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Problem Based Learning Model Integrated with Islamic Values on Global Warming Material

Yusriani
Universitas Islam As'adiyah Sengkang, Indonesia

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ABSTRACT

This article is driven by the necessity for a learning approach that enhances students' cognitive capacities while simultaneously cultivating spiritual character and understanding of increasingly intricate global environmental challenges. The research employs a descriptive qualitative methodology utilizing a literature review approach. Data were acquired from pertinent national and international journal articles published from 2015 to 2025. The findings indicate that the application of the problem-based learning model in physics education enhances students' cognitive dimensions while also cultivating scientific attitudes and 21st-century competencies, including conceptual comprehension, problem-solving skills, critical and creative thinking, and scientific process skills. The subject of global warming is intrinsically linked to fundamental concepts of physics and enhances students' ecological consciousness, particularly in addressing global challenges like the climate catastrophe. Moreover, the incorporation of Islamic principles in physics instruction regarding global warming adds a spiritual dimension that enhances the scientific learning experience. Values such as integrity, leadership, moderation, and ethical stewardship of nature render education not solely the conveyance of knowledge but also the cultivation of a comprehensive character. Islamic doctrines promoting environmental conservation can foster a collective consciousness on the significance of safeguarding the land as a trust from God. The integration of problem-based learning (PBL) with Islamic ideals in the study of global warming is a comprehensive and transformative methodology that enhances students' academic proficiency while simultaneously cultivating their spiritual, social, and ecological character.

Corresponding Author:

Yusriani,
Universitas Islam As'adiyah Sengkang, Indonesia
Email: yusriani3394@gmail.com

1. INTRODUCTION

The education of the 21st century necessitates a reformation in pedagogical methods. Students must now go beyond only mastering theory and facts; they are now expected to engage in critical thinking (Chu et al., 2021; Mutohhari et al., 2021), exhibit creativity (Dilekçi & Karatay, 2023), and demonstrate problem-solving abilities (Adeoye & Jimoh, 2023) in practical contexts. Consequently, comprehensive learning

methodologies are required to satisfy these needs effectively. A pertinent model extensively utilized in many educational settings is Problem-Based Learning (PBL) (Smith et al., 2022; Yu & Zin, 2023; Chandra et al., 2024).

Problem-based learning is an educational methodology that necessitates students' cognitive engagement in comprehending a concept through scenarios and challenges introduced at the lesson's outset (Simanjuntak et al., 2021; Ghani et al., 2021; Muzaini et al., 2022; Anggraeni et al., 2023). The objective is to educate pupils in employing a problem-solving methodology to address challenges. This model can also cultivate students' cognitive abilities, refine problem-solving skills, and augment mastery of the subject matter. PBL is employed to foster higher-order thinking in problem-oriented contexts, encompassing the acquisition of learning strategies (Kivunja, 2014; Moallem, 2019; Boelt et al., 2022).

The attributes of the problem-based learning model include 1) initiation of learning and activities through an engaging problem or issue, 2) students pursuing realistic solutions to genuine and authentic problems, 3) active student engagement in learning via investigation and problem-solving, 4) interdisciplinary perspectives, 5) collaboration in small groups, and 6) demonstration of learning outcomes by students (Darwati & Purana, 2021; Paramitha et al., 2023).

In science education, especially in physics, the PBL model possesses significant potential to change the learning paradigm, which has historically been theoretical and devoid of context (Rizal et al., 2023; Nicholus et al., 2023). Physics is a discipline of natural science that investigates diverse natural phenomena and their interactions according to scientific principles. In educational settings, students frequently see physics as challenging and tedious due to its abstract nature and emphasis on mathematical components. This observation corresponds with the findings of Walidain et al. (2024), indicating that students perceive physics classes as exceedingly complex, challenging to comprehend, daunting, and tedious. Consequently, pupils encounter it challenging to comprehend concepts and are less capable of relating the acquired content to real-life situations. In this scenario, PBL is a suitable method to tackle these difficulties. Utilizing real-world situations as a foundation for learning enables students to comprehend physics principles in a more useful and pertinent manner while actively participating in the process of knowledge acquisition (Al-Kamzari & Alias, 2025).

