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Development and Validation of Climate Change Education Module for Grade 6: Educational Approach for Sustainable Development

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Abstract

This study aimed to develop and validate a Climate Change Education Module for Grade 6. A self-learning module, composed of three (3) lessons namely: Greenhouse Effect and Global Warming, Climate Change as a Problem, and Climate Change Mitigation and Adaptation is the main output of this study. The module was evaluated by Grade 6 Science teachers and expert evaluators and got positive evaluation in the six (6) dimensions; Pedagogical, Language, Layout and Format, Content Validity, Sufficiency, and Usability. Validated module was tested through two-group pretest and posttest design utilized to 30 pupil respondents as experimental group and 28 pupil-respondents in the control group. Pupil-respondent are from Gonzaga North Central School, Gonzaga West District. The developed module was effective, valid, and accepted as an additional learning resource in Climate Change Education in elementary level and is suitable and appropriate to Grade 6 level to master the climate change-related competencies. Recommendations were along utilization of the module as a learning material and encouraging science teachers, educational technologists, and climate change experts to provide continuous feedback for enhancement and updating of relevant information in Climate Change Education learning resources in elementary level as well as providing capacity-building for teachers and stakeholders on Climate Change Education for Sustainable Development as part of Disaster Risk Reduction and Management Program in schools.

Keywords: *Grade 6 learners, Development and Validation, Climate Change Education, Sustainable Development, Greenhouse Effect and Global Warming, Climate Change as a Problem, Mitigation and Adaptation*

INTRODUCTION

The environment, human health, food security, and general quality of life are all significantly impacted by the worldwide phenomenon known as climate change. Recognizing its urgency, education

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sector has already integrated climate change in the curriculum to help young learners to start contributing and be responsible to take action.

Climate Change has been integrated to the K-12 curriculum in the Philippines by the Department of Education (DepEd), especially in subjects like science and Araling Panlipunan. Grade 6 learners are intended to understand concepts like climate change as contemporary issue, weather patterns, environmental protection through proper waste management, environmental laws, effects and ways to prevent hazards brought by animal raising, alternative sources of income, and other scientific practices.

According to studies, exposure to environmental education boost the interest of young learners in embracing pro-environmental attitudes and sustainable practices. But even though climate change is covered in the curriculum, still, many grade 6 learners find it difficult to understand the basic scientific ideas along with climate change.

Grade 6 learners are in the critical stage of growth. They begin establishing their lifelong habits, values, and attitudes at this age of their lives. They are cognitively prepared to learn cause and effect and they may also begin to connect their experiences to real-world problems. When they are taught about climate change, they will grasp important concepts on causes, effects, and what they can do to help. Teaching them this environmental issue is not just a lesson meant to be learned but a way to shape them as *Makakalikasan*, and prepare them for their future and generations that will follow.

"Educational materials for climate change education are very important in building resilient people and community. These must equip individuals with information about the risks, and the actions in order to mitigate its effects. These resources must be accessible and practical so that we can strengthen their ability to adapt in environmental challenges." Mr. Benny Fred G. Sandi, head of the Municipal Environment and Natural Resources Office (MENRO). He believes that Climate change education materials are necessary for helping people and communities get a grasp on the environmental issues we are dealing with, because when people are informed, they can make better choices.

Integration of these climate change education competencies in grade 6 across learning areas and the Homeroom Guidance Program of DepEd through a self-learning module highlights the awareness on basic concepts, cooperation and participation, sustainable development, and environmental responsibility among learners.

The researcher believes that moving forward with conservation and environmental protection initiatives is vital, but so is providing information to young learners for why our planet is in the way it is. In this regard, this material aimed to give learners, as early as Grade 6, knowledge that enable them make decisions to address one of the biggest problems facing humanity and promote a sustainable and healthier planet.

