

Addressing Eco-Anxiety Among Students of Mae Fah Luang University (Thailand) Through HOTS-Oriented Classroom Towards Sustainable Development Goal 4 (Quality Education)

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Abstract

Haze and PM2.5 air pollution in Chiang Rai has adversely affected Mae Fah Luang University (MFU) students, intensifying an emerging form of psychological distress known as eco-anxiety. Recognizing the direct connection between mental well-being and the capacity to engage in learning, this paper examines how integrating Bloom's Revised Taxonomy of higher-order thinking skills (HOTS) in the "Introduction to Sustainable Development" (ISD) classroom can mitigate eco-anxiety. Over one academic year, 60 students participated in qualitative methods (classroom observations, focus group discussions, surveys, and reflections). Results show that 87% of students reported high eco-anxiety, characterized predominantly by fear, anger, and helplessness. By employing a HOTS-based approach, the classroom not only validates

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ecological emotions but also helps develop emotional resilience and empowers students to create actionable solutions to environmental challenges. These insights support SDG 4 (Quality Education) by linking cognitive skill development to students' mental well-being and their capacity to address real-world environmental crises.

Keywords: Eco-Anxiety, SDG 4 (Quality Education), HOTS-Oriented Classroom, Air Pollution, Mae Fah Luang University

ประเด็นความวิตกกังวลจากปัญหาสิ่งแวดล้อมในนักศึกษา มหาวิทยาลัยแม่ฟ้าหลวง (ประเทศไทย) ผ่านชั้นเรียนทักษะ การคิดขั้นสูงที่มีต่อเป้าหมายการพัฒนาที่ยั่งยืน 4 (การศึกษาที่มีคุณภาพ)

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บทคัดย่อ

หมอกควันและมลพิษทางอากาศจากฝุ่น PM2.5 ในจังหวัดเชียงใหม่ ส่งผลกระทบด้านลบต่อนักศึกษามหาวิทยาลัยแม่ฟ้าหลวง (มฟล.) ส่งผลให้เกิดภาวะผิดปกติทางด้านจิตวิทยา ที่เรียกว่าความวิตกกังวลจากปัญหาสิ่งแวดล้อม ทั้งนี้การตระหนักรู้ถึงความสัมพันธ์โดยตรงระหว่างสุขภาวะทางจิต และศักยภาพในการเรียน วิจัยนี้จึงศึกษาการบูรณาการแนวคิดฉบับปรับปรุงของบลูมว่าด้วยทักษะการคิดขั้นสูง กับชั้นเรียนการพัฒนาเพื่อความยั่งยืนเบื้องต้น (Introduction to Sustainable Development หรือ ISD) ว่าสามารถลดความวิตกกังวลจากปัญหาสิ่งแวดล้อมได้อย่างไร โดยใช้เวลาหนึ่งปีการศึกษา มีนักศึกษาเข้าร่วมจำนวน 60 คน ในการวิจัยเชิงปริมาณ (การสังเกตในชั้นเรียน อภิปรายในการสนทนากลุ่ม แบบสำรวจและการสะท้อนคิด) ผลการวิจัยแสดงให้เห็นว่า 87% ของนักศึกษามีความวิตกกังวลจากปัญหาสิ่งแวดล้อมในระดับสูง ซึ่งส่วนใหญ่ปรากฏในรูปแบบ ความกลัว ความโกรธ และความรู้สึกลดทอนทางช่วย ทั้งนี้การใช้กระบวนการทักษะการคิด

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ชั้นสูงในชั้นเรียน ก่อให้เกิดการยืนยันด้านอารมณ์เชิงนิเวศ อีกทั้งยังช่วยให้เกิดความสามารถในการฟื้นตัวด้านอารมณ์ ประกอบกับเพิ่มขีดความสามารถ ให้นักศึกษาสามารถหาทางออกสำหรับความท้าทายด้านสิ่งแวดล้อมได้ นอกจากนี้ ผลวิจัยยังส่งเสริมเป้าหมายการพัฒนาที่ยั่งยืน 4 (การศึกษาที่มีคุณภาพ) โดยเชื่อมโยงการพัฒนาทักษะทางปัญญา ให้แก่สุขภาวะทางจิตของนักศึกษา และความสามารถในการจัดการกับวิกฤตด้านสิ่งแวดล้อมในโลกแห่งความเป็นจริงได้

คำสำคัญ: ความวิตกกังวลด้านปัญหาสิ่งแวดล้อม, เป้าหมายการพัฒนาที่ยั่งยืน, การศึกษาที่มีคุณภาพ, ชั้นเรียนแบบทักษะการคิดขั้นสูง, มลพิษทางอากาศ, มหาวิทยาลัยแม่ฟ้าหลวง

Introduction

In early March, Chiang Rai experienced severe haze conditions, with PM2.5 levels consistently exceeding safe limits. Many students at Mae Fah Luang University began expressing increased worry about their health and academic performance. One third-year student shared during a focus group discussion in the classroom: “The air was terrible. I had headaches almost every day and constantly checked the air quality app. I started to feel hopeless about whether the situation would ever improve.” Another student described: “Walking to class felt risky. My anxiety grew every day, not just about the haze itself, but because it seemed like no one could really do anything about it.” These personal accounts from students vividly reflect the real-life impact of eco-anxiety, highlighting the critical need to explore educational strategies like Higher-Order Thinking Skills (HOTS) to help students cope with such environmental challenges.

Air pollution stands as one of the most significant global environmental challenges, leading to an annual premature death toll of approximately 7 million individuals due to inhalation of highly polluted air (Niampradit et al., 2022). Thailand, alongside numerous Southeast Asian nations, has long grappled with regional smoke-haze events, typically stemming from deliberate forest fires for agricultural purposes (Forsyth, 2014). The northern areas of Thailand confront recurring haze occurrences and transboundary air pollution annually, characterized by the accumulation of particulate matter, notably PM2.5, in the atmosphere (Chansilp et al., 2020). Extensive research underscores the severe respiratory health implications of exposure to specific elemental components of PM2.5, contributing to respiratory, cardiovascular, and neurological disorders (Johnston et al., 2019; Fang et al., 2013). Particularly in Chiang Rai, recurring haze occurrences and transboundary air pollution pose serious health risks, especially during the man-made forest fire season from late January to early May. These challenges have recently intensified, escalating the severity and frequency of air pollution stemming from fire-related incidents in the region.

