

Scientific literacy as a predictor of climate change anxiety among science preservice teachers in Tacloban City

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Abstract

Scientific literacy and climate change anxiety are interconnected dimensions that shape how individuals understand and emotionally respond to environmental threats. However, research examining the predicting effect of scientific literacy on climate change anxiety among science preservice teachers in climate-vulnerable regions remains limited. This study examined this relationship among science preservice teachers in Tacloban City, Philippines, in alignment with SDG 3 (Good Health and Well-Being), SDG 4 (Quality Education), and SDG 13 (Climate Action), anchored in the Transactional Model of Stress and Coping. A non-experimental quantitative research design utilizing comparative and correlational approaches was employed. The Global Scientific Literacy Scale and the Climate Change Anxiety Scale were administered to 125 fourth-year Bachelor of Secondary Education major in Science students enrolled in state universities and private colleges in Tacloban City through total population sampling. Results showed that science preservice teachers demonstrated a very high level of scientific literacy ($M = 4.52$) and a high level of climate change anxiety ($M = 3.37$). No statistically significant differences in climate change anxiety were identified across sex, age, and family income class. Scientific literacy was established as a statistically significant predictor of climate change anxiety ($\beta = 0.376$; $p = .043$), indicating that increases in scientific literacy correspond to increases in climate-related psychological distress. The findings support the integration of mental health support components alongside climate science instruction in teacher education curricula to address the psychological distress that accompanies scientific literacy development among science preservice teachers.

Keywords: *scientific literacy; climate change anxiety; preservice science teachers; Tacloban City; transactional model of stress and coping*

1. Introduction

Climate change represents one of the defining challenges of the contemporary era, with scientific consensus affirming anthropogenic contributions to global temperature increases, sea-level rise, and extreme weather events that have generated corresponding psychological responses among populations worldwide, particularly among younger demographics who face the longest-term consequences of environmental degradation (IPCC, 2021). The Philippines is one of the most climate-vulnerable nations in the world, with human-caused global warming making consecutive destructive typhoons nearly twice as likely, and climate change outcomes severely impacting the mental well-being of Filipinos through post-traumatic stress disorder, anxiety, depression, and generalized eco-anxiety across the population (Aruta & Guinto, 2022; World Weather Attribution, 2024). Climate change anxiety is a distinct psychological phenomenon characterized by worry, distress, and functional impairment related to the climate crisis, and science students occupy a position of particular concern, as their academic training provides systematic exposure to climate science principles while their developmental stage coincides with peak vulnerability to anxiety-related disorders (Clayton & Karazsia, 2020; Hickman et al., 2021). Despite the growing body of research on climate anxiety among Filipinos, little to no investigation has connected the scientific literacy of students to the emotional distress brought about by climate change, compromising the capacity to provide actionable guidance for mental health support and climate change mitigation through science education. To address this gap, this study aimed to determine the predicting effect of scientific literacy on climate change anxiety among science preservice teachers in Tacloban City.

Climate change represents a global threat to ecosystems and human populations, with the IPCC (2021) establishing that human activities drive planetary warming through greenhouse gas emissions, resulting in cascading effects including altered precipitation patterns, ocean acidification, species extinction, and disruptions to food security (Pörtner et al., 2022). The

Philippines is among the most climate-vulnerable nations, facing increased frequency and intensity of tropical cyclones, with Typhoon Haiyan in 2013 resulting in thousands of casualties and widespread displacement, while broader environmental changes continue to threaten biodiversity, agriculture, water resources, and coastal ecosystems (Cinco et al., 2016). These environmental realities produce direct psychological consequences, as repeated exposure to extreme weather events generates distress and anxiety about future climate scenarios, with 84% of Filipino youth reporting extreme climate worry, the highest among ten countries surveyed (Hickman et al., 2021). Climate change anxiety is a distinct psychological phenomenon characterized by worry, distress, and functional impairment, manifesting through cognitive-emotional impairment and functional impairment as identified by the Climate Change Anxiety Scale (Clayton & Karazsia, 2020). The mechanisms driving climate anxiety among Filipinos are rooted in the nation's high hazard vulnerability, with distress further shaped by demographic factors including age, sex, and socioeconomic status, as younger individuals, women, and lower-income groups consistently report higher anxiety levels across multiple studies (Coffey et al., 2021; Hickman et al., 2021; Sanson et al., 2019).