A significant subject in the study of physics that pertains to daily life is global warming (Wulandari et al., 2021). Global warming is a significant environmental concern that has garnered extensive attention globally due to its pervasive effects on ecosystems and human existence (Mariappan et al., 2023; Parvez et al., 2024). Additionally, Wahyuni and Suranto (2021) Global warming is a pervasive issue affecting individuals globally, marked by rising temperatures. Erratic weather patterns are indicative of global warming. Scientists link this phenomenon to physics topics such as heat transport, the greenhouse effect, electromagnetic radiation, and renewable energy. Consequently, incorporating global warming topics into physics education via the PBL approach is exceedingly significant. Students acquire comprehension of

scientific principles while simultaneously cultivating ecological awareness and social sensitivity to environmental challenges.

In the framework of Indonesian education, which is defined by religious values and noble culture, learning cannot be exclusively focused on cognitive mastery and academic skills (Fitriadi et al., 2024). The optimal education is one that cultivates the entire individual, namely one that harmonizes intellectual, emotional, and spiritual dimensions. This aligns with Wahib (2021), who asserted that character education must be combined with IESQ (intellectual, emotional, and spiritual quotient) to effectively address moral and character challenges and harmonize the three dimensions of student intelligence: affective, cognitive, and psychomotor. The incorporation of Islamic ideals into the educational process is a pressing necessity. Islam integrates knowledge with ethics and reason with spirituality (Abuzar & Khondoker, 2024). In the Islamic perspective, knowledge serves not merely as a means to investigate the natural world, but also as a conduit to understand and approach God. The Qur'an offers pertinent moral and spiritual guidance regarding environmental issues like global warming, including the directive to preserve the equilibrium of nature (QS. Ar-Rahman: 7-9), the injunction against causing harm to the earth (QS. Al-A'raf: 56), and the human obligation as khalifah (custodian) of the earth (QS. Al-Baqarah: 30).

The incorporation of Islamic values into physics education via the PBL approach enhances the academic experience while also imparting significant ethical and spiritual dimensions (Nugraha et al., 2024; Anugrah et al., 2025). Students are encouraged to comprehend and address environmental issues through a scientific lens while being trained to perceive knowledge as a trust and ethical obligation. Consequently, education serves as a mechanism for cultivating a well-rounded character: intellectually astute, environmentally aware, and rooted in faith.

This literature analysis seeks to examine the use of the problem-based learning paradigm that incorporates Islamic principles into physics education, particularly concerning global warming. This study is essential for offering both conceptual insights and practical applications in formulating learning strategies that are academically effective and enhance students' character and spirituality.

2. METHOD

This research employed a descriptive qualitative methodology utilizing a literature review technique. Data were sourced from pertinent national and international academic articles published from 2015 to 2025. Selection was based on inclusion criteria: (1) implementation of the problem-based learning model in physics education; (2) integration of global warming concepts into physics education; (3) incorporation of Islamic values into global warming content; and (4) application of the problem-based learning model combined with Islamic values in global warming education. Figure 1 illustrates the design of the literature review method.

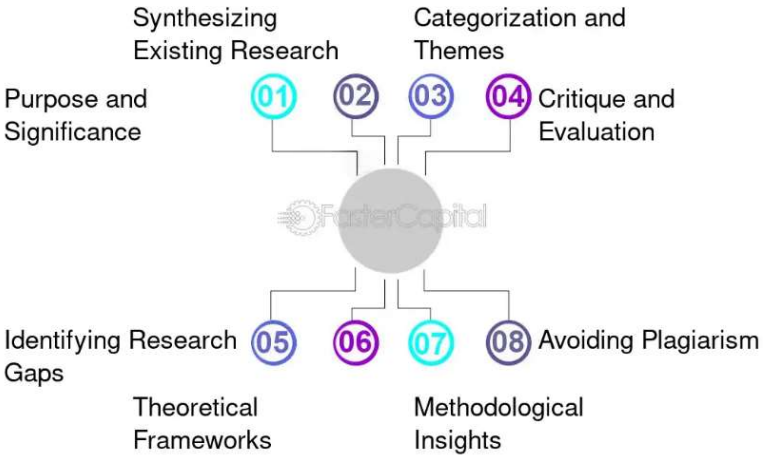

Figure 1. Literature Review Method

The process of constructing a literature review involves identifying the topic and research questions, conducting searches for pertinent literature in academic databases, selecting and assessing these sources, analyzing and synthesizing the findings, and assembling a structured review that includes conclusions and recommendations.

