



CONTEXTUALIZED CLIMATE RESILIENCE EDUCATION FRAMEWORK TO STRENGTHEN TEACHERS' PEDAGOGICAL PRACTICES IN THE DIVISION OF AGUSAN DEL SUR

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ABSTRACT

This study examined teachers' pedagogical practices, knowledge, attitudes, and competencies, as well as the challenges encountered in integrating climate resilience concepts in the Division of Agusan del Sur. Using a quantitative descriptive-correlational research design, the study involved 150 public secondary school teachers selected through stratified random sampling. Data were collected using a researcher-developed questionnaire and analyzed using weighted means and Pearson's correlation coefficient. Findings revealed that teachers' pedagogical practices were highly practiced (WM = 3.59), while their knowledge, attitudes, and competencies were highly evident (WM = 3.65). However, teachers encountered serious challenges in integrating climate resilience concepts (WM = 3.11), particularly the lack of professional development programs, limited training opportunities, and overloaded teaching responsibilities. Significantly low negative relationships were found between pedagogical practices and challenges ($r = -.286, p = .001$) and between teachers' knowledge, attitudes, and competencies and challenges ($r = -.312, p < .001$). These results suggest that stronger teacher capacity was associated with fewer reported challenges, although other institutional and contextual factors may also influence implementation. Based on the findings, a Contextualized Climate Resilience Education Framework was developed to strengthen teacher capacity, improve pedagogical practices, and address implementation barriers through professional development, localized instructional resources, and institutional support. The framework aims to promote meaningful integration of climate resilience education and contribute to more climate-resilient schools and communities.

KEYWORDS: Climate Resilience Education, Pedagogical Practices, Teacher Competencies, Teacher Attitudes, Implementation Challenges, Professional Development, Contextualized Instruction, Agusan Del Sur

I. INTRODUCTION

1.1. Background of the Study

Climate change creates numerous problems that affect both education and the way people earn their living. It is important to ensure that learners develop climate literacy through education. This means that it is important for the Department of Education (DepEd, 2022) in the Philippines to work on enhancing climate change education in the curriculum and improving the delivery of the learning competencies related to this issue.

Agusan del Sur faces some unique problems in relation to climate vulnerability that are caused by the fact that local people's livelihoods depend on agriculture. As a result, a provincial climate risk and vulnerability assessment identified several municipalities, such as San Luis and La Paz, that are highly vulnerable to climate change because of crop suitability (Department of Agriculture, 2022). Therefore, there is a necessity to integrate locally relevant concepts of climate resilience into classroom instruction. However, there is evidence that teachers are not ready to provide students with climate literacy knowledge in an interdisciplinary manner (Leve et al., 2023).

Additional literature also highlights the significance of the capacity building of teachers for climate change education implementation. According to Mavuso et al. (2022), the capacity building of teachers can be useful for bridging the gap between content knowledge and pedagogical practice, whereas

Puttick (2022) pointed out the lack of studies regarding the sources of information used by teachers for climate change instruction. It is obvious that there is a need to explore how teachers implement climate change education policies and professional knowledge in practice.

There are national programs for improving the climate literacy of learners in Agusan del Sur; however, additional local studies are necessary for exploring the pedagogical practices and challenges of teachers from this area, as well as their professional development needs. In order to fill the gap, the current study is dedicated to the development and validation of a climate resilience education framework based on the experiences of teachers in the Division of Agusan del Sur.

1.2 Statement of the Problem

This study sought to determine the effectiveness of a contextualized climate resilience education framework in strengthening teachers' pedagogical practices in the Division of Agusan del Sur.

Specifically, it aims to answer the following research questions:

1. What is the current level of teachers' pedagogical practices in environmental education in terms of:

- 1.1 content integration of climate resilience concepts;
- 1.2 use of contextualized teaching strategies;
- 1.3 learners' engagement and participation; and
- 1.4 assessment practices related to climate resilience?



