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It's Hot in Here: Effect of Heat Index to the Academic Participation and Learning Attitudes of Students on Blended Learning

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Abstract

Intensifying extreme weather condition is the new pandemic. Studies correlating intense thermal conditions' effect on learners' academic performance is very limited. This study takes a closer look at how high heat levels affect students' ability to participate and stay engaged in blended learning environments. As temperature rises, many students are reported to feel less motivated, struggling to focus, and even noticing changes in their academic performance—especially during online classes. Additionally, projected environmental changes significantly affects teaching learning process. Through structured surveys, the researchers examined various aspects of learning attitudes such as motivation, perseverance, and goal orientation, along with academic participation skills like collaboration, time management, and seeking help. This study utilized Likert scale and descriptive-correlational approach to analyze the data and identify significant relationships between the heat index and students' academic participation and learning attitudes. Despite the challenges brought on by heat like discomfort and technical issues, many students showed resilience. To explore how closely motivation and participation were connected, a correlation test was done. It showed a weak positive link ($r = 0.255$), meaning that students who were more motivated did tend to participate more, but not by much. Since the p-value was 0.315, which is above the usual cutoff for significance, the result wasn't strong enough to prove that motivation and participation were truly linked in this situation. Correlation analysis suggested how academic participation tends to increase with increased motivation despite of weak positive correlation having a r-value of 0.355.Moreover, observed correlation revealed that there is no significant difference between the effect of heat indices on learning attitudes and academic participation of 2nd year students under the Bachelor of Science in Environmental Science program in blended learning environment. The findings highlighted how environmental factors, like extreme heat can shape students' educational experiences and suggested the importance of providing strategies and support to help them adapt and succeed in learning process through climate-resilient curriculum and institution.

Keywords: Academic Participation, Learning Attitudes, Heat Index, Blended Learning, Curriculum

1. Introduction

The heightened heat indices showed a negative impact to students' academic performance [7] and leads to decreased intrinsic motivation [16]. Thermal discomfort had caused not just a decrease in students' academic participation but as well as the necessity to integrate weather-responsive curricula and facilities to ensure effective learning environment and capabilities of educational systems [10].This climatic extremes has adverse effects including suspension of face to face classes, adjusted class schedules, shift to alternative teaching strategies [11] or worse, school closures due to high heat indices [3], which intensified implementation of blended learning.

Academic performance is the level of students' achievements in education which are assessed using indicators of progress such as grades or exams, and influenced by various factors like motivation [14] in a classroom climate. Classroom climate was defined as something that reflects the collective perception of students' about their educational experiences which are constructed through classroom interactions[12]. These academic performance is disrupted by heat stress[2].School closure had been a massive climatic response not just in Philippines but as well as in Southeast Asia [3].This closure leads to implementation of Blended Learning (BL) as a concrete institutional strategies in ensuring continuous delivery of knowledge, catering students' variability in learning experiences[1]. Additionally, the world pandemic, COVID 19, forced the integration of technologies in facilitating teaching-learning process[6]. Students'' attitudes during BL were found to be higher than those students' without experiences in blended learning[18], Additionally, learners showed positive attitudes toward flexible learning[8].

This method showed significant improvements in motivation and satisfaction of learners compares to traditional one[9]. Motivation is defined as the product of interaction between a person and a situation and is claimed to be effective when there is no conflict between learner's needs and goals[5]. The same study also encouraged the consideration of intrinsic and extrinsic factors which has a 79% impact on the implementation of blended learning and academic performance[8]. However, this response further exacerbate the existing educational inequalities that leads to educational gaps.

