

## Cultivating Students' Self-Regulation Towards The Environment Through The Integration of The *Tri Hita Karana* Concept in Energy Transformation Learning

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**Abstract:** This qualitative research aims to conduct a literature review and investigate the impact of integrating the *Tri Hita Karana* concept into fourth-grade elementary science lessons on the material of energy transformation, specifically on cultivating students' self-regulation towards the environment. The focus is on the three elements of *Parhyangan*, *Pawongan*, and *Palemahan*, with the primary outcome being students' critical self-regulation awareness of their surroundings. Self-regulation, as one of the indicators of Facione's critical thinking theory, is implied by students' actions towards the environment. A descriptive qualitative approach is employed, with data sourced from interviews, observations, and literature from scientifically credible research findings. The outcomes of our field research and literature survey indicate a positive impact on the cultivation of self-regulation in students, fostering awareness of environmental conservation through energy-saving habits.

**Keywords:** self-regulation, environment, *Tri Hita Karana*, energy transformation learning

## INTRODUCTION

The Merdeka Curriculum emerged as a way to address learning setbacks during the pandemic, providing the "freedom to learn" to educators, including teachers and school principals, in designing, implementing, and developing school curricula that cater to the needs and potential of students (Rahmadayanti & Hartoyo, 2022). Beyond relying solely on the Merdeka Curriculum to overcome learning setbacks during the pandemic, self-regulation is also necessary. Students who regulate themselves to be proactive in setting goals and engaging in the self-regulation cycle require strong motivational beliefs. Contrary to conventional thinking, self-regulation is not defined as an individual form of learning as it also encompasses social forms of learning initiated by oneself, such as seeking help from peers and teachers within the school environment or during teaching and learning activities. In theory, self-regulation is vital for student learning. Self-regulated learners have the cognitive skills,

self-awareness, and motivation to manage their own learning (El-Adl & Alkharusi, 2020). Self-regulation is also a concept within the process of critical thinking, which is a higher-order skill that plays a role in stimulating moral, social, cognitive, and scientific development.

Critical self-regulation among elementary students towards the environment refers to their ability to independently monitor, assess, and adjust their behaviors and attitudes towards environmental issues. This includes understanding the impact of their actions on the ecosystem, setting personal goals for environmental stewardship, and taking initiative to reduce their ecological footprint. When equipped with critical thinking skills, young learners can make informed decisions about their consumption habits, waste management, and conservation efforts. Schools can empower students to become environmental stewards by fostering a sense of responsibility. Critical self-regulation among elementary students towards the environment, particularly when learning about energy transformations in fourth-grade science, involves their ability to consciously apply their understanding of energy concepts to make environmentally responsible choices (Wang, et al., 2022). For instance, students can cultivate sustainable habits, such as opting for pedestrian or cycling transportation for short distances, thus contributing to environmental preservation.

Critical self-regulation among elementary students towards the environment, particularly when learning about energy transformations in fourth-grade science, involves their ability to consciously apply their understanding of energy concepts to make environmentally responsible choices. For instance, after learning about various forms of energy and how they can be transformed, students can independently assess their daily habits and identify opportunities to conserve energy. This might include turning off lights when leaving a room, unplugging electronics when not in use, or choosing to walk or bike short distances instead of using a car. By integrating the *Tri Hita Karana* concept, students can further enhance this process by emphasizing the significance of harmonious coexistence between humans and the natural world. By understanding that humans are part of a larger ecosystem and that their actions have consequences for the environment, students can develop a stronger sense of responsibility and stewardship towards the planet (Anggana, et al., 2022).

## **METHODS**

This research employed a descriptive qualitative approach to delve into the phenomenon of self-regulation towards the environment. Data was collected through a triangulation of methods, including in-depth interviews with teachers, participant observations in schools programs about teachers, students, and a comprehensive review of existing scholarly literature. This multi-faceted approach allowed for a rich and nuanced understanding of the research problem, capturing both subjective experiences and objective observations. A literature review based on a coherent study of the *Tri Hita Karana* concept and its implications for education, character development, and critical thinking skills among students,

sourced from indexed journals. A total of twenty-eight students and three teachers, fulfilling the required criteria, were involved in this study.