2. What is the level of teachers' knowledge, attitudes, and competencies regarding climate resilience education?
3. What challenges do teachers encounter in integrating climate resilience concepts into their pedagogical practices?
4. Is there a significant relationship between teachers' level of pedagogical practices and challenges encountered in integrating climate resilience concepts?
5. Is there a significant relationship between level of teachers' knowledge, attitudes and competencies and challenges encountered in integrating climate resilience concepts?
6. Based on the findings, what Contextualized Climate Resilience Education Framework can be developed to strengthen teachers' pedagogical practices in the Division of Agusan del Sur?

1.3 Hypotheses

There are two hypotheses in this study that the research would like to answer.

1. H_{01} : There is no significant relationship between teachers' level of pedagogical practices and challenges encountered in integrating climate resilience concepts.
2. H_{02} : There is no significant relationship between level of teachers' knowledge, attitudes and competencies and challenges encountered in integrating climate resilience concepts.

1.4 Purpose of the Study

The purpose of this study was to design and validate the Contextualized Climate Resilience Education Framework that could improve the pedagogical skills of teachers within the Division of Agusan del Sur. In particular, the study sought to evaluate the climate resilience competencies, pedagogical skills, and difficulties experienced by the teachers in implementing climate resilience education, and explore the relationships between these variables. Evidence-based inputs for designing a framework were also determined in terms of its relevance and applicability to the needs of teachers and schools.

1.5 Scope and Delimitations

The study was to create and validate a Contextualized Climate Resilience Education Framework to improve teachers' pedagogical practices among teachers in public secondary schools in the Division of Agusan del Sur. It covered teachers' climate resilience competencies, pedagogical practices, and barriers to implementing climate resilience concepts in the classroom, as well as the framework's congruence with national development goals and the United Nations Sustainable Development Goals.

This study delimited to the teachers participating to those within the division's secondary-level public schools. No student, parent, school administrator, or other stakeholder was interviewed as a respondent. This study did not research policies, physical school plant, and community-based climate-resiliency training and programs but only focused on the teachers' teaching strategies and the construct development and validation of an educational framework. Findings were appropriate mainly for the local setting, and generalization to other divisions should be done cautiously.

II. REVIEW OF RELATED LITERATURES AND STUDIES

2.1 Review of Empirical Studies

Climate Resilience Education and Teachers' Competencies

Climate resilience education provides the learner with the requisite knowledge, skills, and attitude that will enable them to comprehend the issues of climate risks and cope with environmental issues. According to Leve et al. (2023), climate literacy calls for teachers who have interdisciplinary climate knowledge as well as the skills to make climate concepts meaningful to learners. In a similar vein, Beach (2023) pointed out some of the issues in the preparation of teachers for climate change instruction, such as the need for content knowledge, interdisciplinary, and local instruction.

Pedagogical Practices and Contextualized Instruction

The pedagogical approaches of teachers play a major role in how climate change ideas are taught and applied in class environments. According to Leve et al. (2023), teaching methods that enable students to make a connection between climate science and the world outside, making them participants in climate change actions, have been emphasized. Furthermore, Puttick (2022) revealed that the current body of literature on the information sources used by teachers for the teaching of climate change has not received enough attention.

Philippine Context and the Need for a Localized Framework

Climate change topics have been noted to be included in various learning areas of K-12 under the Department of Education in the Philippines (2022); however, the emphasis was placed on the need to improve curriculum competencies and their implementation. The Department of Agriculture in the Philippines (2022) has conducted a Climate Risk and Vulnerability Assessment and revealed San Luis, La Paz, and Loreto in Agusan del Sur as highly exposed to climate risks. All these results indicate the significance of climate resilience education adaptation to local conditions. Still, none of the above-mentioned resources reveal the teaching practices in place in Agusan del Sur.

2.2 Theoretical Framework

The theoretical perspectives adopted in this study include the Constructivist Learning Theory, the Transformative Learning Theory, and the Resilience Theory, which will enable the development of a Contextualized Climate Resilience Education Framework that will improve the pedagogy practices of teachers within the Division of Agusan del Sur. According to Constructivist Learning Theory, learning is enhanced through experiences and interactions within social settings, while Leve et al. (2023) point out the significance of interdisciplinary climate knowledge as well as the need for a relevant teaching approach. Transformative Learning Theory, founded by Mezirow (1991), is based on critical reflections and perspective transformation and is a key theory that will assist in defining teachers' reflective practices. In addition to the transformative perspective, teacher resilience is viewed by Vallés and Clarà (2023) as an adaptive dynamic relationship between teachers and the professional environment.



