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Bringing the Climate Crisis into the Classroom: Lessons from Mae Fah Luang University

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ABSTRACT

Introduction: Climate change presents an urgent global challenge that demands action across all sectors, including education. In alignment with Sustainable Development Goal 13 (SDG 13), this study investigates how Mae Fah Luang University (MFU) integrates climate crisis topics into its higher education curricula. The focus is on the "Introduction to Sustainable Development" course, which serves as a lens to assess students' knowledge, attitudes, and practices (KAP) regarding climate change. **Methods:** A mixed-methods research design was employed, combining quantitative and qualitative data. A structured KAP survey was administered to 100 undergraduate students across various disciplines. This was complemented by classroom observations and semi-structured interviews to gain deeper insights into student engagement and instructional methods. **Results:** Findings revealed significant differences in climate awareness based on academic discipline and gender. Health and Medical Sciences students showed the highest understanding of the causes of climate change (53.13%), Humanities and Social Sciences students demonstrated the most awareness of environmental impacts (65.71%), and Science and Technology students exhibited the strongest grasp of SDG 13 objectives (60.61%). Female students consistently scored higher across all indicators of climate awareness compared to male and non-binary peers. Qualitative data indicated a strong student preference for more interactive learning methods and better resource support to deepen their engagement with climate issues. **Discussion:** The data suggest that while MFU's curriculum has initiated meaningful engagement with climate education, there remain gaps in pedagogy and content delivery. Incorporating Bloom's Taxonomy could help scaffold learning from basic understanding to advanced critical thinking and application. Furthermore, interdisciplinary collaboration and community-based learning are essential to build comprehensive climate literacy among students. **Conclusions:** Integrating climate crisis education effectively within university curricula requires more than content inclusion—it demands pedagogical innovation, gender-sensitive strategies, and ongoing assessment. The study recommends adopting active learning frameworks and fostering interdisciplinary and community partnerships to empower students as future leaders in climate action and sustainability.

Keywords: Climate Crisis, University Curriculum, SDG 13, Classroom-Based Research, Mae Fah Luang University

1. INTRODUCTION

Integrating climate crisis education within university curricula is essential for preparing future leaders to address global environmental challenges. Universities serve as pivotal knowledge centers, equipping students with the skills and awareness necessary to respond effectively to climate issues (McCowan, 2021; Guevara et al., 2024). At Mae Fah Luang University (MFU), climate change education has been embedded into the "Introduction to Sustainable Development" course, aligning with Sustainable Development Goal 13 (SDG 13) on climate action. This initiative aims not only to raise awareness but also to foster active participation in climate solutions (Brennan & Quinton, 2020).

The urgency for climate education in higher learning arises from the accelerating impacts of climate change, including rising temperatures and biodiversity loss, which present both environmental and ethical imperatives that intersect social, economic, and political dimensions (Barnett, 2020). Vulnerable populations, particularly in Southeast Asia, are disproportionately affected (Otto et al., 2017). As global awareness of these issues grows, educational institutions must advance beyond purely scientific teaching to deliver interdisciplinary education that connects climate science with social equity and sustainable economic practices (Disterheft et al., 2013). MFU's curriculum addresses this need, encouraging students to engage with climate challenges through critical thinking and collaborative problem-solving.

This study evaluates the integration of climate crisis topics in MFU's curriculum by using a Knowledge, Attitudes, and Practices (KAP) survey administered to 100 students from diverse academic disciplines. The primary objective is to assess students' climate awareness and readiness for climate action, with secondary aims to explore how gender and academic background influence climate perceptions. Recommendations are presented to enhance curriculum design, emphasizing interdisciplinary learning and the structured use of Bloom's Taxonomy to scaffold knowledge progression from foundational to advanced analytical skills (Hargis et al., 2020).

MFU's position in Northern Thailand, a region facing significant climate risks, underscores the relevance of embedding climate education within its curriculum. This initiative aligns with global frameworks while addressing local environmental challenges, supporting the international call for comprehensive climate education across disciplines (Bina & Pereira, 2020; Lozano et al., 2013).