## RESULT AND DISCUSSION

### Students' Self-Regulation in Critical Thinking Skills

Critical thinking skills refer to the ability to think in order to solve problems and make appropriate alternative decisions to resolve them (Kasanah et al., 2024). Critical thinking needs to be taught early to students to develop their skills in facing and solving contextual problems in daily life. Education that emphasizes critical thinking will create students with superior capabilities in dealing with everyday life challenges. According to Thomson & Crompton (in Tohir et al., 2021), critical thinking is defined as the capacity to assess and think deeply about encountered material or events.

According to Facione (in Fitriani et al., 2024), critical thinking involves self-regulated judgment aimed at being able to interpret, analyze, evaluate, infer, and explain evidence, conceptual methodology, determine criteria, or consider context. Facione states that critical thinking is goal-directed thinking, such as striving to explain something, determine its meaning, or solve a problem. There are many opinions regarding the definition and categorization of critical thinking skills. However, this research focuses on Facione's theoretical guidelines.

Based on the above review, critical thinking can be defined as a process of understanding a concept or idea, analyzing, evaluating, and applying the obtained information as a guide for further action to process its relation to other information. Critical thinking is one of the criteria for higher-order thinking and is often known as "Higher Order Thinking Skills" (HOTS) (Fitriani et al., 2024). The main goal of higher-order thinking is to stimulate students to engage in more detailed, complex thinking, such as the ability to critically analyze when faced with new information, think creatively when facing challenges, and think strategically when dealing with complex decision-making.

According to Alsaleh (2020), the consensus on defining critical thinking based on the participation of researchers and teachers in the American Philosophical Project Delphi Association shows that characteristics of a critical thinker include traits such as curiosity, fair-mindedness, flexibility, diligence, and focus on inquiry. According to Facione's critical thinking theory, there are six taxonomies in critical thinking, each with its basic sub-indicators adapted to Indonesian language (Kasanah et al., 2024). Table 1 shows the signs of each critical thinking skill as defined by Facione.

**Table 1. Critical Thinking Skill as Defined By Facione**

Critical Thinking Skill	Breakdown of Define	Sub-indicators
Interpretation	Understanding the sequence of events or experiences, assessing meaning, and converting the significance of an event, expressing beliefs with appropriate procedures.	<ul style="list-style-type: none"> <li>● Categorization</li> <li>● Decoding significance</li> <li>● Clarifying meaning</li> </ul>

Analysis	Identifying the outcomes of representations among relationships of meaning, statements, questions, analyzing data and descriptions, understanding the basis of analysis for expression.	<ul style="list-style-type: none"> <li>● Examining ideas</li> <li>● Identifying arguments</li> <li>● Analyzing arguments</li> </ul>
Evaluation	Descriptions, perceptions, and considering situations, beliefs, or personal opinions to connect to real inferential logic.	<ul style="list-style-type: none"> <li>● Assessing claims</li> <li>● Assessing arguments</li> </ul>
Explanation	Presenting reasoning outcomes, justifying reasoning outcomes, weighing evidence and concepts, testing methodology, presenting arguments from reasoning outcomes.	<ul style="list-style-type: none"> <li>● Stating results</li> <li>● Justifying procedures</li> <li>● Presenting arguments</li> </ul>
Inference	Identifying main elements, drawing logical conclusions, hypothesizing, considering reference data, organizing data and reports, representing judgments and statements.	<ul style="list-style-type: none"> <li>● Querying evidence</li> <li>● Conjecturing alternatives</li> <li>● Drawing conclusion</li> </ul>
Self-regulation	Self-correcting based on cognitive elements, reflecting on personal achievements, applying learning outcomes, evaluating factually.	<ul style="list-style-type: none"> <li>● Self-examination</li> <li>● Self-correction</li> </ul>

Based on the detailed indicators of Facione's critical thinking skills presented in Table 1, self-regulation emerges as the pinnacle of measurement. It is at this level that students are able to correct and manage themselves, applying all their critical understanding to practical concerns. Self-regulation, as the highest level of critical thinking according to Facione, represents a significant milestone in cognitive development. When students exhibit strong self-regulation skills, they demonstrate a deep understanding of their own thought processes and can effectively monitor and adjust their thinking as needed. This ability allows them to approach complex problems with a methodical and thoughtful approach, ensuring that their solutions are not only accurate but also practical and relevant to real-world contexts.

