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Baseline Assessment of Eco-Anxiety Among Nigerian STEM Undergraduates: Prevalence, Intensity, and Demographic Predictors for Developing Trauma-Informed Pedagogy and Counselling Interventions

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ABSTRACT

Eco-anxiety, defined as chronic psychological distress linked to awareness of environmental degradation, is an emerging mental health concern among young people globally. However, its prevalence and correlates among STEM undergraduates in African higher education contexts remain virtually undocumented. This pilot study provides a baseline assessment of eco-anxiety prevalence, intensity, and demographic predictors among STEM undergraduates at Adeyemi Federal University of Education, Ondo (AFUED), Nigeria, as foundation for developing trauma-informed climate pedagogy and counselling interventions. A cross-sectional quantitative survey design was employed with 412 STEM undergraduates (51.9% male, 46.1% female; mean age 21.4 years) drawn from a population of 500. Eco-anxiety was measured using a culturally adapted 13-item Climate Anxiety Scale (CAS; Cronbach's $\alpha = 0.88$; possible range 13–65). Data were analyzed using descriptive statistics, independent t-test, one-way ANOVA, Pearson correlation, and multiple linear regression. Using sample-relative 75th-percentile cutoffs (CAS ≥ 56), 24.8% of participants scored in the elevated range relative to the sample distribution; this is a descriptive, sample-relative index and not a clinical prevalence estimate. Female students reported significantly higher scores than males ($M = 52.1$ vs. 47.6, $p < 0.05$). Physics students reported the highest scores ($M = 53.2$), significantly higher than mathematics, computer science, and vocational education students ($p < 0.05$). Year of study correlated weakly but significantly with eco-anxiety ($r = 0.18$, $p < 0.05$), with final-year students reporting the highest scores. Prior personal experience of climate disasters (reported by 36.2% of participants) was associated with significantly higher scores ($M = 53.6$ vs. 47.2, $p < 0.05$). The regression model explained 24% of variance, with gender, year of study, prior disaster experience, and discipline as significant predictors. These single-institution findings provide preliminary baseline data directly informing the Climate-Emotional Resilience Program (CERP) and a planned multi-institution study; replication is required before national generalization.

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INTRODUCTION

Climate change has transcended its status as a purely environmental phenomenon to become a profound mental health crisis, particularly among young people who face a future shaped by ecological uncertainty (Clayton, 2020; Hickman et al., 2021). The term eco-anxiety—defined as a chronic fear of environmental doom characterized by distress, helplessness, and preoccupation with climate-related threats—has gained increasing recognition in psychological and educational literature (Albrecht, 2011; Clayton, 2020; Cunsolo & Ellis, 2018). Unlike generalized anxiety, eco-anxiety stems from a realistic appraisal of environmental degradation, making it a rational yet potentially debilitating response to planetary crises (Ojala, 2012; Pihkala, 2020).

Globally, studies indicate that eco-anxiety is disproportionately high among adolescents and young adults. Hickman et al. (2021) surveyed 10,000 individuals aged 16–25 across ten countries and found that 75% reported that the future is frightening, with 56% believing humanity is doomed. The study included Nigerian participants, making its findings particularly relevant to the African context. Subsequent research has confirmed that these feelings are not transient but can persist and intensify with continued exposure to climate science education and climate-related disasters (Clayton, 2020; Ogunbode et al., 2022).

The educational context is particularly significant. University students, especially those in Science, Technology, Engineering, and Mathematics (STEM) disciplines, receive intensive training in climate mechanisms, models, and projections. While this knowledge is essential for developing future climate solutions, it also exposes students to catastrophic scenarios without necessarily equipping them with psychological coping resources (Howard, 2023; Pihkala, 2020). This paradox has led scholars to call for trauma-informed climate pedagogy—an approach that acknowledges the emotional weight of climate science and integrates mental health support into environmental education (Atkinson & Ray, 2024; Ojala, 2012; Verlie, 2022).

Despite growing global awareness of eco-anxiety as a legitimate mental health concern, the phenomenon remains severely understudied in African higher education contexts. Nigeria, Africa's most populous nation, faces acute climate vulnerabilities including desertification in the north, coastal erosion in the south, and increasingly frequent flooding and extreme weather events nationwide (IPCC, 2023). Nigerian universities have responded by strengthening climate education curricula, particularly within STEM faculties, to promote sustainability literacy and prepare graduates for climate-related professions. However, preliminary evidence suggests an unintended consequence: rising eco-anxiety among STEM undergraduates. A 2023 internal survey at Adeyemi Federal University of Education (AFUED) revealed that 62% of physics students reported heightened anxiety following climate-related coursework, while nearly half expressed diminished confidence in their professional ability to contribute meaningfully to climate solutions. These findings align with international research demonstrating that climate education emphasizing doom-and-gloom scenarios without solutions-oriented framing can exacerbate psychological distress (Hickman et al., 2021; Ojala, 2012).

The problem is compounded by the absence of culturally adapted assessment instruments and intervention frameworks. Most eco-anxiety research has been conducted in Global North countries (United States, United Kingdom, Australia, Finland), with limited attention to how eco-anxiety manifests in African cultural contexts where climate vulnerabilities are high but mental health infrastructure is under-resourced (Ogunbode et al., 2022). Nigerian universities lack trauma-informed climate curricula, structured counselling protocols for climate distress, and empirical baseline data needed to design culturally appropriate interventions.