The study sought answers to address the following questions:

1. What are the challenges of the teachers and learners in Climate Change Education?
2. What are the features of the Climate Change Education Module to be developed based on the feed forward from the following?
    a. Teachers
    b. Learners
    c. Climate Change Experts
3. What is the assessment of the expert evaluators on the developed Climate Change Education Module in terms of the following factors?
    a. Learning Competencies (LCs)
    b. Instructional Design and Organization
    c. Instructional Quality of Text and Visuals
    d. Readability
    e. Assessment
    f. Intellectual Property Rights Compliance
4. What is the performance of the learners in the control and experimental group?

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a. Climate Change Education Module Lesson 1: Greenhouse Effect and Global Warming
b. Climate Change Education Module Lesson 2: Climate Change as a Problem
c. Climate Change Education Module Lesson 3: Climate Change Mitigation and Adaptation

5. Is there a significant difference between the control and experimental groups?
   a. Pre-test and post test scores
   b. Gain scores
6. What Climate Change Education module exemplar can be proposed for Implementation among Grade 6 Learners?

METHODOLOGY

The descriptive analytical design was used to validate the content, pedagogical aspect, sufficiency, and usability of the Climate Change Education Module, which was validated by Grade 6 science teachers, members of District Quality Assurance team, Professors, and environmentalists. The content, pedagogical aspect, sufficiency, and usability were assessed, and evaluation tools solicited remarks and recommendations to enhance the developed module. This study used quantitative research design. To evaluate the Climate Change Education Module, two group pre-test posttest design was applied.

The study was conducted at Gonzaga North Central School in the Fourth Quarter of the School Year 2024-2025. Gonzaga North Central School is among the big schools in Gonzaga West District located in the Poblacion, Barangay Paradise, Gonzaga, Cagayan which caters to majority of learners from Barangay Paradise and Barangay Progressive.

A total of wenty-seven (27) evaluators evaluated the proposed module. Evaluators are Grade 6 science teachers, members of District Quality Assurance team, professors with specialization in Science and Environmentalists. The breakdown is shown in the Table 1.

Table 1. List and Distribution of Evaluators

Evaluators	**Total**
Grade 6 Science Teachers	20
District Level Quality Assurance Team	5
Environmentalists	2
Total	27

There are thirty (30) Grade 6 learners who served as pupil-respondents in the study which are from Gonzaga North Central School in Gonzaga West District. All pupil-respondents met the appropriate grade level age requirement, and not listed as transferee after the beginning of second quarter for school year 2024-2025. The study was conducted during the academic school year 2024-2025 from March 2025 to April 2025. There are five (5) instruments that the researcher used to gather necessary data.

The first instrument was developed Climate Change Education Module for Grade 6 with pretest and post-test, which assessed the learners' prior knowledge and abilities on the greenhouse effect, global warming, climate change as a problem, adaptability, and mitigation. Each test is composed of ten (10) items. The module was an engaging and interactive tool designed to help learners understand the environmental challenges leading to climate change and actionable solutions. Through hands-on activities and multimedia resources, learners learned all about greenhouse effect and global warming, climate change as a problem, and adaptation and mitigation towards climate change.

The second instrument was evaluation checklist for pedagogical alignment in the aspects of content, language, and technical which is used as the Standard Evaluation Tool of Department of Education Developed Learning Resources.

Third was Edreports 2020 Science Quality Instructional Materials Tool which was directly used for usability test.

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Fourth was Evaluation checklist by UNESCO and University of South Africa, Institute for Adult Basic Education that was directly used for sufficiency test.

Lastly, the module's content validity was checked using an evaluation tool directly adopted from the study of Roebianto et. al. (2023) in the field of psychological research.

Descriptive statistics such as frequencies, percentages, means and standard deviations were used to quantify and describe the variables involved in this study, particularly the performances of the grade 6 pupils in the pre-tests and post-tests.

For pedagogical (content, language, layout and format) and sufficiency of the developed module, dichotomous question (Yes or No) was asked. Frequency, percentages, and weighted mean limits were used to analyze and interpret.