This study contributes to the discourse on climate education within higher education, identifying gaps in fostering interdisciplinary links between climate science, economics, policy, and social justice (Ahmad, 2024). Results indicate that female students generally exhibit higher climate awareness than their male peers, underscoring the value of gender-sensitive approaches. Additionally, the findings emphasize the need for interactive and experiential learning methods that extend beyond traditional instruction, promoting engagement and active learning (Kolb & Koln, 2006).

This paper is structured as follows: a conceptual framework and literature review on climate education in higher education are presented first, followed by the methodology outlining the KAP survey design and mixed-methods approach. The findings discuss climate awareness differences across gender and academic disciplines. Finally, the discussion offers recommendations for strengthening climate education at MFU, with a focus on Bloom's Taxonomy as a framework and strategies for interdisciplinary collaboration and enhanced student engagement in climate action.

1.1. Conceptual Framework

Integrating climate crisis education into university curricula is vital for empowering the next generation of leaders to address pressing global climate challenges. Universities, as centers of knowledge and drivers of social change, play a key role in fostering climate action through education. This study focuses on Mae Fah Luang University (MFU), exploring how its curriculum weaves into climate crisis education, Sustainable Development Goal (SDG) 13, and the Knowledge, Attitudes, and Practices (KAP) framework. These elements form the backbone of MFU's approach to climate education, with Bloom's Taxonomy enriching the curriculum to promote critical thinking and problem-solving skills (Ahmad, 2024; McCowan, 2021). The conceptual framework is presented in Figure 1 below.

Climate change is more than an environmental issue; it's an ethical and social responsibility intricately linked to economic and political dimensions (Barnett, 2020). As climate disruptions intensify, the need for interdisciplinary climate education in universities grows more urgent. Higher education institutions hold a unique role in bridging scientific understanding with social justice, inspiring students to tackle climate issues both in their communities and on a global scale (Bina & Pereira, 2020; Guevara et al., 2024).

At Mae Fah Luang University (MFU), the curriculum integrates climate science, sustainability, and policy, aligning closely with global standards like SDG 13 (Brennan & Quinton, 2020). This study employs the Knowledge, Attitudes, and Practices (KAP) framework to assess students' climate awareness, attitudes, and behaviors across various academic disciplines and genders, fostering

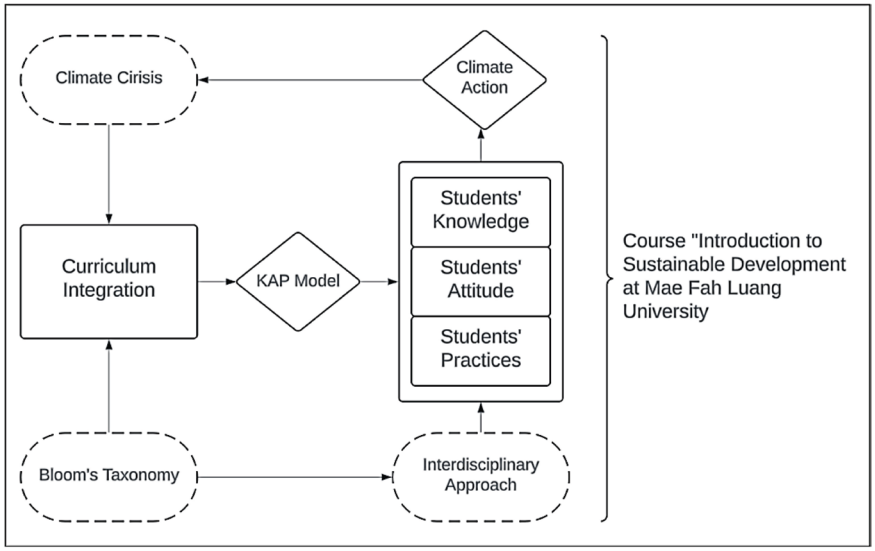

Figure 1. Conceptual Framework.

a shift from rote learning to critical engagement with real-world issues (Disterheft et al., 2013). Bloom's Taxonomy further structures this learning journey, moving students from basic knowledge to applied analytical skills (Hargis et al., 2020).

The framework suggests that a thoughtfully designed interdisciplinary climate curriculum at MFU will elevate students' understanding, attitudes, and actions regarding climate issues. Additionally, it explores how gender and academic background might shape climate awareness and involvement, acknowledging findings that female students often show higher climate sensitivity (Lozano et al., 2013; Otto et al., 2017). This recognition underscores the importance of gender-sensitive strategies in climate education.