Scientific literacy encompasses understanding of scientific concepts, processes, and the nature of science, providing the foundation for comprehending climate mechanisms, evaluating information sources, and understanding the scientific consensus on anthropogenic climate change (Bedford, 2016). It is measured across four dimensions, namely habits of mind, character and values, science as human endeavor, and metacognition and self-direction, each reflecting both cognitive and dispositional aspects of scientific competence (Choi et al., 2011; Mun et al., 2015). In the Philippine context, preservice science teachers generally demonstrate satisfactory to high scientific literacy levels, with longitudinal analyses confirming that literacy significantly improves as students progress through their programs (Flores, 2019; Orleans et al., 2018; Ybañez et al., 2016). Enhanced climate literacy can increase risk perception and motivation for climate action, though knowledge alone does not guarantee behavioral change without corresponding shifts in efficacy beliefs and social norms (Monroe et al., 2019). Research further indicates that increased knowledge of climate science can produce psychological tension when individuals recognize the severity of environmental problems without perceiving adequate solutions or personal efficacy for addressing these challenges (Ojala, 2012).

Despite growing research on both constructs, gaps remain in understanding how scientific literacy and climate change anxiety interact specifically among populations preparing for careers in science education. Studies examining the knowledge-anxiety relationship have produced inconsistent findings, with some indicating that climate literacy reduces anxiety through enhanced self-efficacy and adaptive coping (Hogg et al., 2021), while others demonstrate that deeper scientific understanding correlates with higher distress due to recognition of the severity and irreversibility of climate impacts (Stanley et al., 2021). Research has not adequately addressed this relationship within the specific context of preservice science teachers, who occupy a position as individuals developing scientific expertise while simultaneously preparing to teach climate content to secondary students. Studies on climate anxiety in the Philippines have focused primarily on post-disaster psychological responses rather than chronic climate-related anxiety, leaving gaps in understanding how scientific literacy shapes anxiety among Filipino students who face direct exposure to climate impacts through typhoons and environmental degradation. This study addressed these gaps by examining the relationship between multidimensional scientific literacy and climate change anxiety among science preservice teachers in Tacloban City, a context characterized by high climate vulnerability and ongoing exposure to climate-related hazards.

1.1 Theoretical framework

This study is anchored in the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), which explains how individuals respond to environmental stressors through cognitive appraisal processes. This model proposes that stress responses occur through two sequential yet interrelated cognitive mechanisms: primary appraisal, wherein individuals evaluate whether a situation poses a threat, harm, or challenge to their well-being, and secondary appraisal, wherein individuals assess their available coping resources and capacity to manage the identified threat (Lazarus & Folkman, 1984). In the context of climate anxiety, cognitive appraisal of climate change significantly affects individuals' emotions and coping strategies, with risk appraisal mechanisms influencing both primary coping and emotional responses (Hogg et al., 2021). The model is particularly relevant to the relationship between scientific literacy and climate anxiety among science students, as increased knowledge may alter both primary appraisals of climate threats and secondary appraisals of personal capacity to respond, potentially producing divergent emotional outcomes depending on the balance between threat perception and perceived coping resources (Stanley et al., 2021). Specifically, when scientific literacy heightens the comprehension of climate change as catastrophic, uncontrollable, and morally unjust, and this threat appraisal is not offset by a commensurate increase in perceived coping efficacy, the net result may be amplified anxiety (Clayton, 2020).

1.2 Problem statement and Research objectives

Despite the growing literature on both climate anxiety and scientific literacy, there remains a gap in understanding how these variables interact specifically among populations preparing for careers in science education. Little to no investigation connects the scientific literacy of preservice science teachers to the emotional distress brought about by climate change, compromising the capacity to provide actionable guidance for mental health support and climate change mitigation through science education. To address this gap, this study aimed to determine the predicting effect of scientific literacy on climate change anxiety among science preservice teachers in Tacloban City. Specifically, the study sought to:

- (a) determine the demographic profiles of science preservice teachers in terms of sex, age, and family income class;
- (b) determine the level of scientific literacy in terms of habits of mind, character and values, science as human endeavor, and metacognition and self direction;
- (c) determine the level of climate change anxiety in terms of cognitive-emotional impairment and functional impairment;
- (d) examine whether significant differences exist in climate change anxiety when grouped according to demographic profiles;
- (e) determine whether a significant relationship exists between scientific literacy and climate change anxiety;
- (f) determine whether scientific literacy predicts climate change anxiety; and
- (g) propose policy recommendations based on the findings of the study.