In Chiang Rai, among those most affected by these environmental crises are the students of Mae Fah Luang University, whose well-being is significantly impacted by the deteriorating air quality and ongoing haze episodes. This heightened awareness of environmental challenges has led to increased psychological distress among students, commonly referred to as eco-anxiety, as they grapple with the tangible effects of air pollution on their health and daily lives. The discourse around eco-anxiety and climate anxiety has gained prominence in contemporary research and is increasingly becoming a focus of scholarly investigation. Albrecht and Clayton et al. (2011) initially introduced the term “eco-anxiety” to denote a chronic fear of environmental peril. Usher et al. (2019) applied alternative definitions to include mental distress or anxiety linked to deteriorating environmental conditions or anxiety stemming from the ecological crisis itself (Pihkala, 2020). Eco-anxiety, characterized by feelings of fear, anger, and helplessness in response to environmental concerns, has emerged as a critical issue affecting the mental well-being of university students globally (Brophy et al., 2023). This phenomenon is particularly pronounced in regions like northern Thailand, where the tangible effects of environmental degradation are evident.

This study addresses eco-anxiety by applying Higher-Order Thinking Skills (HOTS) within classroom settings, contributing specifically to educational strategies aimed at enhancing emotional resilience, critical thinking, and active student engagement in sustainability issues. While recognizing the exploratory nature and limitations of qualitative data from a specific classroom context, this research aims to illustrate how structured HOTS activities can practically support emotional processing and cognitive engagement in environmental challenges, potentially benefiting broader educational practices. This case clearly examines the significant issue of eco-anxiety among students at Mae Fah Luang University, specifically linked to severe annual haze pollution (PM2.5). This phenomenon increasingly impacts students’ mental health, learning motivation, and daily activities, creating an urgent educational need to explore practical strategies for emotional and cognitive management.

Method

This study adopts a qualitative case-study approach aimed at investigating the effectiveness of implementing Higher-Order Thinking Skills (HOTS) in the classroom to address eco-anxiety among students at Mae Fah Luang University. The research was conducted over one academic year in the “Introduction to Sustainable Development” (ISD) classroom, involving 60 undergraduate students (27 males, 33 females) who represented diverse backgrounds and experiences. However, demographic variables such as major and age were not statistically analyzed, highlighting a limitation and an area recommended for further quantitative investigation. Qualitative data obtained from classroom observations, focus group discussions, reflective journals, and creative outputs were systematically analyzed using thematic analysis to identify key themes and patterns, providing robust insights into the effectiveness of HOTS-oriented teaching and learning activities in mitigating eco-anxiety. Figure 1 presents the methodological flowchart illustrating the sequence and objectives of each research activity as follow

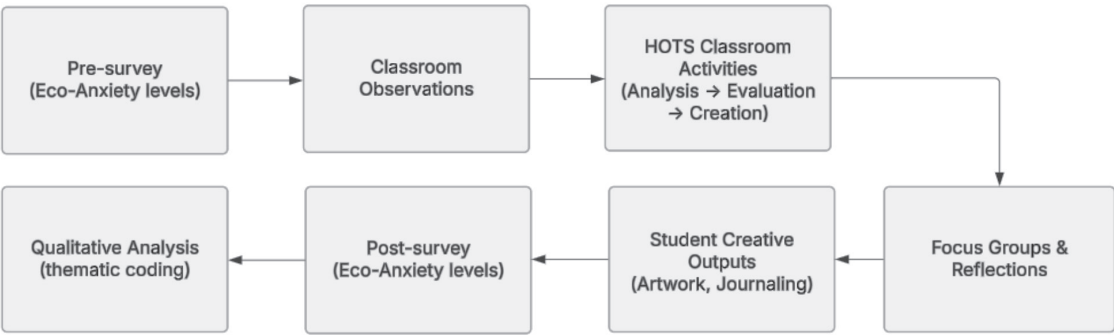


Figure 1: Method Flowchart
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A pre-activity eco-anxiety survey using a Likert scale was administered to students to measure their baseline eco-anxiety levels before participating in the HOTS-oriented classroom activities. Real-time classroom observations were conducted throughout the HOTS activities to assess students’ engagement, analytical skills, and emotional responses. These activities were structured around

Bloom's Revised Taxonomy, focusing on analysis, evaluation, and creation. Specifically, students analyzed real-life environmental issues related to haze and PM2.5, engaged in structured discussions and debates to evaluate these issues critically, and collaboratively created actionable solutions and projects. Focus group discussions were facilitated to capture deeper qualitative insights into students' emotional experiences, reflections, and perceptions of eco-anxiety and the effectiveness of the HOTS approach.

Additionally, students and instructors provided reflective journals documenting their personal experiences, emotions, and observations throughout the intervention. Student creative outputs, including artwork and essays, were collected to enrich the qualitative data and further insights into the emotional and cognitive transformations experienced by students. A post-activity eco-anxiety survey was then administered using the same Likert scale to measure changes in students' eco-anxiety levels and emotional resilience after the intervention. To quantitatively measure changes in students' eco-anxiety levels resulting from participation in the Higher-Order Thinking Skills (HOTS) activities, an Eco-Anxiety Assessment Survey was administered both before and after the intervention. This survey utilized a validated 5-point Likert scale, asking students to indicate their level of agreement or disagreement with statements regarding their emotional responses, worries, and behaviors related specifically to environmental issues, such as haze and PM2.5 air pollution. The survey instrument is presented in the table 1 below.

Students Responded to the Following Statements Using a 5-point Likert Scale, Clearly Indicating the Frequency or Intensity of Their Experiences Related to Eco-Anxiety.

Scale:

1 = Strongly disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly agree

Table 1: Eco-Anxiety Assessment Survey

No.	Statement	1	2	3	4	5
1.	I often feel anxious or worried about environmental issues such as haze and air pollution (PM2.5).					
2.	Concerns about the environment negatively affect my daily activities.					
3.	I experience fear about the long-term health impacts of air pollution.					
4.	I feel angry or frustrated because I think environmental problems are not effectively managed.					
5.	I often feel helpless about solving environmental issues in Chiang Rai.					
6.	My worry about environmental conditions makes it hard for me to concentrate in class or study.					
7.	Discussing environmental issues with others increases my anxiety rather than reducing it.					
8.	My concerns about air pollution often interfere with my sleep or rest.					
9.	I feel uncertain about my future due to ongoing environmental degradation.					
10.	Participating actively in addressing environmental problems reduces my anxiety significantly.					