This study adds to the broader dialogue on climate education in universities. While steps are being made to incorporate climate topics, challenges remain, especially in linking climate issues with policy, economics, and social justice (Kolb & Koln, 2006). Through its focus on interactive, experiential learning, this research offers actionable insights for enhancing climate literacy and empowering students to take meaningful action (McCowan, 2021; Guevara et al., 2024).

In conclusion, the conceptual framework builds on interdisciplinary climate education, shaped by Bloom's Taxonomy and the KAP model. By evaluating how curriculum design influences student outcomes, this study supports efforts to strengthen climate education and foster proactive climate engagement. It also highlights the significance of addressing gender and disciplinary diversity to ensure climate education is inclusive and impactful (Ahmad, 2024; Hargis et al., 2020).

1.2. Literature Review

1.2.1. Introduction to Climate Crisis Education and Sustainable Development Goals (SDG 13) in Higher Education

Climate crisis education is becoming increasingly urgent for meeting global challenges, especially under Sustainable Development Goal 13 (SDG 13: Climate Action). Education for Sustainable Development (ESD) is about more than knowledge transfer; it's about building real-world skills to address complex environmental, social, and economic challenges. Through ESD, students develop critical thinking, problem-solving abilities, and an active engagement with climate issues, empowering them to contribute to both climate mitigation and adaptation (Barth et al., 2007; Avelar et al., 2023; Bonilla-Jurado et al., 2024).

Universities play a unique role here. As centers of learning and change, they bring together the different threads of environmental, social, and economic issues. However, there are still barriers, including a lack of representation for non-scientific disciplines in sustainability initiatives and constraints around resources and faculty training (Chankseliani & McCowan, 2021; Leal Filho et al., 2022). These gaps make it difficult to deliver truly inclusive ESD programs that reach all corners of academia.

At Mae Fah Luang University (MFU), for instance, climate education is woven into the curriculum through frameworks like Bloom's Taxonomy and the Knowledge, Attitudes, and Practices (KAP) model. This approach encourages students to build skills that go beyond classroom learning, preparing them to address global climate issues actively. Other universities, including those in Latin America and Africa, are adopting similar methods,

reinforcing how crucial interdisciplinary learning is to climate action (UNESCO, 2023; Leal Filho et al., 2022).

The real measure of success in climate education isn't just student understanding but how students' attitudes shift and the practical actions they choose to take. ESD programs that prioritize hands-on learning and community involvement tend to create students who are more motivated and committed to climate action (Leal Filho et al., 2020). Yet, a major gap still exists; without enough long-term studies, we can't fully gauge whether these programs lead to lasting behavioral changes (Orakhelashvili, 2024). Even with progress, there's work to do. Many non-environmental disciplines remain on the sidelines, and we need more data on the lasting effects of climate education. Universities must also step-up faculty training to ensure ESD programs reflect the latest in climate research (UNESCO, 2021; Sustainable Earth Reviews, 2022). A truly interdisciplinary approach is essential for preparing both students and educators to play an active role in climate solutions.

In summary, climate crisis education has the potential to drive change, but universities need to address the gaps in curriculum, educator support, and interdisciplinary collaboration. Only by building a well-rounded, inclusive approach can they contribute meaningfully to SDG 13 and cultivate the climate leaders of tomorrow.

1.2.2. Defining Key Frameworks in Climate Education

Sustainable Development Goal 13 (SDG 13) highlights the urgent need for global climate action, and universities are uniquely positioned to make a difference by integrating climate education across a range of fields. Effective climate education isn't just about understanding the science; it's about equipping students with practical skills to address complex, real-world climate challenges. These challenges are inherently interdisciplinary, bringing together environmental science, social justice, policy, and economics (Monroe et al., 2019; Reimers, 2021).

Climate education aims to cultivate not only climate literacy but also critical thinking and problem-solving. As Monroe et al. (2019) point out, climate education becomes much more impactful when it crosses disciplinary boundaries, showing students the links between environmental and socio-economic issues. By using frameworks like Bloom's Taxonomy, educators can guide students from basic understanding to advanced skills like analysis and problem-solving. This approach transforms students into active thinkers who engage deeply with climate challenges, moving beyond passive learning (Reimers, 2021).

