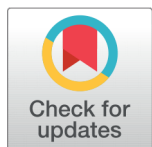


ORIGINAL ARTICLE



OPEN ACCESS

Received: 30/04/2026

Accepted: 12/05/2026

Published: 18/07/2026

Citation: Tupas FP, Abenir MCM, Asis AM, Padronia RZ, Lagon RN, Yu K, Tormon MJF (2026) It's Hot in Here: Thermal Stress and Coping Mechanisms Among Pre-Service Teachers During Periods of Elevated Heat Index. Indian Journal of Science and Technology 19(25): 1752-1760. <https://doi.org/10.17485/IJST/v19i25.707>

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Funding: None**Competing Interests:** None

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Published By Indian Society for Education and Environment ([iSee](#))

ISSN

Print: 0974-6846

Electronic: 0974-5645

It's Hot in Here: Thermal Stress and Coping Mechanisms Among Pre-Service Teachers During Periods of Elevated Heat Index

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Abstract

Objectives: To examine the effects of elevated heat index on the stress levels of pre-service teachers, identify the common problems and coping mechanisms they employ, and develop a contextualized framework for effective heat-related stress management and well-being support. **Method:** The study employed a descriptive-correlational mixed-methods design. Quantitative data were collected through a researcher-developed, validated survey questionnaire, while qualitative data were collected through interviews and focus group discussions (FGDs). A total of 136 pre-service teachers majoring in English, Mathematics, and Science participated in the study. Quantitative data were analyzed using frequency counts, mean, standard deviation, analysis of variance (ANOVA), and Pearson's correlation, while qualitative responses were coded and thematically analyzed. **Findings:** Results revealed that pre-service teachers experienced moderate stress during periods of high heat index ($M = 1.91$), with findings that were relatively consistent across academic majors. Respondents also demonstrated average coping mechanisms ($M = 2.67$), suggesting that although students attempt to manage heat-related challenges, their coping strategies remain moderately effective. Statistical analysis showed no significant differences in stress and coping levels across disciplines, indicating a generally uniform experience among participants. Likewise, the relationship between stress and coping mechanisms was weak and not statistically significant ($r = 0.117$), implying that higher stress levels do not necessarily correspond to stronger coping strategies. Qualitative findings further revealed that extreme heat negatively affects physical well-being, cognitive functioning, emotional stability, classroom engagement, and teaching effectiveness. Although students adopted adaptive strategies such as hydration, the use of portable fans, and schedule adjustments, these were often insufficient to fully address heat-related discomfort. **Novelty:** The study focuses on pre-service teachers in high-heat conditions, showing how heat stress affects learning, coping, and teaching readiness. It highlights the need for better school infrastructure, mental health support, and climate-responsive policies to ensure safe and effective learning environments.

Keywords: Thermal stress; Coping mechanisms; Pre-service teachers; Heat index; Mental well-being

1 Introduction

The Philippines is a tropical country located near the equator, characterized by high temperatures, high humidity, and abundant rainfall. In recent decades, it has experienced increasing heat indices alongside frequent typhoons and other natural hazards. In Metro Manila, temperatures have recently reached 38.8°C, with heat indices rising to 45°C due to humidity, surpassing previous historical records. PAGASA has also warned that some areas may reach heat indices of 52°C or higher, classified as extreme danger, where heat stroke becomes highly likely. Based on health classifications, 33–41°C is considered extreme caution, 42–51°C is danger, and 52°C and above is extreme danger. This worsening heat situation is part of a broader regional and global trend of intensifying heatwaves, posing serious public health concerns that require urgent action⁽¹⁾. Despite growing environmental awareness, human impacts continue to contribute to abnormal weather patterns, indicating that existing efforts remain insufficient.

