# Fostering Grade 9 Students Scientific Literacy and Environmental Awareness of Climate Change Through 7E Model Lesson Plan

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## Abstract

This action research study focuses on developing and evaluating a 7E model lesson plan for grade 9 students to enhance science literacy and environmental awareness of climate change. The research design employed a quasi-experimental approach with a one-group pretest and posttest design, involving 30 students from Ranao Institute for Science and Technology Preparatory School Inc. The study utilized a variety of statistical measures, including mean, frequency, percentage, and normalized gain, to assess the impact of the 7E model intervention. Findings indicate a significant improvement in students' conceptual understanding of climate change concepts, with a posttest average score of 10.6 and a normalized gain of 0.45. The implementation of the 7E model lesson plan demonstrated enhanced student engagement and interest in the topic, as reflected in the overall weighted mean of 3.421. Ethical considerations were carefully observed throughout the study, ensuring participant consent, privacy protection, and data confidentiality. The study concludes that the 7E model lesson plan effectively enhances students' comprehension of climate change concepts and fosters positive attitudes towards environmental stewardship and sustainability practices.

**Keywords**: Climate Change, 7E Lesson Plan, Science Literacy, Environmental Awareness

## 1. Introduction

Climate change refers to long-term changes in Earth's climate which significantly altering ecosystems and human societies connected to economic activity and consumption habits (Carol et. al., 2022). Climate change awareness and science literacy are crucial aspects in addressing the environmental challenges we face today. Climate literacy involves understanding the daily interactions with the environment and making informed decisions for sustainability (Julia et. al., 2023). Scientific literacy, particularly in relation to climate change, is essential for public support and collective action towards mitigation and adaptation (Rowena, 2023).

Climate change education involves teaching about climate change concepts, impacts, and mitigation strategies (Pardasani & Chew-Hung, 2022). The debate surrounding the inclusion of climate change in curricula continues, with a growing awareness of its significance. Climate change education should be transdisciplinary, engaging learners in discussions about climate change causes, implications, and necessary actions (Dianne, 2010; Luengam et.al., 2018). The education sector plays critical role in addressing climate change by preparing students to become informed and responsible citizens who can contribute to sustainable development. Therefore, the development of effective climate change education programs is crucial to promoting science literacy and environmental awareness among students.

The Philippines Republic Act No. 9512 Section 3, also known as the National Environmental Awareness and Education Act of 2008, has been encouraging the other institutions to participate in taking care of the environment. It consists of the responsibilities of citizens to value how to conserve, protect and restore natural resources and to attain sustainable development (Bedural, 2018; Chandran, Gunawardena, & Castro, 2017; Galang, 2010). Furthermore, Commission on Higher Education's (CHED), an agency to foresee tertiary education, set out the CHED Memorandum Order (CMO) No. 20, series of 2013. This document has revised the general education curriculum as well as the serious effort of the government consideration on the environment. The curriculum includes Natural Science (NS) courses specifically, Earth and Environmental Science. These courses were mandated to be included in teacher education programs aiming to open the future generation's mind about various issues and policies affecting the environment and several activities which possibly undertaken to address these matters. Additionally, the course National Service Training Program (NSTP) I and II were also included. It was designed to produce a civic-minded citizenry that can be an agent of change in the next generation (Commission on Higher Education, 2013).

The 7E lesson plan model is an inquiry-based and constructivist teaching framework designed to actively engage learners in the process of building their own understanding. It extends the traditional 5E model by adding two more phases, allowing for deeper conceptual development and stronger connections between new and prior knowledge. The seven stages are: Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. In practice, the teacher first elicits students' prior knowledge to uncover misconceptions, then engages them with thought-provoking questions or phenomena to spark curiosity. During the explore stage, learners carry out hands-on activities or investigations, which leads into the explain phase where they clarify and connect their observations to scientific concepts. The elaborate phase allows learners to apply the concept to new situations, while evaluate provides opportunities for both teachers and students to assess understanding. Finally, the extend phase encourages learners to apply knowledge beyond the classroom, making it relevant to real-life contexts (Vallespin, 2021).

Despite the growing awareness of climate change and its impacts, there is a gap in the literature regarding the development of effective climate change education programs using the 7E model lesson plans. The 7E model is a widely used teaching strategy that promotes active learning and inquiry-based instruction. However, its potential for

developing climate change education programs has not been explored in detail. Therefore, this study seeks to address this gap by investigating the effectiveness of 7E model lesson plans in promoting science literacy and environmental awareness among students.

