

**ORIGINAL ARTICLE**

# Climate challenges: Assessing the effects of adverse temperature conditions on student absenteeism

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**Abstract**

School absenteeism remains a persistent challenge in the education sector. This study explores the relationship between the feels-like temperature and school absenteeism in the selected schools in Trishal Upazila of Mymensingh district. Following a mixed-method design, it considers only perceived temperature variables for absenteeism and incorporates quantitative data from publicly available temperature records and daily school attendance data from school registers. Additionally, it draws insights from the qualitative inputs from teachers and education officers. Spearman's correlation and regression analysis revealed no statistically significant relationship between feels-like temperature and school absenteeism. The Man-Whitney U test, following the summer and winter groups of months, showed that the students from secondary school are likely to be more absent during the hotter days. However, the regression coefficient tables for both schools revealed that the students from secondary schools have a tendency to be absent more often, even when all other factors are constant. Thematic analysis from qualitative findings focused on other prominent factors, such as parental supervision, socioeconomic conditions, and administrative practices for scholarship eligibility for absenteeism. School absenteeism is less influenced by temperature factors and more influenced by structural and behavioral patterns. This study recommends targeted interventions addressing socioeconomic conditions, data manipulation, and age-specific motives. Future studies should consider a wider array of geographic coverage, focusing on climate-adverse locations and broader climatic variables.

**Keywords**

Climate Challenges, Temperature, School Absenteeism, Environmental Education, Feels-Like Temperature.

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## 1 | INTRODUCTION

Children spend a significant amount of their time at school. The environment in school influences the development of mental abilities. Children are proportionately more vulnerable to environmental stressors like extreme temperatures. Especially, the risks of heatwaves on children can range from physiological, metabolic, cardiovascular, and behavioral factors (Xu et al., 2014). Extreme temperatures can affect the mental health, cognitive learning curves, and behavior of the student. Both hot and cold temperatures can contribute to the decrease in their cognitive abilities and impact their test scores at school. Some of the studies documented that the extreme temperature on the test day can influence the test scores negatively (Keivabu, 2024). A study of the public school district in the United States examined the effect of temperature on high-stakes exam performance. Extreme hot temperatures proved to reduce the performance of students by 13 percent (Park, 2022). Exposure to extreme cold and its effect on cognitive ability have not been investigated much. However, a study on university students verified that the cold temperature does harm their test scores. Extreme temperature contributes to the increase in school absenteeism, especially among minority and lower-income groups. Students are likely to be absent 34 percent more on extremely hot days compared to normal days. It might be followed by the heat-induced illness or discomfort of the students or family members. Particularly, the Black, Hispanic, or low-income students are affected by extreme weather conditions like snow, hot, and cold conditions (McCormack et al., 2023). A case study in Zamfara, Nigeria, demonstrated that school attendance was highly influenced by the drought and rain. The attendance rate was higher during the rainfall compared to the drought season (Adejuwon, 2016). Overall, the absence is closely related to the illness or fear of illness caused by the temperature adversity.

In recent years, the temperature of the Earth has been increasing due to global warming and climate change events (Mearns et al., 1984). The impact of global warming in Bangladesh is quite visible. It is considered one of the most climate-vulnerable countries in the world according to the Global Climate Risk Index 2017, in the 6th position of the most affected countries due to climate adversity since 1995 (Kreft et al., 2017). Bangladesh has more than seven hundred rivers, tributaries, and distributaries, having a total length of 22,155 km, which makes the weather of this country more humid (Khalil, 1990). In recent years, warmer summers and colder winters have been reported due to the changing climate conditions (Nishat & Mukherjee, 2013). An interesting trend in increasing in the increasing monthly average trend was also identified in a recent study (Islam' et al., 2004).

However, there are rarely any studies focused on climate-induced school absenteeism in this region. This particular study aims to focus on a very specific section of the climate, temperature, and real feel in indoor setups to correlate with the absent rates of students in school. We focus on Bangladesh, specifically Trishal Upazila under the Mymensingh district. The coldest months and hottest months, according to the temperature data for this location, are used to test the hypothesis using these two variables. Two of the classes, one from the primary school and the other from the high school level, were selected as samples. The temperature data from last year to this current year, along with the attendance data from the school administration, were used for this study.

The core problems introduced by this study are the impeding educational conditions in schools due to adverse climate situations. Recently, Bangladesh has seen significant temperature variance compared to recent years. Extreme temperatures are proven to negatively influence the cognitive abilities of students, which affects their learning curves in the long run. Although Bangladesh does not experience extreme temperature events, the humid air makes the summer more uncomfortable. Being a developing country, not all the schools in Bangladesh have weather-friendly classroom setups like air conditioning, uninterrupted electricity, better fans, or better air ventilation. This puts the classrooms here in vulnerable situations to conduct educational activities properly in times of adverse weather conditions. There have been studies in Canada, the United States of America, and other developing regions, considering that they face extreme weather events. However, the contemporary evidence from other developing or underdeveloped countries possesses a potential impact on Bangladesh as well, which requires the potential impacts to be observed. For instance, a case study in Zamfara, Nigeria, demonstrated that school

attendance was highly influenced by drought and rain. High temperatures can induce health risks like dehydration and heat stroke, while cold temperatures can influence attendance, causing asthma, cough, or flu. The effects of absenteeism have far-reaching consequences. It has direct short-term impacts such as dropouts, individual academic underperformance, and long-term societal impacts on national development. This research focuses on the possible relationship between adverse climate conditions and school absenteeism. It is limited to two selected classrooms from the primary and secondary levels, with the temperature data from the last one and a half years. By employing statistical analysis, this study uses the temperature and attendance data to explore the significance of the potential relationship between these two variables. Although the geographical coverage is limited and other important factors in weather, such as precipitation, and natural disasters, are not taken into consideration, this study still serves as an exploratory investigation into the potential impact of environmental stressors on school attendance.

This study aligns with several Sustainable Development Goals (SDGs), particularly SDG 4: Quality Education, by highlighting barriers to proper formal education at the school level that may be linked to environmental factors. It also supports SDG 3: Good Health and Well-being by identifying the health impacts of environmental stressors on children. Furthermore, the study contributes to SDG 13: Climate Action by providing data-driven evidence and insights into climate adversities that could affect schools. Based on the observed results, evidence-based local solutions for climate-resilient education planning can be incorporated to promote a more equitable approach to improving school attendance.