Literature Review

Eco-Anxiety Literature

Eco-anxiety, a relatively recent phenomenon, has garnered significant attention in scholarly discourse due to its relevance in understanding individuals’ emotional responses to environmental challenges (Pihkala, 2020; Pihkala, 2022). The literature on eco-anxiety encompasses a range of aspects, including definitions, conceptualizations, prevalence rates, contributing factors, psychological impacts, and existing interventions or coping strategies. The literature provides varied definitions and conceptualizations of eco-anxiety. Some scholars describe it as

a chronic fear of environmental doom (Clayton et al., 2017), while others characterize it as extreme worry about current and future harm to the environment (Léger-Goodes et al., 2022; Duggal, 2022). Additionally, eco-anxiety is framed as heightened emotional, mental, or somatic distress in response to dangerous changes in the climate system (Climate Psychology Alliance, 2022). Research indicates a growing prevalence of eco-anxiety among individuals, particularly youth, who are increasingly aware of environmental degradation and climate change. Contributing factors to eco-anxiety include exposure to environmental crises such as air pollution (Verplanken et al., 2020), biodiversity loss (Ojala et al., 2021), and media coverage highlighting ecological challenges (Kankawale & Niedzwiedz, 2023).

Eco-anxiety has significant psychological impacts, leading to feelings of fear, helplessness, anger, and sadness among affected individuals (Brophy et al., 2023). It can manifest as stress, anxiety disorders, depression, and other mental health issues, affecting individuals' overall well-being and quality of life (Pihkala, 2020). While eco-anxiety poses significant challenges, there are emerging interventions and coping strategies aimed at addressing and mitigating its impact. These include environmental education programs, mindfulness practices, cognitive-behavioral therapy techniques, community engagement initiatives, and resilience-building activities (Sims et al., 2020). However, despite the growing body of literature on eco-anxiety, there are notable gaps that warrant further research. Firstly, there is a need for standardized definitions and measurement tools to assess eco-anxiety consistently across studies. The variation in conceptualizations and terminology hinders comparative analysis and understanding of eco-anxiety's point of view. Secondly, there is limited research on the specific demographic factors influencing eco-anxiety, such as age, gender, socioeconomic status, and cultural background. Understanding how these factors intersect with eco-anxiety can inform targeted interventions and support strategies. Thirdly, while existing interventions and coping strategies show promise, their effectiveness and scalability require rigorous evaluation through empirical studies.

Higher Order Thinking Skills (HOTS) in the Higher Education

Scholars have extensively defined and conceptualized Higher-Order Thinking Skills (HOTS), often referencing Bloom's Revised Taxonomy (Krathwohl & Anderson, 2010) as a foundational framework for categorizing cognitive skills into six distinct levels: remembering, understanding, applying, analyzing, evaluating, and creating. HOTS encompasses advanced cognitive abilities such as analysis, evaluation, and synthesis, representing higher levels of cognitive processing beyond basic knowledge acquisition and comprehension. These skills play a crucial role in fostering critical thinking, problem-solving, effective communication, and creativity, collectively known as the 4C skills (Communication, Collaboration, Critical Thinking, and Creativity) (Chinedu et al., 2015). Developing HOTS requires engaging in learning activities that promote the enhancement of these 4C skills, enabling students to tackle global challenges by honing their reasoning abilities, communication proficiency, creative thinking, and collaborative problem-solving skills (Saavedra & Opfer, 2012). The assessment and instruction for 21st-century skills encapsulate four key domains pertinent to contemporary skillsets, encompassing cognitive processes, collaborative abilities, technological proficiency, and life competencies. Cognitive processes such as creativity, critical thinking, problem-solving, decision-making, and continual learning are integral components of Higher-Order Thinking Skills (HOTS)-oriented pedagogy (Heong et al., 2012). In essence, the acquisition of proficient HOTS levels is imperative across all educational levels, constituting a foundational competence for individuals within diverse educational contexts (Sugandi & Ruhimat, 2021).

The literature discusses a range of instructional approaches designed to cultivate Higher-Order Thinking Skills (HOTS) among students. These approaches encompass outcome-based learning, problem-based learning, project-based learning, case studies, critical thinking exercises, Socratic questioning, and collaborative learning activities (Masek & Yamin, 2010; Ahmed et al., 2023). Each strategy is geared towards engaging students in advanced cognitive processes and fostering a profound grasp of subject matter, as well as honing critical thinking abilities. Numerous empirical studies have assessed the impact of HOTS on

students' critical thinking, problem-solving, and analytical skills (Widana, 2017; Artika & Nurmaliah, 2023; Abdullah et al., 2015). These studies utilize a variety of research methodologies, including quantitative assessments, qualitative analyses, pre-post tests, and longitudinal studies. The outcomes of empirical investigations consistently indicate positive associations between the integration of HOTS methodologies and students' academic performance, cognitive growth, and practical problem-solving competencies (Jaenudin et al., 2020; Widana, 2017). Despite the extensive literature on HOTS and its benefits in enhancing students' cognitive skills, there are notable gaps that warrant further research. Firstly, there is a need for more rigorous empirical studies that examine the long-term effects of HOTS implementation on students' cognitive abilities and academic performance across diverse educational settings and disciplines. Secondly, the literature often lacks detailed analyses of specific teaching strategies within the HOTS framework, their applicability to different learning contexts, and their effectiveness in addressing complex challenges such as eco-anxiety discourse among students. Comparative studies that evaluate the outcomes of different HOTS strategies and their impact on student's mental well-being and resilience are needed. Thirdly, there is limited research on the intersection of HOTS with environmental education, sustainable development education, and mental health initiatives within educational settings. Therefore, this study aims to contribute to bridging the existing research gap by exploring how Higher-Order Thinking Skills (HOTS) can be integrated into curriculum content addressing environmental challenges and eco-anxiety discourse. This research seeks to provide valuable insights into innovative approaches for effectively addressing these complex issues.

The Nexus of Mental Health, Quality Education, and Environmental Factors

Extensive scholarly inquiry has thoroughly explored the intricate relationship between mental health and education, elucidating the profound impact of mental well-being on various facets of students' educational experiences, including academic performance, social interactions, and overall learning outcomes. For

instance, positive mental health significantly influences students' capacity to engage effectively in learning activities, sustain focus, and retain information, thereby correlating with heightened levels of motivation, perseverance, and academic attainment (Bailey & Phillips, 2016; Pietarinen et al., 2014; Hartley, 2011). Conversely, mental health challenges such as anxiety, depression, or stress can disrupt cognitive functioning, leading to impediments in learning, memory retrieval, and problem-solving capacities (Aprilia & Aminatun, 2022; Bettis et al., 2017). Consequently, addressing mental health concerns emerges as imperative for optimizing students' cognitive abilities and academic performance (Guedner et al., 2020).