On the other hand, content validity as to relevance and clarity was analyzed using the following Likert scales and weighted means interpreted as follows:

A. Relevance

Scale	Statistical Limits	Descriptive Value
1	1.00 – 1.75	Not relevant
2	1.76 – 2.50	Major Revision
3	2.51 – 3.25	Minor Revision
4	3.26 – 4.00	Relevant

B. Clarity

Scale	Statistical Limits	Descriptive Value
1	1.00 – 1.75	Not clear
2	1.76 – 2.50	Major Revision
3	2.51 – 3.25	Minor Revision
4	3.26 – 4.00	Clear

For the usability test, the researcher used a rating scale for each criterion to examine the data collected from the usability test. The ratings were then added up to determine the final score or total earned, along with the following interpretation.

The effectiveness of the module was quantified through comparison test between the pre-tests and post-tests scores of the Grade 6 pupils. Paired samples t-test was used for this purpose. The hypotheses were tested at 0.05 level of significance.

Design to Facilitate Teacher Learning (3.1) and Assessment Design and Supports (3.4):	
	Meets expectations (10-12 points)
	Partially meets expectations (6-9 points)
	Does not meet expectations (<6 points)

Support for All Students (3.2):	
	Meets expectations (14-16 points)
	Partially meets expectations (9-13 points)
	Does not meet expectations (<9 points)

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Documentation of Design and Usability (3.3):	
	Meets expectations (16-19 points)
	Partially meets expectations (10-15 points)
	Does not meet expectations (<10 points)

Final Score:	
	Meets expectations (50-59 points)
	Partially meets expectations (31-49 points)
	Does not meet expectations (<31 points)

RESULTS AND DISCUSSION

Challenges of the Teachers and Learners in Climate Change Education

Challenges in Climate Change Education Among Teachers

Based from the conducted interviews as to challenges faced in the implementation of Climate Change Education, majority of the teachers pointed out "the need to develop age-appropriate and content relatable to young learners", as mentioned by five (5) teacher-respondents interviewed. This is followed by "the need for localized and engaging instructional science materials", as mentioned by 4 teacher-respondents. And other challenges mentioned are; young learners are more responsive to visual, auditory, and interactive content than to traditional text-based instruction mentioned by 3 teacher-respondents; young learners struggle with abstract scientific concepts; and limited participation of families and communities in raising environmental awareness.

This aligns with the study of Regio and Uri (2023) and Vasquez (2021) stating that there are still difficulties in teaching climate change, such as the need of up-to-date information and resources for learners and presenting contextualized environmental issues. Consistent with study by Sweller (2010) suggesting the importance of limiting complex ideas into smaller sub-topics to avoid confusion. Instructional materials developed in a way that optimize students' cognitive processing abilities in such academic subjects like science is necessary. Resources with simple layouts and design help students understand challenging tasks and encourage their interest in scientific methods.

On the part of the learners, five (5) learners interviewed stated that they "prefer visual, auditory, and interactive content than to traditional text-based instruction". This is followed by the notion that the problem is too complex for their age, while the least mentioned challenge is "having little or no background in climate change". This confirms the conclusion drawn by Ramdani et al (2024), that scientific concepts need multiple representations, and interactive multimedia, which will greatly enhance learners' understanding of scientific concepts.

Feed Forward Information on the Features of a Climate Change Education Module for Grade 6

Feed Forward Information from Teachers

Ten teachers, ten learners and 5 climate change experts were requested to give suggestions and recommendation on the features of a Climate Change Education for Grade 6 as feed forward information for the improvement of the module. From the teachers, the most-mentioned suggestion is that the content

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of the module should be appropriate to the age, reading level and comprehension level of the learners. Other suggestions are the use of localized and relatable examples, colorful illustrations and visuals, and performance tasks.

Feed Forward Information from Learners

Out of the 10 learners, 60% suggested that the module should have pictures or illustrations, 20% suggested that it should be easy to understand, with engaging activities, while 20% also suggested that it should contain experiments and examples. The consolidated suggestions from the learners are supported by the findings of Sutrisno et al (2024) where benefits of integrating multimodal literacy increase understanding, promote critical thinking, and student participation. Multi modal literacy skills are also important in science, as it requires learners to evaluate and analyze across a range of modalities, such as digital technology and others.