### 1.1 | Objectives

This study aims to investigate the impact of adverse temperature events on students' attendance at school (Keivabu, 2024). In addition to exploring and analyzing attendance patterns during such extreme temperature conditions, the study seeks to develop predictive models that can forecast absenteeism rates based on varying temperature factors.

Furthermore, the study intends to suggest preventive and coping measures to address these challenges. By understanding how temperature extremes affect attendance, these solutions can help mitigate the impact of climate-related events on education, promoting better school attendance and overall well-being (Loraas, 2024).

### 1.2 | Hypotheses

Based on the objectives and the conceptual framework of this study, the following hypotheses are proposed. The null hypothesis (H0) states that there is no statistically significant relationship between the feels-like temperature and school absenteeism in the selected schools in the Mymensingh region. In contrast, the alternative hypothesis (H1) suggests that there is a statistically significant relationship between the feels-like temperature and school absenteeism in these schools (Sharmin et al., 2015).

For a more specific aspect of testing, the null hypothesis (H0a) assumes that the distribution of absence remains the same across the hottest and coldest months (Vergura, 2018). Conversely, the alternative hypothesis (H1a) proposes that the distribution of absenteeism varies between the hottest and coldest months.

### 1.3 | Conceptual Framework

Climate and school absenteeism. Every school-aged child spends a significant portion of their day in school. A healthy environment is not only necessary for positive learning but also for their physical wellbeing (Pule et al., 2021). Absenteeism is an important problem among students that has both direct and indirect effects on their studies as well as the education system (Lee et al., 2024). Studies across various contexts have identified extreme weather, particularly temperature anomalies, as one of the significant factors that disrupt students' ability to attend school regularly. A study conducted by McCormack et al. (2023) identified that in the United States, extremely hot temperatures and moderately to extremely hot temperatures alter student attendance rates. The study showed a 34% decrease in absent rate on days with temperatures below 30° F and around 8-16 % decrease when the temperature rises above 70-90° F. These increase in absenteeism can be caused by discomfort or illness faced by

students or the families because of the abnormality of the temperature (Chen et al., 2018; Currie et al., 2009). Even wet weather for a long period of time can disrupt attendance as well as other physical activities (Hyndman, n.d.).

A wide range of studies documented that both heat and cold weather extremes decrease cognitive abilities and cause health hazards, especially among children. Hot days generally increase illness-related absences and authorized holidays (Keivabu, 2024). Some epidemiological studies identified that hospital admissions of children and adolescents increase during hot days. As children are more vulnerable to heat waves, it can affect their physiological, metabolic, cardiovascular, and behavioral factors (Bernstein AS et al., 2022; Zhiwei Xu et al., 2014). Moreover, extreme cold exposure could also damage children's health (Free et al., 2010).

According to Pachauri et al. (2014), adverse weather events like extreme heat or drought or flooding, or storms will greatly increase in both frequency and severity as the planet becomes warmer. According to the World Meteorological Organization, the frequency of global extreme weather events has risen fivefold in the past 50 years. Children globally have been significantly affected by these events. A US study's findings identified that a 0.55°C warmer school year lowered that year's learning by 1 percent (Save the Children, 2024). A report by World Bank (2024) found that about 400 million students worldwide experienced school closures because of adverse weather conditions since 2022, and it is hitting the hardest in low-income countries, where around 18 school days are lost annually. Extreme temperature also affects the mental health of children. Symptoms of posttraumatic stress, depression, and anxiety have also been noticed when a child is exposed to adverse weather events (Barkin et al., 2021).

Bangladesh's geography and topography make it significantly vulnerable to climate change, repeatedly facing adverse temperature events like heat waves. Studies found that between 2000- 2019, the country encountered 185 extreme weather events. According to the Climate Risk Index (2021), Bangladesh ranked seventh on the list of countries most vulnerable to climate change (Huq et al., 2024). The Intergovernmental Panel on Climate Change (IPCC) also considers Bangladesh as one of the most negatively affected countries by climate change in the world. Studies suggested that the average rise in temperature would be 1.3°C and 2.6°C in 2030 and 2075, respectively (Rashid et al., 2023). According to the (National Guideline on Heat-Related Illness, 2024), in Bangladesh, the threshold for heatwaves starts at 36° Celsius and which is considered beyond the benchmark at which the body of a human stops cooling itself. In 2024, Bangladesh experienced widespread school closures in April because of the adverse temperature and significant interruption of school timetables, especially affecting children from pre-primary to upper secondary level (Jacobs, 2025).

One study in Dhaka found that diseases like diarrhea or food poisoning among children increased in number of cases because the high temperature works as the causative agent for these viruses or bacteria. And the compacted environment in most of the country's classrooms adds an extra advantage in this process (McGirr et al., 2025). In recent years, many heat waves have been associated with absenteeism in schools around the country. Especially in months like April, most of the capital's schools were closed, and classes continued online. Even when the offline classes started, parents were reluctant to send their children to school. A report showed a high absentee rate on those particular days (Suhrawardy, 2024). The situation sparked an alarm among the poor and marginalized families, where missing school draws the children towards child labor or child marriage. That could mean the inability to return to the school at all (Save the Children International, 2024).

Climate-related events frequently disrupt educational services, yet they often get overlooked in the policy discussions. One of the primary reasons behind this is that the schools and education systems are not well equipped to protect the children from adverse temperature events. In Bangladesh, 35,378,813 students were affected by climate-related (heatwave) school disruptions in 2024 alone (UNICEF, 2024).

Review of the literature on climate change and children’s education showed that child-centered adaptation methods are relatively limited and not sustainable enough in countries like Bangladesh. Children are one of the most vulnerable groups, and they need direct prevention efforts to reduce their exposure to adverse health and educational effects from climate change. Educational institutions should develop their curriculum to enhance adaptability to adverse temperature events so that children are familiar with the emerging changes (Kabir et al., 2015; Sheffield & Landrigan, 2011).

This study is grounded in the idea that adverse climate conditions, particularly extreme temperatures, may influence human behavior, including the ability and willingness of students to attend schools (Hass et al., 2021). The sole ideation of this research excludes other factors like illness, family issues, dropouts, fear of bullying, and cultural or economic factors for absenteeism, and in this way considers all other things except the weather data to be constant.