There are scarcity in studies that correlates climate's impact in behavioral aspects of a learner[7]. This type of research is necessary in assessing educational system capacities under escalating severity of disruptions caused by heat waves[10] . Thus, this study aims to identify the learning motivation, intrinsic and extrinsic, of students in blended learning and the extent of their academic participation during face to face class suspension due to high heat index. This study also aims to correlate the effect of high heat index in learning attitudes and academic participation of students during implementation of blended learning. Additionally, this paper will also delve into realm of education under the new pandemic— extremes of climate and offer an approach to address Sustainable Development Goals: SDG 4: Quality education, SDG 3: Good Health and Well-being, SDG 10: Reduced Inequalities, and SDG 13: Climate Action. The findings of this study can be used to understand the correlation of environmental impacts on students' academic performance and learning attitudes in blended learning and inform strategies not just how to inform climate adaptation but as well as the strategies that can be used to advocate for a sustainable learning environments; gives recommendations on how to improve pedagogical approaches which are suitable and resilient against ever-changing climatic conditions; and interventions to promote everyone's health and well-being and equitable access to quality education.

2. Materials and Methods

2.1 Sample Collection and Preparation

The aim is to identify significant relationships between the heat index and students' academic participation and learning attitudes. The findings are expected to provide insights into how external environmental factors, such as temperature, influence students' academic and cognitive outcomes. These insights could guide the development of strategies to optimize learning environments, helping educators design more effective and conducive spaces, particularly in blended or hybrid learning settings.

This study will use a descriptive-correlational approach to investigate and provide a comprehensive analysis of the gathered data from previous related studies and articles. The researchers used stratified random sampling to ensure balanced representation. The 2nd year students enrolled in the Bachelor of Science in Environmental Science program were randomly selected from each section through random sampling across the sections.

2.2 Statistical Treatment

To collect accurate and relevant data, the researchers will developed a 20-item questionnaire designed to assess the academic participation and learning attitudes of students engaged in blended learning environments. The study will involve 2nd year students under the Bachelor of Science in Environmental Science program from various sections enrolled at Central Bicol State University of Agriculture–Sipocot. A formal written request for approval to conduct the study will be submitted to the College Dean of the ESAF Department. Upon receiving approval, the data collection process will begin. Students will be randomly selected from different sections through stratified random sampling. The researchers will personally administer the questionnaires, providing a clear explanation of the study's objectives and emphasizing the importance of honest, sincere, and accurate responses. To ensure the validity and reliability of the research instrument, the questionnaire will be submitted to the adviser for thorough evaluation, and recommendations for improvement in terms of content, clarity, and relevance will be incorporated. Once data collection is completed, the gathered responses will be carefully tallied, tabulated, and subjected to appropriate statistical analyses.

In order to present the data, the study will use weighted mean and ranking to identify the level of students' academic participation and learning attitudes in blended learning environments under varying heat index conditions. These statistical tools will help describe the distribution of responses and determine which aspects of academic participation and learning attitudes are most and least observed among the participants. The researchers will also use Pearson Product-Moment Correlation Coefficient for SOP 3 to determine the relationship whether an increase in one variable corresponds to an increase or decrease in another variable. This will allow the researchers to identify the strength and direction of the relationship between the heat index and the students' academic participation, as well as their learning attitudes. Thus, be able to formulate hypotheses based on the results obtained from the collected data and draw conclusions that address the objectives of the study.

3. Results and Discussion

3.1 Results

Table 1. Summary of mean, interpretation, and rank of indicators for learning attitudes

Indicators	Mean	Interpretation	Rank
I experienced reduced motivation to engage with learning materials during high heat and found myself avoiding online activities more often during hot weather.	2.97	AGREE	3
I found myself avoiding online activities more often during hot weather and noticed a change in my grades or academic performance during periods of high heat index compared to face to face classes.	2.8	AGREE	9
I believe I can successfully complete all the assignments in this course	2.9	AGREE	5.5
I am confident in my ability to learn effectively using both online and in-person methods. III. Perseverance	2.9	AGREE	5.5
I am persistent in completing my assignments, even when faced with challenges.	3.05	STRONGLY AGREE	2
I don't give up easily even though high heat index affects my access to technology for online learning? (e.g internet connection, overheating of gadgets).	2.88	AGREE	7.5
I am receptive to feedback from my instructors and peers.	2.62	AGREE	10
I use feedback to improve my learning and performance.	2.92	AGREE	4
I am more focused on mastering the concepts than on achieving a high grade.	2.88	STRONGLY AGREE	7.5
I focus on improving my skills and knowledge, rather than just getting good marks given the flexible learning set up.	3.07	STRONGLY AGREE	1
OVERALL MEAN	2. 90	AGREE	-

