

Preliminary Study on Investigating Heat Stress Symptoms Among Primary School Students in Cambodia

– Case Study: Primary Schools in Phnom Penh.

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Background and objectives

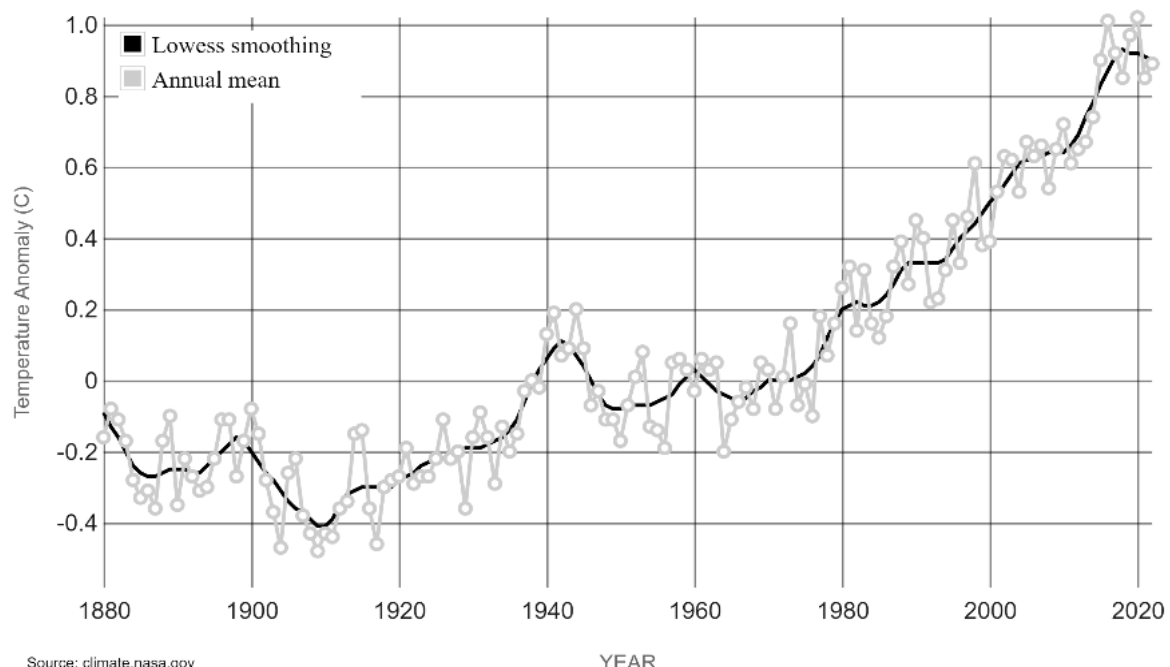


Figure 1. Global temperature (°C compared to the 1951-1980 average) (NASA)

Heat stress is the net heat load to which a person is exposed from the combined contributions of metabolic heat, environmental factors, and clothing worn which results in an increase in heat storage in the body. (Jacklitsch et al., 2016).