A systematic examination of the literature reveals three critical gaps that this study addresses. First, prevalence data from African STEM populations are virtually nonexistent. While eco-anxiety has been quantified among university students in Europe (Hickman et al., 2021), North America (Clayton, 2020), and across 32 countries including Nigeria (Ogunbode et al., 2022), no study has specifically examined eco-anxiety exclusively among Nigerian STEM undergraduates at a single institution as a pilot baseline. Given Nigeria's unique environmental vulnerabilities and distinct educational system, direct extrapolation from aggregated cross-national findings is insufficient (Ogunbode et al., 2022). Second, demographic predictors of eco-anxiety remain poorly understood in non-Western contexts. International studies have yielded mixed findings regarding gender, age, and discipline as moderators of eco-anxiety (Clayton, 2020; Pihkala, 2020). Some research suggests women report higher eco-anxiety, while others find no significant gender differences (Ogunbode et al., 2022). Similarly, the relationship between academic discipline (e.g., physics versus biology versus engineering) and eco-anxiety intensity has not been systematically examined in Nigerian universities. Third, no baseline data exist to inform trauma-informed pedagogy in Nigerian STEM education. The call for trauma-informed climate pedagogy (Atkinson & Ray, 2024; Verlie, 2022) cannot be operationalized without empirical data on the prevalence, intensity, and correlates of student eco-anxiety within specific institutional contexts. Policymakers, curriculum developers, and counselling services require localized evidence to design interventions that are both effective and culturally appropriate (Howard, 2023).

This study provides a pilot baseline assessment of eco-anxiety among STEM undergraduates at a single Nigerian university (AFUED), and its significance is threefold. Theoretically, the study contributes to the growing body of eco-anxiety research by extending empirical investigation to an understudied African higher education context. Findings will illuminate whether established patterns from Global North research (e.g., gender differences, discipline effects) replicate in a Nigerian institutional setting or whether culturally distinct manifestations emerge. Practically, the study generates actionable data for AFUED administrators,

lecturers, and counsellors. By identifying which student subgroups (e.g., specific disciplines, year levels, gender groups) experience comparatively elevated eco-anxiety intensity, the study enables targeted, resource-efficient interventions. The baseline data directly inform the development of trauma-informed climate pedagogy and counselling protocols tailored to AFUED's STEM education context. From a policy perspective, the study addresses a critical omission in Nigerian national education and climate policies. The National Climate Change Policy (2021) addresses mitigation and adaptation but completely overlooks mental health dimensions. Similarly, National Universities Commission guidelines lack provisions for mental health-sensitive STEM education. This study's findings will provide preliminary empirical evidence to advocate for policy reforms integrating psychological wellbeing into climate education frameworks. Importantly, because this is a single-institution pilot study, the findings are intended to inform local practice and to serve as the foundation for a planned multi-institution study across Nigeria's six geopolitical zones; national generalization awaits replication.

The study is guided by the following research questions. First, what is the sample-relative prevalence of elevated eco-anxiety symptoms among STEM undergraduates at AFUED? Second, what is the intensity level (low, moderate, high) of eco-anxiety symptoms among AFUED STEM undergraduates relative to the sample distribution? Third, are there statistically significant differences in eco-anxiety scores based on demographic variables including gender (male vs. female), STEM discipline (physics, chemistry, biology, mathematics, computer science, vocational/technical education), year of study (100-level to 400-level), and prior personal experience with climate-related disasters? Fourth, which demographic variables significantly predict eco-anxiety scores among AFUED STEM undergraduates?

Correspondingly, the following null hypotheses are tested at a significance level of $\alpha = 0.05$:

- $H_{0\,1}$: There is no statistically significant gender difference in eco-anxiety scores among AFUED STEM undergraduates.
- $H_{0\,2}$: There is no statistically significant difference in eco-anxiety scores across STEM disciplines.
- $H_{0\,3}$: There is no statistically significant correlation between year of study and eco-anxiety scores.
- $H_{0\,4}$: Demographic variables (gender, discipline, year of study, prior disaster experience) do not collectively predict eco-anxiety scores among AFUED STEM undergraduates.

This study is conceptually grounded in Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 2006), which posits that individual development is shaped by nested environmental systems. In the context of eco-anxiety, the microsystem includes students' direct interactions with lecturers, course materials, and peers in climate education settings. The mesosystem encompasses interactions between academic departments and counselling services. The exosystem includes institutional policies and curriculum guidelines from the National Universities Commission. The macrosystem comprises broader cultural attitudes toward climate change, mental health stigma, and environmental stewardship in Nigerian society. Eco-anxiety, within this framework, is understood not as an individual pathology but as a dynamic interaction between student characteristics (e.g., climate knowledge, coping styles) and environmental systems (e.g., pedagogical approaches, institutional support structures, cultural narratives). This perspective justifies the study's focus on demographic predictors while recognizing that systemic interventions (trauma-informed pedagogy, counselling protocols) are necessary to address eco-anxiety at multiple ecological levels.

For the purpose of this study, eco-anxiety is operationally defined as chronic psychological distress characterized by fear, helplessness, and preoccupation with environmental degradation, measured by the Climate Anxiety Scale (CAS) adapted for the Nigerian context. Sample-relative prevalence refers to the proportion of STEM undergraduates scoring at or above the 75th percentile of the sample distribution on the CAS, indicating comparatively elevated eco-anxiety symptoms relative to peers in this sample; it is a descriptive, sample-relative index and not a clinical prevalence estimate. Intensity refers to the severity of eco-anxiety symptoms, categorized as low, moderate, or high based on sample-derived tertile cutoffs; these are descriptive categories, not validated clinical severity levels. STEM undergraduates are students enrolled in Bachelor's degree programs in Science, Technology, Engineering, and Mathematics disciplines at AFUED. Trauma-informed pedagogy is defined as an educational approach that recognizes the potential for climate content to induce psychological distress and intentionally incorporates emotional support, agency-building, and coping strategies into climate instruction. Demographic predictors include student characteristics such as gender, STEM discipline, year of study, and prior climate disaster experience.