The Knowledge, Attitudes, and Practices (KAP) model adds another dimension, helping to measure how well climate programs foster understanding and inspire action. Studies using the KAP model have identified gaps in students' climate awareness and readiness to take action, reinforcing the need for climate curricula that evolve. By tracking how knowledge, attitudes, and practices change, universities can better shape programs that inspire both immediate and long-term engagement with climate issues (Leal Filho et al., 2020; Monroe et al., 2019).

Some universities are already leading the way in this space. The University of Groningen, for example, integrates sustainability themes into courses across law, business, and environmental science, underscoring the importance of making climate education relevant to different fields (Leal Filho et al., 2020). In Latin America, universities blend theoretical learning with hands-on, community-focused climate action, demonstrating how higher education can spark real innovation in tackling climate challenges (UNESCO, 2023).

Measuring success in climate education goes beyond just knowing the facts; it's about fostering practical skills and a proactive mindset that students carry into their lives and careers. However, a significant gap remains: we still need more long-term studies to see if this education results in sustained climate action post-graduation. More research is essential to understand if the climate literacy students gain translates into lasting behavioral changes (Orakhelashvili, 2024). And while environmental science programs tend to cover climate topics well, other areas like business, humanities, and social sciences often lack this focus. This gap is especially apparent in business and economics, where traditional growth models still tend to dominate over sustainable ones (Chankseliani & McCowan, 2021; Reimers, 2021).

In short, universities have a crucial role in advancing SDG 13 by embedding well-rounded, interdisciplinary climate education into their curricula. To reach their full potential, they need to close gaps in curriculum design, faculty training, and cross-disciplinary integration. Expanding climate education into non-environmental fields and conducting long-term studies to assess its impact will be essential for preparing students to tackle the climate issues of today and tomorrow. With a holistic approach, universities can become powerful catalysts for climate action, driving progress toward the ambitious goals of SDG 13 (Orakhelashvili, 2024; UNESCO, 2023).

2. MATERIALS AND METHODS

We designed a mixed-methods study to explore how effectively climate crisis topics are integrated into the "Introduction to Sustainable Development" course at Mae Fah Luang University (MFU), focusing on Sustainable Development Goal 13 (SDG 13). By combining surveys with in-depth interviews, we gathered both broad

Table 1. KAP Questions.

Section	Question Code	Question
Knowledge	K1	I am aware of the main causes of climate change, such as greenhouse gas emissions and deforestation.
	K2	I understand the relationship between climate change and rising global temperatures.
	K3	I am familiar with international climate agreements, such as the Paris Agreement and SDG 13.
	K4	I know how climate change affects global ecosystems and biodiversity.
	K5	I am aware of the local impacts of climate change in my country/region.
	K6	I can explain the main goals of Sustainable Development Goal 13 (SDG 13).
Attitudes	A1	I believe that urgent action is required to combat climate change.
	A2	I feel personally responsible for taking steps to reduce my carbon footprint.
	A3	I am optimistic that global efforts can reverse the effects of climate change.
	A4	I think climate change should be a priority issue for all governments and organizations.
	A5	I believe individual actions can make a significant impact in fighting climate change.
Practices	P1	I actively reduce, reuse, and recycle to minimize my environmental impact.
	P2	I take steps to reduce my carbon footprint, such as using public transportation or conserving energy.
	P3	I participate in environmental campaigns or sustainability initiatives at my university or community.
	P4	I seek out opportunities to learn more about climate change and sustainability.
	P5	I have made lifestyle changes to minimize my contribution to climate change.

statistical insights and personal student perspectives (Creswell & Creswell, 2018).

To capture a diverse range of views, we used stratified random sampling to select 100 students from MFU's clusters in Health and Medical Sciences, Humanities and Social Sciences, and Science and Technology. Within each cluster, we considered gender and academic discipline to see if these factors impacted students' climate awareness and engagement (Leal Filho et al., 2020). Each student completed a Knowledge, Attitudes, and Practices (KAP) questionnaire that measured their understanding, opinions, and actions related to climate change. The survey was divided into three sections—Knowledge, Attitudes, and Practices—and students rated each item on a five-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree) (Cohen et al., 2018). A detailed list of the questions is available in Table 1 below.