Data collection was performed by systematic searches of databases, including Google Scholar and ScienceDirect. Chosen articles were examined through content analysis methods, emphasizing principal results, the application of the problem-based learning paradigm, materials on global warming, and the incorporation of Islamic values into education. This method was selected as it corresponds with the study's aims, specifically to cultivate a conceptual and empirical comprehension of the implementation of the problem-based learning model integrated with Islamic values in physics education about global warming in a systematic and focused manner.

3. RESULTS AND DISCUSSION

This study discusses the results of previous research conducted by researchers related to the implementation of the Problem-Based Learning (PBL) model integrated with Islamic values in the topic of global warming.

Implementation of the Problem-Based Learning Model in Physics Learning

The problem-based learning model is an educational strategy that uses contextual problems as the foundation of the learning process. The implementation of Problem-Based Learning (PBL) in physics education has demonstrated a beneficial effect on multiple facets of student proficiency (Dewi et al., 2023). PBL enhances problem-solving abilities as students are prompted to recognize issues, develop hypotheses, devise solutions, and perform evaluations grounded in scientific principles. This process necessitates engaged and contemplative student participation in addressing intricate and genuine difficulties. Research by Umamah and Andi (2020) demonstrates that the PBL paradigm, characterized by its open-ended approach, effectively enhances students'

problem-solving abilities. These findings are corroborated by Manullang et al. (2024), who demonstrated that the PBL model facilitates students in identifying and resolving problems during the learning process, particularly in physics at high school, thereby fostering a more effective teaching and learning environment than conventional methods.

Secondly, PBL enhances comprehension of physics concepts (Simanjuntak et al., 2021). By introducing pertinent and significant challenges, students not only commit formulas to memory but also attain a profound comprehension of subjects through investigation, discourse, and practical application. This renders the acquired knowledge more significant and interconnected with real-world experiences. The findings of Rizqi et al. (2020) indicate that the adoption of PBL enhances students' conceptual understanding and is more successful than standard lecture approaches in this regard.

Third, regarding learning outcomes, numerous studies indicate that students engaged in Project-Based Learning (PBL) exhibit superior academic performance relative to those instructed using traditional methods. This corresponds with the findings of Rahmi et al. (2021), which indicate that the PBL paradigm significantly enhances learning outcomes in all domains (cognitive, affective, and psychomotor) within physics education. The findings of Mayanti et al. (2022) corroborate these results, indicating that pupils instructed through Problem-Based Learning (PBL) utilizing demonstrative and experimental techniques achieved superior learning outcomes compared to those educated by traditional methods.

The PBL paradigm intrinsically fosters critical thinking, compelling students to assess material, evaluate alternative options, scrutinize arguments, and make evidence-based conclusions (Al-Thani & Ahmad, 2025). This method enhances analytical and evaluative abilities, which are crucial in scientific education. This discovery corroborates the results of Arifah et al. (2021), indicating a substantial correlation between the PBL approach and students' critical thinking abilities in physics education. This relationship indicates that the PBL approach substantially affects students' critical thinking abilities in physics education.

Fifth, PBL fosters creative thinking by allowing students to address open-ended challenges, thus providing them the opportunity to generate new ideas, synthesize knowledge, and discover novel and innovative solutions (Pinar et al., 2025). These skills are essential in the study of physics, particularly when students encounter issues lacking a singular definite solution. The findings of Astutik and Jauhariyah (2021) substantiate this assertion, indicating that the adoption of PBL significantly influences physics learning, evidenced by an average effect size of 0.524.

Moreover, these six models enhance scientific process skills, including observation, classification, data interpretation, hypothesis formulation, and result communication (Sari et al., 2021). The activities in PBL closely correspond with the stages of the scientific process, facilitating students' familiarity with it. Research by Azmi et al. (2021) indicates that the PBL model considerably enhances learning motivation and science process abilities in physics education concerning dynamic electricity, with an effect size of 2.02, categorized as high. The implementation of the Problem-Based

Learning (PBL) model in physics education enhances students' cognitive abilities while cultivating scientific attitudes and 21st-century skills, which are crucial for addressing real-world difficulties.