## 2. Methods

The methodology section presents and explains the key procedures of the study, including the research design, respondents, research instrument, data collection, and data analysis.

### 2.1 Research Design

This study employed a quasi-experimental design using a one-group pretest–posttest approach. Before the intervention, a pretest was administered to determine students' initial understanding of climate change concepts. The intervention consisted of teaching the topic through a 7E Model lesson plan (Elicit, Engage, Explore, Explain, Elaborate, Evaluate, Extend). After the lessons, a posttest with the same structure as the pretest was given to measure improvement in students' comprehension.

To assess the effectiveness of the intervention, descriptive statistics such as mean, frequency, and percentage were used. The normalized gain (g) was also computed to determine the level of improvement between pretest and posttest results. In addition, students' participation and engagement during the lesson were evaluated through a Likert-scale questionnaire and an observation checklist, which provided insight into their level of involvement and interest.

### 2.2 Respondents of the Study

The respondents of this study were 30 Grade 9 students from one classroom at Ranao Institute for Science and Technology Preparatory School Inc. during the academic year 2023–2024. Permission to conduct the research was obtained from the school head prior to implementation. Among the participants, 11 were boys and 19 were girls. The students' ages ranged from 14 to 17 years old, which reflects the typical age of Grade 9 learners, with some variations due to differences in school entry age or grade repetition. All of the respondents were Muslims.

### 2.3 Data Collection

The data collection process followed the study's conceptual framework, which identified the 7E lesson plan as the independent variable (IV) and the students' achievement and engagement as the dependent variables (DV).

To measure achievement, the researchers used a standardized 15-item multiple-choice test developed by the Department of Education (DepEd) for Grade 9 Science. The test items covered fundamental climate change concepts such as the greenhouse effect, global warming, climatic phenomena (e.g., El Niño and La Niña), and human activities affecting climate. The pretest was administered before the implementation of the 7E lesson plan to determine the students' initial conceptual understanding of climate change. Following this, the intervention was carried out, during which the 7E Model lesson plan on climate change was taught over a lesson. After the intervention, the posttest was administered using the same 15-item test to measure improvements in students' knowledge and understanding of the topic.

In addition, a Likert-scale questionnaire was given after the lessons to assess students' level of engagement and participation. The survey included items on enjoyment of activities, participation, clarity of lesson delivery, teacher responsiveness, and personal interest in climate change. Responses were recorded on a four-point scale (Strongly Agree, Agree, Disagree, Strongly Disagree).

**2.4 Data Analysis**

The pretest and posttest scores from the achievement test were analyzed using descriptive statistics, specifically the mean, frequency, and percentage, to determine whether there was an improvement in students' conceptual understanding of climate change after the implementation of the 7E lesson plan. To strengthen the results, Normalized Gain were utilized to gather the gain score between the Pretest and Posttest.

The mean is a rough measure of the effectiveness of a course in promoting conceptual understanding. Hence, this was employed in the computation of the acquired information of the students through the achievement tests for Grade – 9 science students. On the other hand, the standard deviation is the statistical tool used to measure the consistency or the spreading out of the mean average scores. Here, the same is used to measure the consistency of the mean average scores of the students both in the Pretest and Posttest.

Table 1: Achievement Test Scores Range

| SCORE RANGE | PERCENTAGE | Description |
|---|---|---|
| 13-15 | 90 and above | Advance |
| 10-12 | 85 - 89 | Proficient |
| 6-9 | 80 - 84 | Approaching Proficiency |
| 1-5 | 75 - 79 | Developing |
| 0 | 74 and below | Beginning |

*Source: DepEd K-12 Grading System*

Table 1. shows the interpretation of the score range, percentage of the achievement test used in the instrument in the analysis of the study. This was based on the given grading system of the DepEd.

Table 2: Gain Score Range

| Normalized Gain Scores | Description |
|---|---|
| $0.71 < (g)$ | High |
| $0.31 < (g) < 0.70$ | Moderate |
| $(g) < 0.30$ | Low |

Table 2. shows the use of the Normalized Gain Scores to evaluate the progress and improvement of participants. The scores were categorized into three levels of interpretation. If the Normalized Gain Score exceeded 0.71, it was considered "High," indicating a significant level of improvement or learning achieved by the participants. Scores ranging from 0.31 to 0.70 were classified as "Moderate," suggesting a moderate level of improvement or learning demonstrated by the participants. On the other hand, scores below 0.30 were categorized as "Low," indicating a minimal level of improvement or learning exhibited by the participants. These categories provide a useful framework for assessing and classifying the level of improvement in learning obtained by the respondents.