Instead of relying solely on the air temperature, this study incorporates humidity and wind speed into consideration to generate a real thermal feeling (Takebayashi, 2022). The human body generates heat, and it cools down based on the evaporation rate through sweating. During the humid weather, the speed of evaporation decreases, and it feels more uncomfortable on humid summer days. Similarly, during winter, the wind speed contributes to the real feel and has differences from the air temperature.

Therefore, this study accumulates feels like temperature, which demonstrates the combined effect of temperature, humidity, and wind speed on the human body (Figure 1).

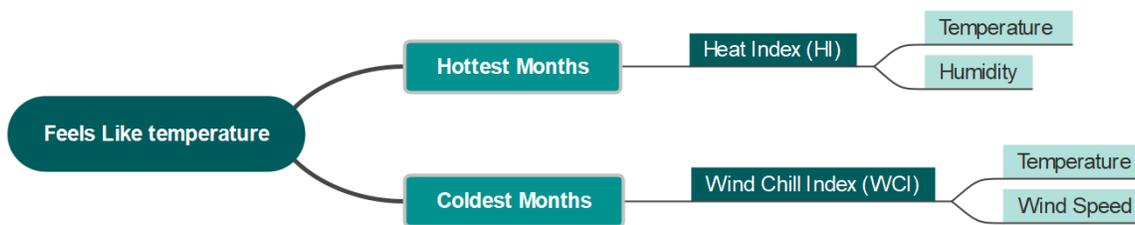


Fig. 1. Conceptual framework.

To quantify the feels-like temperature, this study incorporates two widely used scientific indicators: the Heat Index (HI) during the hottest months (April to June) and the Wind Chill Index (WCI) during the coldest months (December to February). These two indicators provide a more accurate representation of the temperature conditions perceived by students, which may affect their school attendance.

Heat Index (HI). It was first introduced and developed by R.G. Steadman (1979). It measures the actual thermal feel based on the air temperature and the relative humidity. Additionally, it accounts for the psychological strain caused by reduced evaporation from the human body. This model was refined based on regression, known as the Rothfusz Equation, which is widely used by the United States National Weather Service for practical implications (NOAA, 2018).

Heat Index Formula (Rothfusz Equation)

$$HI = -42.379 + 2.04901523T + 10.14333127RH - 0.22475541TRH - 0.00683783T^2 - 0.05481717RH^2 + 0.00122874T^2RH + 0.00085282TRH^2 - 0.00000199T^2RH$$

Here,

T = ambient temperature in °F

RH = relative humidity in %

(The output from this equation was adjusted to °C)

Wind Chill Index (WCI). The wind chill is a phenomenon caused by the effect of wind on heat loss from bare human skin, with a resultant increased rate of cooling and increased sensation of cold. Wind chill is a condition caused by the effect of blowing winds on the heat loss of human skin, which, as a result, increases the sensation of cold (Li et al., 2025).

The WCI index is popular to measure the perceived decrease in temperature due to the cooling effects of wind on human skin. This index was initially developed by Siple and Passel in 1945. Later on, it was revised and adopted by the NOAA and Environment Canada in 2001 for improved accuracy in measuring the real feel in winter (Lankford & Fox, 2021; NOAA, 2001).

Wind Chill Formula (NOAA/NWS 2001)

$$WCI = 35.74 + 0.6215T - 35.75V^{0.16} + 0.4275TV^{0.16}$$

Here,

T = air temperature in °F

V = wind speed in mph

(The output from this equation was adjusted to °C)

## 2 | METHODOLOGY

This research follows a cross-sectional design to investigate the relationship between adverse climate events and school absenteeism over a specific period (Figure 2). The data was collected from November 2024 to July 2025. The design of this research is structured to capture and study only a single time frame over the selected schools to generate insights from the pattern of absent trends and temperature data.

This research primarily follows a quantitative approach by systematically analyzing and interpreting numeric data from two main sources. The first source is school attendance records, where secondary data on daily attendance for specific classrooms is obtained directly from the school authorities. The second source is temperature data, which includes publicly available information on daily temperature, humidity, and wind speeds collected from reputable and recognized online platforms. These combined datasets provide a comprehensive basis for examining the relationship between environmental conditions and student attendance.

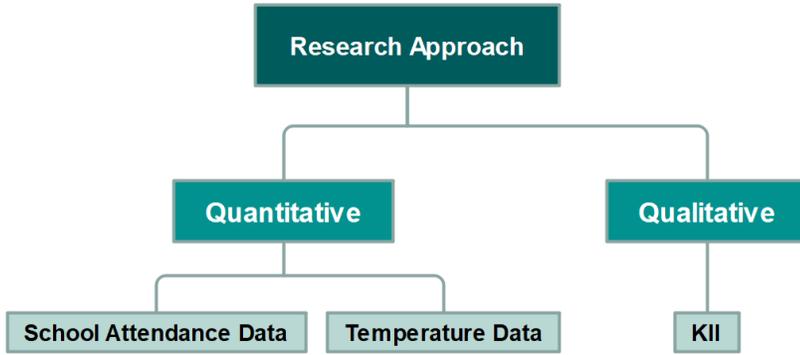


Fig. 2. Research approach.

In addition, this study incorporates a qualitative component by conducting Key Informant Interviews (KIIs) with the school administration and Upazila Education Officer. This method enhances the findings from the quantitative approach, generating valuable insights to increase the understanding of the impact of adverse temperature conditions on absenteeism.

2.1 | Study Area

This study mainly targets the selected schools from Trishal Upazila of Mymensingh district (Figure 3). Mymensingh is known as the ‘City of Education’ to the natives, having several famous educational institutions. Trishal is one of the closest Upazilas to Mymensingh district, known for its rich cultural significance. The national poet of Bangladesh, Kazi Nazrul Islam, spent a significant portion of his childhood in Trishal. At present, a public university has been established in Trishal after the name of the national poet, making Trishal an important educational hub for higher studies in the Mymensingh region. Hence, this upazila was selected for this particular study.

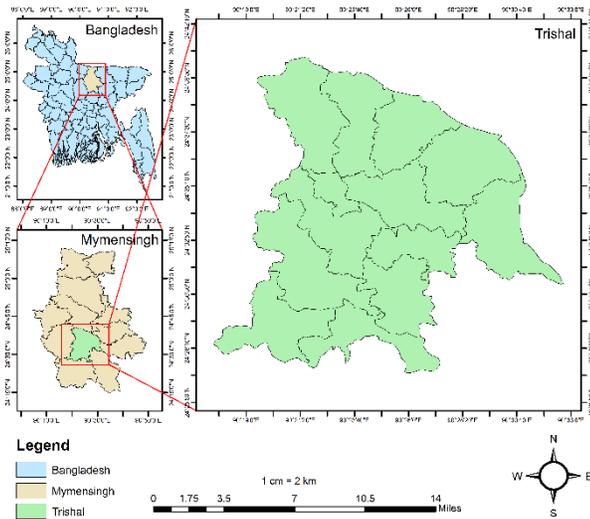


Fig. 3. Study area of Trishal, Mymensingh.