Integration of the Concept of Global Warming with Physics Learning

Global warming is a critical global environmental concern that necessitates scientific comprehension among students. The topic of global warming may be effectively incorporated into physics classes (Lestari et al., 2024), as it is intrinsically linked to fundamental principles of physics, including heat transport, electromagnetic radiation, thermodynamic laws, energy concepts, and the greenhouse effect. Global warming refers to the incremental rise in the mean temperature of the Earth's atmosphere, oceans, and land over an extended duration (Bilgili et al., 2024). A primary contributor to global warming is the greenhouse effect, a natural phenomenon essential for sustaining a steady and livable temperature on Earth.

Khatib (2015) asserts that the greenhouse effect is vital in typical conditions. The greenhouse effect minimizes the temperature variation between day and night on Earth. This indicates that, in the absence of the greenhouse effect, the average nighttime temperature of the Earth's surface not subjected to solar radiation would be quite low (Xu & Cui, 2021). The Earth primarily reflects sunlight as infrared rays back into the atmosphere. The infrared photons are subsequently reabsorbed by atmospheric gases or substances, maintaining the Earth's warmth, even during nighttime.

Nevertheless, escalating human activity has led to an exacerbation of the greenhouse effect, adversely affecting the global climate. The findings of Kurniawan et al. (2024) substantiate that deforestation and heightened greenhouse gas emissions are the principal drivers of global warming. These causes influence alterations in ecosystems, rendering their mitigation critically vital. Moreover, incorporating global warming into physics education is a chance to cultivate environmental consciousness and ethical responsibility among students. When students comprehend the physical phenomena of climate change and acknowledge its social and ecological ramifications, learning becomes more significant and contextualized (Ayotte-Beaudet et al., 2023). Consequently, instructing this subject enhances comprehension of physics topics and fosters the cultivation of environmentally aware and globally responsible student profiles. This corresponds with the assertions of Freije et al. (2017), who contended that substantial efforts are required to include environmental themes into university curricula to enhance environmental consciousness among all students. This step will be important in cultivating a new generation capable of properly confronting the challenges posed by global warming.

By incorporating the principles of environmental awareness, social responsibility, and scientific literacy into global warming education, educators are cultivating an environmentally conscious generation, adept in systematic thinking, and prepared to tackle the challenges posed by climate change. This corresponds with the ethos of the Independent Curriculum, which grants educators and learners the autonomy to engage in meaningful learning according to contemporary contexts and requirements

(Pramesworo et al., 2023). Femilia and Asrizal (2023) assert that the Independent Curriculum is pertinent in tackling the global warming challenge. The Independent Curriculum contributes to imparting knowledge as well as the skills, attitudes, and values essential for cultivating environmentally conscious individuals. The Independent Curriculum promotes active and innovative engagement from both students and educators in identifying and implementing solutions to alleviate the adverse effects of the global warming catastrophe (Sofiyan et al., 2019). Consequently, the autonomous curriculum may serve as a remedy to tackle the global warming catastrophe and nurture an environmentally aware and compassionate generation within the Indonesian educational framework. Incorporating global warming themes into physics education enhances instructional resources and acts as a catalyst for cultivating a scientifically literate generation, aware of global challenges, and prepared to engage in sustainable environmental stewardship.

Integration of Islamic Values in Global Warming Material

Global warming is a worldwide environmental concern that necessitates urgent attention from all societal sectors, including education. In the educational framework of Muslim-majority nations such as Indonesia, the incorporation of Islamic principles into scientific curricula, especially in physics, is a pertinent and strategic methodology (Wajdi et al., 2025). This integration seeks to enhance students' spiritual qualities while promoting ecological awareness rooted in religious beliefs.

The Quran, the repository of all knowledge, is already known to us. The Quran encapsulates, if not elaborates upon, nearly all contemporary scientific knowledge. The Quran was given 14 centuries ago as a divine revelation that transcends the limits of metaphysics and futurism. In contemporary thought, science and religion are fundamentally incompatible, each offering unique viewpoints (Simuziya, 2022). Consequently, while the Quran is primarily a religious text, its analysis and content extend beyond solely religious domains. It also includes various facets of human existence, such as science. Islam perceives the earth as a trust (Quran, Al-A'raf: 56), with humans designated as Allah's vicegerents (khalifah) on earth (Quran, Al-Baqarah: 30). In fulfilling this trust, mankind must preserve the equilibrium of nature and avoid doing harm (Quran, Ar-Rum: 41). Haryanti et al. (2022) contend that the Qur'an reiterates the importance of conserving nature to ensure the Earth's sustainability as a habitat for humanity, hence preventing future natural calamities on the planet. Global warming, marked by elevated greenhouse gas emissions resulting from human activity, constitutes a form of environmental degradation that opposes these ideals. Consequently, the study of global warming can be harmonized with Islamic principles by fostering environmental ethics, social responsibility, and an understanding of the significance of safeguarding God's creation.