Feed Forward Information from Experts

The experts focus more on the technical aspect of the module, that it should contain the causes, effects, mitigation and adaptation strategies, supports inquiry-based learning, project-based learning, with contents that are accurate and relevant to local context, the use of illustrations, diagrams, charts and videos to simplify complex topics and terms, and inclusion of hands-on activities for the cognitive, affective and psychomotor domains of development of learners.

Responses of the experts were mentioned in the discussion of Glavic (2022) on the twelve major concern of Education for Sustainable Development particularly in ESD scope, ESD cooperation, Environmental Pillar, Social Pillar, ESD methodologies and others.

As to design, responses aligned to the claims of Ainsworth (2006), which highlights the values of these elements into science instruction. Well-designed visuals can help students better comprehend complex scientific concepts. Effective and relevant layout and format are important to communicate subject in a coherent and understandable way.

Assessment of the Expert Evaluators on the Developed Climate Change Education Module along its Compliance to Instructional Material Development Standards

Table 4 displays the assessment of expert evaluators on the developed Climate Change Education Module along its compliance to instructional materials development standards along pedagogical dimension. Evaluators evaluated the developed module in six (6) aspects namely; Learning Competencies (LCs), Instructional Design and Organization, Instructional Quality of Text and Visuals, Assessment, Readability, and Intellectual Property Rights Compliance.

The Learning Competencies of the module was evaluated based on the coverage of targeted learning competencies and development of the learning competencies by the learning resource. The overall Criterion Mean is 1.00, signifying compliance, and each standard obtained a Weighted Mean of 1.00, which achieved descriptive value of "Compliant." The findings show that the learning resource developed learning competencies for the quarter or learning strand, meeting the necessary standards. This means that the educational objectives established by the curriculum developers have been successfully reflected in the reviewed materials. The competencies are aligned, however, it needs to be enhanced and contextualized to be appropriate to the present situation of the learners' environment. In support of this, Polikoff Porter (2014) adds that instructional alignment enhances learning effectiveness by assuring that the materials closely aligned to the intended outcomes.

Instructional Design and Organization of the module was evaluated based on ten (10) specific standards such as inclusion of motivational techniques, diversity in tasks and evaluations, alignment with learning competencies, and the development of higher-order thinking abilities. The module was evaluated as "compliant" across all indicators which reflects full compliance to Instructional design and organization

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standards. Supporting this idea, Reigeluth (2013) stated that effective instructional design ensures modules that are goal-oriented, learner-centered, and based on behavioral and cognitive theories. Instructional design is the systematic process of transforming general concepts for teaching and learning into designs for educational materials and activities.

Instructional Quality of text and visuals was also evaluated based on four (4) key standards. Each item received the weighted Mean of 1.00 and descriptive Value of "Compliant". The overall Criterion Mean is 1.00 which means that all standards for Instructional Quality of text and visuals were fully met. This implies that the module is considered visually appealing, interactive, and narrative-based, which is more effective with learners especially those at the elementary level. In like manner, Mayer's (n.d.) Cognitive Theory of Multimedia Learning states that when students are exposed to both text and images instead of just text, they are better equipped to process knowledge. Instructional resources should have supplementary words and images to decrease cognitive overload, and boost memory retention.

The module's readability and quality of assessment standards was assessed by evaluators based on seven (7) key standards. Areas evaluated include accordance of assessments, differentiated types and formats, clear directions, rubrics, and learner engagement, and accuracy of answer keys. Every indicator received a weighted mean of 1.00 and the criterion mean is likewise 1.00. This means that the developed module is considered "Compliant". This implies complete adherence to all assessment and readability requirements of a learning resource. Supporting this idea, according to Snow (2010), readability of educational resources has an effect on learners' comprehension, retention, and application. Educational resources must be designed to learners' reading levels and prior knowledge in order to foster meaningful comprehension. complicated materials may confuse students, while too-simple texts may bore them or fail to stimulate their higher order thinking skills. Educational resources must be guided with the cognitive, linguistic, and experiential levels of the learners in order for learning to be effective.