Furthermore, self-regulation is closely linked to metacognition, or thinking about one's own thinking. Schunk & Zimmerman (2023) said, by developing strong self-regulation skills, students become more metacognitive, allowing them to reflect on their learning experiences and identify areas for improvement. This metacognitive awareness empowers students to become more independent learners, capable of taking ownership of their education and pursuing knowledge with curiosity and enthusiasm. As a result, fostering self-regulation should be a primary goal of any educational endeavor, as it equips students with the essential skills they need to succeed in an increasingly complex and demanding world.

Self-examination is a crucial aspect of self-regulation, enabling individuals to critically assess their own thoughts, feelings, and behaviors (Baars et al., 2022). In the context of learning, self-examination involves reflecting on one's understanding of concepts, identifying areas of strength and weakness, and recognizing personal biases or misconceptions. By engaging in self-examination,

learners can gain a deeper understanding of their own cognitive processes and identify areas where improvement is needed. Self-correction is the active process of modifying one's own behavior or beliefs in response to feedback or new information. By self-correcting, individuals demonstrate their ability to adapt to changing circumstances and learn from their mistakes. In academic settings, self-correction involves identifying errors in problem-solving, revising written work, and seeking clarification on misunderstood concepts. By practicing self-correction, learners can develop resilience, perseverance, and a growth mindset.

Students' self-regulation in critical thinking involves their capacity to independently oversee, evaluate, and manage their thought processes during critical thinking activities (Savina, 2021). Integrating self-examination and self-correction is essential for effective learning and personal growth. By regularly reflecting on their own performance, learners can identify areas where they need to improve. They can then take concrete steps to self-correct, such as seeking additional resources, practicing new strategies, or collaborating with peers. This iterative process of self-examination and self-correction fosters a lifelong learning mindset and empowers individuals to take ownership of their educational journey (Baars et al., 2022).

Critical thinking is a higher-level skill and plays a role in stimulating moral, social, cognitive, and scientific development. This skill becomes a goal in the overall learning process, namely education for institutions and students. According to the cognitive development of grade IV elementary school students, it is at the concrete operational stage. Learning at this stage, which is based on concrete experiences, greatly influences the formation of critical thinking skills in students. According to Kasanah et al. (2024), teaching critical thinking skills effectively depends on the classroom environment that promotes the acceptance of different viewpoints and free discussion.

### **Environment Awareness in Basic Energy Transformation Learning Science**

A strong foundation in environmental awareness is crucial for young learners. By introducing basic concepts of energy transformation, such as the conversion of potential energy to kinetic energy, educators can spark curiosity and ignite a passion for understanding the natural world (Wang et al. 2022). Understanding these basics fosters appreciation for ecological balance and sustainable practices. Environmental awareness for 4th-grade students can begin by learning about the basic forms of energy, such as kinetic, potential, and thermal energy. Grasping energy transformations builds a strong foundation in energy concepts. Teaching about renewable and non-renewable energy is vital for environmental education. Students can learn about the advantages and disadvantages of different energy sources, such as solar, wind, hydro, and fossil fuels (Kasanah, 2024). By understanding the limited nature of non-renewable resources, students can appreciate the importance of conserving energy and adopting sustainable practices.

It's crucial to discuss how human actions affect the environment to raise environmental awareness. Students can explore topics like climate change, pollution, and deforestation, and how

they're tied to energy use. By understanding the negative impacts of unsustainable practices, students can be inspired to make positive changes (Haratua, 2023). To encourage energy conservation, teachers can implement practical activities such as energy audits in the classroom, where students can identify areas for energy savings. Additionally, students can participate in projects like designing energy-efficient homes or creating public service announcements about energy conservation. Wardhani & Mahendradhani, 2024 said, by taking action, students can experience the tangible benefits of energy efficiency and develop a sense of environmental responsibility.

To reinforce environmental awareness, educators can incorporate practical applications of energy transformation into their lessons. For example, students can learn about renewable energy sources, such as solar and wind power, and how they can be used to reduce reliance on fossil fuels. By conducting experiments, observing natural phenomena, and engaging in hands-on activities, students can gain a deeper understanding of energy concepts and their real-world implications (Juni & Sukron, 2023).