Moreover, mental health plays a pivotal role in shaping students' interpersonal dynamics within educational environments. Positive mental well-being fosters the cultivation of healthy relationships, effective communication skills, and collaborative engagement among peers (Kutsyuruba et al., 2015). This fosters a supportive learning milieu characterized by empathy, mutual respect, and inclusivity. Conversely, challenges in mental health may manifest as social withdrawal, interpersonal conflicts, and difficulties in establishing meaningful connections with peers and educators (Reijntjes et al., 2010). Studies have also emphasized the critical importance of promoting mental health literacy, cultivating resilience, and establishing robust support systems within educational contexts to enhance students' psychological well-being. Quality education extends beyond mere academic accomplishments to encompass holistic development, encompassing facets such as environmental awareness, sustainability literacy, and ethical responsibility (Boove-de Pauw et al., 2015; Berkowitz et al., 2005; Jodoin, 2020). For instance, environmental variables like air pollution, climate change, natural calamities, and ecological degradation can profoundly influence educational environments, presenting challenges to students' physical health, cognitive abilities, and emotional wellness (Wang & Liu, 2024; Cianconi et al., 2020; Lawrance et al., 2021).

Moreover, there is a notable absence of comprehensive studies in the literature that examine the role of Higher-Order Thinking Skills (HOTS) concerning the intersection of mental health, quality education, and environmental factors. A critical research gap exists in exploring how HOTS-oriented teaching and learning activities can equip students with the tools to navigate environmental challenges, foster critical thinking abilities, and cultivate emotional resilience. This gap highlights the need for further investigation and empirical inquiry into the efficacy of HOTS in addressing the complex interplay between mental health, educational quality, and environmental considerations. By collecting and analyzing data from real-world educational contexts, this study will contribute valuable insights into the practical implications of integrating HOTS into higher education curricula.

Result

The findings from this study offer valuable insights into the prevalence of eco-anxiety among university students in northern Thailand. As described in the literature review, eco-anxiety refers to the emotional distress and anxiety that individuals experience due to their concerns about environmental issues, such as air pollution, climate change, or ecological degradation (Pihkala, 2020; Verplanken et al., 2020). This study also investigates the efficacy of a Higher-Order Thinking Skills (HOTS)-oriented classroom approach in addressing eco-anxiety and promoting emotional resilience among students. HOTS are cognitive processes that go beyond basic memorization and understanding, focusing instead on critical thinking, problem-solving, analytical skills, and creativity (Chinedu et al., 2015; Heong et al., 2012). By implementing a HOTS-oriented approach in the classroom, students are encouraged to engage deeply with environmental challenges, analyze complex issues, evaluate solutions, and create meaningful responses.

Moreover, this study explores how this HOTS-oriented approach can be a powerful tool in addressing eco-anxiety. By providing students with opportunities to actively participate in discussions about environmental challenges, express their concerns, and collaboratively develop solutions, the classroom becomes a space for validating their experiences and emotions related to eco-anxiety. Additionally,

the development of critical thinking skills through HOTS empowers students to approach environmental issues with resilience, creativity, and agency. This not only enhances their ability to navigate and cope with environmental challenges effectively but also promotes a sense of hope and empowerment in their role as active contributors to sustainable solutions.

The research for this study was conducted in the classroom setting at Mae Fah Luang University (MFU) in northern Thailand under the subject “Introduction to Sustainable Development” for one year (two semesters) of the academic year 2023. At MFU, based on the online information provided by the Office of Registrar, five courses include the term “Sustainable Development” in the subjects, which are 1108703 and 1108706 (Materials for Sustainable Development, Ph.D. and Master Degree, School of Science), 1804441 (Environmentally Sustainable Development for Community Economics, Bachelor Degree, School of Health Science), 2301724 (Global Partnership and Sustainable Development, Master Degree, School of Social Innovation), and 2302308 (Introduction to Sustainable Development, Bachelor Degree, School of Social Innovation). Compared to the total number of schools at MFU, three (out of fifteen) schools started teaching Sustainable Development topics in the classrooms. Especially for the bachelor’s degree program, only two courses teach about Sustainable Development (Environmentally Sustainable Development for Community Economics and Introduction to Sustainable Development). Between the two courses, only “Introduction to Sustainable Development” is open for students from all schools in the bachelor’s degree program as a Free Elective (FE). The course was first opened in the semester one academic year 2022. Up to the present day (semester two academic year 2023), the course has been running for four semesters with 120 students actively enrolled. For this study, 60 students (33 females and 27 males) were involved from two semesters of academic year 2023.

In a case study conducted in the classroom setting at Mae Fah Luang University in northern Thailand, a survey was distributed to 60 students from various study years (Years 2-4) aged between 19-23 years old, with 58 students being Thai and two students are foreign nationality. The background of students’ hometowns and their past experiences with climate disasters and environmental

crises are crucial for understanding the context and relevance of the research on eco-anxiety and Higher-Order Thinking Skills (HOTS). Knowing the regions from which students come provides context to their experiences and perceptions regarding environmental challenges. For example, students from areas prone to flooding or air pollution are likely to have firsthand experiences of these issues, which can significantly influence their eco-anxiety levels. Students who have experienced climate disasters or environmental crises firsthand are more likely to have heightened eco-anxiety due to the direct impact of these events on their lives. This information helps in assessing the mental well-being of the student population. Understanding students' backgrounds helps in tailoring HOTS-oriented teaching strategies to address specific environmental challenges they have encountered. For instance, case studies or problem-solving activities related to local environmental issues can be more impactful in engaging students and fostering critical thinking skills. Figure 2 below summarizes the hometown origin of the Thai students studying at Mae Fah Luang University and their experience of past disasters and other related environmental crises in their hometown.