The Knowledge section (K1–K6) evaluates how well students grasp the causes and effects of climate change and understand global frameworks like SDG 13. To develop these questions, we drew on research by McCright (2010), which examines public knowledge about climate change, and Fielding et al. (2010), which addresses common misconceptions. The choice to include international frameworks reflects insights from UNESCO (2017) on how global educational frameworks shape climate awareness.

The Attitudes section (A1–A5) explores students' views on the urgency of climate action and their sense of personal responsibility. This section is informed by Heath and Gifford's (2006) work on personal and collective efficacy, which explores how people view their role in addressing climate issues. Finally, the Practices section (P1–P5) looks at how students translate their knowledge and attitudes into actions, such as recycling or conserving resources, inspired by Ajzen's (1991) Theory of Planned Behavior and Vining and Ebreo's (1992) Environmental Action Scale.

To better understand students' engagement and the effectiveness of the curriculum, we collected data through semi-structured interviews with 20 students and classroom observations. In the interviews, students were encouraged to talk about their experiences with climate education, any challenges they faced, and ideas for improvement. Questions like, "How do you feel about climate change topics in your courses?" and "What challenges do you face in learning about climate change?" helped us capture their personal experiences, providing valuable insights for enhancing the curriculum.

Classroom observations added a different perspective, allowing us to see student participation and engagement with climate topics in real-time. Observers noted how students interacted during discussions and group activities, identifying areas where the theory-to-practice link could be strengthened. These observations highlighted the need for more interactive learning experiences, especially where students struggled with complex topics or limited resources. Observers recorded their findings as field notes, and all interviews were transcribed for a detailed thematic analysis (Merriam & Tisdell, 2015). For quantitative analysis, we used SPSS to run descriptive statistics and ANOVA to explore any differences across disciplines and genders (Field, 2013). Qualitative data from interviews and observations were

then analyzed for themes using Braun and Clarke's (2006) method, revealing patterns in how students experience and perceive climate education. This combined approach offered a comprehensive look at how students engage with climate topics and pointed to actionable ways to improve the learning experience.

3. RESULTS

As climate change becomes one of the most pressing challenges of our time, universities are stepping up to prepare future leaders to meet these complex issues head-on. Guided by Sustainable Development Goal 13 (SDG 13), universities are uniquely positioned to build climate awareness and inspire meaningful action. Integrating climate-related topics into courses like "Introduction to Sustainable Development" at Mae Fah Luang University (MFU) is an essential step toward fostering a sense of responsibility and encouraging proactive behaviors among students.

In this study, we used the Knowledge, Attitudes, and Practices (KAP) model to measure how well students understand climate change, their attitudes toward taking action, and the steps they're actually taking to make a difference. We surveyed 100 students from MFU's Health and Medical Sciences, Humanities and Social Sciences, and Science and Technology clusters, aiming to capture a range of perspectives and see if factors like academic background or gender influence their climate awareness and actions. Using SPSS for analysis, we looked at descriptive statistics. We ran ANOVA tests to uncover any significant differences across these groups, giving us valuable insights into how students from different fields approach climate issues and where more support might be needed.

3.1. Climate Change Awareness and Optimism

The analysis of the Knowledge, Attitudes, and Practices (KAP) survey revealed significant differences in climate change awareness across academic clusters and genders. The KAP model assessed students' understanding of climate change causes, environmental effects, and SDG 13, as well as their attitudes and engagement in climate-related practices. Table 2 shows notable variations in how students from Health and Medical, Humanities and Social Sciences, and Science and Technology disciplines engage with climate topics.

Health and Medical students showed the highest awareness of climate change causes, with 53.13% reporting a strong understanding, likely due to the link between climate and public health (Watts et al., 2018). Humanities and Social Sciences students demonstrated the highest awareness of environmental effects (65.71%) and optimism (68.5%), reflecting their focus on socio-economic impacts (Leichenko & Silva, 2014). Science and Technology students were most familiar with SDG 13, with 60.61% showing a strong awareness of global climate frameworks, likely due to their focus on technological solutions. Additionally, female students generally exhibited greater awareness and more proactive attitudes toward climate action than their male and non-binary peers, as shown in Table 3.