A key aspect of environmental awareness is promoting responsible energy consumption. Educators can encourage students to adopt energy-saving habits, such as turning off lights when leaving a room, unplugging electronics, and conserving water (Haratua, 2023). Incorporating these practices into daily habits can help students contribute to a sustainable planet. The fundamental goal of environmental education is to foster a sense of environmental care. By forging a connection between students and nature, educators can inspire them to become environmental protectors (Álvarez-Nieto et al., 2022). Field trips, community service, and classroom discussions can foster environmental awareness and sustainable practices.

### **The Impact of *Tri Hita Karana* Concept on Environmental Learning Outcomes**

*Tri Hita Karana* is a life philosophy of the Balinese community that guides their daily activities. The term *Tri Hita Karana* comes from three words: *tri* (three), *hita* (happiness), and *karana* (cause). *Tri Hita Karana* refers to the three ways or causes that lead to happiness, peace, and harmony (Suarni et al., 2023). According to experts, *Tri Hita Karana* embodies three principles that create harmonious relationships in life by practicing the following: 1) The relationship between humans and God (*Parhyangan*); 2) The relationship between humans and the environment (*Palemahan*); and 3) The relationship between humans and one another (*Pawongan*).

In the *Merdeka* curriculum, *Tri Hita Karana* can be implemented as follows in Table 2.

**Table 2. Implementation of *Tri Hita Karana* Concept in Science Energy Transformation Learning**

<b>Element</b>	<b>Potential Analysis</b>	<b>Student Assessment</b>
<i>Parhyangan</i> (Spiritual Dimension)	Integration of religious values	Observation of student reflections, discussions, and artwork.
	Ethical considerations	Role-playing scenarios, debates, and written assignments on ethical dilemmas related to energy use.
	Collaborative learning	Peer assessments, group presentations, and self-evaluations.

<i>Pawongan</i> (Social Dimension)	Community engagement	Community service projects, interviews, and reflective journals.
<i>Palemahan</i> (Environmental Dimension)	Environmental awareness	Quizzes, tests, and research projects on environmental issues.
	Sustainable practices	Energy audits, waste reduction campaigns, and eco-friendly projects.
	Experiential learning	Field trips, experiments, and hands-on activities.

Implementing the *Tri Hita Karana* concept can positively influence learning outcomes. By fostering harmony with God, the environment, and others, students learn to create balanced relationships that support cognitive, psychomotor, and affective development. For teachers, this philosophy can lead to better teaching outcomes, nurturing a holistic approach to guiding students through their educational journey and fostering life skills that go beyond academics (Wardhani & Mahendradhani, 2024).

### Cultivating Students' Self-Regulation through Learning Experience

The formation of learning experiences in students affects the extent to which they can absorb understanding of a subject. The more concrete the experiences students have, the greater their chances of understanding and remembering a topic. The greater the students' involvement in the learning process, the greater their chances of understanding and processing information into long-term memory. Learning activities determine the level of student involvement in acquiring learning experiences and have a significant impact (Khoiroh et al., 2023). The extent of student involvement in learning is depicted in Edgar Dale's cone of experience as shown in Figure 1.