The assessment part of the developed module was evaluated in five (5) specified standards. This area assessed how well the language, length, structure, and questions of the learning material is designed for its target users' level of comprehension. All the indicators got a weighted mean of 1.00 and criterion mean of 1.00, which means the developed module is "compliant". This implies that the developed module's language, length, structure, and instructions are clear and suited to Grade 6 learners. Reflecting similar results, Hattie & Timperley (2007) emphasized that formative assessment to significantly affect students' learning when incorporated into teaching and learning process. Formative assessments, including as quizzes, reflections, peer reviews, and self-assessments, help students identify where they are in their understanding and what they need to do to improve. Besides, feedback from formative assessments that are rapid, focused, and actionable is the most effective

Lastly, the intellectual property rights compliance of the developed module was assessed by three (3) standards set. Areas assessed pertains to plagiarism and copyright infringement, proper citation, and prescribed citation format. Developed module received weighted mean of 1.00 with a descriptive value of "compliant" in all three (3) indicators. The criterion mean is 1.00. This means that the developed module has full compliance to the intellectual property rights. This implies that the learning resource can be distributed and used legally. Securing Intellectual Property Rights (IPR) compliance in education has been necessary as digital information and open educational resources are now more accessible. It is the legal protections afforded to writers, artists, and educators for their authorships and creative works (World Intellectual Property Organization [WIPO], 2020). It ensures that writers as well as content producers are protecting educational institutions from plagiarism and copyright violations.

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Table 4a. Weighted means and compliance of the Climate Change Education Module along pedagogical dimension standards

Standards	Weighted Mean	Descriptive Value
Learning competencies		
1. The LT covered the targeted Learning Competencies (LCs) intended for the quarter/learning strand.	1.00	Compliant
2. The LR sufficiently developed the learning competencies (LCs) intended for the quarter/learning strand.	1.00	Compliant
Criterion mean	***1.00***	***Compliant***
Instructional design and organization		
1. LR has learning objectives that are anchored on the LCs.	1.00	Compliant
2. LR uses a variety (at least 3) of self-directed techniques, learning tasks, and formative assessments.	1.00	Compliant
2. LR has content that is logically developed or organized, i.e., lessons/activities are arranged from simple to complex, from observable to abstract.	1.00	Compliant
3. LR contains essential instructional design elements that contribute to the achievement of the learning objectives.	1.00	Compliant
4. LR allows for review, comparison, and integration with previous lessons (if applicable).	1.00	Compliant
5. LRLR uses various motivational strategies (i.e., advance organizers, puzzles, games) to hook the target user's interest and engagement.	1.00	Compliant
6. LR uses process questions and activities which require different levels of cognitive domain to achieve desired learning outcomes.	1.00	Compliant
7. LR has written and performance tasks that are differentiated based on target user's multiple intelligence, learning styles, and readiness levels.	1.00	Compliant
8. LR develops 21st century skills and higher order cognition.	1.00	Compliant
9. LR integrates desirable values and traits.	1.00	Compliant
Criterion mean	***1.00***	***Compliant***
Instructional quality of text and visuals		
1. All contents in the LR are accurate.	1.00	Compliant