*2.5 Research Framework*

The development of the 7E Lesson Plan Fostering Science Literacy and Environmental Awareness of Climate Change in grade nine level adapted the Input-Process-Output Model (IPO).
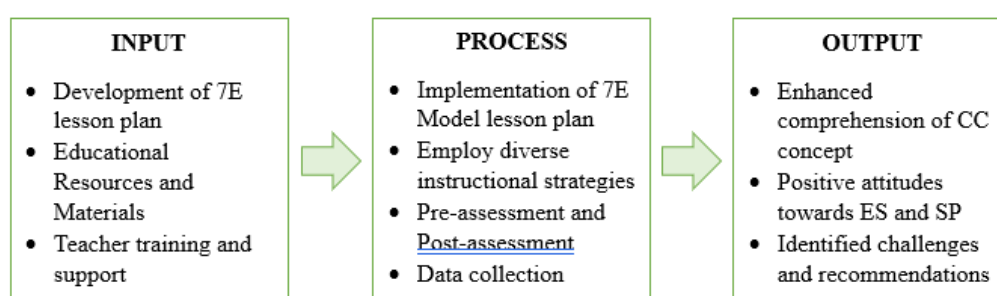
Figure 1. Steps in the Development of 7E Model Lesson Plan on Climate Change

## 3. Result

### 3.1 Development of 7E Lesson Plan for Grade 9 Fostering Science Literacy and Environmental Awareness on Climate Change

The need to develop a 7E Model Lesson Plan Fostering Science Literacy and Environmental Awareness on Climate Change for grade nine students was assessed through reviewing studies related to climate change literacy and adapt a DepEd modular lesson in Science 9.

#### 3.1.1 Initiation Phase

This covers the selection of topic, formulation of learning objectives, and planning and preparation of assessment tools.

#### 3.1.2 Identification of the Topic

Climate Change is part of K-12 framework in Grade 9 level of Science Curriculum within 3rd Quarter. Climate change is rapidly becoming a cornerstone of K-12 curriculums. This critical issue holds immense importance for our planet's future, and equipping younger generations with knowledge empowers them to become responsible citizens and stewards of the environment. The interdisciplinary nature of climate change allows it to be woven into various subjects, fostering a well-rounded understanding. By integrating climate change education, we can not only educate students on the science and impacts, but also inspire them to become part of the solution.

#### 3.1.3 Development Phase

The lesson plan was designed around the topic "Understanding Climatic Phenomena on a Global Level."

| Topic | Understanding Climatic Phenomena on a Global Level | |
|---|---|---|
| **Grade Level** | **9** | |
| Learning Competencies and Objectives | | |
| At the end of the lesson, the students are expected to: 1. Understand factors that affect climate, and the effects of changing climate and how to adapt accordingly 2. Analyze the impact of climatic phenomena on the environment and human beings. 3. Develop an awareness of personal contributions to reducing the negative effects of global warming. | | |
| ELICIT (5 minutes) | | Materials/Assessment Tools |

| | |
|---|---|
| • The teacher begins the lesson by conducting a whole-class brainstorming activity. Students are invited to share what they already know about climatic phenomena on a global scale<br>• Encourage students to discuss any personal experiences or observations related to climate change.<br><br>Key Question:<br>1. What comes to your mind when you hear the term "climate change"?<br>2. Can you share any personal experiences or observations related to changes in weather patterns?<br>3. How do you think human activities impact the environment and contribute to global warming? | Materials: Manila paper or whiteboard/blackboard, markers, and sticky notes for students to record their ideas.<br><br>Procedure: Students' responses are written on the board or posted on the paper to create a concept map of prior knowledge. |

| ENGAGE (10 Minutes) | Materials/Assessment Tools |
|---|---|
| • Display the images related to climatic phenomena (forest fire, drought, etc.).<br><br><br><br>Key Question:<br>1. What do you notice in the images related to climatic phenomena?<br>2. How do these images make you feel about the impact of climate change on the environment?<br>3. Can you identify any patterns or trends in the images that suggest changes in weather patterns? | • Materials: Projector or printed images of climatic phenomena (forest fire, drought, flood, melting glaciers, typhoons, etc.).<br>• Procedure:<br>1. The teacher presents the images one by one.<br><br>2. Students are asked to share their observations and feelings about the environmental situations shown.<br><br>3. A short discussion follows, connecting students' responses to their everyday experiences. |