2.2 | Sampling Techniques

The sampling method in this study combines both convenience sampling and purposive sampling techniques to gather data. Convenience sampling involves focusing on two targeted classrooms—one from a primary school and one from a secondary school located in Trishal Upazila of the Mymensingh district. These schools were selected based on the availability of reliable data as well as the willingness of the school authorities to provide the necessary information.

Within the chosen schools, purposive sampling was applied by deliberately selecting classrooms that had relevant and available data aligned with the research objectives. This combination of sampling methods ensures that the data collected is both accessible and pertinent to investigating the impact of temperature-related factors on school attendance.

### 2.3 | Sample Size

This study uses approximately 200 samples, representing the daily attendance data of each of the students from the selected classrooms in the pre-approved timelines (Table 1). This sample is used to correlate with the daily average temperature data of the students to investigate the relations.

Additionally, it incorporates the experts' viewpoint and perception of the KIIs to triangulate with the quantitative findings. The number of KIIs for this study is 03.

**Table 1.** Sample size.

Category	Type	Sample Size
<b>Quantitative Sample</b>	Primary School Students	100
	Secondary School Students	94
<b>Qualitative Sample</b>	Key Informant Interviews (KIIs)	3
<b>Total</b>		197

### 2.4 | Data Collection Technique

Student attendance data were collected from administrative records, specifically daily attendance sheets obtained from the school registers and provided by the class teachers (Table 2). The attendance records were then systematically coded and entered into an attendance matrix for analysis in line with the study's objectives. For temperature data, information was sourced from reputable and official publicly available weather records, focusing on daily average temperatures during the study period. These temperature data were extracted and aligned with the daily absenteeism numbers based on specific dates. In addition to quantitative data, qualitative data were gathered through interviews with selected key informants, such as the Upazila Education Officer and school administration staff. The interviews were guided by a list of topics designed to collect relevant and in-depth information aligned with the research objectives, providing valuable supporting insights from the experts' perspectives.

**Table 2.** Data collection techniques.

Type	Source	Process
<b>Attendance Data</b>	Administrative records on daily attendance sheets from school registers	Records from school register matrices were coded and systematically input for analysis based on research objectives.
<b>Temperature Data</b>	Publicly available weather data from trusted official sources	Daily average temperature data were collected, extracted, and aligned with daily student absence records according to specific dates.
<b>Qualitative Data (KIIs)</b>	Key Informants (e.g., Upazila Education Officer, school administrators)	Interviews were conducted using a topic guide to collect expert insights relevant to the research objectives.

To investigate the influence of extreme seasonal temperatures and the associated "feels-like" temperature on school absenteeism, specific months were categorized to represent the coldest and hottest periods of the year. According to long-term data from the Bangladesh Meteorological Department (BMD), April, May, and June are

identified as the hottest months, based on temperature measurements and the Heat Index (HI). In contrast, December, January, and February are recognized as the coldest months, representing the lower temperature range in the annual cycle.

These months correspond to the most thermally extreme periods in Bangladesh, providing a solid basis for comparing school absenteeism against seasonal temperature trends. To analyze the data statistically, especially using the Mann-Whitney U test, the dataset will be grouped according to these designated hottest and coldest month categories to reflect the seasonal variations.

### 3 | RESULTS

#### 3.1 | Descriptive Statistics

##### 3.1.1 | Primary School

The descriptive statistics provide insight into the variables of absenteeism and feels-like among primary school students (Table 3). For absenteeism, the mean value was 4.16 with a median of 4.00 and a mode of 4, based on 106 valid observations. The relatively low standard deviation (1.868) indicates limited dispersion around the mean, suggesting that student absences are fairly consistent across the sample.

In contrast, the feels-like variable showed greater variation, with a mean of 25.24, a median of 22.40, and a mode of 20.1. The standard deviation of 7.9448 indicates a wider spread of values, reflecting more diverse perceptions or experiences captured by this measure. These results highlight that absenteeism appears to be a relatively stable characteristic, whereas feels-like varies considerably among respondents.

**Table 3.** Descriptive statistics of primary school.

		Statistics	
		Absent	feels-like
N	Valid	106	106
	Missing	0	0
Mean		4.16	25.242
Median		4.00	22.400
Mode		4	20.1 <sup>a</sup>
Std. Deviation		1.868	7.9448

##### 3.1.2 | Secondary School

The descriptive statistics for secondary school students reveal distinct patterns in absenteeism and feels-like measures (Table 4). For absenteeism, based on 98 valid cases with no missing data, the mean value is 38.55 days, with a median of 39.50 days and a mode of 38 days. These central tendency measures are relatively close to one another, suggesting a consistent pattern of absenteeism among students. However, the standard deviation of 10.679 indicates notable variability, meaning that while many students are absent around 38–39 days, some exhibit much higher or lower levels of absenteeism.

In comparison, the feels-like variable shows an average of 25.74, with a median of 22.95 and a mode of 21.2. Similar to the absenteeism data, the values of mean, median, and mode are relatively aligned, pointing to a clustered distribution. Nevertheless, the standard deviation of 7.79 highlights a moderate spread, reflecting variation in how students experience or report this condition.