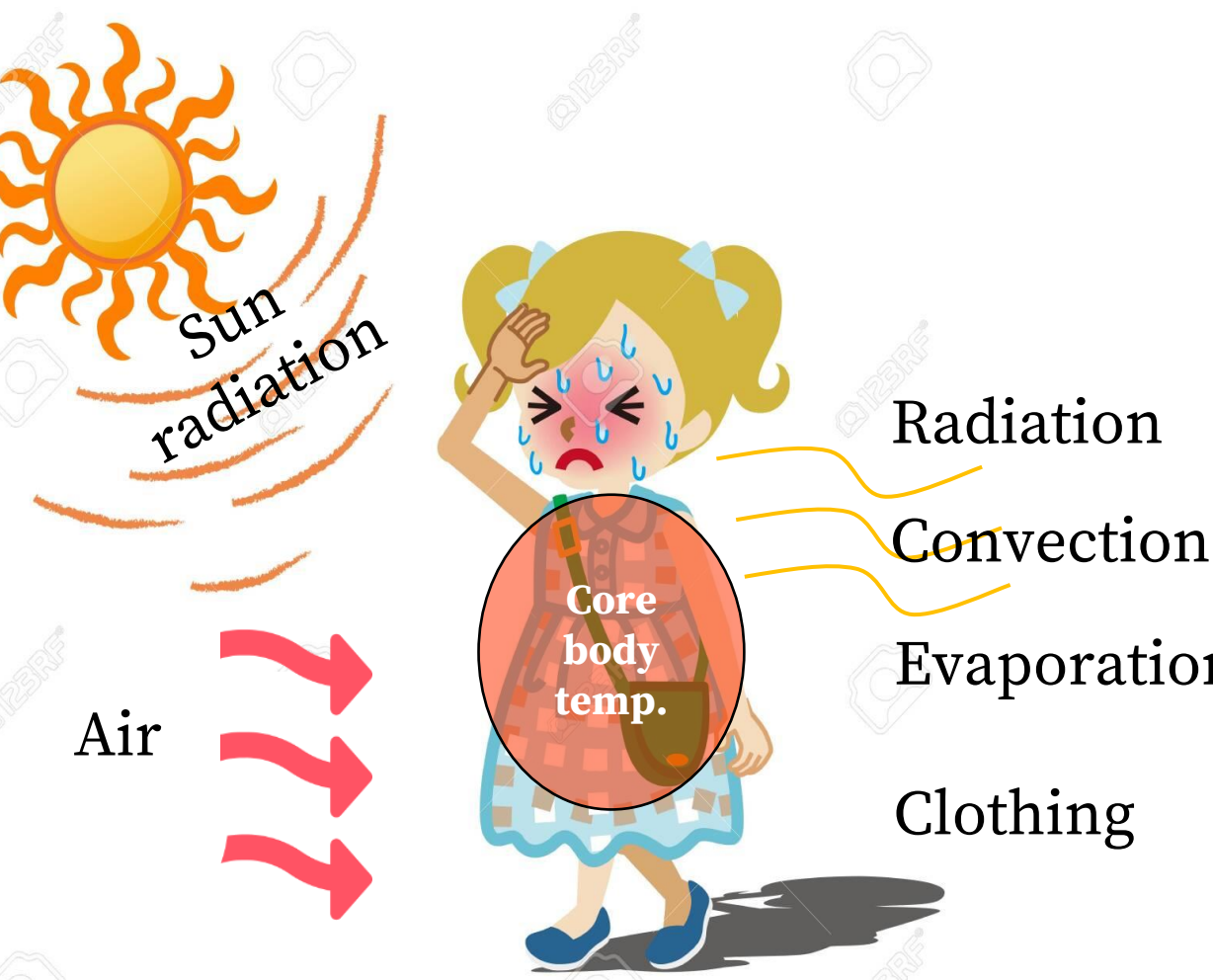


Figure 4. Heat Stress (WWW.123rf.org)

The average global temperature is accelerating in the future according to Climate models (Bidassey-Manilal et al., 2020). In Cambodia, most of the year average annual temperature is 25-27°C, with a maximum of 38°C during the hot season, although the average annual temperature is expected to rise by 0.8 to 1.6°C by 2030 and 1.0 to 2.6°C by 2050 (USAID, 2019). Heat stress in one of the common problem produced by temperature rising.