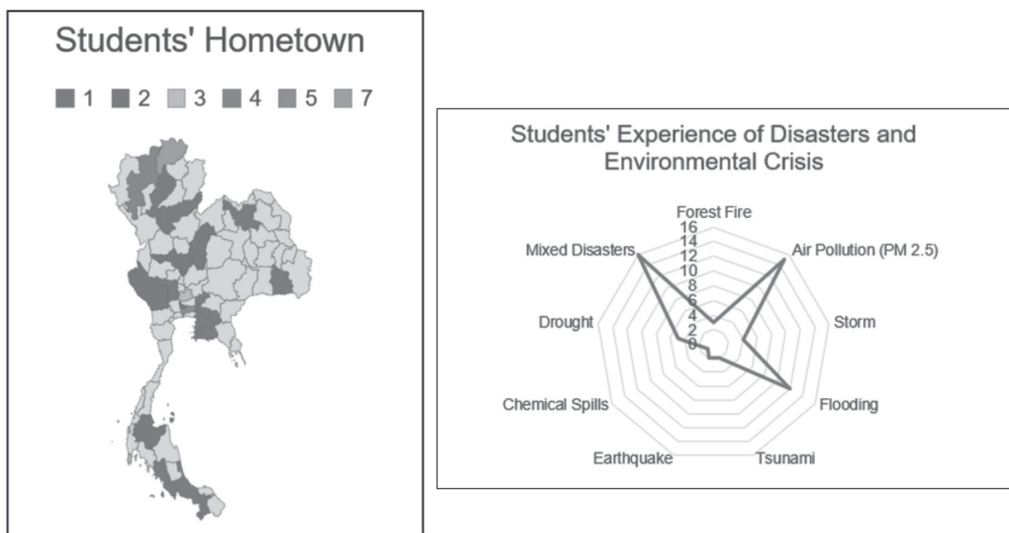


Figure 2: Students' Hometown and Experience of Disasters and Environmental Crisis
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Figure 2 illustrates that the majority of students originate from regions in northern and central Thailand, where they have encountered a diverse range of disasters, including flooding and environmental challenges such as haze and PM 2.5 air pollution. Furthermore, a subset of students has encountered mixed disasters, such as simultaneous occurrences of drought and flooding, as well as flooding and storms. These calamities are interconnected with climate-related disasters, which are increasingly attributed to climate change. In the subsequent phase of the study involving 60 students, a Likert Scale survey was employed, assigning interval numbers to gauge the degree of eco-anxiety experienced by the participants, with 1 representing very low levels and 5 indicating very high levels, as shown in Table 2 below.

Table 2: Eco-Anxiety Level

Scale	Level	Definition
5	Very High	Very high levels of anxiety related to environmental challenges. The student experiences intense anxiety frequently and struggles to cope without significant support or intervention.
4	High	High levels of anxiety related to environmental challenges. The student frequently experiences anxiety and finds it challenging to manage without assistance.
3	Moderate	Moderate levels of anxiety related to environmental challenges. The student experiences noticeable anxiety at times but can cope with it adequately.
2	Low	Mild feelings of anxiety related to environmental challenges. The student may occasionally experience worry or concern but is generally able to manage.
1	Very Low	No noticeable feelings of anxiety related to environmental challenges. The student feels calm and unaffected.

Note. This Likert scale can be used to assess the degree of eco-anxiety experienced by students, ranging from very low to very high levels, with clear definitions for each level to guide the assessment process. Copyright [2024] by Reni Juwitasari and Maya Dania.

The results revealed a substantial majority, accounting for 87% of the total participants (n=52), reporting high levels of eco-anxiety, while the remaining 13% indicated a medium level of eco-anxiety. This outcome emphasizes the significant influence of environmental challenges, particularly issues related to air pollution, on the psychological well-being of students within the region. Figure 3 below depicts eco-anxiety manifestations among the students, as follows.

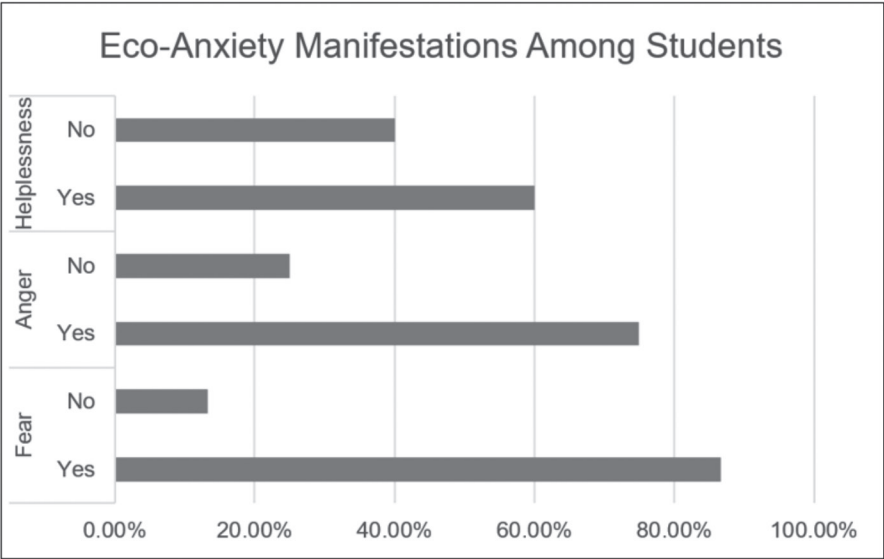


Figure 3: Eco-Anxiety Manifestations Among Students
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The results revealed a significant emotional impact of environmental challenges on the surveyed students. The most prevalent emotion reported was fear, with an overwhelming 86,7% (n=52) of respondents indicating feelings of fear related to environmental challenges due to concern for the individual and family health. This finding underscores the depth of concern and apprehension among

students regarding the environmental situation, highlighting the gravity of the issues they perceive (McBride et al., 2013). Furthermore, a substantial portion of students, comprising 75% (n=45) of respondents, expressed feelings of anger with the reason of politics and government responses towards the haze and PM 2.5 crisis. During a focus group discussion, one second-year student shared openly: “When the haze became really bad, I felt overwhelmed and angry, especially since we couldn’t do much about it. But the class discussions made me see that small actions matter. It made me calmer.” This emotional response reflects the students’ frustration and indignation towards perceived environmental injustices. The expression of anger suggests a strong emotional reaction to environmental problems, potentially stemming from a sense of injustice or inequity in environmental policies or actions (Doherty & Clayton, 2011).

Additionally, a notable proportion of students, accounting for 60% (n=35) of respondents, expressed a sense of helplessness in the face of these challenges because of the geographical complexity of the haze crisis. This feeling of helplessness indicates a perceived lack of agency or control over environmental issues, contributing to feelings of distress and vulnerability among the student population (Schwartz et al., 2023). Another third-year student described in their reflective journal: “Initially, my anxiety was quite intense. I would obsessively check air-quality apps and felt very stressed every day. However, when we worked together on the HOTS project in class, I noticed my anxiety started to fade. I began feeling like I could genuinely contribute to solutions instead of just worrying.”