The gender-based analysis showed that female students had higher awareness and engagement levels across all categories. For example, 55% of female students knew how to protect themselves from climate change, compared to 44% of males and 42% of non-binary students. Knowledge of climate change reduction strategies was more evenly distributed, with 44% of both male and female students and 36% of non-binary students reporting awareness. Regarding optimism, 52% of female students believed reversing global warming is possible, compared to 46% of males and 48% of non-binary students. These findings align with previous studies indicating that women often show greater environmental concern and are more proactive in climate action (Zelezny et al., 2000).

Table 2. KAP Awareness and Optimism Across Clusters

Academic Cluster	Awareness of Climate Causes (%)	Awareness of Environmental Effects (%)	Awareness of SDG 13 (%)	Optimism (%)
Health and Medical	53.13%	42.5%	35.2%	53.13%
Humanities and Social Sciences	40.5%	65.71%	45.3%	68.5%
Science and Technology	45.7%	50.4%	60.61%	60.61%

Table 3. KAP Awareness Across Genders

Gender	Aware of Climate Protection (%)	Aware of Climate Reduction (%)	Believe Reversing Global Warming is Possible (%)
Female	55%	44%	52%
Male	44%	44%	46%
Non-Binary	42%	36%	48%

3.2. Factors Influencing Climate Awareness and Action

To strengthen the initial findings from the Knowledge, Attitudes, and Practices (KAP) survey, additional statistical analyses were conducted to understand better the factors influencing climate awareness and action. These analyses examined the relationship between knowledge and behavior, variations across academic years, and the impact of gender on climate-related practices, aiming to provide more robust recommendations for curriculum improvements.

By incorporating correlation, ANOVA, and Chi-Square tests, this section explores how academic progression, gender, and specific practices contribute to the effectiveness of climate education. These findings reveal how knowledge and attitudes drive real-world climate action and highlight areas where higher education institutions can enhance their climate education programs. The correlation analysis between students' climate knowledge and their practices (e.g., reducing carbon footprint, recycling) assesses whether increased awareness leads to meaningful actions, as shown in Table 4.

A positive correlation (r = 0.62) between knowledge and practices suggests that students with greater awareness of climate change causes and effects are more likely to engage in climate-friendly behaviors (e.g., reducing their carbon footprint). The p-value (< 0.001) indicates that this relationship is statistically significant. This study also looks at how students' knowledge and practices change as they progress through different academic years (freshman, sophomore, junior, senior), as shown in Table 5. This can help identify whether students' awareness grows as they are more exposed to the curriculum over time.

The ANOVA results show significant differences in both knowledge (F = 5.20, p = 0.004) and practices across academic years, with seniors exhibiting the highest levels of awareness and action. This suggests that students' engagement with climate issues improves as they progress through the university and are exposed to more educational content related to sustainability. Additionally, the study also further investigates gender differences in specific climate-related practices, such as recycling, reducing energy use, or participating in environmental campaigns, as shown in Table 6 below.

The Chi-Square analysis reveals statistically significant gender differences in climate-related practices. Female students consistently show higher participation rates across all categories, particularly in recycling (52%) and environmental campaigns (50%), when compared to male and non-binary students. Non-binary students, while showing slightly higher participation than male students, still fall behind female students in all activities. The p-values indicate that these differences are statistically significant, with values below 0.05, supporting the conclusion that gender plays a significant role in shaping climate-related behaviors.

3.3. Student Engagement, Curriculum Effectiveness, and Barriers to Learning

In addition to the quantitative data from the Knowledge, Attitudes, and Practices (KAP) survey, qualitative data were gathered through semi-structured interviews with 20 students and classroom observations to provide deeper insights into student engagement, curriculum effectiveness, and barriers to learning in climate education. These methods explored how students perceive climate change topics, apply their knowledge in daily life, and face challenges in learning. The qualitative

Table 4. Correlation Between Knowledge and Practices

KAP Category	Correlation Coefficient (r)	P-Value
Knowledge and Practices	0.62	< 0.001