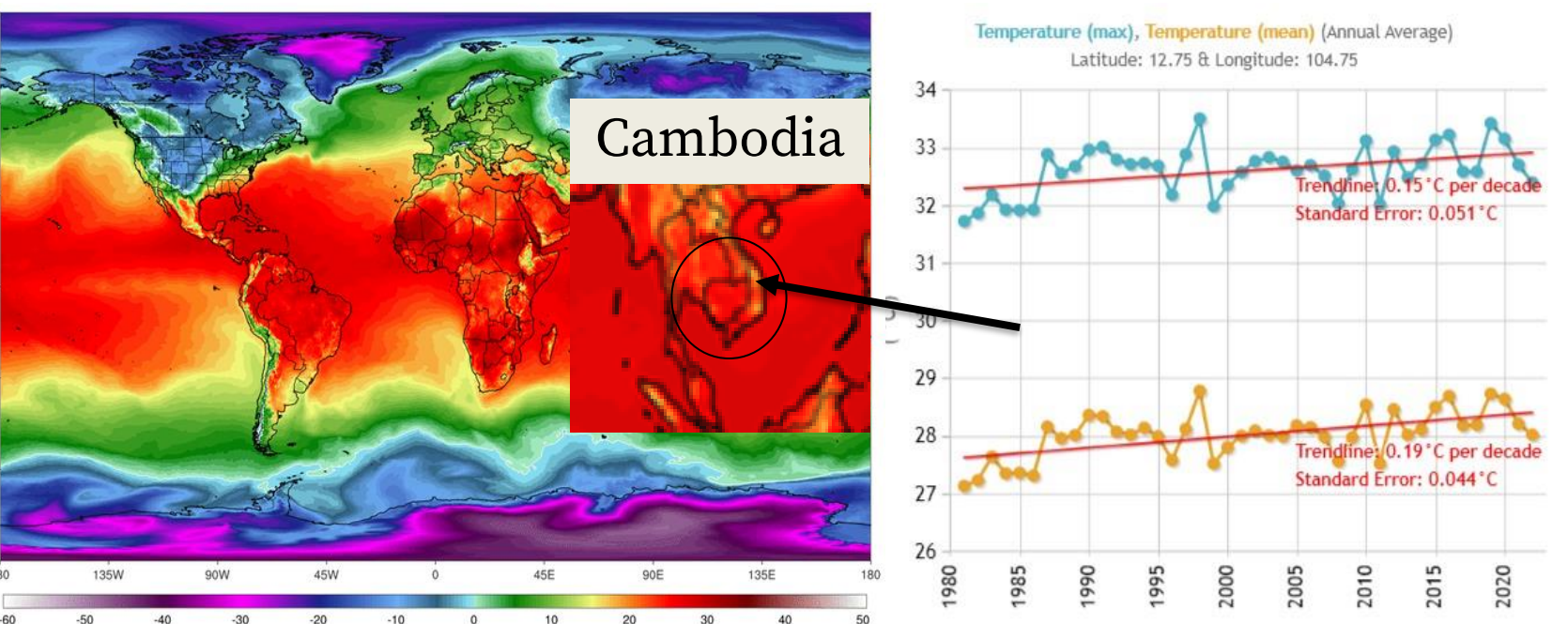


Figure 2. Global heat map (ClimateReanalyzer.org) **Figure 3.** Cambodia temperature (Climate CHIP)

Inadequately regulated indoor air ventilation can contribute to heat stress within a given environment. The public schools in Cambodia employ mainly natural ventilation and may have some ceiling fan for the ventilation. Existing research shows that increasing temperature and low ventilation rates within classrooms have a direct impact on students' schoolwork and health (Sheffield & Landrigan, 2011; Teli, Jentsch, James, et al., 2012).

The objectives: (1) To initiate the preliminary design approach for surveying primary school students within the Cambodian context. (2) To present the survey findings pertaining to heat-related illnesses.

Approaches and technology used

The sample size for the proportion of the infinite population: 500 primary school students (Grade 6) at Phnom Penh Tmey primary school and Pochentong primary school. The questionnaire consists of (1) The information of the interviewer, (2) Personal status of the interviewees, (3) Thermal sensation and thermal comfort vote, (4) Type of learning, (5) The heat stress impacts in school, (6) The impacts of heat on health, (7) The impacts of clothing on heat stress, (8) Coping mechanisms. The survey methodology involved the collection of data from 250 students per school, carried out through a structured procedure comprising three distinct sections:

(1) Random selection of students by classroom teachers, where height and weight measurements were taken before students entered the designated survey area. (2) Obtaining signed consent letters from participants followed by a face-to-face survey session. During this phase, students were individually presented with and guided through a series of questions in a one-on-one format. (3) Upon completion of the survey, students were permitted to return to their respective classrooms to resume their regular academic activities.



