

Climate change knowledge among the community school students of Sindhuli district of central Nepal

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Received: 2, November 2022 Revised: 28, December 2022 Accepted: 16, August 2023 Published: 20, December 2023

Knowledge of climate change is a key instrument to combat climate change and raise awareness of society, but only a few studies have been conducted to assess students' knowledge level in Nepal. In this study, a semi-structured questionnaire survey was conducted on 140 students of grades 7, 8, 9, and 10 from four community schools to assess climate change knowledge. The results showed a statistically significant association between students' responses to being aware (yes/no) of the term "climate change" across genders as well as across different grades. A majority of the surveyed students reported a rise in temperature (n=67.85 %) and increasing rainfall intensity (n=57.85 %) over the course of the years. More than half of the surveyed students (n=55 %) would like to receive climate change education through their own curriculum books. Similarly, 44.27 % of the surveyed students identified plantation activities as a key climate change adaptation measure that they could perform. The findings of our study has indicated that school education is the best medium for students to learn about climate change. Thus, environmental education programs should be widely promoted while climate change education needs to be integrated into school curricula to a greater extent.

Keywords: Adaptation strategies, adolescence, climate change education, global warming and school curriculum

Climate change has become a pressing concern in the twenty-first century (Wong *et al.*, 2022) and is threatening humanity, particularly those who have less capacity to adapt to climate change impacts (Berse, 2017). Adolescents (10–19 years age group) are also one of the vulnerable groups to climate-induced disasters (Baker *et al.*, 2021; Rousell *et al.*, 2020). Extreme climate-induced disasters such as droughts, floods and landslides can put their mental health and academic as well as intellectual development under threat (Clayton & Manning, 2017; Gibbs *et al.*,

2019). In the context of Nepal, adolescents are particularly vulnerable to disasters because of the high incidence of poverty, illness exposure, resource reliance, limited access to climate change adaptation knowledge, disaster risk reduction, rights, and protection (Plan Nepal, 2012). According to the MoFE (2021), Dhading, Rolpa, Humla, Dolpa, Baitadi, Salyan, and Manang are highly vulnerable districts to climate change. Moreover, adolescents, women and marginalized communities of these districts are highly vulnerable because they have least access to relevant information, resources and capacity

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to manage the impacts of climate change and related disasters (Mainlay & Tan, 2012).

School education can be a strategic step towards climate education and social awareness. It creates a platform for intergenerational learning (Lawson *et al.*, 2019). As students learn about disasters and climate change in their schools, they communicate the information with their parents and relatives, as well as provide practical ideas to recover from disasters (Tanner, 2010). Educational institutions like secondary schools can play a crucial role in result-oriented communication on climate change (Nerlich *et al.*, 2010). It is an important means to combat climate change by enhancing students' knowledge and ultimately raising the collective awareness of society (Anderson, 2012). Climate change education has been gaining significance in recent years because of the global interest in international and national educational programs (Læssøe & Mochizuki, 2015; UNESCO, 2009). Therefore, strengthening climate change education and awareness, adaptation, and mitigation is a goal shared by the government, educational institutions, national and international organizations, and other stakeholders in Nepal (MOFE, 2019; Plan Nepal, 2012). The National Climate Change Policy, 2019 of Nepal has also emphasized the causes and impacts of climate change and capacity building of the students through formal and non-formal education curricula of lower secondary- and secondary-levels (GoN, 2019).

Information on students' level of knowledge on climate change has been identified as the key instrument because it acts as a baseline for developing school curriculum education (Özdem *et al.*, 2014; Punter *et al.*, 2011). Furthermore, school students are the future climate activists at the local, national, and international levels, and they are responsible for reducing climate change vulnerabilities and passing on knowledge to the next generation (Seddighi *et al.*, 2020). It is, therefore, important to assess their current state of knowledge on climate change. Several factors such as gender, age group, and academic grades can shape student's knowledge and

understanding of climate change (Ojala, 2015). Limited studies have attempted to quantify students' knowledge regarding the impacts of climate change in Nepal (Devkota & Phuyal, 2017; Gautam *et al.*, 2021). Therefore, this study assessed students' (adolescents') level of knowledge on climate change and its impacts on health and biodiversity in the current context in the selected four community schools in Sunkoshi Rural Municipality of Sindhuli District. Our research can shed light on community school students' current understanding and knowledge regarding climate change, which could be useful for local and national education institutions to strengthen climate change education in school curricula. The current study may not provide the whole scenario of Nepal, but it does serve as a foundation for future research in other parts of the country.