1.3 Significance and Rationale of the study

This study bears significant findings across multiple stakeholder groups. For students and educators, understanding how scientific knowledge shapes emotional responses to climate change enables the normalization of climate anxiety as an adaptive rather than pathological response, and provides a framework for constructive engagement with climate science content (Hickman et al., 2021; Stanley et al., 2021). For educational institutions, the findings provide evidence regarding the psychological impacts of climate science education on preservice teachers, informing curriculum development that integrates both cognitive and affective dimensions of climate education (Pihkala, 2020). For government agencies such as the Commission on Higher Education (CHED) and the Department of Education (DepEd), the results can guide policy decisions regarding teacher education standards, professional development requirements, and mental health support systems. Tacloban City serves as an especially meaningful setting for this inquiry given its documented experience of Super Typhoon Haiyan in 2013 and its continued exposure to climate-related hazards, providing a contextually grounded population in which to examine how scientific literacy intersects with climate change anxiety among future science educators.

2. Methodology

2.1 Research design

This study utilized a combined non-experimental quantitative research design called comparative and correlational research designs. Comparative research design examines differences between two or more groups on one or more measured variables (Creswell & Creswell, 2018). In this study, comparative research design was employed to determine significant differences in scientific literacy and climate change anxiety levels across distinct groups of 4th-year BSED Science students, as defined by their demographic profiles (e.g., gender, age, and socioeconomic status). Moreover, correlational research design is used to examine the relationships between or among two or more variables in a single group (Devi et al., 2022). The correlational nature of this research is aligned for determining the existence of relationship and extent of the effect of scientific literacy towards climate change anxiety.

2.2 Research locale

The study was conducted in state universities and private colleges offering the Bachelor of Secondary Education (BSED) major in Science in Tacloban City, Leyte. The city's geographic exposure to climate-driven extreme weather events, particularly intensifying tropical cyclones, renders it an ecologically and contextually relevant site for studying climate change anxiety. According to Reyes et al. (2021), repeated exposure to climate-related hazards heightens environmental concern and amplifies affective responses to climate change among affected populations, making Tacloban City a contextually meaningful setting for examining how climate change anxiety manifests among future science educators.

2.3 Research respondents

The respondents were 125 fourth-year BSED major in science students enrolled in state universities and private colleges in Tacloban City during the school year 2025–2026. Purposive sampling was employed given the highly specific nature of the target population. Inclusion criteria required respondents to be enrolled as a fourth-year BSED Science student during the 2025–2026 academic year; enrolled in a qualifying institution in Tacloban City; a permanent resident of Eastern

Visayas; having completed all required science major courses; and having voluntarily provided informed consent. Students enrolled in non-degree teacher preparation pathways, those who had not completed required science major courses, or those who declined or withdrew consent were excluded from the study.

2.4 Research instruments

The study utilized two validated instruments. Scientific literacy was measured using the Global Scientific Literacy Scale (GSLS), a 48-item instrument adapted from Mun et al. (2015) with four dimensions: Habits of Mind, Character and Values, Science as Human Endeavor, and Metacognition and Self-Direction. The instrument employs a five-point Likert scale ranging from strongly disagree to strongly agree, with originally reported reliability coefficients of $\alpha = 0.91$, 0.91 , 0.89 , and 0.91 for each respective subscale (Mun et al., 2015). Climate change anxiety was measured using the Climate Change Anxiety Scale (CCAS), an 11-item instrument adapted from Clayton and Karazsia (2020) with two subscales: Cognitive-Emotional Impairment and Functional Impairment, with original reliability coefficients of $\alpha = 0.90$ and $\alpha = 0.85$, respectively. Both instruments were submitted to three science education professors and one physician as expert validators using the Content Validity Rating Scale adapted from Waltz and Bausell (1983). Pilot testing was conducted with 30 third-year BSEd Science students, yielding Cronbach's alpha values of 0.95 , 0.88 , 0.90 , and 0.95 for the GSLS subscales, and 0.93 and 0.96 for the CCAS subscales, confirming strong internal consistency.