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2. The LR is free from any social content violations.	1.00	Compliant
3. The LR is free from factual errors.	1.00	Compliant
4. The LR is free from computational errors (if applicable)	1.00	Compliant
Criterion mean	***1.00***	***Compliant***
Readability		
1. The LR provides sufficient assessment activities that will help the learner track his/her progress and mastery of the target competencies.	1.00	Compliant
2. LR has assessments that are aligned with the specific objectives and contents.	1.00	Compliant
3. The LR provides variety of assessment types.	1.00	Compliant
4. The LR provides variety of assessments that have clear demonstrations/example, instructions, and/or rubrics to serve as guide on how these will be used.	1.00	Compliant
5. The LR has assessment activities that ensure active engagement of the learners.	1.00	Compliant
6. The LR has answer keys that provides exact answers for objective-type assessments and discussion points for non-objective types.	1.00	Compliant
7. The LR has pre- and post-assessment item that are constructed differently.	1.00	Compliant
Criterion mean	***1.00***	***Compliant***
Assessment		
1. Vocabulary used in the LR is appropriate to the target users' level of comprehension and experience.	1.00	Compliant
2. Length and structure of sentences in the LR are suited to the comprehension level of the target users.	1.00	Compliant
3. Paragraph structures in the LR facilitates smooth flow of ideas and concepts.	1.00	Compliant
4. Topics and ideas presented from one lesson to the next coherent and integrated with each other.	1.00	Compliant
5. Instructions, discussion points, questions, and activities are clear to the target users.	1.00	Compliant
Criterion mean	***1.00***	***Compliant***
Intellectual property rights compliance		
1. The LR is free from plagiarism and/or copy right infringement.	1.00	Compliant

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2.	The 3rd party contents/ copyrighted materials used in the LR are accurately cited.	1.00	Compliant
3.	The citation of the 3rd party contents /copyrighted materials follow/s the prescribed format.	1.00	Compliant
	Criterion mean	***1.00***	***Compliant***
	Dimension Mean	**1.00**	**Compliant**

Summary of Evaluation of Compliance

Table 4b shows the summary of criterion and dimension means of the compliance of the Climate Change Education Module. The learning resource achieved criterion mean of 1.00 with descriptive value of "compliant" in all the criteria. The overall dimension mean is 1.00 with descriptive value of "compliant". This result shows that the module is compliant in all the pedagogical dimension standards. This means that the climate change education module can be utilized as a teaching and learning resource.

Table 4b. Summary of criterion and dimension means of the compliance of the Climate Change Education Module

	Criteria	Criterion Mean	Descriptive Value
	Pedagogical dimension		
1.	Learning competencies	1.00	Compliant
2.	Instructional design and organization	1.00	Compliant
3.	Instructional quality of text and visuals	1.00	Compliant
4.	Readability	1.00	Compliant
5.	Assessment	1.00	Compliant
6.	Intellectual property rights compliance	1.00	Compliant
	Dimension mean	***1.00***	***Compliant***

Performance of the Learners along Climate Change Education

Performance in the Lessons

The performance results of 30 Grade 6 learners after engaging to the Climate Change Education Module comprised of three (3) lessons is presented in Table 4a.

All the 30 learners (100%) got a "high" score in Lesson 1 which tackles Greenhouse Effect and Global Warming. The mean score was 30.00, which is considered "high". The standard deviation of 0.00 shows no variation in the performance because all the learners attained perfect score. This implies that they had excellent understanding of the topic greenhouse effect and global warming.

In Lesson 2, Climate Change as a Problem, 29 learners (96.7%) earned a "high" score while only 1 learner (3.3) got an "average" score. The mean score was 9.73, which is considered "high", while standard deviation of 0.52 shows slight variation in their performance. Their performance in lesson 2 remains

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excellent, with majority of learners demonstrating mastery of the lesson. The one average score suggests a minor difference in comprehension level. This is attributed to the fact that there is an increase in complexity of topic presented and background knowledge.

Lastly, 27 learners (90.0%) achieved a "high" score in Lesson 3 which tackles Climate Change Mitigation and Adaptation. Only 3 learners (10%) got an "average" score. The mean score was 9.60, which is considered "high". The standard deviation of 0.67 shows a slightly broader range in scores as compared to the previous lessons. This implies that the overall performance remained high in lesson 3, but there is slightly larger difference in their scores. This suggests that Lesson 3 that covers climate change adaptation and mitigation may be more challenging. This is attributed to the fact that topic adaptation and mitigation demands higher-order thinking skills such as applying, analyzing, and evaluating.

