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# PROFILE OF CLIMATE CHANGE LITERACY AND SUSTAINABILITY AWARENESS ON GLOBAL WARMING MATERIAL

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ABSTRACT

*This study critically maps the climate change literacy (CCL) and sustainability awareness (SA) profiles of eighth-grade students at SMPN Satap 5 Hanau regarding global warming material. Employing a quantitative descriptive approach as an initial R&D needs assessment, the study uses cognitive tests, attitude questionnaires, and behavioral observations. Results reveal a pronounced behavioral gap: students excel in basic knowledge (average 86.5%) and show strong environmental concern (83.2%), but are severely deficient in higher-order thinking skills for mitigation and adaptation (0%). Actual sustainability actions, such as energy conservation, remain low (30.8%–48.1%). Clearly, learning remains confined to knowledge transfer. This evidence underscores the urgent need for action- and project-based learning models to close the gap between students' knowledge and their capacity for meaningful action.*

## INTRODUCTION

Climate change is widely recognized as a major threat of the 21st century, impacting environmental, social, and economic aspects of human life. One of the primary manifestations of climate change is global warming, which has been shown to significantly affect environmental and human systems, highlighting the urgent need for collective and sustainable responses through formal education (IPCC, 2021; Rousell & Cutter-Mackenzie-Knowles, 2020; Choi et al., 2021). Science education plays a strategic role not only in transferring scientific knowledge but also in shaping students' climate

change literacy and sustainability awareness. In this context, it also contributes to developing students' environmental responsibility and engagement through innovative learning approaches (Hayat & Nugroho, 2022).

Climate Change Literacy (CCL) encompasses the ability to understand scientific concepts, develop caring attitudes, and build action competencies for mitigation and adaptation, as emphasized in recent studies on climate change education and literacy (Yli-Panula et al., 2020; Choi et al., 2021). Comprehensive CCL requires students to connect local phenomena to global impacts and to evaluate appropriate mitigation solutions. Strengthening this literacy requires support from structured learning tools that stimulate students' critical thinking skills (Siswanto et al., 2018). Therefore, integrating climate issues into the science curriculum at the junior high school level is highly crucial.

Sustainability Awareness (SA) refers to an individual's readiness to internalize sustainability values and apply them consistently in real-world behavior. SA involves integrating environmental knowledge, empathy for future generations, and a sense of social responsibility. Previous studies have shown that integrating sustainable development values into science learning can enhance students' environmental awareness and responsible behavior (Ramdani et al., 2020; Dimitrova et al., 2021). Consequently, the synergy between Climate Change Literacy (CCL) and SA becomes a key competency that must be developed through science education, particularly on the topic of global warming.

Despite the increasing urgency of strengthening CCL and SA, various studies show that learning achievements are still dominated by the mastery of conceptual knowledge, while students' actual action competence remains relatively low. This gap between knowledge and sustainable behavior underscores the need for a comprehensive initial assessment to map students' actual literacy conditions. The use of appropriate learning models is essential to address weak analytical and problem-solving skills in environmental physics topics. Without targeted interventions, the knowledge students acquire will not translate into tangible mitigation actions.

The urgency of this research lies in the necessity to map the CCL and SA profiles in depth as a basis for developing applicable learning interventions. The core idea of this study is to identify students' weaknesses in higher-order cognitive aspects and action competencies through a needs assessment framework. It is expected that this research will

provide accurate baseline data to develop action- or project-based learning models that can bridge the behavioral gap. Thus, the results of this study are intended to serve as a foundation for strengthening students' actual action competencies in consistently supporting environmental sustainability.

Based on this background, the objective of this research is to map and analyze the climate change literacy and sustainability awareness profiles of eighth-grade students at SMPN Satap 5 Hanau regarding global warming material. The resulting profiles are used as initial data for the development of a research and development (R&D)- based learning model aimed at strengthening students' tangible action competencies to support sustainability

## MATERIALS AND METHODS

This research is a quantitative descriptive study conducted as an initial needs assessment. The data presented detail student profiles in Climate Change Literacy (CCL) and Sustainability Awareness (SA). This stage serves as the foundation of a Research and Development (R&D) project.