2.3 Research Gap and Justification

While there have been numerous studies devoted to climate change education, there is still a lack of information about the ways of transferring climate literacy into systematic frameworks for learning. Leve et al. (2023) stressed the importance of expanding interdisciplinary climate knowledge of teachers and their pedagogical competence in addressing the problem. In the Philippines, Ignacio et al. (2024) showed that a systems-thinking approach can be applied successfully to e-learning with the aim of promoting climate change knowledge and reasoning among teachers at the junior high school level, emphasizing the need for teachers' development. Nevertheless, more research needs to be conducted regarding the connection between teachers' climate resilience competencies, pedagogical practices, and difficulties in climate-vulnerable geographies. In particular, the lack of evidence about public secondary schools in the Division of Agusan del Sur should be noted. To fill this gap, the current study has been devoted to the development and validation of a Contextualized Climate Resilience Education Framework based on teachers' competencies, practices, and challenges. With the help of quantitative research, connections between these variables were investigated, and evidence was collected to create and validate the proposed framework.

III. RESEARCH METHODOLOGY

3.1 Research Design

A descriptive-correlational research design that made use of quantitative research methodology was used in this study in order to explore the climate resilience competency of teachers, pedagogy and difficulties in teaching climate resilience education in the Division of Agusan del Sur. The descriptive method of research design described the study's variables, whereas the correlation method determined the relationship of the variables between teachers' competency and pedagogy.

3.2 Population and Sampling

The respondents consisted of 150 public secondary school teachers from selected schools in the Division of Agusan del Sur during School Year 2026–2027. Stratified random sampling was employed, with schools grouped by district and teachers randomly selected within each stratum. The sample size was determined using Slovin's formula with a 5% margin of error.

3.3 Research Locale

This study was conducted in the Division of Agusan del Sur, Caraga Region, Philippines. This particular division was chosen because of the local environmental hazards and the relevance of climate resiliency in education, teaching, and learning. The various environmental contexts in which the schools were set provided an excellent setting for the research on pedagogical techniques of the teachers.

3.4 Research Instrument

The study employed a researcher-made survey questionnaire designed in line with the literature, conceptual framework, and recommendations of experts regarding climate resilience education, pedagogy, and teacher professionalization. The instrument comprised four parts

focusing on respondents' demographic characteristics, professional development and institutional support, teacher motivation and context, and pedagogical approaches to climate resilience education. Responses to survey questions were given on a four-point Likert scale from Strongly Disagree to Strongly Agree. Content validity was likely achieved through consultation and review by three curriculum and instruction climate resilience education experts and educational research methodology experts. Recommendations from these experts, together with findings from pilot administration to teachers not in the sample population, were used to modify the survey instrument. Reliability of the instrument was established through Cronbach's alpha (an acceptable level of reliability is .70 and above). Validation of the Contextualized Climate Resilience Education Framework was also conducted by an expert panel of researchers on curriculum and instruction climate resilience education (to determine relevancy, applicability, and responsiveness).

3.5 Data Collection Procedures

This study was conducted after gaining all the relevant approvals from the appropriate bodies. Informed consent was sought, and the validated questionnaires were distributed to the identified participants. The completed questionnaires were coded and entered into the database for statistical analysis. Data analysis led to the formulation of the Contextualized Climate Resilience Education Framework.

3.6 Ethical Considerations

The study followed the ethics policies as outlined by the institution, which were followed throughout the conduct of this study. This is evidenced by the research requirement for the participation of study participants to be completely voluntary while outlining the importance of obtaining participants' informed consent, the assurance of anonymity, and data confidentiality. Study participants were informed of the purpose of the study, the procedures that would be employed, as well as the right to withdraw at any time without penalty, while the study maintained complete anonymity through the anonymization of names. Data was kept in the strictest confidence with access only to permitted personnel, according to the Philippine Data Privacy Act of 2012 (Republic Act No. 10173). This indicates that the study was conducted to an excellent research standard.