Following this introduction, the article presents a detailed methodology section describing study design, participants, sampling procedure, instrumentation (including adaptation of the Climate Anxiety Scale), data collection protocols, and ethical considerations. Thereafter, the results section presents descriptive statistics, sample-relative prevalence rates, intensity distributions, bivariate analyses (t-tests, ANOVA), and multivariate regression models. Subsequently, the discussion section interprets findings in relation to

existing literature and theoretical frameworks, and a dedicated Limitations subsection addresses the constraints of the single-site design. Finally, the conclusion outlines implications for trauma-informed pedagogy, counselling interventions, policy advocacy, and future research directions.

MATERIALS AND METHODS

Research Design

This study employed a cross-sectional, institution-based quantitative survey design to assess the sample-relative prevalence, intensity, and demographic predictors of eco-anxiety among STEM undergraduates at Adeyemi Federal University of Education, Ondo (AFUED), serving as a pilot study area for a planned multi-institution research programme.

Study Area

The study was conducted at Adeyemi Federal University of Education, Ondo, located in southwestern Nigeria within the tropical rainforest ecological zone. AFUED was selected as the pilot study area due to preliminary internal data indicating elevated climate-related distress among STEM students (62% of physics undergraduates reported heightened anxiety following climate-related coursework) and institutional commitment to developing trauma-informed pedagogical approaches. Because the study was conducted at a single institution within a single ecological zone, cross-zone comparisons were not possible and are reserved for the planned multi-institution follow-up study.

Study Population and Sample

The target population comprised all STEM undergraduates at AFUED (500 students) across departments of physics, chemistry, biology, mathematics, computer science, and vocational and technical education. A census approach was adopted, inviting all 500 STEM undergraduates to participate. The final achieved sample was 412 students after excluding incomplete questionnaires and students who did not meet inclusion criteria, representing an 82.4% response rate. A stratified random sampling technique ensured proportional representation across disciplines and year levels.

Students were included if they were: (a) currently enrolled in a STEM discipline at AFUED; (b) had completed at least one climate-related course; (c) aged 18 years or older; and (d) provided written informed consent. Students with pre-existing diagnosed mental health conditions or those in their first semester of first year were excluded. The rationale for excluding students with diagnosed mental health conditions was to protect a clinically vulnerable group in a study without an established clinical care pathway; however, as noted in the Limitations, this exclusion likely removed some of the highest-risk individuals and may bias prevalence estimates downward.

Instrumentation

Data were collected using a structured, self-administered questionnaire with three sections.

Section A collected demographic and academic information including gender, age, STEM discipline, year of study, prior climate-related coursework, and personal experience with climate disasters.

Section B measured eco-anxiety using the adapted Climate Anxiety Scale (CAS) developed by Clayton and Karazsia (2020). The original 22-item CAS assesses climate change anxiety via four subscales: cognitive-emotional impairment (8 items), functional impairment (5 items), behavioral engagement (5 items), and personal experience (4 items). However, subsequent validation studies have supported a 13-item two-factor structure (cognitive-emotional impairment and functional impairment) as the best-fitting model (Mouguiama-Daouda et al., 2022). For the purposes of this study, the 13-item two-factor structure was adopted: cognitive-emotional impairment (8 items) and functional impairment (5 items). Each item is rated on a 5-point Likert scale from 1 (never) to 5 (almost always), yielding a possible total score range of 13 to 65. The CAS underwent cultural adaptation for the Nigerian context through translation into Yoruba and Nigerian Pidgin English, cognitive interviewing with 30 students, expert panel review, and pilot testing with 120 students. The adapted 13-item CAS demonstrated excellent reliability (Cronbach's $\alpha = 0.88$).

Section C contained an 8-item Climate Agency and Coping Scale for validation purposes, to be reported separately.

Validity and Reliability

Content validity was established through expert panel review, yielding a Scale Content Validity Index of 0.94. Construct validity was confirmed through confirmatory factor analysis (CFI = 0.91, RMSEA = 0.06). Internal consistency for the 13-item version actually used in the study was excellent (Cronbach's $\alpha = 0.88$); subscale reliabilities were $\alpha = 0.86$ for cognitive-emotional impairment and $\alpha = 0.81$ for functional impairment. Two-week test-retest reliability was strong ($r = 0.85$, $p < 0.05$).

Data Collection Procedures

Data collection was conducted from May to July 2026. Ethical approval was obtained from the Institutional Review Board of AFUED (Approval No: AFUED/IRB/2026/045). Five research assistants were trained in research ethics and data collection protocols. Questionnaires were administered in university classrooms during pre-arranged sessions, requiring approximately 25–30 minutes to complete. Written

informed consent was obtained from all participants, who were assured of confidentiality and anonymity. A licensed counsellor was present at each session for immediate debriefing, and distressed participants were referred to university counselling services.

Data Analysis

Data were analyzed using SPSS version 29.0. Descriptive statistics (frequencies, percentages, means, standard deviations) were computed. The proportion of participants with sample-relative elevated eco-anxiety symptoms was defined as the proportion scoring at or above the 75th percentile on the CAS; this is a descriptive, sample-relative index and not a clinical prevalence estimate. Intensity was categorized using sample-derived tertile-based cutoffs: low (below 33rd percentile), moderate (33rd to 66th percentile), and high (above 66th percentile); these are descriptive categories, not validated clinical severity levels. Independent samples t-test, one-way ANOVA with Tukey's HSD post-hoc tests, Pearson's correlation, and standard multiple linear regression were employed to test four null hypotheses at $\alpha = 0.05$. All parametric assumptions were verified.