The subjects of this research were 14 students in the eighth grade at SMPN Satap 5 Hanau. The study was conducted from January to June 2026. Data collection was carried out using four main instruments:

1. CCL Cognitive Test: Assesses students' mastery of scientific concepts, from foundational knowledge to analytical skills (C1–C4) in Climate Change Literacy.
2. CCL Questionnaire: Measures students' attitudes and emotional responses to climate change issues.
3. SA Observation Sheet: Evaluates students' implementation of Action Literacy and Sustainability Awareness in daily activities.
4. SA Observation Questionnaire: Designed to assess students' sustainability awareness as demonstrated by consistent real-world actions in practicing sustainability values, including energy conservation, waste management, environmental stewardship, and engagement in environmental initiatives.

The quantitative data were analyzed descriptively by calculating achievement percentages for each competency indicator. These percentages were then classified

using specific criteria to determine students' strengths and weaknesses in Climate Change Literacy and Sustainability Awareness.

## RESULTS AND DISCUSSION

The results of the Climate Change Literacy assessment (Figure 1) show that students have a high mastery of basic concepts, reaching 96%. However, there is a sharp decline in indicators of higher-order thinking. Students' ability to analyze the impacts of climate change is only 50%, and, remarkably, their competency in mitigation and adaptation strategies is 0%. This indicates that while students "know" what global warming is, they "do not know" how to solve the problem or act as part of the solution to the crisis.

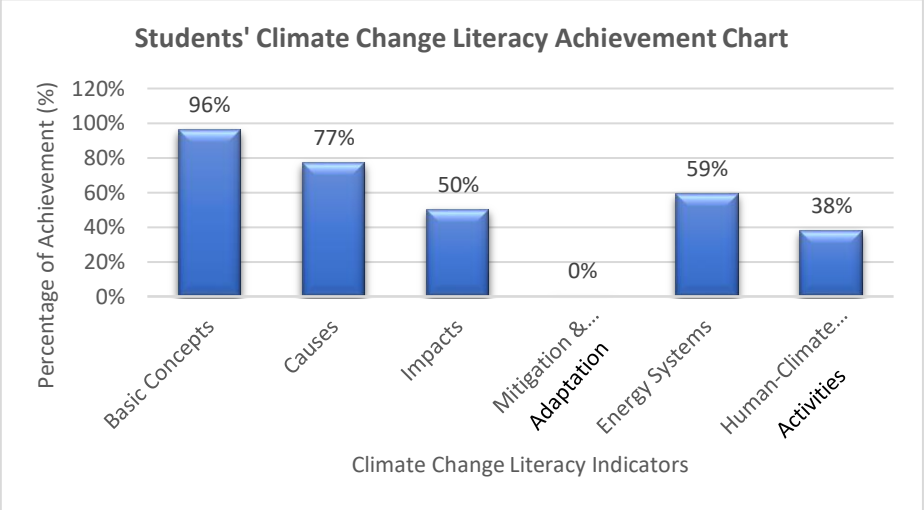


**Figure 1.** Percentage of Students' Climate Change Literacy (LPI) Achievement

Figure 1 shows students score higher in conceptual knowledge than in literacy skills that need real-world understanding and solution-oriented thinking. High scores in basic concepts and the causes of global warming indicate that current science teaching is effective at delivering factual and conceptual information on climate change. This aligns with the focus of school science programs, which often emphasize content mastery and basic understanding (UNESCO, 2017; Pertiwi & Ningsih, 2021).

However, the marked drop across indicators of climate change impacts, energy systems, and especially mitigation and adaptation shows clear gaps in students' climate change literacy. Low results in mitigation and adaptation mean students lack the evaluative and solution-oriented reasoning needed to address climate change. This pattern supports previous research: transmissive environmental education does not foster action competence because it fails to engage students in

critical thinking and problem-solving (Jensen, 2011; Rousell & Cutter-Mackenzie-Knowles, 2020; Yli-Panula et al., 2020).

The achievement differences in Figure 1 make it clear that students' climate change literacy is incomplete and fragmented. Students struggle to connect human activity to climate systems, showing that lessons have not yet linked scientific ideas to real-life and local issues. Recent research also finds that without relevant, reflective learning, students gain facts but not an understanding of real-world consequences (Hayat and Nugroho, 2022).

From an Education for Sustainable Development (ESD) perspective, the LPI achievement profile in the diagram shows that science learning does not yet include an action bridge. ESD stresses that sustainability literacy requires not just conceptual understanding but must also involve learning that fosters critical reflection, decision-making, and real-world action (UNESCO, 2020). This finding supports Hayat and Nugroho (2022), who state that ESD-based science learning must link scientific knowledge with students' action-oriented skills and their sense of responsibility for sustainability issues.