Figure 7. Procedure of data collection

The final sample consisted of 493 students, out of which (48.28%) were male students and (51.72%) were female students. The mean age of the respondents was 12.35 years old (± 0.75) and all of them were from grade 6. Their mean Body-Mass Index was 18.34 kg/m² (± 3.49). Those who were categorized as from the morning shift and afternoon shift were (47.46%) and (52.54%), respectively. The percentage of the respondents whose classes were equipped with mechanical ventilation was (49.49%) (fan).

Get the ethics approval from NECHR

Obtain permission from the MoEYS for access to schools

Contact schools for study appointment

Explain the project study to the schools

Deliver information letter, permission letters and students informed consent to schools

Install the data logger (Temperature and RH)

Conducting the survey

The documents identified and approved from NECHR before deliver

Figure 6. Survey procedure

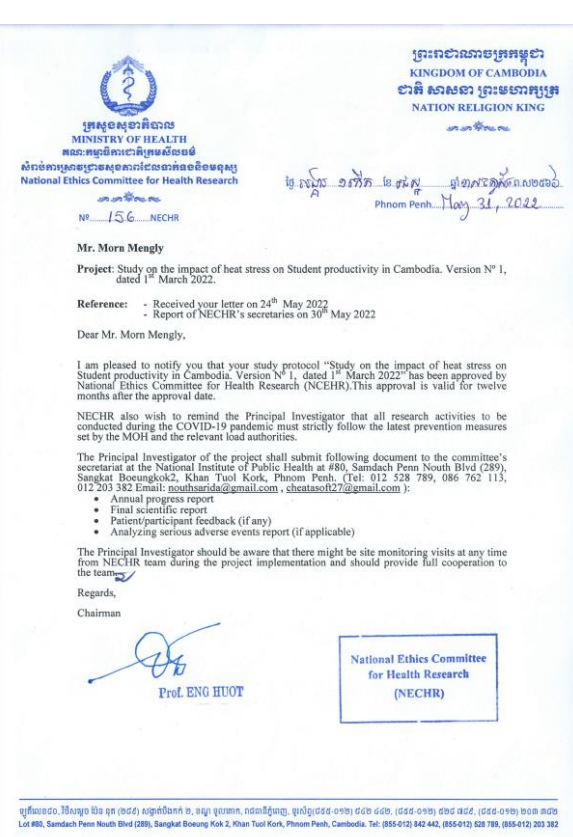


Figure 5. Ethical approval of NECHR

Results