2.5 Data gathering procedure

Data collection was conducted across three phases. In Phase One, the researcher secured ethical clearance from the Leyte Normal University Research Ethics Board Committee before obtaining written institutional permissions from the deans and program coordinators of participating institutions. The GSLS and CCAS were submitted to four expert validators who assessed item relevance, clarity, simplicity, and ambiguity using the Content Validity Rating Scale adapted from Waltz and Bausell (1981). Items that did not meet the acceptable content validity index threshold were revised accordingly. A pilot test was then administered to 30 third-year Bachelor of Secondary Education (BSEd) major in science students to establish instrument reliability. Cronbach's alpha coefficients of 0.95 , 0.88 , 0.90 , and 0.95 were obtained for the four GSLS subscales, and 0.93 and 0.96 for the two CCAS subscales, confirming internal consistency across all dimensions. In Phase Two, the researcher coordinated with program coordinators to schedule administration sessions within designated classrooms across participating institutions. Participants were briefed on the purpose of the study, the voluntary nature of participation, and their right to withdraw without consequence. Written informed consent was obtained before questionnaire booklets were distributed. The researcher was present throughout each session to address item clarifications and ensure independent responding. Completed questionnaires were assigned a unique numerical code, collected, and stored in a locked cabinet accessible only to the researcher. In Phase Three, responses were encoded into a password-protected spreadsheet and verified for accuracy through double-entry checking. Statistical analyses were performed in consultation with a qualified statistician. Upon completion of the study, all physical documents were shredded and incinerated, and electronic files were permanently deleted in compliance with the Data Privacy Act of 2012. Destruction logs were maintained by the researcher as required by institutional ethics protocols.

2.6 Data analysis

The following statistical procedures were employed. Mean, frequency, and standard deviation were used to describe demographic profiles and determine the levels of scientific literacy and climate change anxiety, interpreted against established score interval tables adapted from Turgut and Yakal (2020) for scientific literacy and Manan et al. (2022) for climate change anxiety. An independent samples t-test was used to determine significant differences in scientific literacy and climate change anxiety by sex, while one-way analysis of variance (ANOVA) was used for comparisons across age groups and family income classes. Pearson r correlation was employed to examine the relationship between scientific literacy and climate change anxiety. Linear regression was used to quantify the predictive effect of scientific literacy on climate change anxiety. All tests were evaluated at $\alpha = 0.05$.

2.7 Ethical considerations

This study adhered to ethical research principles throughout all phases. Ethical clearance was obtained from the Leyte Normal University Research Ethics Committee prior to data collection. Participation was entirely voluntary, and participants were informed of their right to withdraw at any time without consequence. Written informed consent was obtained from all respondents. All data were anonymized using numerical coding systems, stored in locked cabinets accessible only to the researcher, and handled in compliance with the Data Privacy Act of 2012. Upon research completion, all physical and electronic data were securely disposed of through incineration, shredding, or permanent deletion, with destruction logs maintained by the researcher.

1. Results and Discussion

3.1 Demographic profile of science preservice teachers

Table 1. Frequency Distribution and Percentage on Sex of Science Preservice Teachers

Sex	Frequency	Percentage
Female	85	68.0%
Male	40	32.0%

Table 1 presents the frequency distribution and percentage of the demographic profiles of science preservice teachers in Tacloban City in terms of sex, age, and family income class. Out of 125 respondents, the majority were female ($n = 85$; 68.0%), followed by male ($n = 40$; 32.0%). This distribution reflects a pattern observed in teacher education programs both locally and internationally. In the Philippines, 87.6% of teachers at the primary level are female as of 2021, and teaching remains a female-dominated field despite efforts toward gender diversity in educational settings (Bernardo et al., 2024). These findings indicate that female students constitute the majority in science preservice teacher education programs.

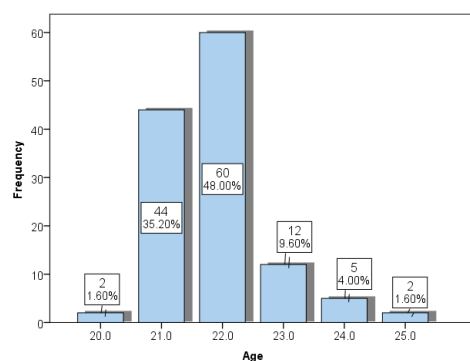


Figure 1. Bar Graph of Frequency Distribution and Percentage on Age of Science Preservice Teachers

Figure 1 reveals that the dominant age among science preservice teachers is 22 years old ($n = 60$; 48.0%), followed by 21 years old ($n = 44$; 35.2%), 23 years old ($n = 12$; 9.6%), 24 years old ($n = 5$; 4.0%), while ages 25 and 20 years old have the least frequency ($n = 2$; 1.6% each). The concentration of respondents within the 21 to 23 age range indicates that the majority are traditional-aged college students progressing through their teacher education program within the expected timeframe. This age distribution aligns with findings by Darling-Hammond et al. (2017), who established that teacher candidates entering the profession at younger ages tend to have greater adaptability to pedagogical training and professional development.