| EXPLORE (15 Minutes) | Materials/Assessment Tools |
|---|---|
| • Students participate in a hands-on simulation to observe how changes in environmental conditions affect climate-related outcomes. This activity allows them to connect scientific concepts to real-world scenarios.<br>• Procedure:<br>1. Place a thermometer inside each bottle/jar.<br>2. Leave one bottle open (control) and cover the other tightly with plastic wrap (greenhouse condition).<br>3. Position both bottles under the lamp or in direct sunlight for 10 minutes.<br>4. Record the temperature in each bottle at the start and at the end of the activity.<br><br>5. Students compare the results and discuss what they observed.<br>Key Question:<br>1. What changes do you observe in the climate change simulation activity?<br>2. How do these changes in the simulation reflect real-world scenarios of climate change?<br>3. What factors do you think are contributing to the observed effects in the simulation? | Materials:<br>• Two clear plastic bottles or jars<br>• Two thermometers<br>• Plastic wrap or transparent cover<br>• Rubber band or tape<br>• Lamp or flashlight (to act as sunlight) |

| EXPLAIN (10 Minutes) | Materials/Assessment Tools |
|---|---|
| • Present a multimedia presentation or video explaining the causes and effects of climatic phenomena on a global level.<br>• Highlight key terms and concepts related to climate change and its impact on the environment.<br><br>Key Question:<br>1. How do the concepts of greenhouse effect, global warming, and climate change interrelate and contribute to environmental changes?<br>2. What are the primary factors driving climate change on a global scale, and how do they impact ecosystems and human populations?<br>3. In what ways do El Niño and La Niña events influence weather patterns and climatic conditions around the world?<br>4. How can human activities mitigate the effects of global warming and climate change on the environment? | • Pictures<br>• Videos<br>• Projector |
| ELABORATE (10 Minutes) | Materials/Assessment Tools |
| • Group Discussion - Solutions to Climate Change (10 minutes):<br>• Divide students into groups and assign each group a specific aspect of climate change to focus on (e.g., deforestation, greenhouse gases).<br>• Ask students to brainstorm and discuss possible solutions to address the challenges posed by their assigned aspect of climate change.<br><br>Key Question:<br>1. In what ways can individuals, communities, and governments work together to mitigate the effects of climate change and promote sustainable practices for a more resilient future?<br>2. How do scientific research, data analysis, and modeling help us understand the complexities of climate change and make informed decisions to address environmental challenges?<br>3. What ethical considerations should be taken into account when discussing climate change, especially in terms of social justice, equity, and the responsibilities of developed and developing nations? | Materials Needed:<br><br>• Manila paper or chart paper<br>• Markers or pens<br>• Sticky notes (optional for brainstorming) |
| EVALUATE (5 Minutes) | Materials/Assessment Tools |
| • Quiz on Climatic Phenomena (5 minutes):<br>• Administer a short quiz to assess students' comprehension of the key concepts discussed during the lesson.<br>• Include multiple-choice and short-answer questions to gauge different levels of understanding. | • Printed quiz sheet |
| EXTEND | Materials/Assessment Tools |
| • Homework Assignment - Climate Change Action Plan<br>• Assign students to create a climate change action plan outlining steps they can take in their daily lives to contribute to mitigating climate change. | • Notebook or bond paper (for individual students)<br>• Pen/pencil<br>• (Optional) Illustration materials like colored pens, markers, or images if the teacher wants students to present their action plan in a creative format (poster, infographic, or journal entry). |

*3.1.4 Evaluation Phase*

The developed 7E Model lesson plan was subjected to face validation by a licensed science teacher with teaching experience in the Junior High School Science curriculum. The evaluator reviewed the lesson plan using a structured evaluation form that focused on content accuracy, alignment with learning competencies, clarity of objectives, appropriateness of activities, integration of materials, and suitability for Grade 9 learners.

Based on the evaluation, the teacher recommended several improvements to ensure that the objectives were fully met. These included refining the wording of the learning objectives to make them more measurable, adding clearer instructions for group activities, and specifying the materials needed for the simulation activity in the Explore phase. The feedback was incorporated into the final version of the lesson plan before classroom implementation.

**3.2 Pre-Test and Posttest Assessment**

This part explains the results of the gathered data, the recommendation of the teacher that evaluated the module about climate change, and the student collaboration, engagement and interest from the Pre-test to the Posttest.

