instrument is reliable and suitable for use in research at MIN 2 Bandar Lampung.

After the research instrument was confirmed to be valid and reliable, the next stage involved a descriptive analysis of students' learning outcomes. This analysis aimed to provide an overview of the pretest and posttest results for each research group before and after the treatment. The groups consisted of students receiving instruction through Problem-Based Learning (PBL) based on Islamic Ecotheological values, Contextual Teaching and Learning (CTL) based on Islamic Ecotheological values, and conventional instruction as the control group. The descriptive statistics of the pretest and posttest scores for the three groups are presented in Table 3.

Table 3. Descriptive Statistics of Student Learning Outcomes

Groups	N	Pretest Mean ± SD	Posttest Mean ± SD	Improvement
PBL based on Islamic Ecotheology	37	11.00 ± 2.71	16.62 ± 1.95	5,62
CTL based on Islamic Ecotheology	36	11.50 ± 2.84	14.50 ± 2.41	3,00
Controls	36	10.17 ± 2.80	12.22 ± 2.86	2,06

As shown in Table 3, all three groups experienced an increase in their average learning outcomes after the learning process. The Islamic Ecotheology-based PBL group demonstrated the highest average improvement of 5.62 points, increasing from 11.00 in the pretest to 16.62 in the posttest. The Islamic Ecotheology-based CTL group showed an improvement of 3.00 points, from 11.50 to 14.50. Meanwhile, the control group experienced an increase of approximately 2.06 points, from 10.17 to 12.22. These findings indicate that the average learning outcomes improved across all three groups, with the greatest improvement observed in the Islamic Ecotheology-based PBL group.

To determine whether the data met the assumptions required for parametric statistical analysis, a normality test was conducted using the Shapiro–Wilk test. The results of the normality test for the pretest and posttest scores of the three groups are presented in Table 4.

Table 4. Normality Test Results

Groups	Pretest	Posttest	Remarks
PBL	0,223	0,078	Normal
PBL	0,084	0,340	Normal
CTL	0,221	0,351	Normal

As presented in Table 4, the Shapiro–Wilk normality test yielded significance values of 0.223 for the pretest and 0.078 for the posttest in the PBL group. In the CTL group, the significance values were 0.084 for the pretest and 0.340 for the posttest. Meanwhile, the control group obtained significance values of 0.221 for the pretest and 0.351 for the posttest. Since all significance values exceeded 0.05, the pretest and posttest scores across the three groups did not show statistically significant deviations from normality. Therefore, the data satisfied the normality assumption required for parametric analysis.

Furthermore, a homogeneity of variance test was conducted using Levene's Test to determine whether the posttest score variances were equal across the three groups. The results of the homogeneity test are presented in Table 5.

Table 5. Homogeneity Test Results by Levene

Living Statistic	df1	df2	Sig.	Remarks
2,737	2	106	0,069	Homogeneous

As shown in Table 5, Levene's Test produced a statistic of 2.737, with df1 = 2, df2 = 106, and a significance value of 0.069. Since the significance value was greater than 0.05, the variances of the posttest scores across the PBL, CTL, and control groups were considered homogeneous. Thus, the data met the homogeneity of variance assumption required for One-Way ANOVA.

After the normality and homogeneity assumptions were satisfied, a One-Way ANOVA was conducted to examine whether there were statistically significant differences in the mean posttest learning outcomes among the Islamic Ecotheology-based PBL group, the Islamic Ecotheology-based CTL group, and the control group. The results of the One-Way ANOVA are presented in Table 6.

Table 6. One-Way ANOVA Results Posttest Scores

Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	353.213	2	176.606	29.908	<0.001
Within Groups	625.925	106	5.905	–	–
Total	979.138	108	–	–	–

As presented in Table 6, the One-Way ANOVA results revealed a statistically significant difference in mean posttest scores among the three groups, $F(2, 106) = 29.908$, $p < 0.001$. Since the significance value was below 0.05, the null hypothesis of equal group means was rejected. These findings indicate that at least one group differed significantly from the others in terms of posttest learning outcomes. Therefore, further post hoc analysis was necessary to identify the specific group comparisons that demonstrated statistically significant differences.

A post hoc analysis using Tukey's Honestly Significant Difference (HSD) test was subsequently performed to determine which pairs of groups differed significantly in their posttest learning outcomes. The results of the Tukey HSD test are presented in Table 7.

Table 7. Post Hoc Results of Tukey HSD in Posttest Comparison

Group Comparison	Mean Difference	Sig.	Remarks
PBL – CTL	2,12162	0,008	Significant
PBL – Control	4,39940	<0.001	Significant
CTL – Control	2,27778	0,004	Significant

As shown in Table 7, the Tukey HSD test revealed a statistically significant difference between the PBL and CTL groups, with a mean difference of 2.12162 (p = 0.008). A significant difference was also observed between the PBL and control groups, with a mean difference of 4.39940 (p < 0.001). Furthermore, the comparison between the CTL and control groups showed a significant mean difference of 2.27778 (p = 0.004). Since all significance values were below 0.05, each pairwise comparison demonstrated a statistically significant difference in posttest learning outcomes. These results indicate that the Islamic Ecotheology-based PBL group achieved significantly higher posttest scores than both the CTL and control groups, while the CTL group also performed significantly better than the control group.