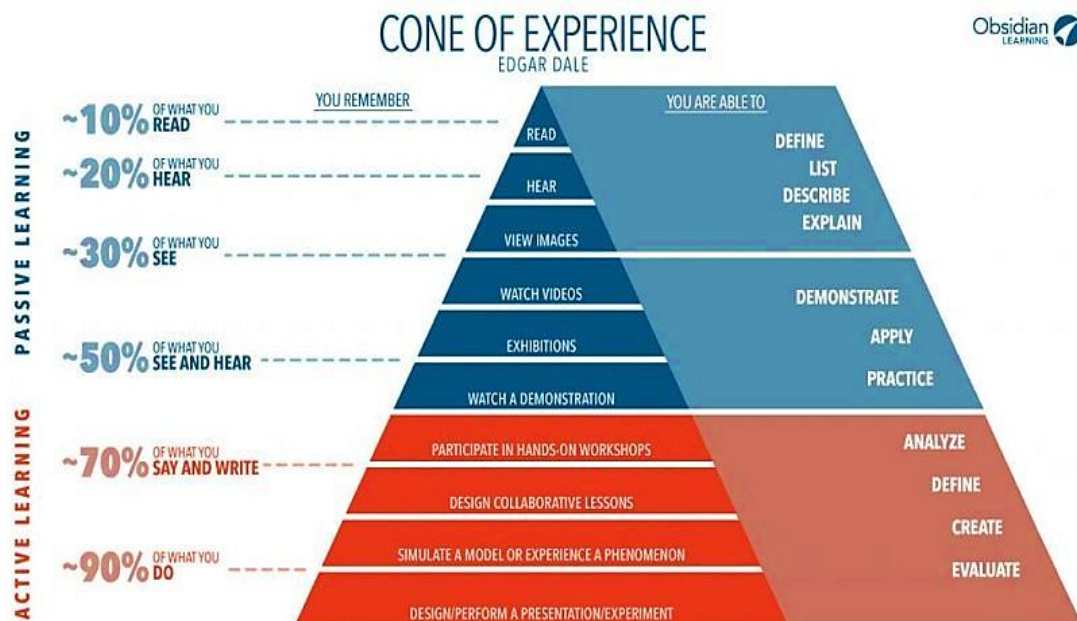


Figure 1. Edgar Dale’s Cone Learning Experience

Source: Hadi (2019)

Figure 1 above illustrates that student involvement in the learning process significantly influences their ability to understand and remember the material they acquire. Learning activities that involve real-world experiences have a significant impact on student comprehension. When students learn through reading and listening, the experiences gained are limited to defining and listing, and are categorized as passive learning, with retention rates of only 10-20%. When students learn using visual media, such as pictures, their involvement increases in describing and explaining, and their retention rate improves to around 30%, although it still falls under passive learning. In contrast, when students learn through more concrete media, such as videos, exhibitions, and demonstrations, they gain a better learning experience. Here, student involvement increases to demonstrating, applying, and practicing, with a retention rate of around 50%, although it is still considered passive learning.

Active learning, through student involvement in analyzing and defining through speaking and writing activities, offers a retention rate of 70%. These learning activities can include hands-on projects, completing worksheets, collaborative design, and similar activities. The peak of optimal active learning occurs when students engage in creating and evaluating, which requires action, reasoning, and skills. It is during this process that critical thinking is developed through activities such as simulations, learning experiences, analyzing phenomena, experiments, presentations, and design/project demonstrations. In this learning experience, students have a retention rate of 90%.

Based on the explanation of Edgar Dale's cone above, it is clear that learning experiences are crucial for developing students' understanding and retention. The more active and concrete the learning activities, the more they stimulate critical thinking in students. This effort to independently construct knowledge while engaging in higher-order thinking is known as the constructivist learning process.

### **Self-Regulation and *Palemahan* of THK: A Synergy for Energy Transformation Learning**

Building upon the foundation of active learning and concrete experiences, educators can further cultivate students' self-regulation by integrating environmental themes into the science curriculum. By focusing on energy conservation and sustainability, students can develop a deep understanding of their impact on the planet and the importance of making conscious choices.

For instance, when studying energy transformations, students can be tasked with designing and conducting experiments to investigate the efficiency of various energy sources. Through hands-on activities, they can learn about renewable and non-renewable energy, the concept of energy conservation, and the environmental implications of their energy choices. By encouraging students to reflect on their findings and propose solutions, educators can foster a sense of agency and empower them to make informed decisions about energy use in their daily lives.

Additionally, project-based learning can help students apply their knowledge to real-world situations (Ikhtiana, 2020). For example, students could design and build a model of a sustainable community, complete with energy-efficient buildings, renewable energy sources, and waste reduction

strategies. This type of project allows students to work collaboratively, develop critical thinking skills, and gain a deeper appreciation for the interconnectedness of environmental issues.

Self-regulation is a key skill that enables individuals to direct their own learning. It involves setting goals, tracking progress, and adapting strategies. In the context of energy transformation learning, self-regulation enables students to actively engage with the material, seek clarification when necessary, and apply their knowledge to real-world scenarios. By developing strong self-regulation skills, students can become more independent learners and achieve greater academic success.

The Balinese philosophy of *Tri Hita Karana* offers valuable insights into the interconnectedness of humans and nature. Palemahan, one of the three elements of *Tri Hita Karana*, emphasizes the importance of harmony with nature. By integrating Palemahan principles into energy transformation learning, educators can foster a deep appreciation for the environment and inspire students to become responsible energy consumers. Self-regulation plays a vital role in this process, as it enables students to make conscious choices about their energy consumption habits and take action to reduce their environmental impact.