Extreme heat has also become a critical issue in education, affecting school safety, learning conditions, and student well-being. It limits physical activity, increases health risks, and promotes sedentary behavior among learners, highlighting the need for adaptive measures such as adjusted schedules, hydration strategies, shaded environments, improved facilities, and supportive policies⁽²⁾, ⁽³⁾. Although thermal stress has been widely studied, most research has focused on industrial workers, athletes, and general student populations, with limited attention given to pre-service teachers as a distinct group in educational settings. This is a significant gap, as teacher preparation involves both academic demands and environmental exposure that may influence future classroom performance and well-being. Existing studies in workplace settings show that heat stress negatively affects safety, productivity, and job satisfaction, and that these effects are influenced by environmental conditions and organizational policies⁽⁴⁾. However, perceptions of heat stress may differ from actual measurements due to individual and situational factors, suggesting the importance of combining objective data with personal experiences for more effective interventions⁽⁵⁾. Research in educational and outdoor contexts further shows that heat exposure varies by time, surface, and environment, requiring careful scheduling and institutional planning⁽⁶⁾. Studies on vulnerable populations also confirm high levels of heat stress and support the use of systematic assessment tools to improve safety measures⁽⁷⁾.

In the Philippine context, extreme heat has already disrupted education, particularly during the summers of 2023 and 2024. Government responses, such as class suspensions and alternative learning modalities, have been implemented but remain insufficient. Studies recommend more consistent policies, improved heat monitoring, and structured academic response plans to reduce learning disruptions⁽⁸⁾. Meanwhile, pre-service teachers who are more aware of environmental issues tend to demonstrate higher readiness for climate-related challenges⁽⁹⁾. Although institutions such as NISU implement hybrid learning and allow flexible dress codes during face-to-face classes, students still experience stress due to environmental and academic pressures, prompting them to develop individual coping strategies.

Generally, the existing literature shows that heat stress is a widespread yet fragmented issue, affecting multiple populations and with limited integration of solutions across contexts. Most studies emphasize physical impacts, while coping mechanisms in educational settings, particularly in tropical and resource-limited environments, remain underexplored. There is also limited research focusing specifically on pre-service teachers and how thermal stress affects their preparation, cognitive performance, and readiness to teach. Additionally, stress from academic, social, and personal factors may compound these environmental challenges, with unmanaged stress linked to serious mental health risks, including depression, which the World Health Organization projects will become a leading global disease burden by 2030⁽¹⁰⁾. While individuals often rely on personal coping strategies, these are frequently not supported by institutional systems, highlighting the need for integrated approaches⁽¹¹⁾.

This study, therefore, examines the effects of elevated heat index on the stress levels and coping mechanisms of pre-service teachers majoring in English, Mathematics, and Science at Northern Iloilo State University–Ajuy Campus, Iloilo, Philippines. It specifically explores how heat stress influences their comfort, cognitive performance, and readiness to teach in a tropical environment. By addressing this gap, the study aims to develop a contextualized framework for effective heat-related stress management and well-being support in teacher education programs.

2 Methodology

2.1 Research Design

This study employed a descriptive-correlational mixed-methods design to examine the levels of stress and coping mechanisms among pre-service teachers during periods of elevated heat index at Northern Iloilo State University, Ajuy Campus, Ajuy, Iloilo, Philippines. The quantitative component assessed perceived stress and coping strategies, while the qualitative component, through interviews and focus group discussions (FGDs), explored students' lived experiences, challenges, and adaptive responses to high-heat conditions. The integration of quantitative and qualitative findings through triangulation provided

a more comprehensive understanding of the phenomenon and served as the basis for developing a proposed institutional framework and policy recommendations for heat-stress management in educational settings.

2.2 Research Respondents and Dataset Description

The respondents were Bachelor of Secondary Education students majoring in English, Mathematics, and Science enrolled during the academic year 2025–2026, from first to fourth year levels. Of the total population of 284 students, 136 (48%) participated in the study, comprising 53 English majors, 25 Mathematics majors, and 58 Science majors.

The dataset consisted of survey responses, interview transcripts, and FGD recordings collected directly from participants during the study period from August to December 2025. Due to ethical and confidentiality considerations involving human participants, the dataset is not publicly accessible through an online repository. However, anonymized data may be made available on a reasonable request to the corresponding author, subject to institutional approval.

2.3 Research Instrument

The study utilized a researcher-developed questionnaire based on related literature, validated stress and coping scales, and preliminary interviews from similar studies on stress and coping mechanisms. The instrument measured perceived thermal stress, coping strategies, and experiences during high-heat index conditions. Key parameters considered in the study included perceived thermal stress level, coping mechanisms, heat exposure context during class hours, and demographic variables such as program and year level. These parameters were selected because previous studies identified environmental heat exposure and coping capacity as important factors influencing learning performance, well-being, and classroom engagement.