Table 5. ANOVA Results for Climate Awareness Across Academic Years

Academic Year	Mean Knowledge Score	Mean Practices Score	F- Statistic	P-Value
Freshman	3.4	2.9	5.20	0.004
Sophomore	3.8	3.3		
Junior	4.1	3.7		
Senior	4.4	4.1		

Table 6. Gender and Practices

Climate Practice	Male Participation (%)	Female participation (%)	Non-Binary Participation (%)	Chi-Square Value	P-Value
Recycling	38%	52%	44%	6.15	0.013
Reducing Energy Use	45%	60%	50%	4.25	0.039
Participating in Environmental Campaigns	32%	50%	42%	8.33	0.005

findings complement the statistical results, offering important perspectives on refining climate education to foster meaningful engagement and action (Sterling et al., 2018; Leal Filho et al., 2020).

Most students expressed positive engagement with climate content, finding it relevant to global challenges and appreciating the focus on Sustainable Development Goals (SDG 13). Classroom discussions were noted for encouraging critical thinking about climate action. However, many students called for more interactive learning, such as hands-on activities and case studies, to better connect theory to practice (Tilbury, 2011). While students acknowledged the curriculum's strong foundation in climate science, they noted a gap between theory and practical application. One student remarked, "I understand the science, but I feel less prepared for real-world actions." This highlights the need for more practical skills, like carbon footprint reduction and community-based initiatives, as well as interdisciplinary collaboration on climate projects (Leicht et al., 2018).

Challenges such as time constraints and limited resources were common themes. Some students felt that climate topics were rushed due to course overload, while others noted a lack of access to up-to-date materials and digital tools (Sterling, 2001). Additionally, students expressed a desire for more cross-departmental collaboration to develop practical solutions to climate challenges (Tilbury & Wortman, 2004).

In conclusion, while students are knowledgeable about climate change, gaps remain in translating knowledge into action. The findings suggest the need for interactive learning and interdisciplinary collaboration to bridge theory and practice, enhancing student preparedness for real-world climate challenges.

4. DISCUSSION

The findings from this study point to a clear need for a more structured and hands-on approach to climate education. It's not enough for students to understand climate issues in theory; they also need the practical skills and confidence to take action. This gap between knowledge and application is significant, and if universities aim to foster real climate advocates, they must rethink how climate education is delivered. Key strategies to enhance climate education include integrating climate topics more deeply across the curriculum, adopting interactive and experiential learning methods, encouraging interdisciplinary collaboration, supporting climate-related research, engaging students in community initiatives, allocating resources effectively, and implementing regular assessments to track progress and adjust approaches as needed.

Bloom's Taxonomy stands out as an especially useful tool here, providing a step-by-step framework that can guide students from foundational knowledge to the higher-order skills essential for tackling climate challenges head-on. Moving from basic understanding to advanced critical thinking and action requires structured support, and Bloom's framework helps educators scaffold learning to achieve just that (Bloom et al., 1956; Anderson & Krathwohl, 2001). By using this approach, universities can support students in progressing from passive awareness to active problem-solving, as illustrated in Figure 2.

The results of this study reinforce the importance of using Bloom's Taxonomy to bridge the gap between what students know and what they can actually do about climate change. For example, while 53.13% of students in

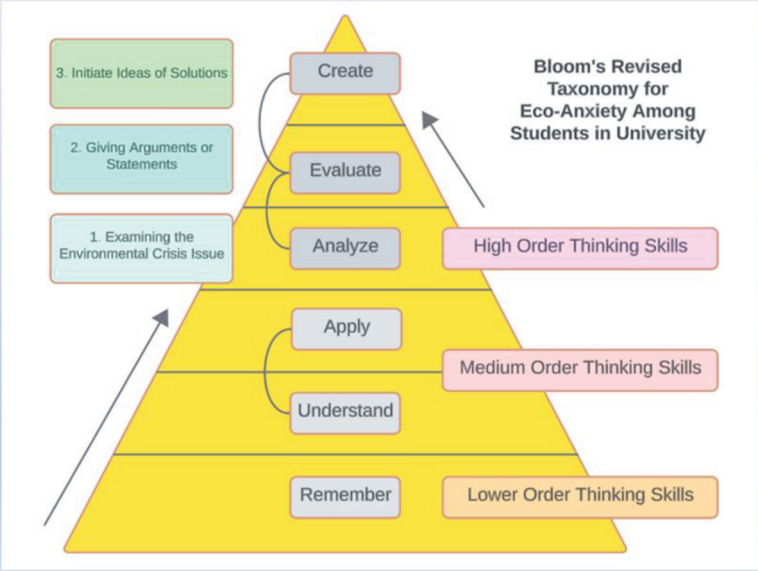

Figure 2. HOTS by Bloom's Revised Taxonomy (adapted from Krathwohl & Anderson, 2010).