**Table 4.** Descriptive statistics of secondary school.

		Statistics	
		Absent	Feels-like
N	Valid	98	98
	Missing	0	0
Mean		38.55	25.744
Median		39.50	22.950
Mode		38 <sup>a</sup>	21.2
Std. Deviation		10.679	7.7903

a. Multiple modes exist. The smallest value is shown

### 3.2 | Preliminary analysis: Normality tests

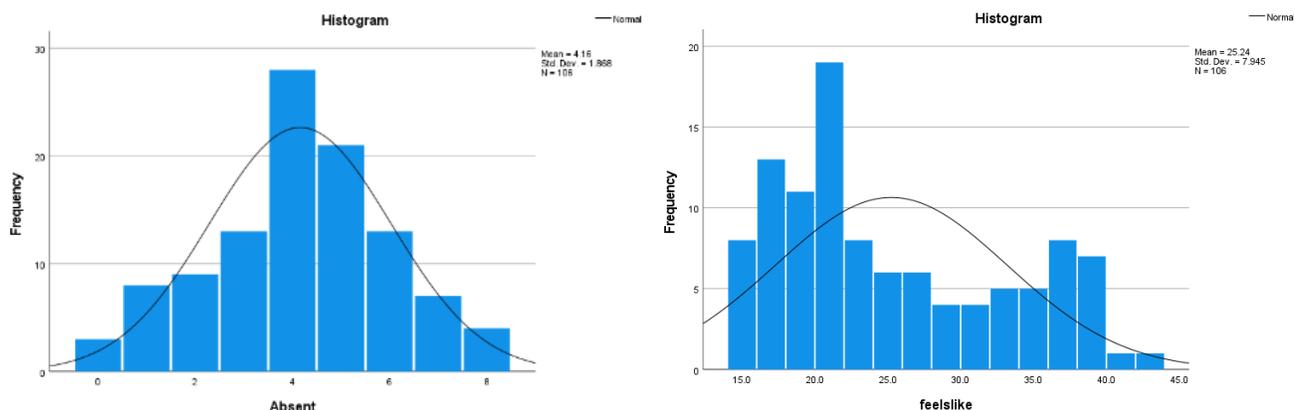
A Shapiro-Wilk and Kolmogorov-Smirnov test of normality was run on both the primary and secondary school data before conducting the inferential statistical test. This test helps to confirm the distribution of data to assess whether the variables meet the requirements for parametric tests.

#### 3.2.1 | Primary School

The results for the secondary school data indicate that, in both tests, the distribution of ‘Absent’ and ‘Feels like’ variables significantly deviate from normality ( $p < .05$ ) (Table 5 and Figure 4).

**Table 5.** Test of normality (Primary School).

Tests of Normality (Primary School)		
Variable	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.
Absent	<0.001	0.005
Feels like	<0.001	<0.001



**Fig. 4.** The distribution of ‘Absent’ and ‘Feels like’.

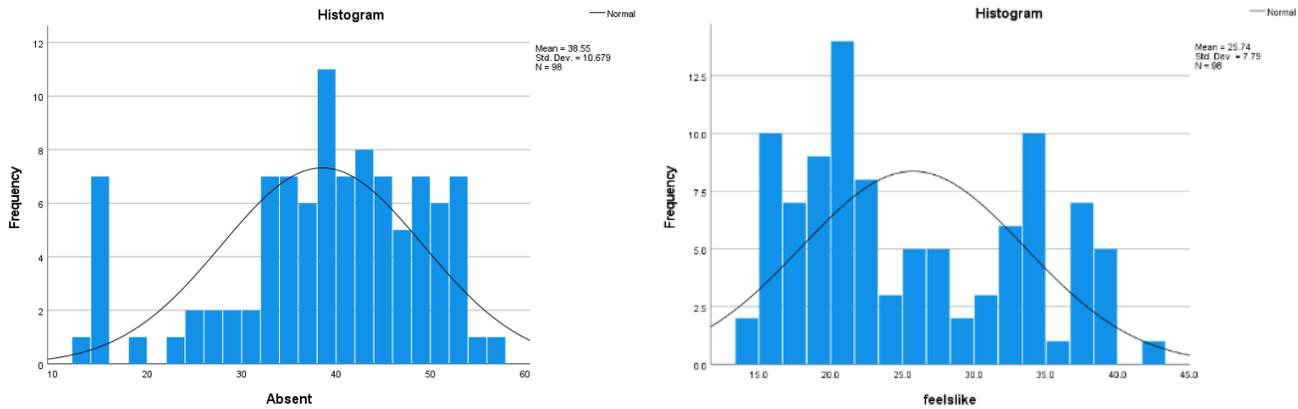
Specifically, the Kolmogorov-Smirnov test for ‘Absent’ shows a significance of <0.001 and the Shapiro-Wilk test is 0.005. And for the ‘Feels like’, both the Kolmogorov-Smirnov and Shapiro-Wilk test scores are <0.001.

### 3.2.2 | Secondary School

Similarly, the results for the secondary school data indicate that, in both tests, the distribution of ‘Absent’ and ‘Feels like’ variables significantly deviates from normality ( $p < .05$ ) (Table 6 and Figure 5).

**Table 6.** Test of normality (Secondary School).

Tests of Normality (Secondary School)		
Variable	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.
Absent	0.041	<0.001
Feels like	<0.001	<0.001



**Fig. 5.** The distribution of ‘Absent’ and ‘Feels like’ variables significantly deviate from normality.

Specifically, the Kolmogorov-Smirnov test for ‘Absent’ shows a significance of 0.041 and the Shapiro-Wilk test is <0.001. And for the ‘Feels like’, both the Kolmogorov-Smirnov and Shapiro-Wilk test scores are <0.001. Therefore, the assumption of normality for parametric tests for both schools is violated, and non-parametric tests are required for these datasets.

### 3.3 | Correlation analysis

Considering the violation of the normality of the datasets, Spearman’s Rank-Order (Spearman rho) was performed to examine the relationship between school absenteeism and feels-like temperature data.

#### 3.3.1 | Primary school

The analysis conducted in 106 observations revealed a negligible positive correlation ( $p = .007$ ) between feels-like temperature and school absenteeism. Additionally, given that the p-value (0.940),  $p > 0.05$ , is substantially larger than the predetermined significant level of 0.05, we fail to reject the Null hypothesis ( $H_0$ ) (Table 7).

**Table 7.** Correlation table (Primary School).

Correlation Table (Primary School)			
Correlation between	Spearman’s rho	Sig. (2-tailed)	N
Feels like temperature & Absent	0.007	0.940	106

The findings indicate that there is no statistically significant relationship between the feels-like temperature and school absenteeism in the selected primary school in the Mymensingh region. In simple terms, the observed

data does not provide sufficient evidence to suggest that the feels-like temperature has a reliable influence on school absenteeism in the particular study area.

### 3.3.2 | Secondary school

For the secondary school, Spearman’s correlation coefficient ( $\rho$ ) was 0.102, indicating a very weak, positive relationship between school absenteeism and the feels-like temperature data. The result was not statistically significant, p-value (0.316) is considerably larger than the pre-established significance level of 0.05 ( $p\text{-value} > 0.05$ ). Therefore, we fail to reject the Null hypothesis ( $H_0$ ) (Table 8).