An open-ended interview guide was also developed for the qualitative component to identify common issues and challenges pre-service teachers face during periods of extreme heat. The qualitative findings were used to formulate a framework for possible university policies and interventions related to heat-stress management.

To ensure validity and reliability, the instruments were evaluated by guidance counselors, nurses, psychologists, and educators. A pilot test involving a comparable group of students was conducted to assess clarity, consistency, and suitability of the questionnaire items. Reliability testing was performed using Cronbach's alpha, with a value of 0.70 or higher considered acceptable for internal consistency. Content validity was likewise established through expert review, focusing on clarity, relevance, and alignment with the study's objectives. The qualitative guide questions were also validated to ensure thematic consistency and appropriateness.

2.4 Research Procedure

The researchers conceptualized the study in 2024 following significant increases in temperature and heat index levels observed in the locality. After preparing the research proposal, the study underwent institutional review and approval procedures. Upon approval, formal permission was secured from the campus administrator to conduct the study among pre-service teachers.

Participants were informed about the objectives, procedures, and voluntary nature of the study before data collection. Surveys, interviews, and FGDs were conducted from August to December 2025 under similar environmental and time conditions to minimize variability and improve consistency in data collection procedures.

2.5 Data Analysis

Quantitative data were analyzed using frequency counts, percentages, mean, and standard deviation to describe stress levels and coping mechanisms. Inferential statistics, including one-way analysis of variance (ANOVA) and Pearson's correlation, were utilized to determine significant differences and relationships among variables. Statistical analyses were performed using standard statistical software with assistance from a licensed statistician to ensure accuracy and reliability of results.

For the qualitative component, responses from interviews and FGDs were coded, categorized, and thematically analyzed. Data triangulation was employed to compare and validate findings across quantitative and qualitative sources. Themes derived from participant responses were further synthesized to aid in developing a proposed framework for institutional heat-stress response and support mechanisms. ChatGPT was used solely as an assistive tool to organize and synthesize framework concepts based on the analyzed themes, while interpretation and validation remained under the researchers' supervision.

To strengthen methodological rigor and reproducibility, standardized procedures were consistently followed throughout data collection and analysis. Expert validation, pilot testing, triangulation, and statistical assumption testing, including tests of normality and homogeneity of variance, were conducted to ensure the reliability, internal consistency, and validity of the findings.

2.6 Ethical Considerations

Ethical considerations were strictly observed throughout the study. Prior to implementation, informed consent was obtained from all participants, including parental consent for respondents below the legal age. Participation was voluntary, and respondents were informed that they could withdraw from the study at any time without penalty. Confidentiality and anonymity were maintained by excluding personal identifiers from all datasets and reports. All collected information was securely stored and used solely for research purposes.

3 Results and Discussion

Table 1 presents the stress levels of pre-service teachers during periods of high heat index, grouped by major fields of study.

Table 1. The stress level of preservice teachers during the High Heat Index

Category	n	Mean	SD	Description
<i>Major</i>				
English	53	1.86	.24	Moderate
Science	58	1.97	.27	Moderate
Mathematics	25	1.90	.30	Moderate
Total	136	1.91	.27	Moderate

Legend: 2.34 – 3.00 (Severe); 1.67 – 2.33 (Moderate); 1.00 – 1.66 (Mild)

The data show that English ($n = 53$, Mean = 1.86, SD = 0.24), Science ($n = 58$, Mean = 1.97, SD = 0.27), and Mathematics ($n = 25$, Mean = 1.90, SD = 0.30) majors all experienced moderate stress based on the given scale (1.67–2.33). Science majors reported the highest mean stress level (1.97), followed by Mathematics (1.90), while English had the lowest (1.86). The differences are minimal, indicating generally consistent stress levels across groups. The overall mean ($n = 136$) is 1.91 (SD = 0.27), also within the moderate range, suggesting that pre-service teachers experience noticeable but manageable stress during high heat conditions. The relatively low standard deviations (0.24–0.30) further indicate consistent responses among participants.

High temperatures negatively affected students' learning, making it harder to focus and perform academic tasks. The study identified key stressors, including time management issues, heavy workload, student behavioral problems, and limited institutional support⁽¹²⁾. One study found that pre-service teachers receive limited stress management training and emphasized the need to integrate these skills into teacher education programs⁽¹³⁾.