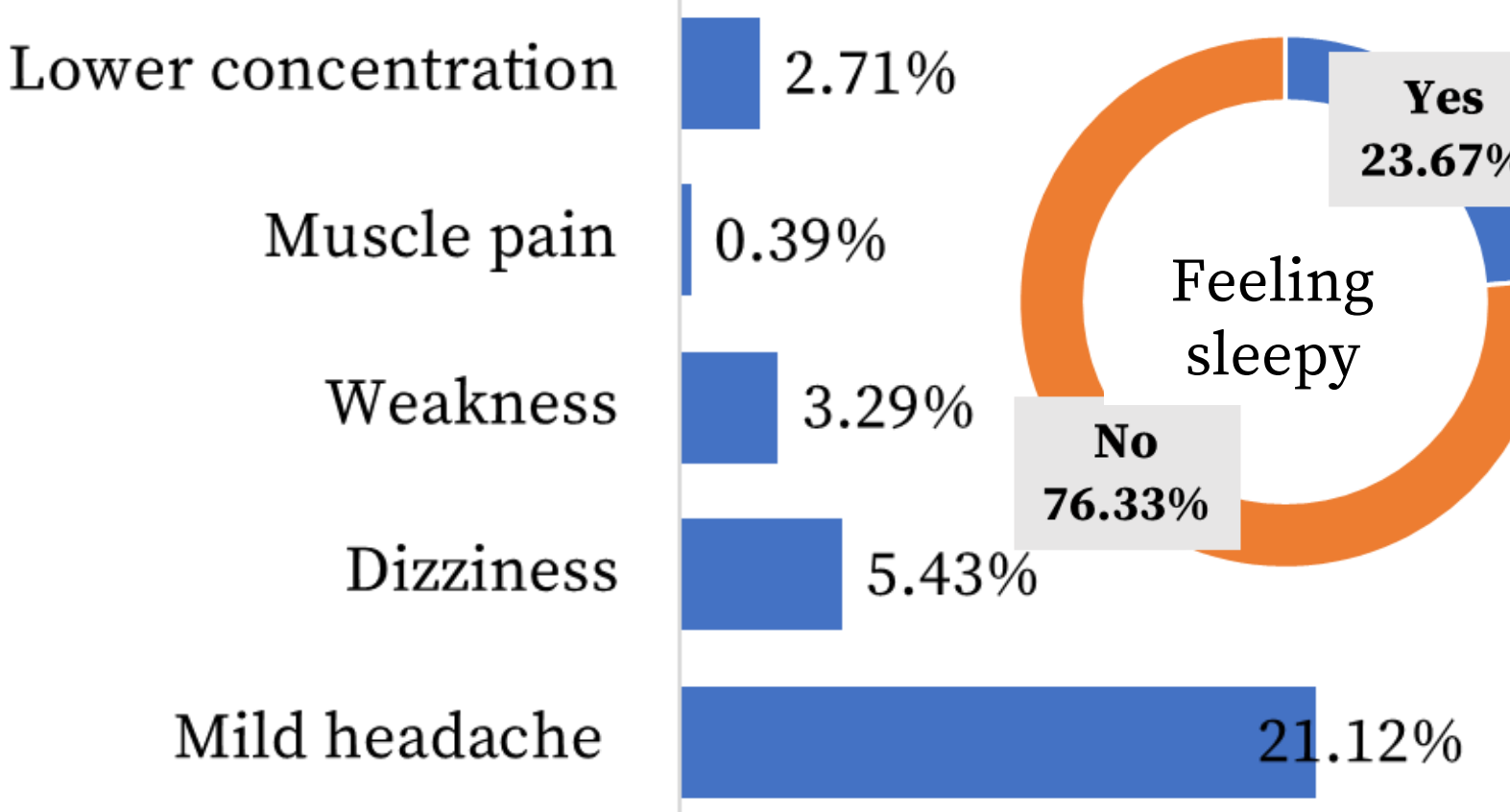


Figure 8. Heat stress symptoms while learning

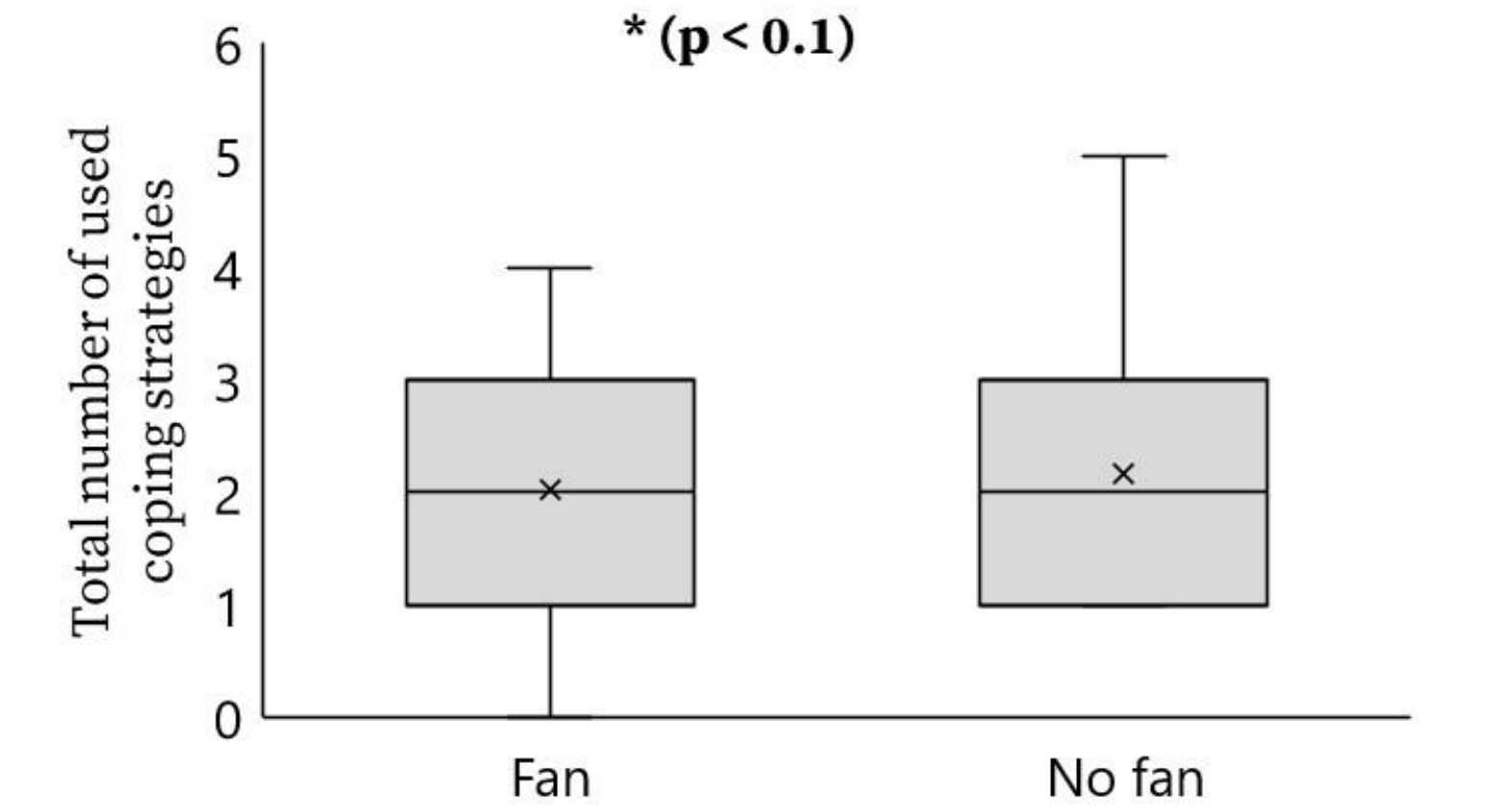


Figure 9. The total number of used coping strategies at the school of used nv and fans for ventilation

Figure 9 shows a significant difference between the total number of used coping strategies at the school of used nv and fans for ventilation ($t(479) = 1.904$, $p < 0.1$). The fans helped the students in preventing the heat and also reduced some unnecessary mitigation strategies.