Material and methods

Study area

Four community schools within the Sunkoshi Rural Municipality of Sindhuli District of Nepal (see Figure 1) were selected to assess the students' perceptions and level of knowledge regarding climate change. Sunkoshi Rural Municipality is located between 85° 47' 30"–85° 59' 10" E longitudes and between 27° 21' 23"–27° 27' 00" N latitudes, and is about 150 kilometers east from Kathmandu, the capital city of Nepal. The SRM exhibits subtropical type of climate, with major vegetation such as Chir Pine (*Pinus roxburghii*), Katus (*Castanopsis* spp.), and Chilaune (*Schima wallichii*). There are, altogether, 4,920 households with a total of 18,136 populace consisting of various ethnic groups such as Brahman, Chhetri, Tamang, Magar, Damai, Kami, and Sarki (CBS, 2021). The SRM consists of around 21 secondary- and lower-secondary-level community schools (SRM, 2018). Around 64 % of the rural municipality area is occupied by forests (SRM, 2018). The Sindhuli district lies within a climate-induced disaster-prone zone due to its geographic and climatic conditions, where landslides and debris flows are prevalent mostly in the hills while massive floods occur in the plain areas (GON, 2010; Neupane & Dhakal,

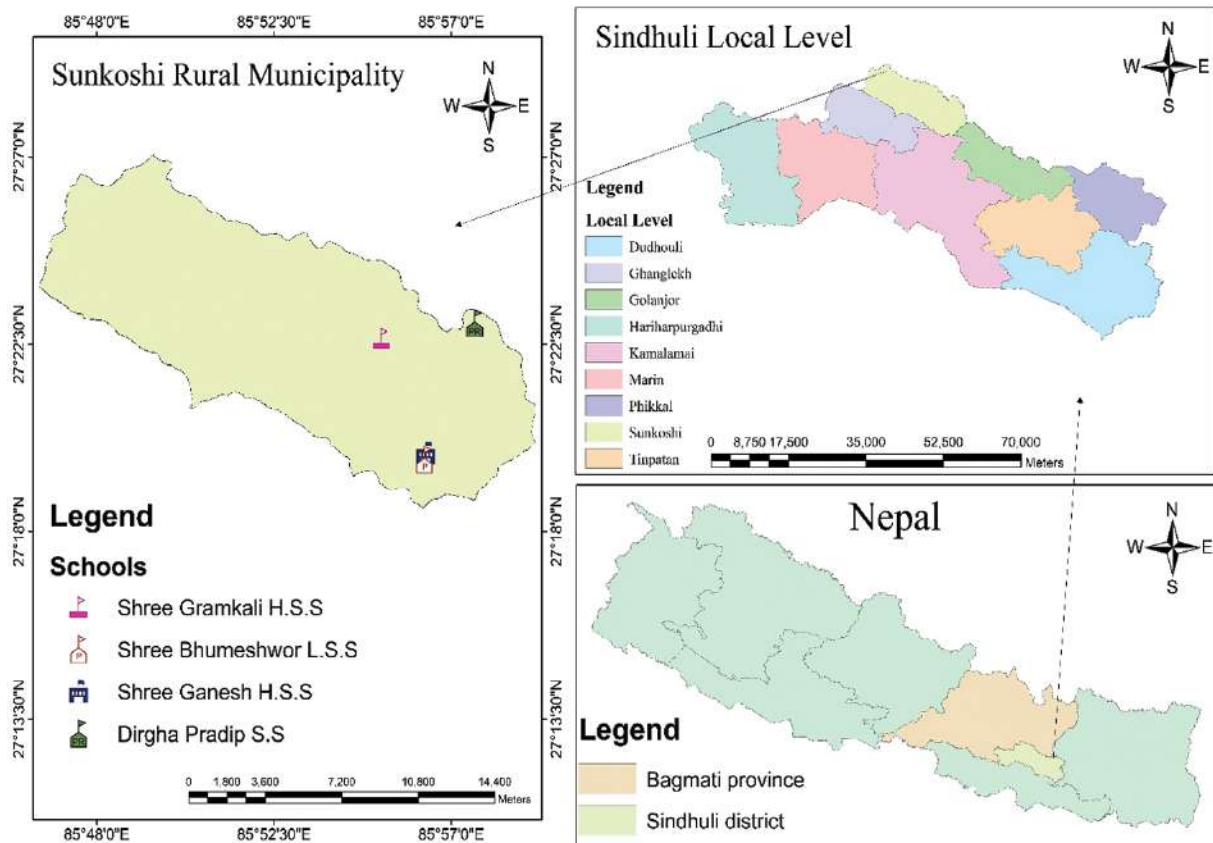


Figure 1. Location of Sindhuli District (study area) in the map of Nepal (lower right corner); Administrative boundaries of the local units of Sindhuli District (upper right corner); and the selected schools within the Sunkoshi Rural Municipality (upper left corner)

2017). The SRM is situated in the Mahabharat Range which features remote hilly terrain prone to landslides and debris flows. Therefore, it is vital to assess the young mind’s knowledge and perceptions regarding climate change in such climate vulnerable zone. This study is the purposive project undertaken in the hilly region of Nepal to understand the knowledge of climate change among the students of community schools.

Data collection approach

The survey was conducted in Sep, 2020. A total of 140 students from four different schools were surveyed through a self-administered questionnaire following a simple random sampling method. The sample sizes taken from the four different schools were 48 (34% of 140) from the Gramkali Higher Secondary School, 20 (33% of 60) from the Bhumeswor Lower Secondary School, 31 (23% of 135) from the

Ganesh Higher Secondary School, and 41 (29 % of 142) from the Dirgha Pradip Secondary School. An appropriate size of sample was taken from the estimated 20,000 students of grades 7, 8, 9, and 10 of Sindhuli district using the equation developed by Newey and McFadden:

$$n=[Z^2 PqN/e^2 (N - 1) + Z^2$$

Where n = sample size; P = representative population size; q = 1-p; Z =1.96 at 95% confidence level; e = margin of error; and N = population size (Newey & McFadden, 1994).

We used a self-administered questionnaire in our survey to avoid the undesirable interviewers’ effects and to prefer the cost-effective approach (DeLeeuw, 2008). A standardized questionnaire was designed in Nepali on those developed by Özdem *et al.* (2014) and Berse (2017), which consisted of both open- and closed-ended questions. The questionnaire was divided into

five different sections (Table 1). We only used the English term “climate change” in Q5 because we aimed to determine whether the students were familiar with this specific English term or not. In the remaining questions, we used the Nepali term “jalabayu parivartan” instead of the English term to denote climate change.

Table 1: Questionnaire’s section and its description used to assess climate change knowledge among the community school students

Section	Theme	Description
I	Students’ basic demographic information (Q1–4)	Students’ basic demographic information.
II	Familiarity with the term “climate change” (Q5).	Students’ familiarity with the term “climate change” assessed through binary-choice questions (yes/no).
III	Temperature and rainfall trends (Q6 & 7).	Perception on temperature and rainfall trends assessed through multiple-choice questions.
IV	Observed impacts of climate change (Q8–11)	The observed impacts of climate change assessed through multiple-choice questions as well as through binary questions (yes/no) consisting of four different statements as a single question.
V	Climate change education and understanding about adaptation strategy (Q12–13)	Perceived medium to pursue climate change education assessed through multiple-choice questions whereas students’ understanding about adaptation strategy assessed through an open-ended question.

On an average, it took 12 minutes to accomplish a survey. Almost two-third of the surveyed students (64%) were female (n=64%) and one-third (36%) were male. The mean age of the students was found to be 14.1 years (± 1.4 SD), ranging from 11 to 19 years. More than one-third of the surveyed students (n=33%) were from grade 9 followed by the students of grade 7 (n=25%), grade 8 (n=23%), and grade 10 (n=19%, Table 2).

Table 2. Student’s basic-demographic characteristics

Characteristics	Number (n)	Percentage
Gender		
Male	50	36
Female	90	64
Total	140	100
Grade		
7	35	25
8	32	23
9	47	33
10	26	19
Total	140	100

Source: Field Survey, 2020.