**Table 8.** Correlation table (Secondary School).

Correlation Table (Secondary School)			
Correlation between <b>Feels like temperature &amp; Absent</b>	Spearman’s rho	Sig. (2-tailed)	N
	0.102	0.316	98

The results from this analysis demonstrate that there is no statistically significant relationship between absenteeism and feels-like temperature in the selected secondary school of Trishal Upazila. In simpler terms, the observed data from the analysis fail to provide evidence to establish that the feels-like temperature has a significant influence on school absenteeism in the Mymensingh region.

## 3.4 | Mann-Whitney U test (Hot vs Cold Months)

### 3.4.1 | Primary School

A Mann-Whitney U test was performed to investigate the difference in school absenteeism between the hottest (April-June) and coldest (December-February) months.

The test results for the primary school show a non-significant ( $U = 741.500$ ,  $p = 0.449 > 0.05$ ). That means we fail to reject the Null hypothesis ( $H_0a$ ), suggesting there are no significant differences in absenteeism in the coldest month (Mean Rank = 39.95) and the hottest months (Mean Rank = 36.02) for the selected primary school of the Mymensingh region (Tables 9-10 and Figure 6).

**Table 9.** Mann-Whitney test statistics (Primary).

Test Statistics	Value
Mann-Whitney U	741.500
Wilcoxon W	1917.500
Z	0.757
Asymptotic Sig. (2-tailed)	0.449
Total N	76

**Table 10.** Mean rank (Primary).

Seasonal Group	N	Mean Rank
Hottest Months (April-June)	28	36.02
Coldest Months (Dec- February)	48	39.95

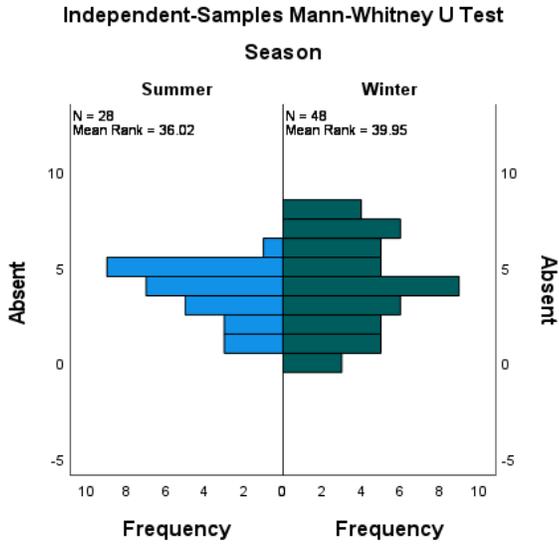


Fig. 6. Independent-Samples Mann-Whitney U Test

### 3.4.2 | Secondary school

Similarly, a Mann-Whitney U test was conducted to investigate the difference in school absenteeism between the hottest (April-June) and coldest (December-February) months.

The test indicated a significant difference in absenteeism rates between the coldest and hottest months ( $U = 380.500$ ,  $p = 0.002 < 0.05$ ), meaning it successfully rejects the Null hypothesis ( $H_0a$ ). The mean ranks show that school absenteeism was higher during the hottest months (Mean Rank = 45.47) than in the coldest months (Mean Rank = 30.01) (Tables 11-12 and Figure 7). It confirms that the students in the selected secondary school are likely to be absent more often during high-temperature events.

Table 11. Mann-Whitney test statistics (Secondary).

Test Statistics	Value
Mann-Whitney U	380.500
Wilcoxon W	1200.500
Z	-3.100
Asymptotic Sig. (2-tailed)	0.002
Total N	73

Table 12. Mean rank (Secondary).

Seasonal Group	N	Mean Rank
Hottest Months (April-June)	33	45.47
Coldest Months (Dec- February)	40	30.01

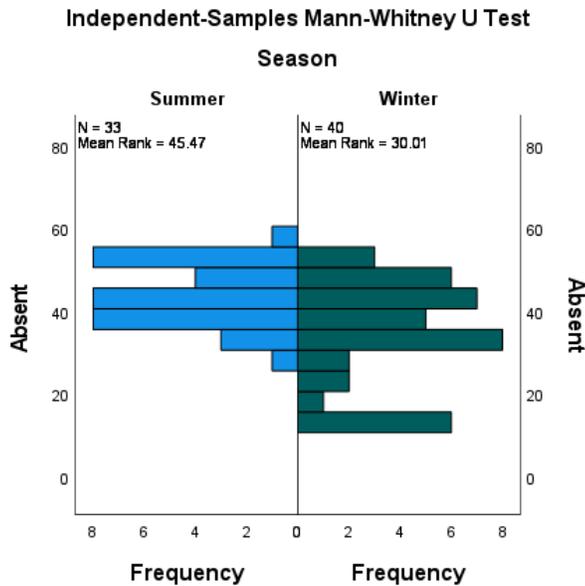


Fig. 7. Independent-Samples Mann-Whitney U Test.

### 3.5 | Regression analysis

#### 3.5.1 | Primary School

A simple linear regression analysis was conducted to test whether the feels-like temperature can predict school absenteeism in primary school.

The correlation coefficient ( $R = 0.051$ ) demonstrates an extremely weak positive relationship between feels-like temperature and absenteeism (Table 13). The  $R^2 = 0.003$  suggests that only 0.3% of the variance in absenteeism can be explained by this model. The ANOVA F-test ( $F(1,104) = 0.267, p = 0.606$ ) confirms that this particular regression model is not statistically significant. In simple terms, feels-like temperature is not a significant predictor of absenteeism in the selected primary school of the Mymensingh region.

**Table 13.** Regression model fit summary (Primary School).

Regression Model Fit Summary (Primary School)	
Measure	Value
R	0.051
$R^2$	0.003
Adjusted $R^2$	-0.007
Std. Error of Estimate	1.874
F (1, 104)	0.267
Sig.	0.606

From the regression coefficient table, the constant ( $B = 4.461$ ) confirms that, on average, around 4.46 students would be absent regardless of the feels-like temperature (Table 14). The regression coefficient for feels like temperature ( $B = -0.012$ ) is negative but extremely small and insignificant. It implies that each  $1^\circ\text{C}$  increase in feels-like temperature is associated with a decrease of only 0.012 students in the classroom. Given the high p-value ( $p = 0.606 > 0.05$ ), this effect is not statistically significant. The standardized beta ( $-0.051$ ) further reinstates that the predictive influence of temperature is trivial.