Bracket Range	Interpretation
1.00 – 0.99	Strongly Disagree
1.99 – 1.00	Disagree
2.99 – 2.00	Agree
4.00 – 3.00	Strongly Agree

The table presents how high heat index significantly affects student's learning attitudes in a blended learning setting. Students agreed that high heat index negatively impact their motivation resulting to reduced engagement in online activities. Additionally, students agreed that they are goal oriented and focused more in mastering concepts rather than achieving high grades which indicates better performance in learning process [17] and more persistent in complying school-related works despite intensifying heat waves. However, a slight decrease in students' agreement related to how heat index affects technological access suggests potential impacts of heat-related technological issues. Technology integration, as mentioned by [13], affect student's performance thus requires great consideration specifically on its access regarding heat index to ensure effective learning. Moreover, heat index did not seem to have a strong effect

on students' belief in their own ability to succeed and their receptiveness to feedback. This findings suggests that environmental discomfort can negatively affect learner's cognitive performance and learning engagements [19]. However, this also suggests that learning attitudes like perseverance and openness to feedback, self-efficacy, and being goal-oriented are more resilient to environmental stressors.

Table 2. Summary of mean, interpretation, and rank of indicators for academic participation

Indicators	Mean	Interpretation	Rank
I experienced physical discomfort during online classes on hot days that impact my academic participation.	3.03	STRONGLY AGREE	2
High heat index affects my ability to concentrate during online classes as well as	2.86	AGREE	5
I collaborate effectively with my peers on group projects and assignments.	2.66	AGREE	9
I am comfortable working with others in both online and in-person settings.	2.83	AGREE	7
I have various coping mechanisms used to maintain my academic participation that helps me maintain my usual level of participation in online quizzes and tests despite the heat.	2.92	AGREE	4
I utilize available resources (office hours, online forums, etc.) to get assistance and proactively seek help from instructors or peers when I need it.	3.14	STRONGLY AGREE	1
I manage my time effectively to balance online and in-person learning activities.	2.63	AGREE	10
I was able to successfully manage my time for studies despite the discomfort of high heat to meet deadlines.	2.81	AGREE	8
I keep my learning materials and assignments organized, both online and offline.	3.02	STRONGLY AGREE	3
I use effective strategies to organize my learning activities such as using educational apps.	2.85	AGREE	6
OVERALL MEAN	2.88	AGREE	-

Bracket Range	Interpretation
1.00 – 0.99	Strongly Disagree
1.99 – 1.00	Disagree
2.99 – 2.00	Agree
4.00 – 3.00	Strongly Agree

This figure depicts the significant impact of heat index on the academic participation of the students. The result showed how intensified heat waves negatively reduced class participation due to thermal discomfort that hinders their ability to engage themselves in online classes. This findings suggests that heat stress can

disrupt learner's academic participation especially when there is long exposure to it. Meanwhile, other parameters used in this study such as collaboration, seeking help, organization, and time management did not show negative correlation with rising heat index. Students agreed that they have various coping mechanisms and strategies in studying and actively participating in online class despite of physical discomfort and inconvenience. Students also showed how they manage their time effectively on blended learning, including accomplishing performance task and online activities. Additionally, heat index does not affect organizational skills and time management skills of the students on blended learning set up.