Treatment of gender in analyses: In the corrected dataset (N = 412), 8 participants (1.9%) selected non-binary/prefer not to say. Because this group is too small for stable estimation and the study's gender hypothesis concerns male–female differences, these 8 participants were excluded listwise from the gender t-test and from the regression model; the regression therefore runs on N = 404 (male = 214, female = 190). A footnote reports that entering the non-binary group as a separate dummy variable did not change the pattern or significance of the other predictors.

RESULTS AND DISCUSSION

This section presents the findings of the baseline assessment of eco-anxiety among STEM undergraduates at Adeyemi Federal University of Education, Ondo. The results are organized according to the research questions and hypotheses that guided the study. Descriptive statistics, bivariate analyses, and multivariate regression results are presented in tabular format, with each discussion following directly beneath its corresponding table. All results are based on the corrected dataset (N = 412) and the correct 13-item, 5-point CAS scoring (possible range 13–65).

Sample Characteristics

A total of 412 STEM undergraduates at Adeyemi Federal University of Education, Ondo participated in the study. Table 1 presents the demographic and academic characteristics of the sample.

Table 1: Demographic and Academic Characteristics of Participants (N = 412)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	214	51.9
	Female	190	46.1
	Non-binary/Prefer not to say	8	1.9
STEM Discipline	Physics	69	16.7
	Chemistry	66	16.0
	Biology	82	19.9
	Mathematics	58	14.1
	Computer Science	74	18.0
	Vocational/Technical Education	63	15.3
Year of Study	100-level	103	25.0
	200-level	124	30.1
	300-level	107	26.0
	400-level	78	18.9
Prior Climate Disaster Experience	Yes	149	36.2
	No	263	63.8
Mean Age (years)		21.4 (SD = 2.3)	

The sample was predominantly male (51.9%) with a mean age of 21.4 years. Biology students constituted the largest disciplinary group (19.9%), while 200-level students were the most represented year group (30.1%). More than one-third (36.2%) of participants reported prior personal experience with climate-related disasters such as flooding or extreme heat. This demographic distribution is broadly representative of STEM enrollment patterns at AFUED, where male students typically outnumber female students in physical sciences and engineering disciplines, while biological sciences tend to have more balanced gender representation. The high proportion of students reporting disaster exposure (36.2%) reflects Nigeria's increasing vulnerability to climate-related hazards, particularly flooding in the southwestern region where AFUED is located. This

contextual factor is significant because direct disaster exposure has been shown to amplify psychological responses to climate information, as will be discussed in subsequent sections.

Research Question 1: What is the sample-relative prevalence of elevated eco-anxiety symptoms among STEM undergraduates at AFUED?

The proportion of participants with sample-relative elevated eco-anxiety symptoms was determined using the adapted Climate Anxiety Scale (CAS), with a possible score range of 13 to 65 (13-item two-factor structure). The mean CAS total score was 49.8 (SD = 11.4). Using the 75th percentile cutoff (CAS score ≥ 56), the proportion of participants with sample-relative elevated eco-anxiety symptoms relative to the sample distribution was 24.8% (n = 102). Table 2 presents the distribution of CAS scores.

Table 2: Distribution of Climate Anxiety Scale (CAS) Scores (N = 412)

Statistic	Value
Mean CAS Score	49.8
Standard Deviation	11.4
Minimum Score	24
Maximum Score	63
Skewness	0.38
Kurtosis	−0.21
25th Percentile	42
50th Percentile (Median)	49
75th Percentile (Cutoff)	56

Note: Possible CAS range = 13–65 (13 items × 5-point scale). All observed scores fell within this range. The 75th-percentile cutoff is sample-relative and descriptive; it is not a validated clinical cutoff.

The finding that 24.8% of AFUED STEM undergraduates scored at or above the 75th percentile of the sample distribution represents a substantial sample-relative symptom burden within this population; the clinical significance of this figure requires validation against a diagnostic standard, which does not currently exist for the Nigerian context. This proportion is broadly comparable to findings from global studies. Hickman et al. (2021) reported that 75% of young people across ten countries found the future frightening, with 56% believing humanity is doomed. The present study's proportion of 24.8% for sample-relative elevated symptoms is lower, but direct comparison is limited because Hickman's study measured general climate distress rather than elevated symptoms meeting a cutoff threshold, and because the present study used a sample-relative rather than clinical cutoff. The mean score of 49.8 indicates that the average student experiences eco-anxiety at a level that is noticeable and potentially disruptive, though the sample-relative nature of the classification should be kept in mind. The near-normal distribution (skewness = 0.38, kurtosis = −0.21) suggests that eco-anxiety is distributed across the student population rather than concentrated in a small subgroup, reinforcing the need for both universal and targeted interventions.

Research Question 2: What is the intensity level (low, moderate, high) of eco-anxiety symptoms among AFUED STEM undergraduates relative to the sample distribution?

Eco-anxiety intensity was categorized using sample-derived tertile-based cutoffs: low (scores below the 33rd percentile), moderate (33rd to 66th percentile), and high (above the 66th percentile). Using this approach, the intensity distribution among participants is presented in Table 3.

Table 3: Intensity Levels of Eco-Anxiety Among Participants (N = 412)

Intensity Level	CAS Range	Frequency (n)	Percentage (%)
Low	Below 44	136	33.0
Moderate	44–55	159	38.6
High	56 or above	117	28.4

Note: The 33rd and 66th percentile cutoffs were 44 and 55, respectively, based on the sample distribution. These are descriptive categories, not validated clinical severity levels.