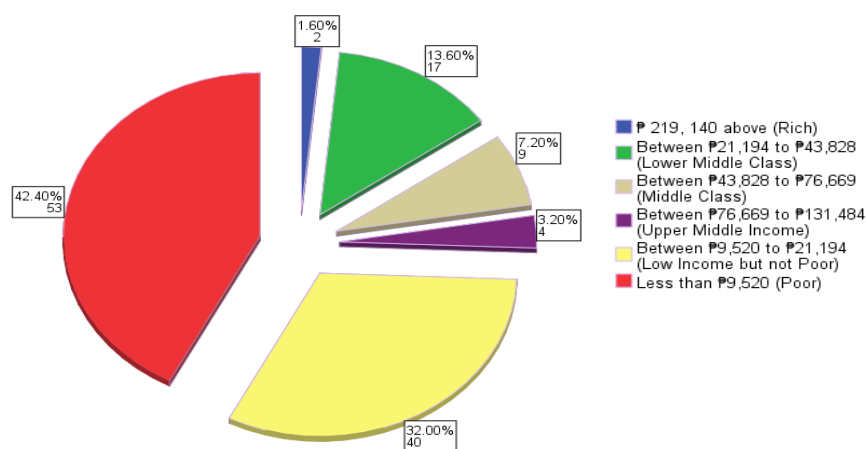


Figure 2. Pie Graph of Frequency Distribution and Percentage on Family Income Class of Science Preservice

Figure 2 shows that the majority of science preservice teachers belong to the poor class ($n = 53$; 42.4%), followed by low income but not poor ($n = 40$; 32.0%), lower middle class ($n = 17$; 13.6%), middle class ($n = 9$; 7.2%), upper middle income ($n = 4$; 3.2%), and rich class with the least frequency ($n = 2$; 1.6%). The predominance of science preservice teachers from poor and low-income families indicates that teacher education in Tacloban City draws significantly from economically disadvantaged segments of the population. Carver-Thomas and Darling-Hammond (2017) established that schools serving low-income communities disproportionately draw from candidates with similar socioeconomic backgrounds, as teaching is perceived as a more accessible and stable profession relative to other fields.

3.2 Scientific literacy of science preservice teachers

Table 2. Mean, Standard Deviation, and Verbal Interpretation of the Subscales and Overall Scientific Literacy

Scientific Literacy	N	Mean	SD	Interpretation
<i>Habits of the Mind</i>	125	4.43	0.478	<i>Very High</i>
<i>Character and Values</i>	125	4.61	0.397	<i>Very High</i>
<i>Science as Human Endeavor</i>	125	4.59	0.408	<i>Very High</i>
<i>Metacognition and Self-Direction</i>	125	4.47	0.501	<i>Very High</i>
Total	125	4.52	0.381	Very High

Science preservice teachers demonstrated very high overall scientific literacy ($M = 4.52$; $SD = 0.381$). All four subscales were rated at the very high level: Habits of Mind ($M = 4.43$; $SD = 0.478$), Character and Values ($M = 4.61$; $SD = 0.379$), Science as Human Endeavor ($M = 4.59$; $SD = 0.408$), and Metacognition and Self-Direction ($M = 4.47$; $SD = 0.501$), as seen in Table 2. The very high Habits of Mind scores suggest that preservice teachers are highly competent in investigating scientific phenomena and addressing challenges at personal, community, and global levels (Mun et al., 2015), consistent with findings by Wiyarsi et al. (2024). The Character and Values subscale results indicate that preservice teachers exhibit excellent dispositions as global citizens capable of initiating environmental action (Çalik et al., 2020). The Science as Human Endeavor results reflect an advanced understanding of science as a socially embedded enterprise enabling evidence-based decision-making (Dogan et al., 2022), while the Metacognition and Self-Direction scores indicate effective self-regulatory practices integral to lifelong learning (Dori et al., 2024). These outcomes affirm that the science teacher education curriculum in the study locale effectively develops global scientific literacy competencies. Walag et al. (2022) established that Filipino science teachers' scientific literacy is significantly correlated with science teaching efficacy, confirming the practical significance of the very high literacy levels observed.