Table 4: Mean Score of the Learners Achievement Test

| Average Score | Mean | Description |
|---|---|---|
| Pretest | 8 | Low |
| Posttest | 10.6 | moderate |

Note:
    0.0-4.9 – The learners' achievement is categorized as very low.
    5.0-9.9 – The learners' achievement is categorized as low.
    10.0 - 13.99 – The learners' achievement is categorized as moderate.
    14.0-19.9 – The learners' achievement is categorized as high.
    20.0 - The learners' achievement is categorized as excellent.

Table 4 shows that the pretest mean score of eight (8), with the verbal interpretation of "Low," suggests that the students had a limited level of understanding of the topic being assessed. This indicates that their performance on the pretest was below the expected proficiency level.

However, the posttest average score of 10.6, with the verbal interpretation of "Moderate," indicates that the students' performance improved after the intervention. Their scores were higher than the average or expected level, indicating a commendable improvement in their understanding and knowledge of the subject.

Overall, these results suggest that the teaching intervention or instructional period had a positive impact on the students' learning outcomes. Their performance improved from a poor level in the pretest to an above-average level in the posttest. This indicates that the teaching methods or interventions employed were effective in enhancing the students' understanding and proficiency in the assessed topic.

Table 5: Frequency and Percentage Distribution of the Respondents' Achievement Test

| Range Score | Pre-Test | | Posttest | | Descriptions |
|---|---|---|---|---|---|
| | frequency | Percentage | frequency | Percentage | |
| 13-15 | 0 | 0 | 18 | 60 | Advance |
| 10-12 | 6 | 20 | 8 | 27 | Proficient |
| 6-9 | 12 | 40 | 4 | 13 | Approaching |
| 1-5 | 12 | 40 | 0 | 0 | Developing |
| 0 | 0 | 0 | 0 | 0 | |

Scaling:
    13-15 – Advance level of achievement
    10-12 – Proficient level of achievement.
    6-9 – Approaching Proficiency level of achievement.
    1-5 – Developing level of achievement.
    0 - Beginning level of achievement.

Table 5 presents the frequency and percentage distribution of the respondents' accomplishment test results for both the pre-test and post-test, along with their corresponding descriptions.

Table 6: Mean Gain Score of the Respondents' Achievement Test

| | Mean Score | Normalized Gain | Description |
|---|---|---|---|
| Pretest | 8 | 0.45 | Moderate |
| Posttest | 10.6 | | |

Table 6 shows that the pretest means score 8 indicates the average score achieved by the Grade 9 students before the implementation of the teaching intervention. On the other hand, the posttest mean score of 10.6 reflects the average score obtained by the students after they received instruction using the Developing 7E Model Lesson Plan for Science Literacy and Environmental Awareness. The normalized gain of 0.45 suggests that there has been a moderate improvement in student performance from the pretest to the posttest. This improvement indicates that the teaching intervention using the 7E Model Approach was effective in enhancing the students' understanding and knowledge about science literacy and environmental awareness. It is important to note that the qualitative description of "Moderate" further reinforces the notion that the teaching intervention had a noticeable impact on the students' learning outcomes. While the gain is not extremely high, it still represents a significant improvement in student performance. These results suggest that the implementation of the 7E Model Lesson Plan for Science Literacy and Environmental Awareness.   to Grade 9 students has the potential to enhance their understanding and academic achievement in this subject area.
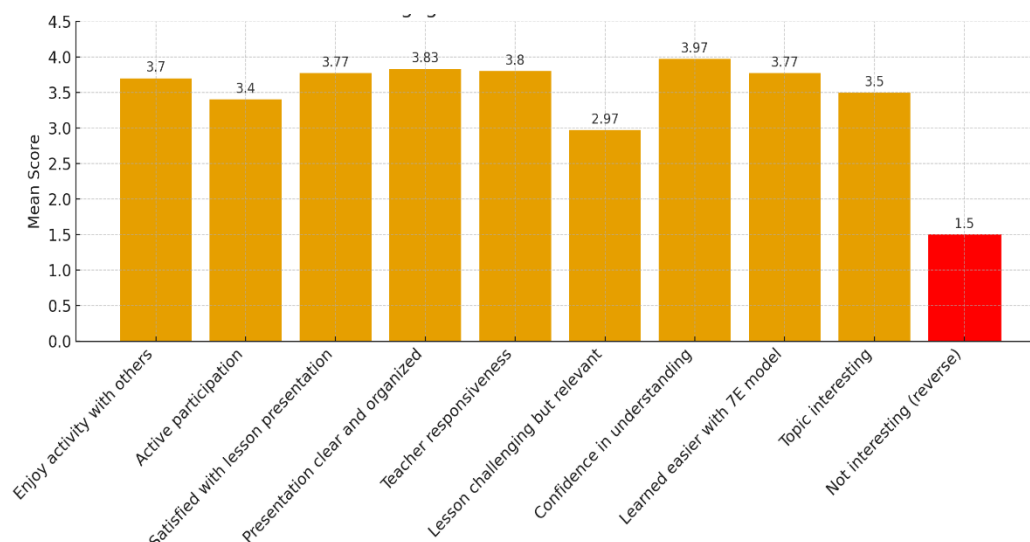
*3.2.1 Student's Engagement and Interest*