Data analysis

Initially, the surveyed data were entered into the Microsoft Excel Spread Sheet (Professional Plus 2016). The data were analyzed using descriptive statistics, cross-tabulations, and chi-square test. The chi-square test was performed using the R Studio Version 4.1.3 (R Core Team, 2022) to test the association between the male and female students and between the students of different grades with regards to their responses (yes/no) with the term “climate change” following the techniques of Haq & Ahmed (2020) and Özdem *et al.* (2014).

Results

Student’s awareness regarding the term “climate change”

Majority of the students (n=90%) were found to be aware of the term “climate change”. The results of the chi-square test showed a statistically significant association ($\chi^2=9.487$, $df=2$, $p=0.0087$) between the male and female students with regards to their responses (yes/no) with the term “climate

change”; the male students being more aware than the female ones. Similarly, there was also a statistically significant association ($\chi^2=17.601$; $df=6$; $p=0.0073$) between the students (both male and female) of different grades with regards to their response (yes/no) with the term “climate change”; the students of higher grade being more aware than those of lower grade.

Knowledge on temperature and rainfall trends

Majority of the students ($n=67.85\%$) reported that the temperature had been increasing over the years. On the contrary, about one-fourth of the students ($n=24.28\%$) reported it to be in the decreasing trend. Only a few students ($n=7.87\%$) reported that it had neither been rising nor decreasing over the years (see Figure 2).

In the case of rainfall, majority of the students ($n=57.85\%$) reported that the rainfall intensity had been increasing over the years. On the contrary, a slightly more than 32% (32.15%) of the students reported it to be in the decreasing trend while 10% of the students reported that it was neither increasing nor decreasing (Figure 3).

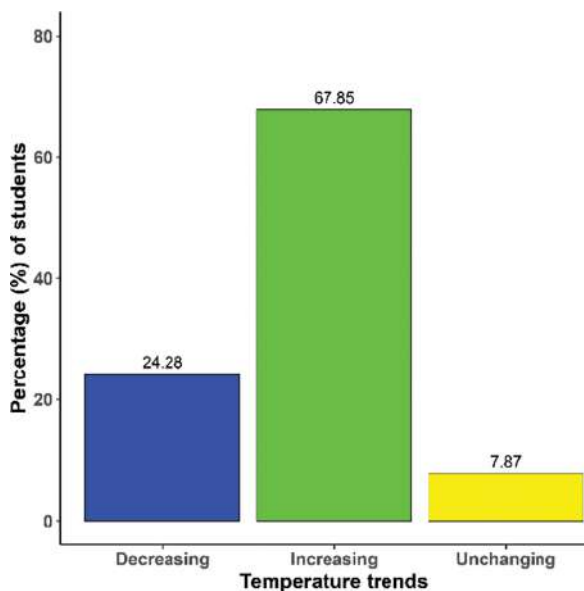


Figure 2: Percentage of students regarding their response on increasing/ decreasing/ unchanging trend of temperature

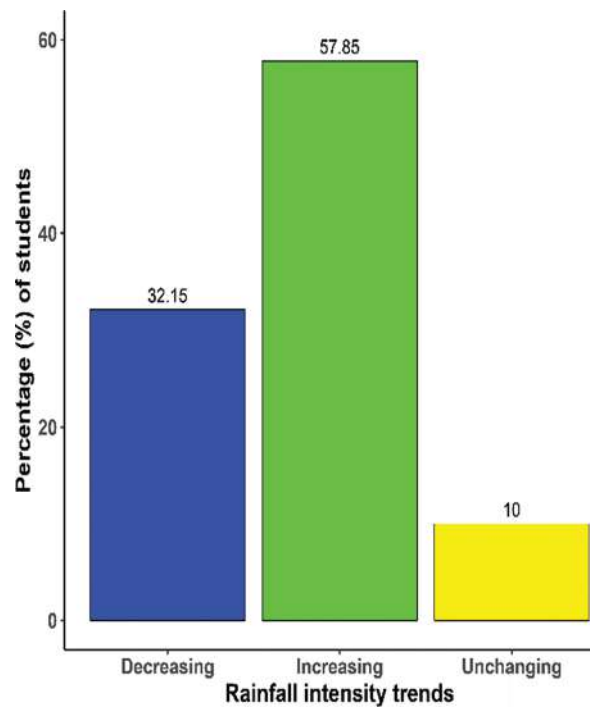


Figure 3: Percentage of students regarding their response on increasing/ decreasing/ unchanging trend of rainfall