More than half of the participants (67.0%) exhibited moderate to high eco-anxiety symptoms relative to the sample distribution, with 28.4% in the high category. The cognitive-emotional impairment subscale (M = 29.6, SD = 7.1) yielded higher scores than the functional impairment subscale (M = 20.2, SD = 5.0), suggesting that students experienced greater distress in thinking and

worrying about climate change than in day-to-day functional disruptions.

The intensity distribution reveals that nearly one in three AFUED STEM students is experiencing high-level eco-anxiety symptoms relative to the sample distribution. In practical terms, this means that in a typical STEM classroom of 50 students, approximately 12–14 students may be experiencing sample-relative elevated climate-related distress. This finding justifies the need for institutional-level responses, including training for lecturers to recognize eco-anxiety symptoms and accessible counselling protocols specifically addressing climate distress. The severity distribution also highlights the need for tiered interventions: universal prevention for all students, targeted support for those with moderate symptoms, and more intensive support for those with high-level symptoms. These figures are sample-relative and descriptive; they should not be interpreted as clinical caseness rates.

The finding that cognitive-emotional impairment exceeds functional impairment is noteworthy. This pattern suggests that STEM students are experiencing significant psychological distress in the form of rumination, worry, and helplessness about climate change, but this distress has not yet fully translated into widespread functional disability (e.g., inability to attend classes, complete assignments, or maintain social relationships). This distinction is practically important because it indicates a window of opportunity for preventive intervention. If trauma-informed pedagogy and counselling support are implemented at this stage, further deterioration into functional impairment may be preventable. This finding aligns with the concept of eco-anxiety as a continuum rather than a categorical condition, where early intervention can prevent progression from cognitive-emotional distress to functional disability (Clayton, 2020; Pihkala, 2020). The high cognitive-emotional scores indicate that students are deeply engaged with climate issues at a cognitive level, which is both a strength (they are informed and concerned) and a vulnerability (they are experiencing significant distress). This dual nature of climate engagement underscores the need for pedagogical approaches that maintain scientific rigor while providing psychological support.

Research Question 3: Are there statistically significant differences in eco-anxiety scores based on demographic variables?

(a) Gender (male vs. female)

Hypothesis 1 ($H_{0\ 1}$): There is no statistically significant gender difference in eco-anxiety scores among AFUED STEM undergraduates.

An independent samples t-test was conducted to compare mean CAS scores between male and female participants. Table 4 presents the results.

Table 4: Gender Differences in Eco-Anxiety Scores

Gender	n	Mean CAS Score	SD	t-value	df	p-value	Cohen's d
Male	214	47.6	10.7	−4.21	402	< 0.001	0.42
Female	190	52.1	11.9				

Note: The 8 participants who selected non-binary/prefer not to say were excluded listwise from this analysis.

Female participants reported significantly higher eco-anxiety scores (M = 52.1, SD = 11.9) compared to male participants (M = 47.6, SD = 10.7). This difference was statistically significant ($t(402) = -4.21$, $p < 0.001$, Cohen's d = 0.42), indicating a small-to-moderate effect size. Therefore, null hypothesis one ($H_{0\ 1}$) was rejected.

The finding that female students report significantly higher eco-anxiety than male students is consistent with a substantial body of international research documenting higher climate anxiety among women and girls (Clayton, 2020; Hickman et al., 2021; Ogunbode et al., 2022). The present result extends this pattern to the AFUED context, suggesting that gender differences in eco-anxiety may be consistent with findings from other cultural contexts. The effect size (Cohen's d = 0.42) indicates that while the difference is statistically significant, it is modest in magnitude, suggesting that gender is one of several factors influencing eco-anxiety rather than the dominant determinant.

Several explanations for this gender difference have been proposed in the literature. First, socialization patterns often encourage emotional expression and empathy in females, while males may be socialized to suppress emotional responses, including fear and distress about environmental issues (Pihkala, 2020). This socialization may lead males to underreport eco-anxiety while females feel more comfortable acknowledging and expressing such distress. Second, women and girls are disproportionately affected by climate change impacts globally, particularly in contexts where they bear primary responsibility for water collection, food production, and child care (IPCC, 2023). In Nigeria, women are more vulnerable to climate-related displacement and resource scarcity, which may heighten their awareness of and emotional response to climate threats. Third, research suggests that females tend to have higher risk perception across multiple domains, including environmental risks (Ogunbode et al., 2022). The present study cannot determine which of these mechanisms is operative, as

these variables were not directly assessed. However, the clear gender difference underscores the need for gender-sensitive approaches to trauma-informed pedagogy and counselling interventions. Lecturers and counsellors should be aware that female STEM students may be at comparatively elevated risk for eco-anxiety and may require additional support.

(b) STEM discipline (physics, chemistry, biology, mathematics, computer science, and vocational/technical education)

Hypothesis 2 ($H_{0\ 2}$): There is no statistically significant difference in eco-anxiety scores across STEM disciplines among AFUED undergraduates.

A one-way analysis of variance (ANOVA) was conducted to compare mean CAS scores across six STEM disciplines. Table 5 presents the results.

Table 5: Eco-Anxiety Scores by STEM Discipline

Discipline	n	Mean CAS Score	SD	95% CI
Physics	69	53.2	12.0	[50.3, 56.1]
Chemistry	66	50.1	11.3	[47.3, 52.9]
Biology	82	50.6	11.7	[48.0, 53.2]
Mathematics	58	45.2	10.1	[42.5, 47.9]
Computer Science	74	46.8	10.4	[44.4, 49.2]
Vocational/Technical Education	63	48.3	10.9	[45.6, 51.0]

The ANOVA revealed a statistically significant difference in eco-anxiety scores across STEM disciplines ($F(5, 406) = 8.62$, $p < 0.001$, $\eta^2 = 0.10$, a medium effect size). Tukey's HSD post-hoc tests indicated that physics students ($M = 53.2$, $SD = 12.0$) reported significantly higher eco-anxiety than mathematics ($p < 0.001$), computer science ($p < 0.001$), and vocational/technical education ($p = 0.004$) students. Biology and chemistry students also reported significantly higher scores than mathematics and computer science students. No significant differences were found between physics, biology, and chemistry students. Therefore, null hypothesis two ($H_{0\ 2}$) was rejected.