3.7 Data Management and Data Analysis Procedures

The data collected were coded, recorded, verified for missing information and inconsistencies, and then analyzed through statistical software. The frequency count and percentage distribution provided summary statistics on the respondents' background and problems encountered. The mean and weighted mean gave the respondents' climate resilience competencies and pedagogical approaches, whereas the standard deviation showed the variability of responses. Pearson's product-moment correlation coefficient was adopted to measure the significance and magnitude of the relationship between the climate resilience competencies and pedagogical practices of the respondents, with the significance level set at ($\alpha = .05$).



IV. RESULTS AND DISCUSSION

Question 1. What is the current level of teachers' pedagogical practices in environmental education in terms of

content integration of climate resilience concepts, use of contextualized teaching strategies, learners' engagement and participation, and assessment practices related to climate resilience?

Table 1

Composite Results of Teachers' Pedagogical Practices in Climate Resilience Education

Dimensions	Overall Weighted Mean	Verbal Interpretation
Content Integration	3.57	Highly Practiced
Contextualized Teaching Strategies	3.59	Highly Practiced
Learner Engagement and Participation	3.62	Highly Practiced
Assessment Practices	3.59	Highly Practiced
Composite Weighted Mean	3.59	Highly Practiced

Based on **Table 1**, the findings show that the level at which teachers employed pedagogical approaches in climate resilience education was Highly Practiced, with a composite weighted mean of 3.59. It means that climate resilience concepts were being practiced through teaching, learning, contextualization of teaching, engagement of learners, and assessment.

From among the four dimensions assessed, Learner Engagement and Participation had the highest weighted mean of 3.62, while Contextualized Teaching Strategies and Assessment Practices had a mean of 3.59 each. Content Integration got the lowest mean of 3.57. Although there were some small differences, all the dimensions were Highly Practiced. This implies that the teachers had been emphasizing the active participation of the learners in learning about climate while integrating the concepts, contextualizing, and assessing their learning.

The composite weighted mean of 3.59 indicates that climate resilience education was generally manifested in teachers' reported practices. These are just the levels of practicing the practices and do not conclude whether or not these practices are effective or poor in developing the learners' climate resilience skills.

The findings further validate the research carried out by van de Wetering et al. (2022). Their study, which was conducted through a meta-analysis, reveals that environmental education is an important tool for increasing the environmental knowledge, attitude, intentions, and behavior of learners. It not only highlights the effectiveness of environmental education but also calls for an investigation into how these outcomes can be realized through different teaching approaches. Professional development will then be centered around topics such as curriculum mapping, climate learning activities, and others.

Question 2. What is the level of teachers' knowledge, attitudes, and competencies regarding climate resilience education?

Table 2

Teachers' Knowledge, Attitudes and Competencies in Climate Resilience Education

No.	Statement	Weighted Mean	Verbal Interpretation
1	I have sufficient knowledge of climate resilience concepts.	3.56	Highly Evident
2	I understand the importance of climate resilience education.	3.72	Highly Evident
3	I am confident in teaching climate resilience.	3.58	Highly Evident
4	I am motivated to integrate climate resilience into lessons.	3.74	Highly Evident
5	I continuously update my knowledge on climate resilience.	3.49	Highly Evident
6	I believe climate resilience education benefits learners.	3.76	Highly Evident
7	I am competent in designing climate resilience lessons.	3.57	Highly Evident
8	I am skilled in using contextualized strategies.	3.55	Highly Evident
9	I can engage learners in climate resilience.	3.65	Highly Evident
10	I am confident in assessing climate resilience learning.	3.53	Highly Evident
11	I value climate resilience education in curriculum design.	3.70	Highly Evident
12	I am willing to attend training on climate resilience.	3.79	Highly Evident
13	I believe climate resilience education strengthens communities.	3.75	Highly Evident
14	I am competent in integrating climate resilience across subjects.	3.59	Highly Evident
15	I am committed to promoting climate resilience education.	3.81	Highly Evident
	Overall Weighted Mean	3.65	Highly Evident

From **Table 2**, it was noted that the teacher's climate resilience education knowledge, attitude, and competencies were Highly Evident with a mean score of 3.65. The commitment of the teachers to climate resilience education received the highest mean of 3.81, willingness to undergo training received the second highest mean of 3.79, and

continuous update on climate resilience received the lowest mean score of 3.49. This shows that teachers had a strong commitment and positive attitude towards climate resilience education; however, continuous professional learning might have to be enhanced.