The implementation of a HOTS-oriented classroom approach emerged as a promising strategy for addressing eco-anxiety among students. Students explicitly demonstrated their ability to manage eco-anxiety through reflective journals, classroom interactions, and creative outputs. Reflective journals clearly documented how students became more aware of their emotional triggers related to environmental issues such as haze and PM2.5 pollution. For example, one student clearly articulated, “Initially, discussing pollution made me anxious, but analyzing real cases and developing solutions significantly reduced my anxiety.”

During classroom discussions and structured debates, students explicitly showed improved critical thinking skills by constructively transforming anxiety and frustration into informed discussions about policy and potential solutions. Additionally, through solution-oriented projects, students explicitly demonstrated proactive problem-solving skills, collaboratively developing tangible and realistic environmental initiatives.

Furthermore, the HOTS-oriented classroom environment facilitated the development of emotional resilience among students, enabling them to cope with environmental challenges more effectively. Importantly, this approach also fostered collective agency among students, instilling a sense of hope and empowerment in their ability to contribute meaningfully to addressing environmental issues. The strategic application of Higher-Order Thinking Skills (HOTS) through focused group discussions is fundamental in deeply understanding and addressing eco-anxiety among students within the complex landscape of sustainable development education. These deliberate discussions are carefully designed to provide a supportive platform, creating an atmosphere where students can openly express their thoughts, share personal stories, and effectively communicate their emotional responses related to eco-anxiety. By actively involving students in discussions and valuing their experiences, educators gain valuable qualitative insights into the depth of students' worries, fears, and diverse perspectives on environmental issues. Figure 4 presents illustrate the HOTS implementation in the classroom.

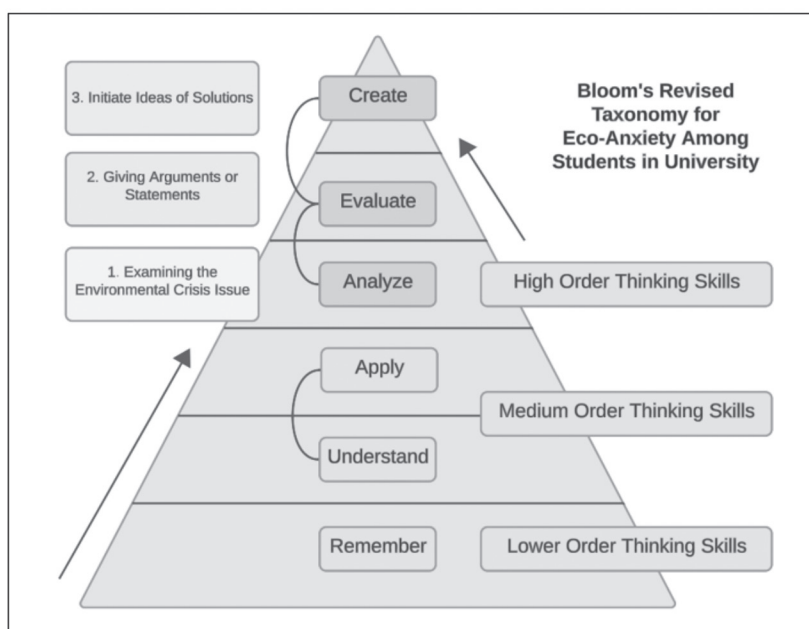


Figure 4: Bloom's Revised Taxonomy
(Adapted from Krathwohl & Anderson, 2010)
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According to Bloom's Revised Taxonomy (Krathwohl & Anderson, 2010), educational learning objectives are divided into six hierarchical levels, from simplicity to complexity, that describe the students' cognitive abilities to achieve. The six cognitive levels are: 1) Remembering, 2) Understanding, 3) Applying, 4) Analyzing, 5) Evaluating, and 6) Creating. From Bloom's Revised Taxonomy, the levels of Remembering are included in the lower-order thinking skills. Understanding and Applying are included in the medium-order thinking skills, while Analyzing, Evaluating, and Creating are included in the higher-order thinking skills (HOTS). In the context of enhancing student thinking quality through higher-order thinking skills (HOTS)-oriented assessment methods within classroom learning, this research implemented a strategic selection of operational verbs in crafting item questions aimed at evaluating student learning outcomes. These operational verbs, carefully chosen to align with higher-order thinking skills, included actions such as "examining cases," "giving arguments," and "initiating ideas." The rationale behind using these verbs stemmed from their alignment with the cognitive processes classified in

Bloom’s Taxonomy, revised by Krathwohl and Anderson (2010), which emphasize critical thinking, problem-solving, and creative thinking abilities. By incorporating these verbs into assessment questions, the research sought to prompt students to engage in deeper levels of cognitive processing, moving beyond basic recall and comprehension tasks to encourage analytical thinking, logical reasoning, and innovative problem-solving approaches. This approach aimed to not only measure students’ mastery of subject matter but also to cultivate and assess their higher-order thinking skills essential for academic success and lifelong learning. Table 3 below shows the questions applied to trigger discussion by using the HOTS framework.

Table 3: Implementation of HOTS in the Classroom

Skills	Definitions	Learning Activities
To Analyze	The analysis aspect entails dissecting material into smaller components and assessing the connections among these parts and the overarching structure. Enhancing this aspect can be achieved by integrating problem-based learning and problem-solving strategies into classroom instruction.	Examining the environmental issue in Chiang Rai (case study haze and PM 2.5)
To Evaluate	The evaluation aspect involves making decisions using predefined criteria and standards, which students themselves establish. Enhancing this aspect can be achieved by incorporating problem-based learning and problem-solving approaches in classroom activities.	Giving arguments or statements (opinions for case study haze and PM 2.5)
To Create	The creation aspect entails assembling elements to form a unified whole. Enhancing this aspect can be achieved through integrating project-based learning in the classroom.	Initiating ideas of solutions (case study haze and PM 2.5)

Note: Implementation of HOTS (Adapted from Krathwohl & Anderson, 2010)
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Table 3 outlines the implementation of Higher-Order Thinking Skills (HOTS) in the classroom setting, focusing on three key skills: Analyzing, Evaluating, and Creating. Analyzing skill involves breaking down material into smaller parts and understanding the relationships between these parts and the overall structure. To enhance this skill, teachers incorporated problem-based learning and problem-solving strategies into classroom activities. For instance, students were presented with a detailed case study of the environmental issue in Chiang Rai, particularly focusing on haze and PM2.5 air pollution. The case study included background information, data, and relevant statistics regarding the environmental challenges faced in the region. Students worked in groups to analyze the case study and broke down the information into smaller parts to understand the complexities of the issue. This activity allowed students to apply analytical thinking to real-world challenges. Classroom instruction explicitly involved structured Higher-Order Thinking Skills (HOTS) activities, such as 1) Case Study Analysis (students explicitly analyzed Chiang Rai's haze crisis, clearly connecting pollution levels to health and anxiety), 2) Structured Debates (students explicitly focused on policy and political dimensions of air pollution, clearly aiming to channel emotional frustration constructively, 3) Solution-Oriented Projects (students explicitly brainstormed and created practical environmental solutions, clearly addressing geographic complexities underlying eco-anxiety).