Figure 2. Students' Engagement and Interest in the 7E Lesson Plan

Table 7: Students' Engagement and Interest in the 7E Lesson Plan

| Indicators | Mean | Rank | Description |
|---|---|---|---|
| I really enjoy the activity with other students. | 3.70 | 5 | Strongly Agree |
| I actively participated in the activities and task. | 3.40 | 7 | Strongly Agree |
| I am satisfied how does the lesson was presented. | 3.77 | 4 | Strongly Agree |
| I find the presentation of the topic organize and clear. | 3.83 | 2 | Strongly Agree |
| I find my teacher responsive in our inquires. | 3.80 | 3 | Strongly Agree |
| I find the lesson challenging but relevance topic. | 2.97 | 1 | Strongly Agree |
| I am confident in my understanding on the topic climate change | 3.97 | 1 | Strongly Agree |
| I've learned the lesson easier by the used of 7E Model presented by our teacher. | 3.77 | 4 | Strongly Agree |
| I find the topic interesting and I am trying to obtain more information. | 3.50 | 6 | Strongly Agree |
| I do not find the lesson very interesting so I keep my self-work minimum. | 1.50 | 8 | Strongly Disagree |
| Overall Mean | 3.421 | | Strongly Agree |

Scaling: Strongly agree - 3.41-4.20
    Agree - 2.61-3.40
    Disagree - 1.81-2.60
    Strongly Disagree - 1.00-1.80

The results of the student engagement survey yielded an overall mean of 3.421, interpreted as "Strongly Agree." This indicates that students responded positively to the use of the 7E Model lesson plan, particularly in terms of active participation, interest, and

interaction during class activities. The findings suggest that the 7E Model enhanced students' comprehension of climate change concepts by providing structured opportunities for them to recall prior knowledge (Elicit), engage with real-world images (Engage), conduct hands-on simulations (Explore), and apply concepts through group discussions (Elaborate). Such activities enabled students to construct meaning rather than passively receive information, which aligns with the principles of constructivist learning theory.

The improvement in students' test performance provides further evidence of this impact. The pretest mean score of 8.0 (Low) increased to a posttest mean score of 10.6 (Moderate), with a normalized gain of 0.45 (Moderate improvement). This indicates that students not only enjoyed and participated in the activities but also demonstrated measurable gains in their conceptual understanding.

These findings are consistent with earlier studies, according to Rahman and Chavhan (2022) reported that the 7E model promotes deeper comprehension because students actively construct knowledge through inquiry and discussion. Similarly, Anisah, Sulastri, and Syukri (2020) found that the 7E approach improves motivation, which in turn leads to better academic performance.

Taken together, the survey results, test score improvements, and literature support confirm that the 7E Model is effective in enhancing students' comprehension of climate change concepts by making learning more interactive, engaging, and student-centered.

## 5. Conclusion

In conclusion, the study on developing and evaluating a 7E model lesson plan for grade 9 students has demonstrated significant improvements in students' comprehension of climate change concepts and their attitudes towards environmental stewardship and sustainability practices. Through the implementation of the 7E model, students showed enhanced engagement and interest in learning about climate change, as evidenced by the positive posttest results and normalized gain. The structured framework of the 7E model effectively promoted science literacy and environmental awareness among the participants, highlighting the importance of innovative teaching methodologies in addressing complex challenges like climate change. The study's findings underscore the potential of tailored lesson plans to empower students with the knowledge, skills, and attitudes necessary to contribute meaningfully to environmental advocacy and sustainable practices, thus fostering a more informed and proactive generation capable of addressing pressing global issues.

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