Table 4a. Performances of the learners (exposed in the module) along the lessons in Climate Change Education

Performance	Frequency (n=30)	Percentage
Lesson 1:		
Greenhouse Effect and Global Warming		
Low (0 to 4)	0	-
Average (5 to 8)	0	-
High (9 to 10)	30	100.0
	Mean = 30.00 (High)	***SD = 0.00***
Lesson 2:		
Climate Change as a Problem		
Low (0 to 4)	0	-
Average (5 to 8)	1	3.3
High (9 to 10)	29	96.7
	Mean = 9.73 (High)	***SD = 0.52***
Lesson 3:		
Climate Change Mitigation and Adaptation		
Low (0 to 4)	0	-
Average (5 to 8)	3	10.0
High (9 to 10)	27	90.0
	Mean = 9.60 (High)	***SD = 0.67***

Performance in the Pretest and Posttest

Performances of 58 Grade 6 learners, 30 learners exposed with the Climate Change Education Module and 28 learners not exposed to the module, is revealed in table 4b.

According to the results of the pretest of the control group, 18 learners (64.35%) had "average" scores, 6 learners (21.4%) scored "low", and only 4 learners (14.3%) got "high" scores. The pretest mean score was 6.43, which is considered "average". The standard deviation of 2.18 shows a moderate to high variation in scores of learners. While the results of their posttest shows that 6 learners (21.4%) scored "low", 9 learners (32.1%) got "average" scores, and 13 learners (46.4%) achieved "high" scores. Their posttest mean score was 6.82, which is considered "average".

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The number of learners who got "high" scores increased and number of learners who got "low" score is consistent. While, mean scores increased but remained in the average range. This means that the posttest performance of the control group as compared to the pretest has a slight improvement in their performance. This implies that only few learners made progress and significant number of learners experienced lack of progress.

On the other hand, result of the pretest of the experimental group reveals that 21 learners (70.0%) had "average" scores, 8 learners (26.7%) got "low" scores, and only 1 learner (3.3%) achieved "high" score. Their pretest mean score was 5.67, which is considered "average". The standard deviation 1.84 shows moderate variation in the scores of learners. While result of their posttest show that 27 learners (90.0%) achieved "high" scores and only 3 learners (10%) got "average" scores.

The result of posttest of the experimental group manifests noticeable improvement from their pretest. The experimental group performed significantly better in terms of mean and score consistency when compared to the control group posttest mean 6.82, which is considered high, and standard deviation 2.42. This implies that the Climate Change Education Module improved the learners understanding of Climate change.

Table 4b. Performances of the learners in the pretest and posttest along Climate Change Education

Performance	Pretest		Posttest	
	Freq.	Percentage	Freq.	Percentage
Control Group (n=28)				
Low (0 to 4)	6	21.4	6	21.4
Average (5 to 8)	18	64.3	13	46.4
High (9 to 10)	4	14.3	9	32.1
Mean	***6.43 (Average)***		***6.82 (Average)***	
SD	***2.18***		***2.42***	
Experimental Group (n=30)				
Low (0 to 4)	8	26.7	0	0.0
Average (5 to 8)	21	70.0	3	10.0
High (9 to 10)	1	3.3	27	90.0
Mean	***5.67 (Average)***		***9.50 (High)***	
SD	***1.84***		***0.68***	

Difference between the Performances of the Learners along Climate Change Education Module

The data in table 5 provides a comparative analysis of performance of Grade 6 learners' in the control and experimental group, showcasing differences between their pretest and posttest scores. This study hypothesized that there is no significant difference between the pretest and posttest of Grade 6 learners on the developed and validated Climate Change Education Module.

As shown in the results of the control group, the pretest of the learners has a mean of 6.43 with an equal difference of 2.19, while the posttest has a mean of 6.82 with an equal difference of 2.42. This means that control group's mean score increased slightly and suggests that there is a significant difference with their t-value 2.645.

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Results of the experimental group show that the pretest of the learners has a mean of 5.67 with an equal difference of 1.85, while posttest has a mean of 9.50 with an equal difference of 0.68. This means that experimental group's mean score increased significantly from average to high and suggests that there is an extremely significant difference with their t-value 12.474. This implies that the Climate Change Education Module significantly improved students' performance.