These results are consistent with Leve et al. (2023), which highlights the importance of teachers' climate knowledge and competencies in conducting successful climate literacy

education. Hence, continuous professional development would help in building teachers' knowledge, competence, and skills in climate resilience education.

Question 3. What challenges do teachers encounter in integrating climate resilience concepts into their pedagogical practices?

Table 3
Challenges in Integrating Climate Resilience Concepts

No.	Statement	Weighted Mean	Verbal Interpretation
1	Lack of instructional materials on climate resilience.	3.21	Serious Challenge
2	Limited training opportunities for teachers.	3.34	Serious Challenge
3	Curriculum constraints that restrict integration.	3.12	Serious Challenge
4	Insufficient time allocation for climate topics.	3.28	Serious Challenge
5	Lack of administrative support.	2.87	Serious Challenge
6	Limited access to technology for climate education.	3.05	Serious Challenge
7	Inadequate financial resources for instructional materials.	3.18	Serious Challenge
8	Difficulty in contextualizing global concepts to local realities.	2.94	Serious Challenge
9	Limited collaboration with other teachers on climate resilience.	2.82	Serious Challenge
10	Lack of student interest in climate topics.	2.71	Serious Challenge
11	Overloaded teaching responsibilities.	3.31	Serious Challenge
12	Insufficient community support for climate education.	2.89	Serious Challenge
13	Difficulty in assessing climate resilience learning outcomes.	3.06	Serious Challenge
14	Limited availability of localized case studies.	3.16	Serious Challenge
15	Lack of professional development programs focused on climate resilience.	3.38	Serious Challenge
	Overall Weighted Mean	3.11	Serious Challenge

As stated in **Table 3**, it is evident that teachers faced major difficulties in embedding the notions of climate resilience, with a mean weight of 3.11. The major difficulties encountered by the respondents included lack of professional development initiatives (WM = 3.38), lack of training (WM = 3.34), and heavy teaching duties (WM = 3.31). It is noteworthy that the least difficulty faced by the respondents is the lack of students' interests (WM = 2.71). However, it is a serious challenge.

The above conclusions have been proven in Ennes et al.'s (2021) research paper, which showed time restrictions to be the main obstacle to teachers engaging in professional development related to climate change issues. Overall, the findings show the importance of regular professional development that is specifically targeted at certain contexts, enough time for preparing lessons, availability of localized teaching materials, and institutional support.

Question 4. Is there a significant relationship between teachers' level of pedagogical practices and challenges encountered in integrating climate resilience concepts?

Table 4
Significant Relationship Between Teachers' Pedagogical Practices and Challenges Encountered in Integrating Climate Resilience Concepts

Variables	Pearson r	p-value	Decision on H ₀	Verbal Interpretation
Teachers' Pedagogical Practices and Challenges in Integrating Climate Resilience Concepts	-0.286	0.001	Reject H ₀	Significant Low Negative Relationship

Note: Significant at $p < 0.05$.

Results from **Table 4** indicated a statistically significant negative association between the pedagogical practices of teachers and the difficulties associated with teaching climate resilience ($r = -0.286$, $p = 0.001$). The null hypothesis was rejected because the p-value is less than the alpha value of .05. In

essence, strong pedagogical practices were associated with few challenges, although there was a weak association.

This study supports Rushton et al. (2025), who have pointed out that the agency of teachers in climate change and sustainability education is dependent not only on the capacities of the teachers but also on the supportive school environment.



Question 5. Is there a significant relationship between level of teachers' knowledge, attitudes and competencies and challenges encountered in integrating climate resilience concepts?