Next, evaluating skills centers on making decisions based on predefined criteria and standards, often determined by students themselves. To improve this skill, teachers integrated problem-based learning and problem-solving approaches into classroom tasks. For example, students participated in structured debates or discussions centered around the environmental issue of haze and PM2.5 pollution in Chiang Rai. They are divided into groups with assigned roles, such as proponents and opponents of specific policies or actions related to air pollution control. Students conducted research and gathered evidence to support their arguments, critically evaluated opposing viewpoints, and presented persuasive arguments based on predefined criteria and standards. Students were also tasked with writing opinion pieces or argumentative essays expressing their viewpoints on the case study of

haze and PM2.5 pollution. They analyzed information, data, and expert opinions related to air pollution in Chiang Rai, identified key issues and controversies, and developed well-reasoned arguments to support their opinions. This activity encouraged students to consider multiple perspectives, weigh evidence, and articulate their thoughts effectively to formulate reasoned judgments.

Finally, creating skill involves assembling various elements to create a coherent and unified whole. Teachers enhanced this skill by incorporating project-based learning methods into teaching practices. For instance, Students collaborated to develop an environmental action plan that addressed solutions to air pollution in Chiang Rai. They conducted research and identified key stakeholders and partnerships to implement effective strategies for reducing emissions, promoting clean energy initiatives, and raising public awareness. The action plan included specific goals, fostering strategic planning and social responsibility among students. This activity fostered creativity, innovation, and teamwork among students as they worked towards developing comprehensive solutions. Table 4 describes the learning activities and outcomes to cope with eco-anxiety and its manifestations in fear, anger, and helplessness.

Table 4: Eco-Anxiety and HOTS Learning Activities

Eco-Anxiety Manifestations	Reasons	Learning Activities	Learning Outcomes
Fear	Health	Case Study Analysis: Students critically examined the haze and PM2.5 pollution crisis in Chiang Rai, emphasizing health impacts.	Students critically examined the haze and PM2.5 pollution crisis in Chiang Rai, emphasizing health impacts. Students learned about eco-anxiety, including fear and its link to health. They also explored why fear arose in response to environmental issues, like the haze and PM 2.5 pollution in Chiang Rai. Through real-world examples, they improved their analytical skills and understood how pollution affected mental health. This knowledge would help them be informed and involved in solving environmental problems. Additionally, they developed empathy and understanding for those dealing with eco-anxiety, creating a supportive community for mental health and the environment.

Table 4: Cont.

Eco-Anxiety Manifestations	Reasons	Learning Activities	Learning Outcomes
Anger	Politics and Policies	Structured Debates: Students articulated arguments and opinions about the political and policy dimensions influencing haze and PM2.5 management.	Students explored the connections between eco-anxiety expressions, such as anger, and their links to political and policy influences. They also examined the reasons behind anger in environmental issues, particularly in the context of the haze and PM 2.5 pollution case in Chiang Rai. Strengthened critical thinking skills through discussions and the exchange of viewpoints on this case, leading to a deeper understanding of environmental challenges and their societal and political dimensions.
Helplessness	Geographical complexity	Solution-oriented Projects: Students collaboratively generated practical ideas and actionable solutions addressing the geographical complexities of haze and PM2.5 pollution.	Students understood the manifestations of eco-anxiety, specifically feelings of helplessness, and their connection to the geographical complexity of environmental challenges. They explored why feelings of helplessness arose in response to environmental issues, focusing on the case study of haze and PM 2.5 pollution in Chiang Rai. Students developed problem-solving skills by brainstorming and proposing solutions to address the challenges outlined in the case study, contributing to a more proactive approach to environmental concerns.

Note: Results of HOTS implementation in the classroom about eco-anxiety among students. Copyright (2024) by Reni Juwitasari and Maya Dania

During structured classroom debates exploring anger towards political inaction, students wrote reflective journal entries highlighting their emotional transformation. One male student candidly noted: “Initially, discussing government policies made me feel frustrated and powerless because nothing seemed to change. But hearing different viewpoints in class made me realize that my anger could be constructive, pushing me to learn more and speak out responsibly.” Similarly, after participating in group activities aimed at addressing geographical complexities through solution-focused brainstorming, a student wrote in her

reflective journal: “Before, I felt completely helpless about Chiang Rai’s haze issue because it seemed too big and complicated. However, working with classmates to create practical solutions showed me that even small, local actions can bring hope and real improvements.” These classroom-produced creative outputs clearly illustrate how the HOTS-based learning approach provided students with valuable emotional coping tools and significantly shifted their perspectives from anxiety and frustration toward optimism and action-oriented thinking.

In-depth interviews revealed that students experienced significant emotional shifts through specific HOTS activities. For instance, students reported that solution-oriented projects clearly resonated most effectively. One fourth-year student explicitly shared during the interview: “Working on tangible solutions reduced my anxiety because it gave me a real sense of control. It felt empowering to see practical ways we could help manage the haze issue instead of only discussing it.” Another student mentioned that structured classroom debates facilitated emotional processing clearly, stating: “Initially, I felt very frustrated about environmental policies. But debating and exchanging views helped me transform that anger into a clearer understanding and motivated me to be more engaged and proactive.” Moreover, observations of classroom interactions demonstrated that instructors actively facilitated discussions linking emotional responses to analytical thinking and actionable problem-solving. The teachers explicitly addressed eco-anxiety during activities by asking reflective questions such as: “How does understanding the health risks of haze influence your feelings, and how can recognizing these emotions help you propose better solutions?” This approach visibly encouraged students to process emotions productively.