Strategies for cultivating self-regulation in energy transformation learning can be cultivated into integrated learning. To foster self-directed learning in energy transformation, educators can use a range of approaches. Encouraging students to set precise and practical learning targets is a helpful technique, offering chances for students to monitor their advancement and pinpoint areas needing development, prompting students to contemplate their learning journeys and evaluate their own achievements, and assisting students in self-identifying and correcting their mistakes.

After analyzing the relevant literature, a field study was carried out, employing observation and interviews in elementary schools. The outcomes of this field study are summarized in Table 3.

**Table 3. Finding Outcomes of Field Study about Cultivating Students' Self-Regulation towards Environment**

Strategy	Specific Action	Expected Outcome
Goal Setting	<ul style="list-style-type: none"> <li>a. Encourage students to set personal goals for energy conservation, such as turning off lights when leaving a room or unplugging electronics when not in use.</li> <li>b. Use a goal-setting worksheet to help students visualize and track their progress.</li> </ul>	Students develop a sense of ownership and motivation to take action.
Self-Monitoring	<ul style="list-style-type: none"> <li>a. Provide students with checklists or logs to record their energy-saving behaviors.</li> <li>b. Conduct regular class discussions to reflect on progress and identify areas for improvement.</li> </ul>	Students become more aware of their habits and can identify opportunities to make changes.
Self-Evaluation	<ul style="list-style-type: none"> <li>a. Use rubrics or self-assessment checklists to help students evaluate their own work and learning.</li> <li>b. Encourage peer feedback to provide constructive criticism and support.</li> </ul>	Students develop critical thinking skills and the ability to assess their own performance.
Self-Correction	<ul style="list-style-type: none"> <li>a. Provide opportunities for students to identify and correct their own mistakes, such as through peer editing or self-reflection.</li> <li>b. Offer specific feedback and guidance to help students improve their work.</li> </ul>	Students become more resilient and independent learners.

Time Management	<ul style="list-style-type: none"> <li>a. Teach students time management strategies, such as creating schedules and prioritizing tasks.</li> <li>b. Encourage students to divide large projects into smaller tasks.</li> </ul>	Students become more organized and efficient in their work.
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Alsaleh (2020) said, the benefits of self-regulation in energy transformation learning can make students get many skills development in real life for environment awareness.

1) Enhanced Academic Performance

Self-regulated learners excel academically due to their increased motivation, focus, and persistence. By effectively managing their time, setting goals, and monitoring their progress, students can improve their learning outcomes and achieve higher grades.

2) Independent Learning

Self-regulation empowers students to become independent learners. By taking ownership of their learning, they can actively seek out resources, ask questions, and collaborate with peers to deepen their understanding. This autonomy fosters a lifelong love of learning and prepares students for the challenges of higher education and the workforce.

3) Critical Thinking Skills – Identify Biases

Self-regulation is closely linked to critical thinking. By monitoring their own thought processes, students can identify biases, evaluate evidence, and make informed decisions. This ability to think critically is essential for problem-solving, creativity, and innovation.

4) Environmental Responsibility

Understanding the impact of energy consumption on the environment is crucial for sustainable living. Self-regulated learners can make conscious choices to reduce their carbon footprint, such as conserving energy, reducing waste, and promoting sustainable practices. By fostering a sense of environmental responsibility, we can empower future generations to protect our planet.

5) Future Success

Self-regulation is a versatile skill that enhances all areas of life. Effective time management and problem-solving are just a few examples of how self-regulated learners excel academically and professionally. By fostering self-regulation, educators equip students for future success.

Combining these two aspects, teachers can develop a comprehensive and productive learning space that promotes both academic success and ecological awareness. Self-regulation grants students the authority to guide their own learning, resulting in increased motivation, concentration, and self-reliance. By setting targets, observing their progress, and utilizing effective learning methods, students can enhance their learning achievements. Moreover, Palemahan underscores the value of harmony with nature. By incorporating environmental issues into energy transformation learning, educators can foster a sense of environmental accountability in students.

## CONCLUSION

This research underscores the pivotal role of self-regulation in cultivating students' environmental consciousness. Integrating the Tri Hita Karana philosophy into energy education can empower students to drive positive change. Self-directed learning can equip students with the knowledge, skills, and mindset to make informed decisions about energy consumption and sustainable practices. By fostering a deep connection with nature, educators can inspire students to become responsible citizens who contribute to a sustainable future.

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