Table 5

Significant Relationship Between Teachers' Knowledge, Attitudes and Competencies and Challenges Encountered in Integrating Climate Resilience Concepts

Variables	Pearson r	p-value	Decision on H ₀	Verbal Interpretation
Teachers' Knowledge, Attitudes and Competencies and Challenges Encountered in Integrating Climate Resilience Concepts	-0.312	0.000	Reject H ₀	Significant Low Negative Relationship

Note: Significant at $p < 0.05$.

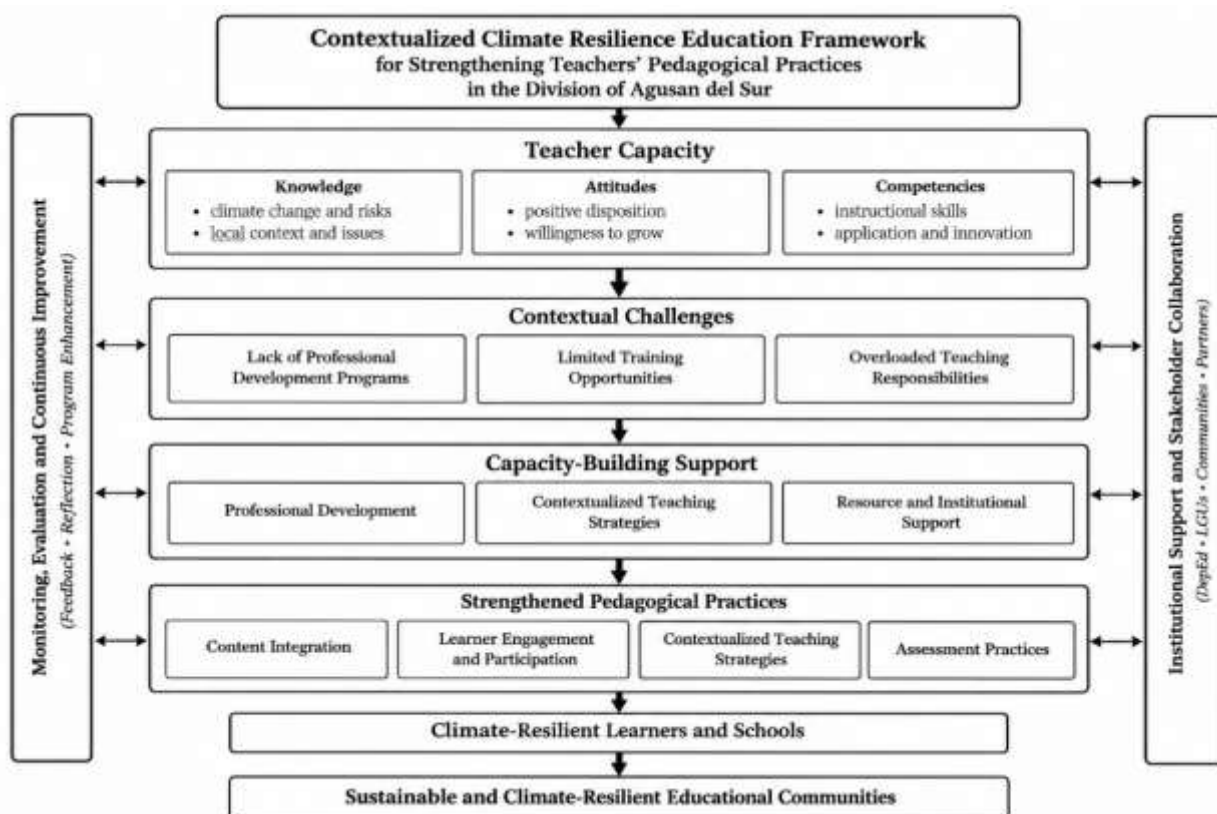
The findings presented in **Table 5** indicated that there was a significant negative low correlation between teachers' knowledge, attitude, and competence and the challenges faced in integrating climate resilience issues in their classroom instruction ($r = -.312$, $p < .001$). Based on the findings, the null

hypothesis was rejected, leading to the conclusion that increased teacher competence reduces the challenges.