During this high heat index, the university decided to shift to online learning; thus, one factor causing stress among pre-service teachers is the availability of gadgets and connectivity. To support these university students, academic institutions must provide mechanisms to effectively manage stress. One study found that a digital stress management program improved well-being, coping, and mindfulness among pre-service teachers and was highly accepted, supporting its inclusion in teacher education programs⁽¹⁴⁾. According to one study, mindfulness practices, such as meditation and breathing exercises, help reduce stress and improve well-being among pre-service teachers, supporting emotional resilience and reducing burnout⁽¹⁵⁾.

Table 2 presents the levels of coping mechanisms among students during the post-pandemic period, grouped by major.

Table 2. Level of Coping Mechanisms of Preservice Teachers during the High Heat Index

Category	N	Mean	SD	Description
<i>Major</i>				
English	53	2.58	.28	Average Coping
Science	58	2.73	.30	Average Coping
Mathematics	25	2.73	.35	Average Coping
Total	136	2.67	.30	Average Coping

Legend: 3.26 – 4.00 (Well Coping); 2.51 – 3.25 (Average Coping); 1.76 – 2.50 (Poor Coping); 1.00 – 1.75 (Not coping)

The results show that all groups reveal average coping. English majors ($n = 53$) have a mean score of 2.58 (SD = 0.28), while both Science ($n = 58$) and Mathematics ($n = 25$) majors report slightly higher and equal mean scores of 2.73 (SD = 0.30 and 0.35, respectively). This shows that Science and Mathematics students tend to cope slightly better than English majors, although the differences are minimal. The overall mean score of 2.67 (SD = 0.30) also falls under the average coping category.

This suggests that, in general, students can manage the challenges posed by high heat indices. Their coping strategies are not particularly strong or well-developed. The relatively small standard deviation values (ranging from 0.28 to 0.35) indicate that students' responses are consistent within each group, with little variation in coping levels. In addition, the findings imply that while students across all majors are managing their learning challenges to a reasonable extent, there is still room to strengthen their coping mechanisms to better support academic success in a post-pandemic learning environment.

The study highlights coping strategies, emphasizing the need for schools to consider environmental conditions in planning and improve learning experiences during extreme heat⁽¹⁶⁾. One study on coping strategies among university students in China found that students employed various strategies to manage COVID-19. They have already adopted techniques to survive the crisis⁽¹⁷⁾. The study highlights the need for targeted coping strategies and stakeholder support to help teachers manage stress, improve resilience, and enhance teaching and learning outcomes⁽¹²⁾.

Table 3 presents the results of an analysis of variance (ANOVA) examining whether there are significant differences in pre-service teachers' stress levels and coping levels during periods of high heat index.

Table 3. The significant difference between pre-service teachers' stress and coping levels in high heat-indexed

		Sum of Squares	df	Mean Square	F	Sig.
Stress Level	<i>Between Groups</i>	.38	2	.19	2.71	.07
	<i>With groups</i>	9.25	133	.07		
	<i>Total</i>	9.63	135			
Cope Level	<i>Between Groups</i>	.74	2	.37	3.77	0.26
	<i>With groups</i>	13.13	133	.10		
	<i>Total</i>	13.13	135			

Alpha: .05 level of significance.

For stress level, the computed F-value is 2.71 with a p-value (Sig.) of 0.07. Since the p-value is greater than 0.05, there is no statistically significant difference in stress levels among the groups. In other words, although there are slight variations in mean stress scores, these differences are not strong enough to conclude that they are meaningful or influenced by group membership. For the coping level, the F-value is 3.77 with a reported p-value of 0.26. Similarly, since this p-value is also greater than 0.05, there is no statistically significant difference in coping mechanisms across the groups. This suggests that pre-service teachers, regardless of grouping, tend to exhibit similar coping behaviors during high heat conditions. Looking at the variance components, the between-group sums of squares for both stress (0.38) and coping (0.74) are relatively small compared to the within-group sums of squares (9.25 and 13.13, respectively). This further indicates that most of the variation in stress and coping levels occurs within groups rather than between them. Overall, the findings imply that differences in stress and coping levels among pre-service teachers during high heat index periods are not statistically significant, signifying a generally uniform experience across the groups studied.