The finding that physics students reported the highest eco-anxiety scores reveals important disciplinary patterns. One possible explanation, which requires empirical testing in future research, is that physics students receive intensive training in climate mechanisms, atmospheric science, thermodynamics, and climate modeling. This advanced scientific knowledge includes direct engagement with worst-case scenario projections, feedback loops, tipping points, and irreversible changes. Unlike students in some other STEM disciplines, physics students cannot avoid confronting the physical realities of climate change, including the mathematics of carbon budgets and the physics of positive feedback mechanisms. This deep, mechanistic understanding of climate systems may paradoxically increase eco-anxiety because it leaves less room for optimistic denial. This finding aligns with research suggesting that greater climate knowledge, when not accompanied by coping resources, can increase rather than decrease distress (Clayton, 2020; Ojala, 2012). However, this study did not directly assess curriculum content, teaching approaches, or climate knowledge, and therefore these explanations remain hypothetical and require future investigation. Biology and chemistry students also engage substantially with climate content, including ecosystem collapse, ocean acidification, and biogeochemical cycles, which may explain their elevated scores relative to mathematics and computer science students.

These disciplinary differences have important practical implications. Trauma-informed pedagogy cannot be uniformly applied across all STEM disciplines; instead, interventions should be tailored to the specific ways each discipline engages with climate content. Physics and biology departments may require the most intensive integration of counselling support and solution-oriented framing, while computer science departments may already incorporate constructive engagement pathways that could be shared as best practices. This finding also suggests that cross-disciplinary sharing of pedagogical approaches could be beneficial, with computer science departments offering models of solution-oriented climate education that could be adapted for physics and biology contexts.

(c) Year of study (100-level, 200-level, 300-level, and 400-level)

Hypothesis 3 ($H_{0\ 3}$): There is no statistically significant correlation between year of study (100-level to 400-level) and eco-anxiety scores among AFUED STEM undergraduates.

Pearson's product-moment correlation coefficient was calculated to examine the relationship between year of study (100-level to 400-level) and CAS scores. Table 6 presents the mean scores by year of study.

Table 6: Eco-Anxiety Scores by Year of Study

Year of Study	n	Mean CAS Score	SD
100-level	103	45.4	10.2
200-level	124	48.1	10.8
300-level	107	51.9	11.5
400-level	78	53.6	12.1

A weak but statistically significant positive correlation was found between year of study and eco-anxiety scores ($r = 0.18$, $p < 0.001$). As students progressed through their academic programs, eco-anxiety scores increased modestly, with the correlation accounting for approximately 3% of variance. Senior students (400-level) reported the highest mean scores ($M = 53.6$, $SD = 12.1$), while first-year students reported the lowest ($M = 45.4$, $SD = 10.2$). Therefore, null hypothesis three ($H_{0\ 3}$) was rejected.

The weak but significant positive correlation between year of study and eco-anxiety indicates a cross-sectional association of modest magnitude, with senior students reporting higher scores than junior students. However, this could reflect cohort differences (e.g., older cohorts having different environmental experiences or concerns) rather than within-student changes over time. Longitudinal research is needed to determine whether eco-anxiety truly changes over time for individual students. The increase from first-year to final-year students (approximately 8 points on the CAS) represents a modest but meaningful elevation in distress within the sample.

A one-way ANOVA was also conducted to compare eco-anxiety scores across the four year-of-study levels. The analysis revealed a statistically significant difference ($F(3, 408) = 10.24$, $p < 0.001$, $\eta^2 = 0.07$). Tukey's HSD post-hoc tests showed that 300-level and 400-level students reported significantly higher eco-anxiety than 100-level students ($p < 0.001$ for both). However, no significant difference was found between 100-level and 200-level students ($p = 0.07$) or between 300-level and 400-level students ($p = 0.38$). This pattern suggests that the transition from 200-level to 300-level may be a period in which eco-anxiety scores diverge, a cross-sectional pattern consistent with a possible transition effect that requires longitudinal confirmation.

This finding is concerning because it suggests that the current climate pedagogy at AFUED—and possibly at Nigerian universities more broadly—may be inadvertently associated with higher climate distress rather than alleviating it. If climate education is delivered without trauma-informed principles, students may accumulate climate knowledge while also accumulating psychological distress. By the time students reach their final year, they may be both the most knowledgeable about climate solutions and the most despairing about their implementation. This pattern aligns with the concept of "doom-focused" pedagogy identified in the literature (Hickman et al., 2021; Ojala, 2012), where emphasis on catastrophic scenarios without corresponding emphasis on solutions and agency leads to increased distress.

This finding provides preliminary support for the central argument of this research: that climate education should be reconceptualized as a trauma-informed practice. The current curriculum appears to be effective at raising awareness and building knowledge, but it may be failing to build psychological resilience. Students need not only climate science content but also coping skills, hope cultivation strategies, and constructive engagement pathways. Without these elements, the logical endpoint of climate education may be highly knowledgeable but deeply distressed graduates. This finding also highlights the importance of early intervention, with trauma-informed principles integrated from the first year of study rather than only at advanced levels.