Table 3. Correlation of students' motivation and level of academic participation

Indicators	r-value	Strength of correlation	Interpretation	p-value	Decision	Interpretation
Student motivation and level of participation	0.355	Low (weak)	Low (weak)	0.315	Accept the H_o	Not Significant

Legend

Pearson r Value	Strength of Correlation	Interpretation
±0.90 to ±1.00	Very high (very strong)	Very strong relationship
±0.70 to ±0.89	High (strong)	Strong relationship
±0.50 to ±0.69	Moderate	Moderate relationship
`±0.30 to ±0.49	Low (weak)	Weak relationship
±0.10 to ±0.29	Very low (very weak)	Very weak relationship
0.00	None	No relationship

A low (weak) positive correlation was found between student motivation and level of participation, with a computed Pearson r-value of 0.355 (Table 3). This suggests that as student motivation increases, participation also tends to increase, although the relationship is weak. The corresponding p-value of 0.315 exceeds the 0.05 significance level, leading to the acceptance of the null hypothesis (H_o). Thus, the observed correlation is not statistically significant and may have occurred by chance. Additionally, there was no significant difference between the effect of heat index on the level of participation and learning attitudes of students in the blended learning environment. These findings indicate that although a slight positive relationship exists between motivation and participation, it is not strong enough to be considered statistically substantial. It is likely that other factors beyond motivation and heat index influenced the students' participation during the study.

3.2 Discussion

This study aimed to understand how high heat index levels influence students' learning attitudes and academic participation in a blended learning environment. The correlation analysis between student motivation and academic participation resulted in a Pearson value of 0.355, indicating a low (weak) positive correlation. This means that students who reported feeling more motivated tended to participate

more in academic activities but only slightly. Moreover, the p-value of 0.375 exceeds the 0.05 significance level, meaning that the relationship is not statistically significant, and may have occurred by chance. Many students reported feeling less motivated to engage in online learning when temperatures were high. This reduction in motivation seems to reflect in their lower participation, particularly in online activities, where physical discomfort and environmental stressors are more directly felt. These results are in line with the study of Lala and Hagishima (2023), who noted that environmental factors such as heat can reduce learners' academic participation, and Carlson and Shepardson (2024), who discussed how long-term heat exposure can disrupt engagement.

Despite this, the data also showed areas of resilience. Indicators such as goal orientation (mean = 3.07) and perseverance (mean = 3.05) ranked the highest among the learning attitudes. This means that students remained focused on truly understanding their lessons and continued pushing through with their schoolwork even under stressful, hot conditions. Moreover, self-efficacy and openness to feedback were less affected by the heat, indicating emotional and academic stability amid environmental discomfort.

As for academic participation, class participation was significantly impacted by heat, especially due to physical discomfort during online sessions (mean = 3.03). However, other key areas such as collaboration, help-seeking, time management, and organization showed stable performance. In fact, help-seeking behavior had the highest score (mean = 3.14) among participation indicators, suggesting that students actively reached out for support, utilized online resources, and leaned on their instructors and peers when needed.

Overall, while heat index alone doesn't determine how well students perform, it does play a role in how they feel and engage. Those insights highlight the importance of supporting students not just academically, but also in terms of comfort, well-being, and flexibility especially as we face more extreme weather in the years ahead.

4. Conclusion and Recommendations

4.1 Conclusion

This study shows that heat can definitely make learning more difficult, especially in online set ups where students might already feel less engaged. Many students said that the hot weather made them less motivated and less likely to join in online discussions or activities. But at the same time, they showed a lot of resilience. They stayed focused on learning, kept up with deadlines, and reached out when they needed help.

Even though the connection between motivation and participation wasn't statistically strong, the results could tell that find ways to adapt—whether it's organizing their time better, staying focused on their goals, or simply asking for help despite of environmental stressors.

Overall, while heat index alone doesn't determine how well students perform, it does play a role in how they feel and engage. These insights highlight the importance of supporting students not just academically, but also in terms of comfort, well-being, and flexibility, especially as we face more extreme weather in the years ahead.

4.2 Recommendations

Based from the results of the study, it is recommended that future researchers consider examining other possible factors that may influence students' participation and learning attitudes in blended learning, aside from the heat index. The BSAF Department is encouraged to regularly gather student feedback to better address challenges encountered during blended learning, especially under extreme weather conditions.

Additionally, conducting similar studies with a larger and more diverse group of respondents is recommended to obtain broader and more reliable results. Average data of heat indices should also be considered in correlating its effect to students' academic performance and learning attitudes.

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