Haryanti et al. (2022) assert that humans are the vicegerents of God on Earth, tasked with safeguarding the universe to maintain its beauty and comfort. The Earth, along with its ecosystems, is designated for human utilization, as it was created by God for humanity's habitation. If human actions result in harm, natural laws will manifest in

disasters such as floods, storms, and droughts, reflecting the cause-and-effect relationship of human impacts. Environmental degradation, including illicit logging and ozone layer depletion due to diverse human activities, will result in suffering for humanity. Islamic education can facilitate various initiatives aimed at cultivating environmentally conscious students (Hajar, 2024), such as imparting knowledge on the significance of environmental protection, promoting contemplation of nature, encouraging the planting of trees or flora referenced in the Qur'an, advocating for clean and healthy living practices that do not harm the environment, and instructing students against littering, among others. This is founded on Islamic doctrines and the guidance of the Qur'an (Leu, 2021). The concept of global warming in physics can be elucidated through the greenhouse effect, heat transmission, energy and power, and alternative energy sources. Simultaneously, educators can associate this content with Islamic principles such as trustworthiness (amanah), responsibility (mas'uliyyah), moderation (qana'ah), and restraint (israf) in energy consumption. For instance, when addressing the increase in global temperatures attributed to CO_2 emissions, students are prompted to contemplate the role of human consumption in environmental degradation and how Islam advocates for equilibrium and compassion for all living beings.

This integration can also be achieved through problem-based learning activities, including the design of ecologically sustainable solutions, the creation of simple devices that harness renewable energy, or the execution of energy conservation campaigns. These activities cultivate 21st-century competencies while simultaneously fostering students' spiritual and social character as accountable agents of change. Consequently, the incorporation of Islamic values into the study of global warming enhances the physics learning experience while cultivating environmentally conscientious students with a global outlook and virtuous character (Shibghatullah, 2023).

Implementation of the Problem Based Learning Model Integrated with Islamic Values in Global Warming Learning

The problem-based learning model is an educational strategy that prioritizes active student engagement in addressing contextual issues pertinent to real life. In the realm of physics education, especially regarding global warming, Problem-Based Learning (PBL) serves as an excellent instrument for fostering conceptual comprehension, critical thinking abilities, and environmental consciousness among students (Ardiansyah et al., 2024). Moreover, when combined with Islamic principles, this approach can serve as a strategic instrument for cultivating students' spiritual character and ecological accountability.

Global warming is a multifaceted and intricate scientific phenomenon. Through problem-based learning, students are prompted to discern the fundamental reasons for global warming (Ismiandini et al., 2024), including heightened greenhouse gas emissions from fossil fuel consumption, deforestation, and consumer habits. Students are subsequently directed to identify solutions grounded in scientific data and evaluate them from an Islamic viewpoint. This process utilizes Islamic ideals such as *khalifah fil*

ardh (earthly leadership), *amanah* (trust), moderation (israf), and the preservation of ecological balance (mīzān) as the ethical basis for developing solutions.

Fundamentally, science and spirituality pursue a common objective: the quest for truth and comprehension of life's reality (Pearce et al., 2021). Science aims to elucidate phenomena by observation, experimentation, and rational analysis, whereas spirituality endeavors to comprehend existence through introspection, ethical principles, and transcendent consciousness. Science and spirituality mutually enhance one another: science offers rational understanding, whereas spirituality imparts significance and guidance for the application of that understanding. Al'asror et al. (2025) assert that knowledge and spirituality should not be perceived as conflicting forces but as complementing elements that foster the growth of intelligent and wise individuals.

The integration of Project-Based Learning (PBL) with Islamic values in the context of global warming education can be achieved through the fundamental stages of the PBL model: (1) Problem orientation begins with a case study of environmental degradation or global warming, linked to Quranic verses such as Surah Ar-Rum: 41; (2) data collection and problem identification, where students analyze the scientific and ethical dimensions of the issue; (3) formulating hypotheses and solutions that reflect social and spiritual accountability; (4) evaluating and presenting solutions that yield both scientific and ethical outcomes, based on Islamic principles.