the Health and Medical Sciences cluster demonstrated a strong understanding of climate causes, fewer students (44%) felt equipped to take active steps to reduce their climate impact. This shortfall is striking; it suggests that many students, while knowledgeable about climate science, feel less confident or less prepared to translate that knowledge into tangible actions. To us, this points to a missed opportunity in climate education: we are teaching students about the urgency of climate issues, but we're not giving them enough tools to become part of the solution.

At the basic levels of Remembering and Understanding, students seem to grasp key concepts, such as global warming and environmental degradation, with Health and Medical Sciences students, in particular, showing a solid awareness of climate causes. But as students move to more advanced stages, like Applying and Analyzing, where they engage with practical climate actions, the numbers drop. Only 44% of students reported knowing how to actively reduce their impact, which signals a need for a stronger emphasis on critical assessment and hands-on application.

In short, these findings suggest that universities have a powerful opportunity (and responsibility) to improve climate education by embedding more action-oriented, practical learning experiences into their curricula. This way, students can graduate not only as informed citizens but as proactive climate advocates ready to drive meaningful change.

At the advanced stages of Bloom's Taxonomy: Evaluating and Creating, students are not just absorbing information; they're analyzing climate policies and brainstorming innovative solutions. In this study, students from the Humanities and Social Sciences cluster showed a distinct optimism, with 68.57% believing in the possibility of reversing global warming. I found this particularly interesting because it seems to reflect how their exposure to social and policy frameworks shapes a hopeful perspective on climate action. By contrast, Science and Technology students, while more knowledgeable about SDG 13 (60.61%), were less optimistic. This could be due to a more scientific and perhaps more cautious view of the challenges ahead, which underscores how disciplinary backgrounds influence students' attitudes toward climate solutions.

There were also notable gender differences. Female students reported a higher awareness of personal protection strategies (55% compared to 44% of male students), while male students (65.71%) showed greater knowledge of mitigation measures. This difference suggests that each gender might be focusing on distinct aspects of climate preparedness, which makes me think that climate education could benefit from a more tailored, gender-sensitive approach that addresses these diverse perspectives.

Using Bloom's Taxonomy in climate education doesn't just align with curriculum integration and interdisciplinary collaboration; it helps move students from simply learning about climate issues to actively developing solutions. I believe this structured approach is essential to closing the gap we observed in the study: many students understand the concepts, but fewer know how to apply them in real life. By guiding students from foundational knowledge to critical thinking and hands-on problem-solving, universities can equip them to become proactive, solution-oriented climate advocates. This kind of learning isn't just theoretical; it's about preparing students to tackle real-world challenges and contribute meaningful change (Monroe et al., 2019).

5. CONCLUSION

This study makes it clear that embedding climate crisis education across university curricula is essential if we want to prepare students to address the realities of climate change truly. What stood out to us was the variation in climate awareness across disciplines. For example, students in health sciences grasped climate causes, social sciences students showed optimism and awareness of societal impacts, while tech-focused students leaned into solutions yet were more cautious about change. The gender differences also suggest that climate education isn't one-size-fits-all; female students showed stronger engagement in protective strategies, hinting at a need for approaches that resonate across diverse experiences. But perhaps the most critical takeaway is the gap between knowing and doing; students understand the issues but often struggle to act on that knowledge. Using Bloom's Taxonomy as a framework could bridge this gap by guiding students from basic awareness to practical, solution-oriented skills, helping them move from informed to actively engaged. In our view, this shift is crucial if universities are to foster not just climate awareness but genuine climate leadership.

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Declaration of Conflicting Interests

The author declares that she has no competing interests.

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