Therefore, the feels-like temperature is not a proper predictor for school absenteeism in the selected classroom of the primary school in the Trishal area.

**Table 14.** Regression coefficients (Primary School).

Regression Coefficients (Primary School)					
Predictor	B	SE(B)	Beta	t	p
(Constant)	4.461	0.609	—	7.325	0.000
Feels like temperature	-0.012	0.023	-0.051	-0.517	0.606

### 3.5.2 | Secondary School

The simple linear regression was performed for the secondary school as well to test the predictability of feels-like temperature to absenteeism.

The correlation coefficient ( $R = 0.149$ ) indicates a weak positive relationship between feels-like temperature and absenteeism (Table 15). The  $R^2 = 0.022$  suggests that only 2.2% of the variance in absenteeism can be explained by feels-like temperature. The ANOVA F-test ( $F(1,96) = 2.165$ ,  $p = 0.144$ ) confirms that this particular regression model is not statistically significant. In simple terms, feels-like temperature is not a significant predictor of absenteeism in the selected secondary school of the Mymensingh region.

**Table 15.** Regression model fit summary (Secondary School).

Regression Model Fit Summary (Secondary School)	
Measure	Value
R	0.149
$R^2$	0.022
Adjusted $R^2$	0.012
Std. Error of Estimate	10.616
F (1, 104)	2.165
Sig.	0.144

According to the regression coefficient table, the constant ( $B = 33.3$ ) confirms that, on average, approximately 33.3 students were absent regardless of the feels-like temperature (Table 16). The regression coefficient for feels like temperature ( $B = 0.204$ ) is positive but very small. It implies that each  $1^\circ\text{C}$  increase in feels-like temperature absenteeism is predicted to rise by 0.204 students. Given the high p-value ( $p = 0.144 > 0.05$ ), this effect is not statistically significant. The standardized beta (0.149) further underscores the small, predictive effect of feel-like temperature.

**Table 16.** Regression coefficients (Secondary School).

Regression Coefficients (Secondary School)					
Predictor	B	SE(B)	Beta	t	p
(Constant)	33.310	3.720	—	8.955	0.000
Feels like temperature	0.204	0.138	0.149	1.472	0.144

Therefore, the feels-like temperature is not a proper predictor for school absenteeism in the selected classroom of the secondary school in the Trishal area.

### 3.6 | Recurring Points of KII

A thematic analysis of KIIs revealed some key factors that actively contribute to school absenteeism patterns, other than climate factors. Table 17 represents the most frequent codes that are interpreted into several themes based on the qualitative data collected from the teachers and the responsible education officer.

**Table 17.** Thematic frequent-nodes.

Most Frequent Codes	Categories	Themes
Illness Family Obligations Poor Transportation Child labor Exam Fear	Non-environmental factors	<b>Other Drivers of Absenteeism</b>
Parents' Economic Pressure Lack of school supplies Siblings' care responsibilities Seasonal Work Migration	Socio-economic and personal barriers	
Scholarship Eligibility Incentives Pressure to meet the attendance target Teacher's Indulgence to meet the attendance target	Minimum Attendance Requirement Attendance Manipulation	<b>Impact of scholarship programs on record-keeping</b>
Missing/Manipulated attendance sheets Parents insist on attendance. Guardian's monitoring Teacher-Parent communication	Strong Parental guidance	<b>Age-Specific Absenteeism</b>
Older students make their own decisions. Peer influence Unresponsiveness of adolescents	Independence of secondary students	

### 3.7 | Other Drivers of Absenteeism

This particular study focuses on a specific factor for consideration to explore the attendance patterns in the selected schools in Trishal Upazila, assuming all the other factors are constant. The KIIs, however, highlight some non-environmental, socio-economic, and personal barriers. Sometimes, the seasonal flu or other kinds of illness can contribute to the rising absenteeism in classes. There are a lot of families here that are not solvent, hence, some students, basically the boys, are forced to join as child laborers, like shop assistants. Similarly, the girls are often tasked with caring for the younger siblings at home. The economic pressure on parents can result in the migration of families to newer locations. Sometimes, more than one of these factors can influence a single case, contributing to the rising absenteeism patterns at schools regardless of the weather events.

### 3.8 | Impact of scholarship programs on record-keeping

At the primary level, a government scholarship program for students of classes one to five is provided to encourage students, reduce dropout rates, and help them financially. To be eligible for the scholarship, every student has to maintain a certain academic record and a minimum attendance rate. In reality, not everyone can maintain this because the external factors discussed in the last paragraph are involved. There is pressure on the teachers regarding this from the government level. Thus, failing to meet the requirement, the teachers have to take the odd and

unethical responsibility of manipulating the attendance sheets to show less absenteeism. This situation is common at the primary school level, influencing the validity of the attendance data collected.

### 3.9 | Age-Specific Absenteeism

The age-specific absenteeism at schools is mainly influenced by two of the most dominant factors, distinctively, for primary schools and secondary schools. The primary school attendance rates can be explained by the strong parental guidance. The comparatively younger students at the primary level receive constant supervision and parental control. This leads the parents to insist on going to school and monitoring both academic and non-academic records at school. That is possible through frequent communication with the teachers, which creates an environment that shrinks the chances of missing school for the students of primary school.

Conversely, the students of secondary schools, at the peak of their adolescence, are comparatively reluctant to follow the rules and guidelines. They normally try to make their own decisions and are less likely to show compliance with the controlled environment. Thus, some of them neither listen to the teachers nor the parents and are prone to deviant behaviors. Additionally, peer influence and pressure are also dominant factors for school absenteeism at the secondary level. They follow their closest peer, and group behavior often contributes to declining attendance rates.

## 4 | DISCUSSION

This study seeks to investigate whether the variations in feels-like temperature influence the absenteeism rates in primary and secondary schools of Trishal Upazila in Mymensingh district. For analysis, this study assumes all other factors, such as illness, family issues, and socioeconomic issues constant. The evidence from the quantitative analysis revealed that the feels-like temperature has no significant impact or predictability over absenteeism in most of the analyses. The Spearman's rank-order correlations observed were extremely weak and statistically insignificant for both the primary and secondary schools ( $\rho = 0.007$ ,  $\rho = 0.940$  and  $\rho = 0.102$ ,  $\rho = 0.316$ , respectively). Likewise, the simple linear regression analyses showed a negligible proportion of the variance that could be explained by the feels-like temperature for both primary and secondary levels. Additionally, the model fails to reach a statistical significance level ( $p > 0.05$ ).