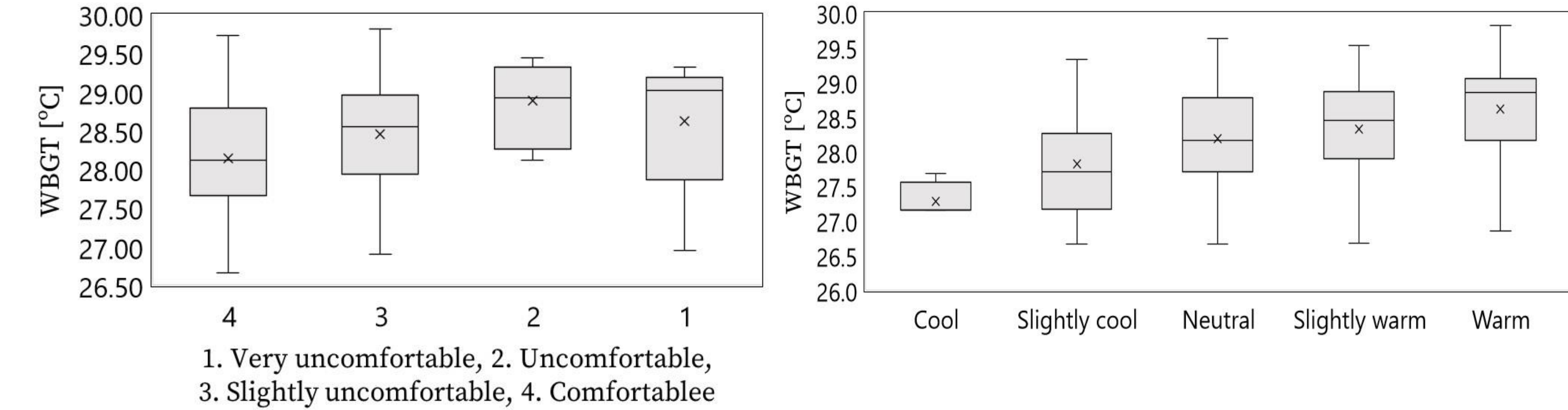


Figure 10. Thermal comfort and sensation vote in WBGT heat stress index

Figure 10 shows the mean WBGT that the students feel comfortable is 28.15°C (± 0.73), they start to feel slightly uncomfortable at the mean WBGT of 28.46°C (± 0.69), feel uncomfortable at the mean WBGT of 28.88°C (± 0.48), surprising some students found that they feel very uncomfortable even at the mean WBGT of 28.62°C (± 0.95). the students felt cool in the mean WBGT of 27.28°C (± 0.27), felt slightly cool in the mean WBGT of 27.83°C (± 0.77), they felt normal in the mean WBGT of 28.19°C (± 0.69), and they start to feel slightly warm in the mean WBGT of 28.33°C (± 0.71), feeling exactly warm in the mean WBGT of 28.59°C (± 0.73).

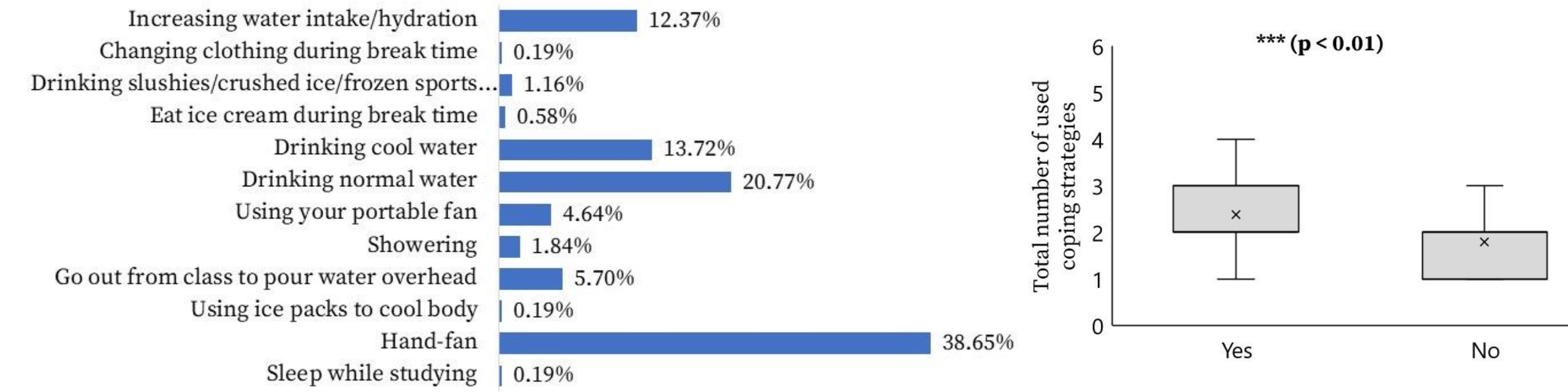


Figure 11. Mitigation strategies and Comparing the total number of used mitigation strategies at school for lost concentration and not lost concentration at school

Figure 11 shows the elevated temperatures within the classroom environment correlate with a notable increase in the adoption of coping strategies, significantly impacting students' ability to maintain focus and concentration during study sessions.

Conclusion

The student's attention levels decreased even more as a result of the symptoms of heat stress they encountered while studying (2.71%), including headache (21.12%), dizziness (5.43%), weakness (3.29%), muscular pain (0.39%), feelings of sleepiness (23.67%), sweating (67.31%), exhaustion (32.65%), thirst (84.58%), and suffer from the heat (57.61). Participants feel comfortable in the WBGT $< 29.3^\circ\text{C}$, and gradually feel uncomfortable in the WBGT $29.4^\circ\text{C} < \text{WBGT} < 32.1^\circ\text{C}$. The school equipped with fans for ventilation has better thermal comfort ($p < 0.01$). Female students reported more heat stress symptoms ($p < 0.1$).

Acknowledgement

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References

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