Thus, college students worldwide already have various strategies for coping with current situations. People living in extreme heat, especially in low-income areas, often experience very high indoor temperatures and rely on behavioral and natural physiological adaptations since air conditioning is not accessible. The passage highlights the need for further research to better understand how people truly adapt to extreme heat⁽¹⁸⁾.

Table 4 shows the relationship between stress level and coping mechanisms among pre-service teachers during periods of high heat index.

Table 4. The relationship between the stress level and coping mechanism level among pre-service teachers during high heat index

		Level of Stress	Level of Coping Mechanisms
Stress Level	<i>Pearson (Correlation)</i>	1.000	.117
	<i>Sig. (2-tailed)</i>		.174
	<i>N</i>	136	136
Cope Level	<i>Pearson (Correlation)</i>	.117	1.000
	<i>Sig. (2-tailed)</i>	.174	
	<i>N</i>	136	136

The correlation coefficient ($r = 0.117$) indicates a very weak positive relationship between stress and coping. This means that as stress levels increase slightly, coping mechanisms also tend to increase, but the relationship is weak and not strong enough

to suggest a meaningful pattern. The p-value (Sig. = 0.174) is greater than the 0.05 level of significance. This indicates that the relationship is not statistically significant, so the observed correlation may be due to chance rather than a true association between the variables. The sample size (N = 136) indicates that the analysis is based on responses from 136 pre-service teachers, providing a reasonable basis for interpretation. Therefore, the findings suggest that stress levels and coping mechanisms are not significantly related among pre-service teachers during high heat index conditions. In practical terms, this means that higher stress does not necessarily correspond to better or worse coping strategies within this group. This is confirmed by the study, which found that stressors and coping strategies did not significantly affect pre-service teachers' practicum performance⁽¹⁹⁾.

Table 5 presents the common issues and problems pre-service teachers experience during periods of high heat index, organized into themes based on their responses.

Table 5. The Responses of Pre-service Teachers on the Common Issues and Problems during High Heat Index

Themes	Responses
Physical Discomfort and Health Concerns	"Because of the extreme heat, I easily get tired and sometimes feel dizzy, especially during afternoon classes."
Difficulty in Concentration and Learning	"It's difficult to focus on the lesson when it's too hot. I get distracted and lose track of what the teacher is discussing."
Reduced Teaching Effectiveness (for Practicum Students)	"I find it hard to teach effectively because my students and I feel uncomfortable due to the heat."
Lack of Adequate Facilities	"Our classroom has limited ventilation, and sometimes the electric fan is not enough to ease the heat."
Decreased Motivation and Engagement	"The hot weather makes me feel lazy and less motivated to participate in class activities."
Coping Challenges and Adjustments	"I try to cope by staying hydrated and bringing a small fan, but sometimes it's still not enough."
Increased Stress and Irritability	"I become more irritable when it's too hot, and it affects how I deal with my classmates."

High-heat conditions negatively affect students' and learners' health, concentration, and participation, often leading to heat-stress symptoms, absenteeism, and reduced academic performance. Studies show that extreme temperatures can cause fatigue, lower attention, and decreased information retention, highlighting students' vulnerability to heat. In addition, the findings emphasize the need for school policies and institutional interventions to improve learning environments and ensure safety during periods of extreme heat⁽²⁰⁾. Also, High temperatures can reduce cognitive performance by making it harder to focus, think clearly, and stay alert. Even short exposure may slightly affect thinking, while long-term exposure can lead to greater decline. However, people in warmer regions may adapt better. Overall, extreme heat negatively impacts mental functioning, highlighting the need for protective measures in the face of climate change⁽²¹⁾. In addition, Extreme heat can lower motivation and engagement and create challenges such as stress, absenteeism, and poor classroom conditions, highlighting the need for climate-resilient learning strategies.

While some pre-service teachers attempt to cope by drinking more water, using handheld fans, or taking breaks, others struggle to manage the discomfort effectively. To address these issues, teachers used adaptive strategies such as modifying instruction, conducting outdoor learning, ensuring hydration, and improving classroom airflow. Overall, the findings highlight the need for climate-resilient school infrastructure and training programs to help teachers manage heat-related stress and maintain effective teaching and learning conditions⁽²²⁾.