The results from the tables showcasing the implementation of higher-order thinking skills (HOTS) in the classroom setting reveal significant insights into addressing eco-anxiety among students within the context of sustainable development education. Firstly, the analysis aspect of HOTS, involving the dissection of material into smaller parts and assessing their relationships, provides a structured approach for students to understand the complexities of environmental

challenges. By engaging in activities such as examining the environmental issue in Chiang Rai, particularly the case study of haze and PM2.5 pollution, students develop analytical skills crucial for problem-solving and decision-making in real-world scenarios. Secondly, the evaluation aspect of HOTS emphasizes critical thinking and decision-making based on predefined criteria. Through activities like giving arguments or statements on the case study, students learn to assess information, form reasoned judgments, and express their opinions effectively. This fosters a deeper understanding of the socio-political dimensions of environmental issues, including the influence of politics and policies. Lastly, the creation aspect of HOTS encourages students to generate ideas and propose solutions to address environmental challenges. By engaging in initiatives such as initiating ideas for solutions related to the haze and PM2.5 pollution case study, students develop problem-solving skills and contribute to a proactive approach to tackling environmental concerns.

To quantitatively measure the impact of Higher-Order Thinking Skills (HOTS) activities on student eco-anxiety, a pre- and post-activity Likert-scale survey was administered. Table 5 illustrates the comparison of eco-anxiety levels reported by students before and after participating in the classroom intervention.

Table 5: Comparison of Student Eco-Anxiety Levels (Before and After HOTS Activities)

Eco-Anxiety Level	Pre-Program (%)	Post-Program (%)	Change (%)
High	87%	62%	-25%
Moderate	13%	7%	-5%

As shown in Table 5, there was a noticeable decrease (25%) in the proportion of students reporting high levels of eco-anxiety following the HOTS intervention. Simultaneously, the percentage of students experiencing moderate levels of anxiety increased by 20%, and those with low anxiety levels also rose slightly by 5%. These

findings suggest that engaging students actively through analyzing, evaluating, and creating solutions within HOTS-oriented classroom activities contributed to reducing severe eco-anxiety and promoting emotional resilience.

Discussion and Conclusion

Higher Education Institutions (HEIs) have been deemed essential for implementing the 2030 Agenda for Sustainable Development by the United Nations (UN) (Shulla et al., 2020). The United Nations introduced the 2030 Agenda for Sustainable Development in 2015, which includes 17 Sustainable Development Goals (SDGs) aimed at achieving global solutions for the current challenges, particularly in the three areas of the 3Ps: people (social), planet (environmental), and prosperity (economic) (Zarestky & Collins, 2017). The UN urged all nations, including Thailand, to apply and include the concepts of Sustainable Development in all educational institutions during this decade. The complex and interconnected global challenges society faces prove that education is central to efforts to increase the younger generation's capacity. The acceleration of the SDGs agenda can only be realized with the help of HEIs. By 2030, education's mission is to ensure every student has the theoretical and practical knowledge required to foster Sustainable Development. As a result, to change the paradigm in HEIs toward SDG teaching techniques, teachers and researchers must collaborate and be motivated to put forward innovative ideas (El-Jardali et al., 2018).

It is very evident from the target of SDG 4 (Quality Education) that the purpose of Sustainable Development is to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” With the United Nations' recognition of the importance of education in achieving the SDGs, Thai HEIs share a major responsibility for how they can more successfully contribute to Sustainable Development through classroom teaching and learning to ensure the implementation of the SDGs. HEIs in Thailand should also greatly impact students' and graduates' future thinking and behaviors toward the SDGs by integrating Sustainable Development components into teaching and learning activities. Therefore, teaching about the nexus of environment and mental health in HE classrooms is important to build students' preparedness and skills levels of competitiveness in the 21st-century workforce (González-Pérez & Ramírez-Montoya, 2022).

Murugiah (2020) observes that HE students in the twenty-first century have unparalleled challenges in the future, encompassing social, economic, and environmental issues (the 3Ps). These challenges reflect the complex and interconnected nature of the world today, requiring innovative and holistic approaches to education. In response to these challenges, this research addressed eco-anxiety through the strategic implementation of Higher-Order Thinking Skills (HOTS) within the framework of sustainable development education. Eco-anxiety, stemming from concerns about environmental degradation and climate change, is a significant issue affecting the mental well-being of students, particularly in regions like northern Thailand, where environmental challenges are pronounced. Thus, the insights garnered from this study hold considerable implications for enhancing Quality Education in HE. By equipping students with HOTS, including critical thinking, problem-solving, and analytical skills, institutions can better prepare them to navigate the complex challenges of the modern world. These skills are not only essential for academic success but also for fostering a deeper understanding of environmental issues and promoting proactive engagement in sustainable solutions. Students gain a broader perspective that transcends traditional disciplinary boundaries, enabling them to approach problems from multiple angles and collaborate effectively across diverse fields.

The detailed findings from student interviews and classroom observations explicitly demonstrate how specific HOTS activities facilitated effective emotional processing of eco-anxiety alongside promoting critical thinking and problem-solving skills. Solution-oriented tasks resonated strongly by clearly empowering students with practical strategies. Structured debates facilitated emotional clarity, turning frustration into constructive engagement. The explicit manner in which instructors facilitated these interactions underscores the educational significance of addressing emotional dimensions in environmental education, highlighting the broader potential for integrating emotional resilience into sustainability curricula. The findings explicitly indicate improved resilience and active sustainability engagement among students through specific skill demonstrations observed during the intervention. Students exhibited

clear emotional self-regulation, as evidenced by reflective journals documenting transitions from heightened anxiety to empowerment. Moreover, structured debates explicitly indicated enhanced analytical and critical thinking skills, enabling students to navigate emotional complexities effectively. The solution-oriented projects explicitly revealed improved resilience through students' development of practical, achievable solutions to environmental challenges, demonstrating genuine proactive engagement with sustainability issues. These explicit outcomes align with existing literature, which emphasizes the critical role structured higher-order thinking activities play in fostering emotional resilience and proactive behavior in environmental education contexts.

Practically, these findings highlight implications extending beyond classroom instruction into broader educational domains, including curriculum development, teacher training, assessment methods, and community engagement. By demonstrating that structured HOTS activities can effectively address emotional and cognitive aspects of eco-anxiety, this research offers educators and policymakers evidence-based approaches for integrating mental health and critical thinking strategies within sustainability education.

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