Furthermore, Mann-Whitney U tests compare the absenteeism rates between the coldest months (December to February) and the hottest months (April to June). This test showed no statistically significant or meaningful differences in absenteeism at the primary school level. In contrast, the Mann-Whitney U test reveals that absenteeism at the secondary school level was found to be significantly higher during the hottest months compared to the coldest months ( $U = 380.500$ ,  $p = 0.002$ ). This implies that, to some extent, secondary school may be vulnerable to extreme weather events.

The qualitative findings gathered from the KIIs present some important insights for a richer understanding of the results. Teachers and administrators pointed out some of the dominant factors influencing absenteeism, most of which are not related to temperature or climate. Some of the factors include illness, family issues, child labor, responsibilities at home, and seasonal migration, which can directly contribute to school absenteeism. Administrators also indicated that the scholarship program at the primary level to encourage students can also have a negative impact on school attendance data. The predeterminants of scholarship requirements, such as attendance rate and academic performance, need to be maintained for eligibility. Failing to meet the minimum requirement in attendance, the teachers at the primary school often manipulate and distort the data. This practice potentially explains the lack of observed seasonal or temperature effects on attendance at the selected primary schools in Mymensingh.

Additionally, the qualitative analyses provide some important age-specific differences. Younger students at the primary level remain under frequent monitoring and supervision by their parents and teachers. The duplex communication between the teachers and parents/guardians makes absenteeism at primary schools less sensitive

to temperature or adverse weather conditions. In contrast, secondary school students enjoy more independence, often make their own decisions about not attending classes, and can be easily influenced by peer groups. Teachers observed that older students are less sensitive and responsive to parental and institutional control, which proves their increasing rate of absenteeism on regular days, especially during hot summer days.

Above all, the findings from this study suggest that mostly the climate factors, such as the feels-like temperature, have very little to no effect at all on school absenteeism, except that it may have some impact on the secondary level. The absenteeism at both primary and secondary schools is mostly driven by socioeconomic, administrative, and behavioral factors rather than temperature factors. These issues need a more holistic approach to improve school attendance to address the structural and societal challenges faced by the schools in this region.

## 5 | CONCLUSION AND RECOMMENDATIONS

### 5.1 | Conclusion

The study set out to explore the relationship between feels-like temperature and school absenteeism in the selected schools of Trishal, Mymensingh. The quantitative analysis demonstrated that feels-like temperature is not a significant predictor for absenteeism in primary school, while having a weak relationship in secondary schools, resulting in slightly higher absenteeism during hotter days. These results suggest that temperature variation alone is not a significant predictor of school absenteeism. In contrast, the qualitative data digs deeper into the other factors of absenteeism, such as poverty, parent-teacher supervision, illness, family obligations, child labor, administrative pressure, etc. Often, the administrative requirement for scholarship money can drive the teacher to be more sensible about absenteeism or manipulate the attendance data. This study underscores the importance of considering the environmental factors in a wider geographic context with broader climate factors.

This study concludes that addressing school absenteeism requires a multidimensional factors including the socioeconomic context of the society. The policy interventions should focus on strengthening parent-teacher engagement, incentives for the economically disadvantaged communities, better monitoring for scholarship eligibility with ethical reporting and developing targeted programs for the improvement of the adolescents. The further studies of absenteeism should incorporate the indivisible factors closely associated with attendance with a broader geographic sample coverage and wider climatic variables to support more compact policy suggestions.

### 5.2 | Recommendations

The recommendations highlight a multi-dimensional approach to reducing absenteeism at both primary and secondary school levels (Table 18). Key strategies include strengthening parent-teacher communication to enhance parental supervision, improving school facilities such as fans, shaded spaces, and clean water sources to ensure comfort during heat, and introducing targeted support programs like stipends and school meals to reduce absenteeism caused by economic hardship. At the primary level, training teachers to maintain ethical reporting practices is also prioritized to ensure the authenticity and accuracy of attendance records.

In addition, the recommendations stress the importance of addressing health and climate-related challenges. Regular health checkups and awareness campaigns are expected to minimize illness-induced absenteeism, while climate-adaptive school schedules aim to reduce heat-related disruptions, especially for secondary school students. Finally, peer mentoring workshops at the secondary level are proposed to build positive peer networks and accountability. These actions require strong collaboration across ministries, schools, local organizations, and communities to create a sustainable and supportive learning environment.

**Table 18.** Recommendations-Matrix

Recommendations	Expected Benefits	Priority	Authority Responsible
Improve parent-teacher communication	Improved parental supervision and reduced absenteeism	Secondary level	Ministry of Education (MoE), Schools
Improved school facilities such as, fan, shaded space, and clean water sources	Enhanced comfort and attendance during heat	Both Primary & Secondary level	Ministry of Primary and Mass Education (MoPME), Ministry of Education (MoE), Schools
Targeted programs for economically disadvantaged families (stipends, school meals)	Reduction of absenteeism due to economic hardships and child labor	Both Primary & Secondary level	Ministry of Social Welfare, Ministry of Primary and Mass Education (MoPME), Ministry of Education (MoE), Schools
Training of teachers to maintain ethical attendance reporting and discouraging manipulation	Improved data authenticity and accuracy of attendance sheets	Primary level	Ministry of Primary and Mass Education (MoPME), Upazila Education Offices
Arrange regular health checkups and awareness campaigns	Reduction of illness-related absenteeism rates	Both Primary & Secondary level	Upazila Health Complex, Schools
Develop a climate-adaptive school schedule	Minimize the heat-induced absenteeism	Primary & Secondary level	Ministry of Social Welfare, Ministry of Primary and Mass Education (MoPME), Ministry of Education (MoE), Schools
Arrange interactive peer mentoring workshops	Build up positive peer networks, increased attendance and accountability	Secondary level	Local Youth Organizations, NGO, Schools

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## Disclosure Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research was conducted as part of academic activities at the Department of Local Government and Urban Development, Jatiya Kabi Kazi Nazrul Islam University, without any external commercial influence.

## Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author at the Department of Local Government and Urban Development, Jatiya Kabi Kazi Nazrul Islam University, upon reasonable request. Some data may be subject to institutional guidelines and ethical considerations regarding data sharing.

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