Descriptively, the average posttest of the PBL group was 16.62, the CTL group was 14.50, and the control group was 12.22. The results of the ANOVA test showed significant differences between groups, while the Tukey HSD test showed that these differences were found in each group pair. Thus, the results of the analysis showed that the application of PBL learning based on Islamic Ecotheology values and CTL based on Islamic Ecotheology values resulted in differences in learning outcomes compared to learning in the control group.

Discussion

The results showed an increase in learning outcomes after learning in the three research groups. The increase was seen in the PBL group based on Islamic Ecotheology values, the CTL group based on Islamic Ecotheology values, and the control group. Descriptively, the increase in the PBL group was greater than in the CTL and control groups. However, these findings need to be understood carefully because the increase also occurred in the control group. Therefore, the increase in scores in the experimental group cannot be entirely considered as a direct result of the application of PBL or CTL, but needs to be seen together with the results of the comparison between groups.

In the PBL group, learning starts from problems that are close to students' lives, especially problems related to the environment. This pattern provides opportunities for students to not only receive information, but also identify problems, seek relevant information, discuss, and formulate solutions (Aidil et al., 2026; Bhardwaj et al., 2025; Fit et al., 2023; Rivas et al., 2022; Song et al., 2025; Zhang et al., 2023). This process may explain why PBL results in greater improvement. Previous research on PAI learning has also shown that PBL can encourage learner engagement and improve learning outcomes.(Muhammad Ridho Abdul Rozaq, Uus Ruswandi, Willy Alawiah, Shopiah Syafaatunnisa, 2024), for example, through quasi-experiment research, it was found that there was an increase in PAI learning outcomes after the implementation of PBL. Other findings on PAI learning also show that PBL can provide space for students to be more active in the learning process.

The advantage of PBL in this study is not only related to the characteristics of problem solving, but also to the way in which Islamic Ecotheology values are placed in the learning process. The values of the caliphate and the mandate are used as a basis to understand the environmental problems faced by students. When students discuss the problems of waste, cleanliness, water use, or environmental care, these problems do not stop as daily problems, but are linked to human responsibility as caliphs and mandates in protecting the earth. Thus, religious values serve as a framework to understand and assess the problems that are being solved. Recent studies on the integration of eco-theology in Islamic education also show that the values of caliph, trust, and ecological responsibility can be integrated into learning to connect Islamic teachings with responsibility for the environment. (Rohman et al., 2024)

Meanwhile, the CTL group also showed an increase in learning outcomes. The mechanism of CTL in this study lies in the effort to connect the material of Akidah Akhlak with the real experience of students. Adab material towards the environment can be associated with activities they encounter daily, such as maintaining class cleanliness, using water responsibly, caring for plants, and disposing of garbage in its place. The relationship between the material and the experience makes the concepts learned more concrete. Thus, CTL provides a context that helps students understand the meaning of the values of trust and caliph in daily life. Previous comparative research has also shown that PBL and CTL can both be used in learning to improve learning outcomes, although the results can differ according to the characteristics of the material and the learning process. (Setiawan et al., 2023)

The difference in achievement between PBL and CTL in this study can be explained from the level of demands of the learning activities given. CTL mainly helps students connect concepts with real experiences or situations, while PBL adds the stages of problem identification, information search, discussion, and solution formulation (Lago & Cruz, 2021). In the material on environmental manners, both approaches are equally relevant because the environment is a context that is close to the lives of students. However, PBL provides a more structured series of activities to process a problem to produce alternative solutions. This can be one of the pedagogical reasons why the average PBL posttest is higher than CTL in this study. Comparative findings in other studies also show that there is a difference in learning outcomes between the application of PBL and CTL, so the characteristics of activities in each model need to be considered when explaining the research results.

However, the results did not show that only the experimental group experienced development. The control group also experienced a significant increase in learning outcomes from pretest to posttest. This condition is important because it shows that the learning process in general still provides opportunities for students to acquire new knowledge. The improvement can be related to several factors, such as the learning process that continues during the research, the learning experience obtained by the students, and the possible testing effect, where students become more familiar with the form or material of the questions after taking the pretest. In addition, the maturation or development of students during the study period may also contribute to changes in learning outcomes. Because the study does not fully control for these factors, the improvement in the experimental group needs to be understood in the context of comparison with the control group (Huang et al., 2023; M. Ismail et al., 2026; S. M. Ismail et al., 2022; Pike et al., 2021).