(d) Prior personal experience with climate-related disasters (yes vs. no)

Although not formally hypothesized as a separate research question, exploratory analysis examined the relationship between prior personal experience with climate-related disasters and eco-anxiety intensity. Among the 149 participants (36.2%) who reported experiencing a climate disaster (primarily flooding, $n = 97$; extreme heat, $n = 35$; both, $n = 17$), mean CAS scores were significantly higher ($M = 53.6$, $SD = 12.3$) compared to those without such experience ($M = 47.2$, $SD = 10.6$; $t(410) = -5.87$, $p < 0.001$).

The finding that students with prior personal experience of climate disasters reported significantly higher eco-anxiety than those without such experience is both intuitive and concerning. More than one-third (36.2%) of participants reported direct exposure to flooding, extreme heat, or both. Nigeria has experienced devastating floods in recent years, including the 2022 floods that affected over 4 million people and displaced 1.4 million. Many AFUED students are from Ondo State and surrounding regions that have experienced recurrent flooding and coastal erosion.

Direct disaster exposure appears to be associated with amplified eco-anxiety beyond the effects of climate education alone. Students who have personally experienced flooding or extreme heat do not need to imagine climate impacts; they have lived through them. For these students, climate change is not an abstract future threat but a present reality that has already disrupted their lives, damaged their homes, or displaced their families. This finding aligns with research on

ecological grief and trauma, which demonstrates that direct exposure to environmental loss intensifies psychological distress (Cunsolo & Ellis, 2018). The difference of approximately 6 points on the CAS between disaster-exposed and non-exposed students represents a practically meaningful elevation in distress within the sample that may warrant targeted intervention.

Trauma-informed pedagogy must be particularly attentive to students with direct disaster exposure, who may experience climate-related content as retraumatizing rather than educational. Counselling interventions should prioritize students with direct disaster exposure, as they represent a comparatively high-risk subgroup requiring both psychological support and recognition of their lived experiences. Lecturers should be aware that students with direct experience of flooding or extreme heat may be particularly vulnerable and should avoid using disaster imagery or worst-case scenarios without providing adequate psychological support and debriefing. This finding underscores the importance of recognizing the intersection between personal experience and educational content in shaping psychological responses to climate education.

Research Question 4: Which demographic variables significantly predict eco-anxiety scores among AFUED STEM undergraduates?

Hypothesis 4 ($H_{0\ 4}$): Demographic variables (gender, STEM discipline, year of study, and prior climate disaster experience) do not collectively and significantly predict eco-anxiety scores among AFUED STEM undergraduates.

A standard multiple linear regression analysis was conducted to determine whether demographic variables collectively predicted eco-anxiety scores. The model included gender (dummy coded: 0 = male, 1 = female), STEM discipline (dummy coded with physics as reference category), year of study (continuous), and prior climate disaster experience (dummy coded: 0 = no, 1 = yes) as predictor variables, with CAS total score as the outcome variable. Table 7 presents the regression results.

Table 7: Multiple Linear Regression Results for Demographic Predictors of Eco-Anxiety (N = 404)

Predictor Variable	B	SE	β	t	p-value	95% CI	VIF
(Constant)	41.2	1.98	—	20.81	< 0.001	[37.31, 45.09]	—
Gender (Female)	4.31	0.79	0.18	5.46	< 0.001	[2.76, 5.86]	1.04
Year of Study	1.94	0.44	0.13	4.41	< 0.001	[1.08, 2.80]	1.05
Prior Climate Disaster Experience	5.12	0.89	0.17	5.75	< 0.001	[3.37, 6.87]	1.08
Mathematics (vs. Physics)	−7.64	1.42	−0.19	−5.38	< 0.001	[−10.43, −4.85]	1.42
Computer Science (vs. Physics)	−6.21	1.37	−0.17	−4.53	< 0.001	[−8.90, −3.52]	1.38
Vocational/Tech Ed (vs. Physics)	−4.87	1.45	−0.12	−3.36	< 0.001	[−7.72, −2.02]	1.44
Chemistry (vs. Physics)	−2.41	1.40	—	−1.72	0.09	[−5.16, 0.34]	1.40
Biology (vs. Physics)	−2.13	1.36	—	−1.57	0.12	[−4.80, 0.54]	1.39

Note: R^2 = 0.24, Adjusted R^2 = 0.23, F(8, 395) = 15.62, p < 0.001. The 8 participants who selected non-binary/prefer not to say were excluded listwise from this model (N = 404). Entering the non-binary group as a separate dummy variable did not change the pattern or significance of the other predictors.

Residual diagnostics were conducted to assess model assumptions. The Durbin-Watson statistic (1.93) indicated no autocorrelation. Visual inspection of residual plots suggested approximate normality, linearity, and homoscedasticity. Cook's distance values ranged from 0.000 to 0.081, all below the threshold of 1.0, indicating no influential cases. Variance inflation factor (VIF) values ranged from 1.04 to 1.44, indicating no multicollinearity.

The regression model was statistically significant ($F(8, 395) = 15.62$, $p < 0.001$) and explained 24% of the variance in eco-anxiety scores ($R^2 = 0.24$). The following predictors were statistically significant: gender ($\beta = 0.18$, $p < 0.001$), year of study ($\beta = 0.13$, $p < 0.001$), prior climate disaster experience ($\beta = 0.17$, $p < 0.001$), and discipline comparisons for mathematics ($\beta = -0.19$, $p < 0.001$), computer science ($\beta = -0.17$, $p < 0.001$), and vocational/technical education ($\beta = -0.12$, $p < 0.001$). Chemistry and biology were not significant predictors compared to physics. Therefore, null hypothesis four ($H_{0\ 4}$) was rejected.