3.3 Climate change anxiety of science preservice teachers

Table 3. Mean and Standard Deviation of Climate Change Anxiety among Science Preservice Teachers

Climate Change Anxiety	N	Mean	SD	Interpretation
Cognitive-Emotional Impairment	125	3.45	0.790	<i>High Level</i>
Functional Impairment	125	3.28	1.014	<i>Moderate Level</i>
Total	125	3.37	0.790	<i>High Level</i>

As seen in Table 3, science preservice teachers exhibited a high overall level of climate change anxiety ($M = 3.37$; $SD = 0.790$). The Cognitive-Emotional Impairment subscale was rated high ($M = 3.45$; $SD = 0.790$), indicating persistent intrusive thoughts and distressing emotions related to climate change that disrupt daily functioning, consistent with findings by Bakul et al. (2025) among Gen-Z populations reported a significant mean score on the cognitive-emotional impairment subscale among Gen-Z Bangladeshis, highlighting their negative cognitive and emotional responses related to climate change. The Functional Impairment subscale was at a moderate level ($M = 3.28$; $SD = 1.014$), suggesting that while climate-related distress affects academic and social functioning, secondary appraisal processes or the evaluation of available coping resources, partially buffer its impact on daily life (Clayton & Karazsia, 2020). These findings align with the results of Hickman et al., (2021) indicating that 84% of Filipino youth experience extreme climate worry, the highest proportion among ten countries studied, and with Aruta and Simon's (2022) assertion that these psychological responses are driven by the nation's high hazard vulnerability. Within the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984),

the elevated cognitive-emotional impairment scores indicate that primary appraisals categorize climate change as a significant existential threat, while the moderate functional impairment scores suggest that coping resources are only partially sufficient in moderating this distress.

3.4 Group differences in climate change anxiety

Table 4. Independent Samples T-test (Student's t) on Climate Change Anxiety when Grouped According to Sex

Demographic Profile		Statistic	df	p
Sex	Student's t	-0.0264	123	0.979

Table 4 presents the Independent Samples T-test on climate change anxiety when grouped according to sex. Table 4 shows that climate change anxiety mean scores across sex groups are not statistically significant, $t(123) = -0.0264$, $p = .979$, thereby failing to reject the null hypothesis. This finding suggests that climate change anxiety levels do not differ when grouped according to sex. Sanchez et al. (2024) established that climate-related psychological distress operates as a broadly shared experience among Filipino university students regardless of sex, affirming that demographic variables such as sex do not function as differentiating factors in the manifestation of eco-anxiety.

Table 5. One-Way ANOVA on Climate Change Anxiety when Grouped According to Age and Family Income Class

Demographic Profile	F	df1	df2	p
Age	1.43	5	119	0.219
Family Income Class	1.09	5	119	0.367

Table 5 presents the One-Way ANOVA on climate change anxiety when grouped according to age and family income class. Table 5 shows that climate change anxiety mean scores across age groups are not statistically significant, $F(5, 119) = 1.43$, $p = .219$, thereby failing to reject the null hypothesis. This finding suggests that climate change anxiety levels do not differ when grouped according to age. Ogunbode et al. (2023) found that climate distress is fundamentally driven by direct exposure and perceived vulnerability rather than age. In high-risk areas, the shared reality of climate threats creates a uniform baseline of anxiety that outweighs developmental or generational variations.

Table 5 shows that climate change anxiety mean scores across family income class groups are not statistically significant, $F(5, 119) = 1.09$, $p = .367$, thereby failing to reject the null hypothesis. This finding suggests that climate change anxiety levels do not differ when grouped according to family income class. Aruta (2023) observed that climate change anxiety among Filipino university students is primarily driven by collective awareness and the nation's shared geographic vulnerability rather than individual economic status. Within the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), this suggests that the primary appraisal of climate change as an existential threat is so overwhelming in a post-disaster context that individual material resources are perceived as insufficient to mitigate the resulting emotional distress.