Additionally, these results corroborate the study by Tang (2025), where it was suggested that teachers' attitudes, self-efficacy, and support from the contexts where they are working could affect their motivation to teach about climate change.

Question 6. Based on the findings, what Contextualized Climate Resilience Education Framework can be developed to strengthen teachers' pedagogical practices in the Division of Agusan del Sur?

Contextualized Climate Resilience Education Framework to strengthen teachers' pedagogical practices in the Division of Agusan del Sur



The **Contextualized Climate Resilience Education Framework** was proposed based on the results of the study regarding teachers' knowledge, attitude, competence, pedagogy, and constraints in implementing climate resilience education in the Division of Agusan del Sur. The framework recognizes the teachers' existing strengths as well as obstacles to its implementation.

The framework is built on Teacher Capacity, the fundamental aspect of climate resilience education. The framework uses Contextual Challenges, such as limited professional development, inadequate training opportunities,

and increased teaching load, as a challenge, which it then addresses with Capacity-Building Support, by offering professional development, a contextualized teaching approach, instructional resources, and institutional support.

These interventions aim to improve the four critical areas of Pedagogical Practices – Content integration, learner engagement, contextualized teaching approaches, and assessment practices—the framework aimed at nurturing climate-resilient learners and schools, leading to a sustainable teaching-learning environment.



Additionally, the frameworks Monitoring, Evaluation and Continuous Improvement, and Institutional Support and Stakeholder Collaboration were designed as continuous processes to maintain the framework. The negative correlations between teacher capacity, pedagogy, and integration barriers highlight the importance of building teacher capacity and removing institutional barriers.

V. SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

The findings of the study reveal that the pedagogical practices of teachers in climate resilience education were found to be highly practiced (Weighted Mean=3.59), and their knowledge, attitude, and competencies were highly evidenced (Weighted Mean=3.65). It is, however, shown that teachers' experience of challenges in the implementation of climate change resilience education was much faced (Weighted Mean=3.11), especially due to a lack of professional development, poor availability of training opportunities, and overload of teachers. In addition, the study clearly shows a significantly low negative correlation between the pedagogical practice and challenges ($r=-0.286$, $p\text{-value}=0.001$); and between teachers' knowledge, attitude, and competencies and challenges ($r=-0.312$, $p\text{-value}<0.001$). These imply that the more teachers' capacity, they can face or face less challenges that they face in climate change education.

Conclusions

The findings show that teachers were highly skilled in their pedagogy and highly competent in terms of their knowledge, attitude, and competence in climate resilience education. Despite being prepared to incorporate the climate resilience concepts into classroom instruction, they still encountered severe implementation challenges. There was a considerable negative correlation among teacher capacity, pedagogy, and implementation challenges, meaning that teacher capacity was related to fewer implementation challenges. Regardless, there is no assurance that the identified program will be sustained. It was discovered that professional development, instruction resources, a reasonable workload, support of the institution, and a flexible program were viewed as the most important elements in improving the school climate to support climate resilience education within the Division of Agusan del Sur.

Recommendations

Studies utilizing larger and broader geographic populations of teachers may also be rewarding. Additional Institutional and communal elements might be worthwhile subjects for investigations. Qualitative, mixed-method, and longitudinal designs represent robust potential for gaining a more holistic appreciation of teachers' engagement with the climate crisis as a school concern; and a further research need is for evaluative studies that relate these pedagogical decisions to learning outcomes in the areas of climate knowledge, attitudes, values, and practices in students themselves.

It is recommended that educators and schools explore the domains of curriculum standards, professional development, relevant curriculum resources and materials,

curriculum workload, and administration and leadership as areas in which climate resilience education may be integrated. However, current literature demonstrates that educator actions such as learner-centered, place-based, participatory, and experiential approaches may be utilized for addressing climate resilience in relation to the community environment in which the local school operates. Recent literature suggests that teacher preparation programs might enhance teachers' knowledge regarding climate change and how to teach and assess for it, as well as how to collaborate professionally. In addition, the curriculum needs to be developed in such a way as to include climate resilience education into specific disciplines and develop contextually-based curriculum and assessment tools.

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