Teacher factors also need to be considered in reading the research results. Teachers remain an important part of delivering materials, providing direction, class management, and providing feedback, both in the experimental and control groups. Therefore, some changes in learning outcomes can be related to the learning process carried out by the teacher, not solely the characteristics of the learning model. In addition, there are differences in initial ability between groups that can be seen from the average pretest. The PBL group has an average pretest of 11.00, CTL of 11.50, while the control group is 10.17. These initial differences need to be considered when interpreting the results of the posttest because the research design used is a nonequivalent control group design. Thus, the results of the study are more accurately understood as differences in achievement after treatment in predetermined classroom conditions, not as evidence that all changes are only caused by the learning model.

The results of the One-Way ANOVA provide evidence that there is a significant difference in the average posttest between the three study groups. The results of Tukey HSD's follow-up test also show that differences exist in each group pair, namely PBL with

CTL, PBL with control, and CTL with control. Thus, the differences that can be seen descriptively are supported by statistical testing. However, these results still need to be read together with the fact that the three groups have improved and there are differences in initial ability. This approach makes the interpretation of the results more in line with the characteristics of quasi-experimental research.

Overall, the findings of the study show that learning that combines active or contextual activities with Islamic Ecotheological values can be used in learning Akidah Akhlak in adab materials on the environment. The values of the caliph and amanah provide a religious framework to understand the relationship between humans and the environment, while PBL and CTL provide a pedagogical way to connect these values with the learning process. Recent studies on ecotheology in Islamic education also emphasize that the integration of ecological values will be more meaningful when it is not only conveyed as knowledge, but is linked to students' experiences and activities.

Thus, the results of the study show that there is a difference in learning outcomes between PBL based on Islamic Ecotheology values, CTL based on Islamic Ecotheology values, and control learning, with the PBL posttest average being higher than CTL and control. PBL is higher descriptively and significantly different from CTL based on the Tukey HSD test. Pedagogically, this difference can be understood from the character of PBL which not only relates the material to the real context, but also directs students to identify problems, seek information, discuss, and formulate solutions. However, because the control group also experienced an increase and there were other factors such as the effect of measurement, student development, teacher influence, and differences in initial abilities, the results of the study should not be interpreted as all improvements solely due to treatment.

CONCLUSION

Based on the results of the study, the three groups experienced an increase in learning outcomes after learning, both the PBL group based on Islamic Ecotheology values, the CTL based on Islamic Ecotheological values, and the control group. Descriptively, the PBL group showed higher posttest outcomes than the CTL and control groups, while the CTL group also showed higher outcomes than the control group. The results of the One-Way ANOVA showed a significant difference in the average posttest learning outcomes between the three groups. Furthermore, the results of the Tukey HSD test showed that significant differences were found in the PBL–CTL, PBL–control, and CTL–control pairs. Thus, the study showed that there was a difference in learning outcomes between the three groups after learning. Pedagogically, higher PBL outcomes can be understood from the learning characteristics that lead students to identify problems, seek information, discuss, analyze, and formulate solutions. Meanwhile, CTL helps students connect the material of Akidah Akhlak with environmental experiences and conditions that are close to their lives. Islamic Ecotheological values, especially the caliph and amanah, are used as the basis of the content to provide an Islamic context in understanding the material of Adab towards the Environment.

The results of the study need to be understood in accordance with the limitations of quasi-experimental designs that use the available classes. There are differences in initial ability between groups and the control group also experiences an increase in learning outcomes. Therefore, the results of the study cannot be interpreted as all improvements solely due to PBL or CTL. In addition, the research design has not been able to specifically separate the contribution of Islamic Ecotheology values from the influence of the PBL and CTL models because these values are applied together with the learning model in both experimental groups. For further research, the control of initial abilities can be strengthened and research can be carried out with a longer duration of treatment. The next research can also measure

affective aspects and ecological behavior so that the application of Islamic Ecotheological values is not only seen from cognitive learning outcomes, but also from the development of students' attitudes and behaviors towards the environment.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

In the preparation of this manuscript, the author uses ChatGPT, Blackbox AI, and Gemini, Mendeley as tools in the writing process, especially for language editing, sentence structure improvement, grammar checking, and the initial development of some parts of the text. Google Scholar is used as a search engine to identify and search relevant literature and scientific references. All outputs and information obtained through the tool are reviewed, verified, and revised by the author. The author is solely responsible for the accuracy, content, interpretation, citation, and final version of the manuscript.

AUTHOR CONTRIBUTION STATEMENT

The author(s) is responsible for all stages of research, including problem formulation, data collection, data analysis, interpretation of results, and manuscript preparation and revision.

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DATA AVAILABILITY STATEMENT

Research data is available from the author based on reasonable request and by paying attention to institutional provisions and policies related to the use of student data.

DECLARATION OF INTERESTS

The author(s) declares that there are no conflicts of interest related to the research and publication of this manuscript.

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