3.5 Relationship between scientific literacy and climate change anxiety

Table 6. Pearson r Analysis on Scientific Literacy Mean Scores and Climate Change Anxiety Mean Scores

		Scientific Literacy
Climate Change Anxiety	Pearson's r	0.181
	df	123
	p-value	0.043

Table 6 presents the Pearson r analysis on scientific literacy mean scores and climate change anxiety mean scores. Table 6 reveals that the relationship between scientific literacy ($M = 4.52$; $SD = 0.381$) and climate change anxiety ($M = 3.37$; $SD = 0.790$) shows a statistically significant, positive, weak relationship, $r(123) = .181$, $p = .043$, thereby rejecting the null hypothesis of no relationship. This finding indicates that science preservice teachers who demonstrate higher levels of scientific literacy tend to experience slightly higher levels of climate change anxiety. Stanley et al. (2021) specifically found that deeper comprehension of climate science correlated with higher distress due to recognition of the severity and irreversibility of climate impacts. Similarly, Sanchez et al. (2024) and Simon et al. (2025) found that greater climate change awareness was significantly associated with slightly increased eco-anxiety among university students in the Philippines. The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) explains the operation of primary appraisal processes wherein scientific knowledge intensifies perceived threat. Clayton (2020) argued that people experience stronger climate anxiety when they appraise climate change as catastrophic and uncontrollable, an appraisal pattern most likely to be informed by rigorous scientific understanding. The weak magnitude of the correlation ($r = .181$) indicates that scientific literacy accounts for only a modest portion of the variance in climate anxiety, and that lurking variables may play substantial roles. Hogg et al. (2021) found that problem-focused coping strategies and perceived efficacy can moderate the relationship between climate knowledge and distress, suggesting that the knowledge-anxiety link may be mediated by coping-related variables not examined in the present study.

3.6 Scientific literacy as a predictor of climate change anxiety

Table 7. Linear Regression Analysis (Model Fit Measures and Model Coefficients) on Scientific Literacy Mean Scores and Climate Change Anxiety Mean Scores

Model	R	R ²	Overall Model Test			
			F	df1	df2	p
1	0.181	0.0327	4.16	1	123	0.043
Predictor			Estimate	SE	t	p
Intercept			1.678	0.834	2.01	0.046
Scientific Literacy			0.376	0.184	2.04	0.043

Table 7 presents the Linear Regression Analysis on scientific literacy mean scores and climate change anxiety mean scores. Table 7 shows that scientific literacy significantly predicts climate change anxiety, $F(1, 123) = 4.16$, $p = .043$, with scientific literacy explaining approximately 3.27% of the variance in climate change anxiety ($R^2 = .033$). The regression equation was: Climate Change Anxiety = $1.678 + 0.376(\text{Scientific Literacy})$. The intercept was statistically significant ($\beta = 1.678$, $SE = 0.834$, $t = 2.01$, $p = .046$), as was the slope for scientific literacy ($\beta = 0.376$, $SE = 0.184$, $t = 2.04$, $p = .043$), indicating that for every one-unit increase in scientific literacy, climate change anxiety increases by 0.376 units. The null hypothesis that scientific literacy does not significantly predict climate change anxiety is therefore rejected. The positive predictive effect aligns with the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). Increased scientific literacy facilitates a more comprehensive technical understanding of climate change, which intensifies the primary appraisal of the phenomenon as a systemic threat to well-being. Ojala (2012) noted that scientific knowledge can generate psychological tension when the recognized severity of environmental issues exceeds perceived personal efficacy or available solutions. Monroe et al. (2019) affirmed that preservice teachers with higher risk perception benefit from structured guidance that pairs content instruction with emotional coping strategies. Bakul et al. (2025) further found that ecological coping is significantly related to climate anxiety, suggesting that coping-oriented instruction may simultaneously address distress and promote pro-environmental behavioral engagement among future educators. The limited explanatory power of scientific literacy ($R^2 = 3.27\%$) confirms that climate change anxiety is multiply determined, and future research should incorporate coping efficacy, perceived institutional support, and place-based climate exposure as additional predictors to construct a more complete explanatory model of climate anxiety among preservice science teachers.