High heat levels can lead to emotional strain, including irritability and stress, which may affect interactions with peers and students. The discussion highlights that heat stress can negatively affect mental health by increasing stress and anxiety and impairing cognitive function, with vulnerable groups such as children, older adults, and individuals with mental health conditions being most at risk. Socioeconomic factors can further increase this vulnerability. To reduce these effects, the study recommends coping strategies such as mindfulness, stress management techniques, and therapy to help individuals manage psychological distress during high temperatures⁽²³⁾.

The qualitative responses reveal that high heat index conditions significantly affect pre-service teachers' physical well-being, cognitive performance, teaching effectiveness, and emotional state. While some employ basic coping strategies, the lack of adequate facilities and environmental support remains a major challenge. These findings highlight the need for institutional interventions, such as improved classroom ventilation, flexible scheduling, and health-conscious policies, to support both learning and teaching under extreme weather conditions.

Figure 1 shows the proposed frameworks for helping pre-service teachers during high heat index conditions at Northern Iloilo State University, Ajuy Campus, Iloilo, Philippines.

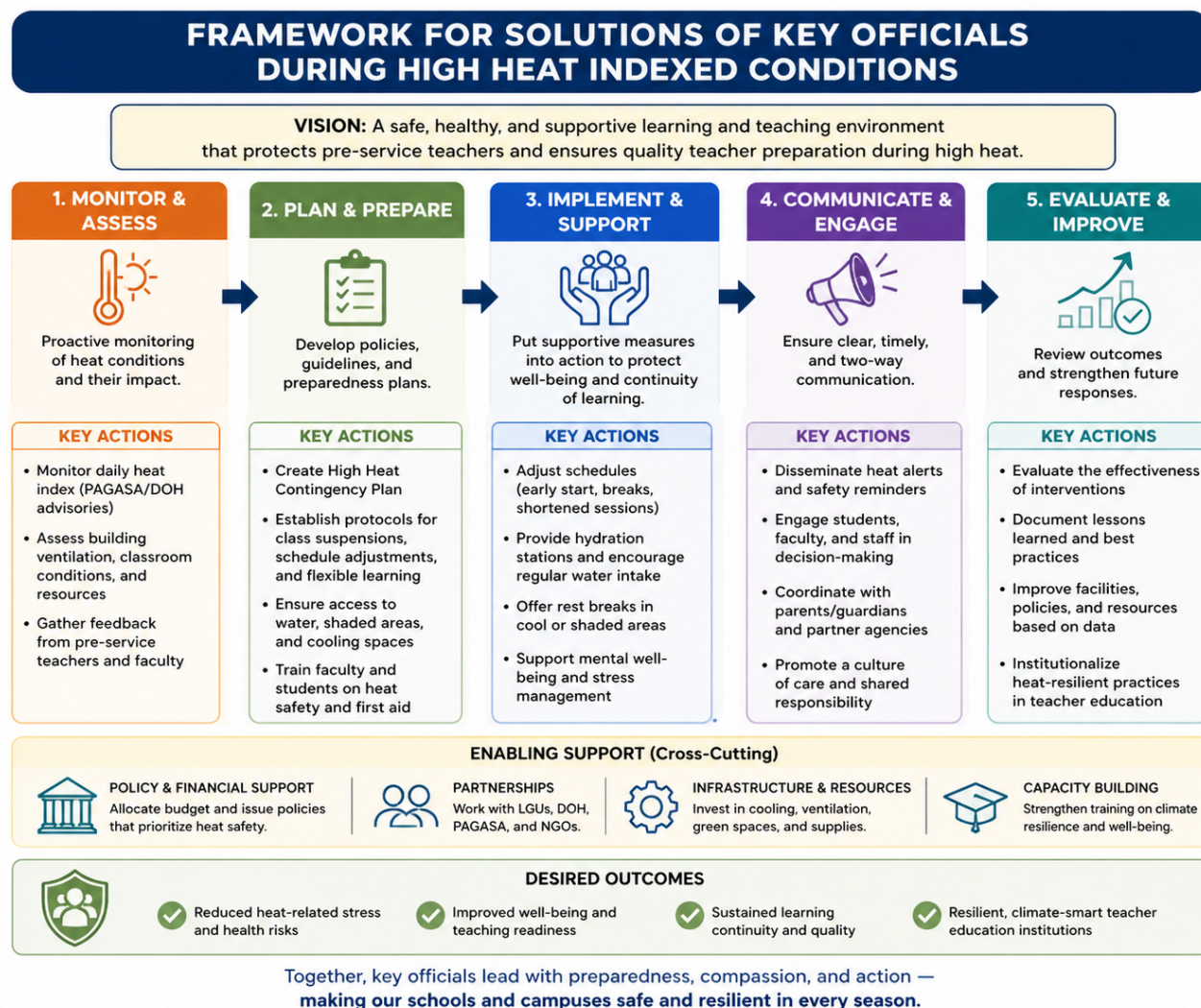


Fig 1. The Proposed Framework during High Heat Index

The infographic presents a comprehensive framework designed to help school and university officials effectively respond to extreme heat conditions while ensuring the safety and continuity of learning. The framework focuses on preparing schools for heat risks through planning, implementing safety measures, promoting communication, and continuously improving responses. It is supported by strong policies, partnerships, and infrastructure to ensure safe, resilient, and climate-responsive learning environments. One study confirmed that, as climate change intensifies heat, policymakers need to set clear heat safety standards for children and invest in better infrastructure to ensure schools, childcare centers, and communities remain safe and healthy environments for them⁽²⁴⁾. Also, one study found that the framework focuses on creating safe, climate-responsive learning environments by monitoring heat conditions and promoting resilience and climate action in education⁽²⁵⁾. Furthermore, climate action and disaster risk reduction in the Philippines face challenges in policy implementation and coordination, prompting reforms and capacity-building efforts to strengthen resilience.

4 Conclusion

This study concludes that high heat index conditions are associated with noticeable stress experiences, coping behaviors, and learning challenges among pre-service teachers; however, not all observed differences are statistically significant. Quantitative results showed that all groups experienced moderate stress levels, with science majors obtaining the highest mean score ($M = 1.97$, $SD = 0.27$), followed by Mathematics ($M = 1.90$, $SD = 0.30$) and English majors ($M = 1.86$, $SD = 0.24$). The overall stress level