Overall, the LPI achievement diagram shows that students' climate change literacy remains mostly conceptual and lacks action competence. This highlights the need for contextual and action-oriented learning interventions, such as Project-Based Learning (PBL) and environmental action–based models, to bridge the gap between knowledge and real-world sustainability practices, as recommended by contemporary ESD studies (Jensen, 2011; Amin & Rahmawati, 2022; Hayat & Nugroho, 2022).

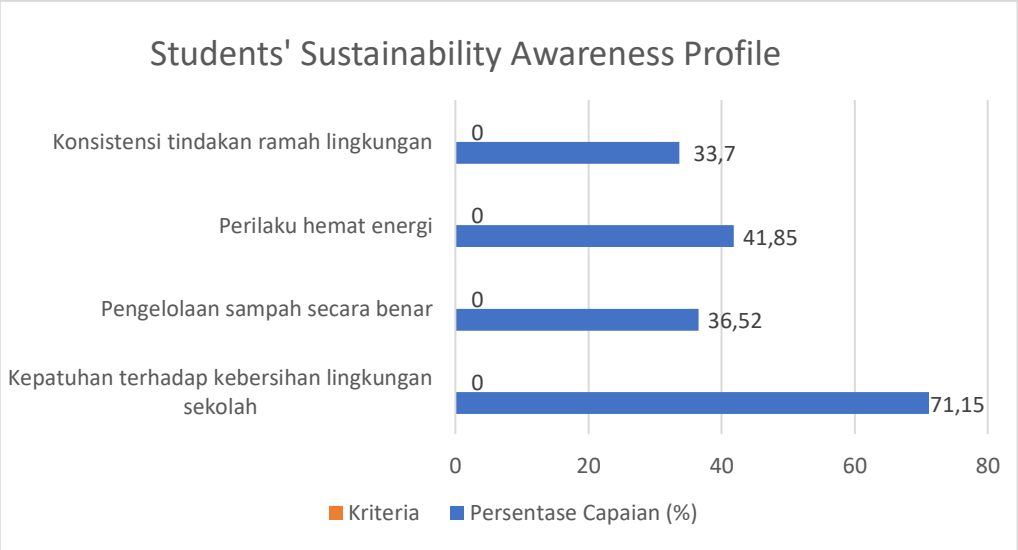


**Figure 2.** Percentage of Students' Sustainability Awareness Profile

Figure 2 shows a significant gap between students' compliance with school environmental norms and their consistent sustainable behaviors in daily life. Over 70% of students comply with school cleanliness norms, highlighting that externally regulated and monitored behaviors are

internalized more readily. This supports research indicating pro-environmental behaviors are stronger when reinforced by external rules and social controls (Kollmuss & Agyeman, 2002; Dimitrova et al., 2021; Hidayat et al., 2023).

By contrast, indicators of personal awareness, such as waste management, energy saving, and sustained environmentally friendly actions, have much lower achievement. This low performance indicates that most students' sustainability awareness has not developed into consistent habits, creating a gap between their knowledge and behavior (Kollmuss & Agyeman, 2002).

Low consistency in environmentally friendly actions signals that the main challenge in sustainability education is fostering long-term behavioral change—not just values or attitudes. Research indicates that without action-based learning, students often fail to build the competence needed to act consistently on environmental issues (Jensen, 2011).

From an Education for Sustainable Development (ESD) perspective, Figure 4 shows that current science education is not yet driving behavioral transformation. While ESD aims to connect knowledge, values, and actions through real-life learning (UNESCO et al., 2014), low scores on sustainability action indicators show that students still lack meaningful opportunities to experience, reflect on, and practice sustainable behaviors. These results are consistent with Hayat and Nugroho (2022), who stress that ESD-based science learning should bridge the awareness–action gap through project-based, hands-on activities. The findings reinforce the need for instructional interventions that help students develop both concern and consistency in sustainable behaviors as life skills.

## CONCLUSION

Students' mastery of basic knowledge is relatively strong. However, higher-order thinking skills and action competence remain low. As a result, sustainability knowledge and attitudes are not consistently shown in real-world actions. This finding shows that learning is still focused on knowledge transmission. It provides a foundation for developing action-based instructional models through further research using a research-and-development approach.

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