This application ensures that physics education transcends mere conceptual comprehension, fostering students who possess critical thinking skills, creativity, environmental consciousness, and spiritual awareness. They recognize that global warming is both a scientific challenge and a moral obligation, integral to their devotion and duty as servants of Allah and stewards of the land. Sartika et al. (2022) assert that Islam perceives nature and its elements as creations of God that require protection and stewardship for human survival. Human apathy toward ecological equilibrium results in ecosystem disruptions, global warming, and climate change. Research findings demonstrate that the meaning-making learning paradigm effectively enhances students' moral sensitivity to their environment. The PBL model is one approach that can enhance meaningfulness. According to research by Yulisriyanti (2024), the PBL model effectively enhances cognitive skills and comprehension of material within groups through investigations and inquiries into real-life problems, facilitating a deeper and more meaningful understanding of the subject matter. Scott (2017) assert that the PBL model is an educational framework that engages students' diverse cognitive talents, both individually and collaboratively, in real-world contexts to address problems, rendering the learning experience meaningful, pertinent, and contextualized.

The integration of the PBL paradigm with Islamic beliefs in education Global warming is a strategic initiative aimed at fostering conceptual comprehension and spiritual consciousness among students regarding environmental challenges. PBL promotes collaborative and critical problem-solving among students, while the incorporation of Islamic ideas fosters religious attitudes, moral responsibility, and environmental stewardship as a divine commandment from God. In the context of global warming, students assess the scientific causes and implications while also reflecting on

Islamic teachings regarding environmental protection, as articulated in QS. Ar-Rum: 41 and QS. Al-A'raf: 56. Consequently, education acquires greater significance, cultivating the character of students as khalifah fil ardh who actively contribute to the sustainability of the world, grounded in the principles of faith and virtuous ethics. The findings of Nafisah and Setyarsih (2024) indicate that the application of the PBL model, integrated with the Qur'an on global warming material, was well executed in the experimental class, achieving a percentage of 90.3%, categorized as very satisfactory. The integration of Problem-Based Learning (PBL) with the Qur'an has facilitated students' exploration of innovative solutions to physics issues, enhanced their motivation to learn, rendered the learning experience pleasurable, and reinforced their conviction in the applicability of Qur'anic verses to scientific concepts. Musa'adah and Dwikoranto (2024) observed that the application of the PBL model for the greenhouse effect, combined with the Qur'an, was highly successful. The students demonstrated a moderate N-Gain score in critical thinking skills, and their feedback regarding the PBL model was favorable.

The findings indicate that the application of the problem-based learning approach in physics education on global warming produces favorable outcomes, particularly when combined with Islamic values. This method enhances comprehension of physics ideas while cultivating Islamic values and environmental consciousness in kids.

4. CONCLUSION

The application of the Problem-Based Learning (PBL) model in physics education enhances students' cognitive abilities while fostering scientific attitudes and 21st-century competencies, including conceptual comprehension, problem-solving skills, critical and creative thinking, and scientific process skills, all of which are vital for addressing real-world challenges. Incorporating the concept of global warming into physics education enhances the curriculum and acts as a catalyst for cultivating a generation that is scientifically literate, attuned to global challenges, and prepared to engage in sustainable environmental conservation, particularly in tackling the climate crisis.

The incorporation of Islamic principles into global warming teaching adds a spiritual dimension that enhances the scientific learning experience. Values such as truthfulness (amanah), caliphate (khalifah), moderation (israf), and moral duty towards nature elevate learning beyond mere knowledge transfer to encompass comprehensive character development. Islamic principles advocating for environmental conservation can foster a collective consciousness on the significance of safeguarding the earth as a trust from Allah SWT. The integration of Project-Based Learning (PBL) with Islamic beliefs in the context of global warming education is a comprehensive and transformative strategy that improves students' academic proficiency and cultivates their spiritual, social, and ecological identities. This strategy has proven highly effective in enhancing student engagement, cultivating religious attitudes and environmental consciousness, and advancing 21st-century skills.

As a suggestion, teachers can apply problem-based learning models in science lessons, particularly on global warming, to increase student engagement and understanding. Learning materials can be developed by integrating Islamic values and using problem-based learning

models to improve the quality of learning. Further research can be conducted to develop more effective and contextual problem-based learning models by integrating Islamic values. Additionally, research can be conducted to create more effective tools for measuring students' understanding of global warming and Islamic values.

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