3.7 Policy recommendation based on the findings of the study

The findings of this study carry direct implications for policy development at multiple institutional and governmental levels, as the confirmation that scientific literacy significantly predicts climate change anxiety among science preservice teachers provides an empirical basis for revising existing policy frameworks governing science teacher education in the Philippines. The Commission on Higher Education is recommended to revise CMO 75, s. 2017 to mandate the integration of climate change mental health literacy as a required learning competency within the BSEd Science program, addressing the current omission of affective and psychological dimensions in the existing policy framework. A revised curriculum framework should require all BSEd Science programs to include learning outcomes related to climate science communication, emotional regulation in the context of environmental distress, and agency-building approaches embedded

across existing science content courses rather than isolated in a standalone subject (Monroe et al., 2019). CHED is further recommended to issue a separate memorandum directing all teacher education institutions to establish institutional mental health programs responsive to climate change anxiety, in compliance with Republic Act No. 11036, with implementing guidelines specifying that institutions in climate-vulnerable areas including Eastern Visayas and Bicol are required to develop climate-responsive mental health support mechanisms. These mechanisms should include psychoeducational programs that normalize climate anxiety as a legitimate psychological response, peer support structures organized around shared environmental concerns, and referral pathways connecting students experiencing severe functional impairment to licensed mental health professionals. Collectively, these policy recommendations advance the simultaneous achievement of SDG 3, SDG 4, and SDG 13 by ensuring that science teacher education addresses the scientific, psychological, and pedagogical dimensions of climate change in an integrated and institutionally supported manner.

4. Conclusion

This study examined scientific literacy as a predictor of climate change anxiety among 125 science preservice teachers in Tacloban City, addressing a research gap concerning how scientific literacy relates to psychological distress in a climate-vulnerable Philippine context. Science preservice teachers demonstrated very high overall scientific literacy ($M = 4.52$) across all four dimensions of the GSLS, indicating that the current science teacher education curriculum effectively develops the cognitive, ethical, and metacognitive competencies associated with global scientific literacy. Concurrently, the same respondents exhibited a high overall level of climate change anxiety ($M = 3.37$), with cognitive-emotional impairment at a high level ($M = 3.45$) and functional impairment at a moderate level ($M = 3.28$).

Climate change anxiety did not differ significantly across any of the three demographic variables examined, indicating that climate-related distress in this locale operates as a shared experience driven by collective geographic vulnerability rather than individual characteristics (Aruta, 2023; Ogunbode et al., 2023). A significant, positive, weak relationship was established between scientific literacy and climate change anxiety [$r(123) = .181, p = .043$], and linear regression confirmed that scientific literacy is a statistically significant predictor of climate change anxiety [$(\beta = 1.678, SE = 0.834, t = 2.01, p = .046)$], with each unit increase in scientific literacy associated with a 0.376-unit increase in anxiety [$(\beta = 0.376, SE = 0.184, t = 2.04, p = .043)$]. These findings demonstrate that within a population of science preservice teachers in a high-risk locale, greater scientific literacy intensifies rather than buffers climate-related psychological distress, consistent with the primary appraisal mechanism of the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984). The results affirm the need to integrate psychological coping resources alongside scientific content in preservice teacher education and underscore the urgency of institutional and policy-level responses addressing both the competency and mental health dimensions of climate change education.

5. Recommendations

Based on the findings, the following recommendations are advanced. First, the Commission on Higher Education is recommended to revise existing curriculum policy (CHED CMO 75, s. 2017) to mandate the integration of climate change mental health literacy competencies into the BSEd Science curriculum. This revision should incorporate evidence-based coping strategies grounded in the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), climate science communication skills, and agency-building approaches consistent with constructive hope frameworks (Ojala, 2012), given that scientific literacy absent corresponding coping competencies significantly amplifies climate-related distress (Monroe et al., 2019). Second, CHED is recommended to issue guidelines requiring all teacher education institutions to establish or strengthen institutional mental health programs specifically responsive to climate change anxiety, in compliance with Republic Act No. 11036, particularly for institutions situated in climate-vulnerable areas such as Tacloban City. Third, science educators are encouraged to pair content delivery with efficacy-building and solutions-focused activities and to adopt psychoeducational approaches universally applicable across demographic groups, given that climate-related distress did not differ significantly across sex, age, or income class. Fourth, future researchers are encouraged to replicate this study across geographic regions with varying degrees of climate hazard exposure, to incorporate coping efficacy and perceived institutional support as additional predictor variables, and to extend the line of inquiry to in-service teachers and secondary school students in order to advance the generalizability of findings on the scientific literacy–climate anxiety relationship.

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