The regression model revealed that demographic variables collectively explained 24% of the variance in eco-anxiety scores. This is a substantial proportion for a demographic-only model, indicating that student characteristics are important determinants of eco-anxiety. The finding that gender and prior disaster experience had the strongest beta weights ($\beta = 0.18$ and $\beta = 0.17$, respectively) suggests that these are particularly important factors. The negative beta weights for mathematics, computer science, and vocational/technical education compared to physics indicate that these disciplines are associated with lower scores relative to physics.

The explained variance of 24% is substantial for a demographic-only model, but the remaining 76% of

unexplained variance suggests that other factors—including pedagogical approaches, coping strategies, social support, and institutional culture—also play significant roles. This finding supports the theoretical framework of Bronfenbrenner's Ecological Systems Theory, which posits that multiple ecological levels shape individual development. Future research should examine these additional factors to develop a more comprehensive understanding of eco-anxiety determinants.

The significant predictive power of prior disaster exposure suggests that students who have experienced climate-related disasters are a comparatively high-risk group requiring targeted intervention. The significant predictive power of gender supports the call for gender-sensitive approaches to trauma-informed pedagogy and counselling. The significant predictive power of discipline, particularly the higher scores associated with physics, suggests that departmental-level interventions may be appropriate. The significant predictive power of year of study supports the call for early intervention, with trauma-informed principles integrated from the first year of study. This study has several limitations. First, it was conducted at a single institution (AFUED) within one ecological zone, so findings cannot be generalized nationally without multi-institution replication. Second, the sample-relative percentile cutoffs are descriptive, not clinical prevalence estimates, as no validated Nigerian clinical cutoff for the CAS exists. Third, excluding students with diagnosed mental health conditions likely removed some of the highest-risk individuals, potentially biasing estimates downward. Fourth, the cross-sectional design precludes causal or longitudinal inference, and all measures were self-report. Fifth, the small non-binary subgroup (n = 8) was excluded listwise, limiting conclusions about gender-diverse students. Finally, unmeasured variables (e.g., pedagogy, coping, social support, climate knowledge) likely account for much of the unexplained variance, and the corrected population (500) and sample (412) figures reported here supersede those in the original submission.

CONCLUSION

This pilot baseline assessment has established, for the first time in a Nigerian higher education context, empirical evidence that eco-anxiety is a measurable and prevalent phenomenon among STEM undergraduates at Adeyemi Federal University of Education, Ondo. Using sample-relative 75th-percentile cutoffs (CAS $\geq$ 56), 24.8% of participants scored in the elevated range relative to the sample distribution, with 67.0% in the moderate-to-high range; these are descriptive, sample-relative indices, not clinical prevalence estimates. Female students, physics students, senior students (300-level and 400-level), and those with prior personal experience of climate-related disasters reported comparatively elevated scores in this sample. These findings indicate that AFUED STEM students are experiencing climate-related psychological distress that current educational practices may not be adequately addressing. Because this is a single-institution pilot study, the findings characterize AFUED STEM undergraduates and await replication in multi-institution studies before national generalization.

The results provide preliminary justification for the central thesis of this research programme: that Nigerian STEM education may benefit from a reconceptualization that integrates trauma-informed pedagogy with structured counselling interventions. The cross-sectional association observed between year of study and eco-anxiety ($r = 0.18$, a weak correlation) is consistent with the possibility that current climate pedagogy, while effective at transmitting climate knowledge, may be associated with higher psychological distress; longitudinal research is needed to test this interpretation. The disciplinary differences, with physics students reporting the highest scores, suggest that some STEM departments may require more intensive intervention than others. The gender difference highlights the need for gender-sensitive approaches. The disaster exposure finding underscores the importance of trauma-informed practices that recognize the lived realities of students who have directly experienced climate impacts.

This study has moved beyond mere documentation of the problem to provide preliminary baseline data that directly inform the design of the Climate-Emotional Resilience Program (CERP) and the broader Eco-Anxiety Framework proposed in the research programme. The finding that cognitive-emotional impairment exceeds functional impairment indicates a possible window of opportunity for preventive intervention before distress escalates to disability. The comparatively high endorsement of helplessness items points to agency-building as a core intervention target. The identification of comparatively elevated subgroups enables targeted, resource-efficient intervention strategies at AFUED, pending replication.

Recommendations

All STEM lecturers at AFUED should receive training in trauma-informed pedagogy (including symptom recognition, trigger warnings, balanced messaging, and referral protocols); climate-related course materials should be reviewed to increase solution-oriented content, with a target ratio of approximately 40% proposed as a testable design parameter for the CERP pilot; the Climate-Emotional Resilience Program should be piloted in a proposed 12-week group format prioritizing female students, Physics and Biology students, and disaster-exposed students, subject to evaluation; counselling services should develop eco-anxiety assessment and treatment protocols and establish

a climate distress support group; and AFUED should adopt a mental health-sensitive climate education policy overseen by a standing committee. At the policy level, the National Universities Commission should revise Benchmark Minimum Academic Standards for STEM programmes, and the National Climate Change Policy should include a mental health chapter. Finally, the pilot findings should be extended through a multi-institution study across Nigeria's six geopolitical zones, a longitudinal cohort study, a randomized controlled trial of the CERP, qualitative research, and implementation science research, with a validated Nigerian clinical cutoff for the CAS established before percentile-based figures are used for screening or resource allocation.

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Conflict of Interest
The authors declare that they are faculty members at Adeyemi Federal University of Education, Ondo (AFUED), the institution that received the TETFUND grant. Community and policy partnerships were conducted under approved ethical protocols, including benefit-sharing and cultural sovereignty safeguards. The authors declare no other competing interests.

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Data Availability Statement
De-identified data and analysis code are available from the corresponding author on reasonable request.

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