Results reveal that the mean gain score of the control group is 0.39 with a standard deviation of 0.79, while the mean gain score of the experimental group is 0.39 with a standard deviation of 1.68. This means that the experimental group gained higher average gain score than the control group and there is more variability of gain scores in experimental group. There was a highly significant difference in learning gains between the two groups, as indicated by the t-value of 10.080 and the p-value of 0.000. These results imply that the Climate change education module was the primary cause of the significant performance gain and the learning resource utilized was considered effective.

Consistent with the findings of Abarra (2024), which assessed the impact of printed modules on sixth-grade pupils' scientific achievement. Results indicate a considerable improvement in learners' performance after eight weeks of modular instruction. This proves how well-developed modules help in the attainment of science objectives.

Another study that supports this claim is conducted by Ederon (2024) results demonstrate that the usage of inquiry-based modules significantly improved students' science process skills, demonstrating the value of these resources in a modular learning environment. A range of instructional strategies, including as project-based learning, inquiry-based learning materials, multiple representations, and interactive multimedia, can greatly enhance students' understanding of scientific concepts. (Ederon, 2024; Nirina et al. 2024)

Table 5. Comparison test results in the performances of the learners in the control and experimental groups

	Mean	SD	t-value	p-value	Inference
Within control group					
Pretest	6.43	2.19	2.645	0.013	**Significant**
Posttest	6.82	2.42			
Within experimental group					
Pretest	5.67	1.85	12.474	0.000	**Significant**
Posttest	9.50	0.68			
Between groups					
Gain score of control	0.39	0.79	10.080	0.000	Significant
Gain score of experimental	3.83	1.68			

**tested at 0.05 level of significance*

CONCLUSION

The Climate Change Education Module for Grade 6 was developed to address the challenges that Grade 6 science teachers and learners stated. It contains appropriate content, localized, relatable examples, colorful illustrations, and engaging activities. It covers the most important concepts about climate change; the causes, effects, mitigation and adaptation strategies, with videos to simplify complex topics and terms,

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and inclusion of hands-on activities for the cognitive, affective and psychomotor domains of development of learners.

The Climate Change Education Module has positive evaluation of pedagogical dimension in terms of its six aspects, namely Learning Competencies, Instructional Design and Organization, Instructional Quality of Text and Visuals, Assessment, Readability, and Intellectual Property Rights Compliance. Positive evaluation was also given to the other dimensions: Language, Layout and Format, Sufficiency, Content Validity, and Usability.

After testing, results of pretest and posttest of control group reveal that only few learners made progress and significant number of learners experienced lack of progress in the control group. While the result of posttest of the experimental group manifests noticeable improvement from their pretest. The experimental group's mean score increased significantly from average to high and suggests that there is an extremely significant difference.

The Climate change education module was the primary cause of the significant performance gain in the experimental group. The developed module is suitable and appropriate for Grade 6 level to master the climate change competencies along with most essential learning competencies. With this, It was effective, valid, and accepted as an additional learning resource in Climate Change Education in elementary level.

RECOMMENDATION

In light of the findings and conclusions of this study, the following recommendations are proposed to improve and sustain the implementation of Climate Change Education in elementary level, particulary in Grade 6.

1. **Science teachers** may research and align more developmentally-appropriate competencies and materials to strengthen the sustenance of Climate Change Education in elementary level.
2. **Climate change experts and educational technologists** are encouraged to provide continuous feedback for enhancements and updating of relevant information in Climate Change Education learning resources.
3. **Grade 6 learners** may use developed and validated Climate Change Education Module integrated in the Homeroom Guidance Program and as a supplementary learning material across subjects such as Science, Araling Panlipunan, and Edukasyon sa Pagpapakatao.
4. **DepEd (SDO Cagayan)** top management could provide school-based or district-based workshops and capacity-building for school heads, teachers, and stakeholders on National Curriculum Standards and International Frameworks on Climate Change Education for Sustainable Development as part of Disaster Risk Reduction and Management Program.
5. **Future researchers** may enhance and replicate this study to get a more conclusive assumption to the effectiveness of a Climate Change Education Module for Grade 6.

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