($M = 1.91$, $SD = 0.27$) suggests that participants generally experienced manageable levels of stress during high-heat conditions. In terms of coping mechanisms, all groups were classified under average coping, with an overall mean of 2.67 ($SD = 0.30$), indicating that pre-service teachers do employ strategies to manage heat-related discomfort. However, these coping responses appear to be moderate and may still require further enhancement and institutional support. Inferential analysis showed that there were no statistically significant differences in stress levels among the groups ($F = 2.71$, $p = 0.07$) and in coping mechanisms ($F = 3.77$, $p = 0.26$). These results suggest that although slight variations in mean scores across academic majors exist, these differences are not strong enough to be statistically significant. Likewise, the relationship between stress and coping mechanisms was found to be very weak and not statistically significant ($r = 0.117$, $p = 0.174$), indicating that higher stress levels do not necessarily predict stronger or weaker coping responses among participants. The qualitative findings complement these results by showing that high heat conditions negatively affect concentration, motivation, teaching performance, participation, and emotional well-being. Participants reported fatigue, dizziness, irritability, and reduced engagement during classroom activities. While some coping strategies, such as hydration, handheld fans, and short breaks, were reported, they were often insufficient due to environmental constraints, including poor ventilation, limited cooling systems, and inadequate institutional support. The study's novelty lies in its focus on pre-service teachers, an underexplored group in thermal stress research in a tropical, high heat index context. Unlike prior studies that primarily examined workers or athletes, this research integrates stress, coping mechanisms, cognitive functioning, and learning experiences within teacher education. Overall, the findings highlight the need for climate-responsive educational policies, including improved classroom ventilation, heat safety protocols, flexible scheduling, and strengthened mental health support systems. They also suggest the importance of integrating stress management and climate adaptation strategies into teacher education programs. Future research may further explore long-term effects of heat exposure, including physiological measures of stress, and examine broader institutional responses to climate-related educational challenges.

5 Acknowledgments

The author sincerely expresses gratitude to the Office of Research and Development Services (ORDS), NISU Main Campus, Estancia, Iloilo, Philippines, for the financial support of this study. Appreciation is also extended to the evaluators and participants for their valuable time and contributions to the research process.

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