Observed impacts of climate change

More than half of the surveyed students ($n=52.85\%$) observed drought, forest destruction, heavy storms, and water scarcity as the climate change impacts (see Table 3). Similarly, more than half ($n=52.87\%$) of the surveyed students observed diarrhea, malnutrition, and malaria as the climate-change-related health issues. Ninety percent ($n=90\%$) students responded that climate change had negative impact on agricultural productivity while a slightly more than 81% ($n=81.5\%$) students responded that climate change had caused pests in agricultural crops. Similarly, a slightly more than 69% ($n=69.30\%$) students believed that climate change had been causing forest fires. A slightly more than 61% ($n=61.50\%$) assumed that climate change had caused habitat shifting and wildlife migration.

Table 3: Perceived impacts of climate change: closed-ended questions (multiple and binary choices)

S.N.	Statement	Response
1.	What is/are the impact/s of climate change? a) Drought; b) Forest destruction; c) Heavy storms; d) Water scarcity; e) All of them	a) Drought (16.00 %) b) Forest destruction (19.28 %) c) Heavy storms (3.00 %) d) Water scarcity (8.87 %) e) All of them (52.85 %)
2.	What is/are the health issue/s caused by climate change? a) Diarrhoea; b) Malnutrition; c) Malaria; d) All of them	a) Diarrhea (34.28 %) b) Malnutrition (7.85 %) c) Malaria (5.00 %) d) All of them (52.87 %)
3.	What do you think about the following?; are those the impacts of climate change? a) Forest fire b) Habitat shifting and wildlife migration c) Pests in agricultural crops d) Low productivity of agriculture	a) Yes (69.30 %); No (30.70 %) b) Yes (61.50 %); No (38.50 %) c) Yes (81.45 %); No (18.55 %) d) Yes (90.00 %); No (10.00 %)

Perceived medium to receive climate change education

More than half of the surveyed students (n=55 %) would like to pursue climate change education through their own school-curriculum books (see Figure 4). Similarly, almost 28% (n=27.86 %) students preferred awareness and outreach programs while around 17 % (n=17.14 %) students preferred radio and television programs as the best medium to pursue the same.

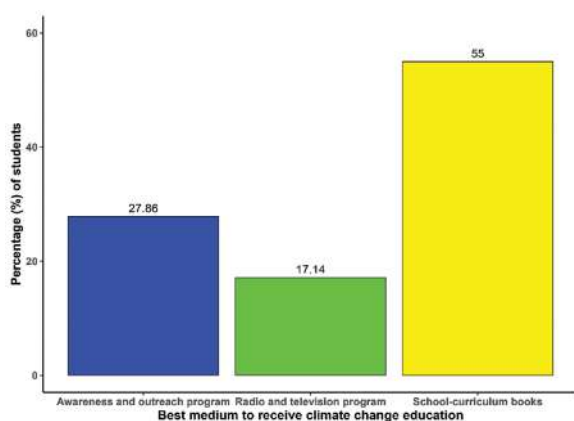


Figure 4: Percentage of students preferring best medium to pursue climate change education

Understanding the adaptation strategy

About 72 % of the students were able to answer one action that they can do from their own level to minimize the impacts of climate change in their communities (Table 4). Among them, a slightly more than 44% (n=44.27 %) stated that they would perform plantation. On the other hand, almost 10 % (n=9.88 %) gave importance for environmental cleanliness while nearly 8% (n=7.85 %) focused on water source conservation for adaption to climate change.

Table 4: Students’ understanding on adaptation strategy

Statement	Responses
List one action that you can perform from your level to reduce the effects of climate change in your community.	- Plantation (44.27 %); - Environment cleanliness (9.88 %); - Conservation of water sources (7.85 %); - Awareness among the community people (7.14 %); and - Organic farming (2.85 %)

Discussion

Our study showed a higher awareness among the school students regarding the term “climate change”, which corresponds with a similar study conducted in Nigeria (Oruonye, 2011). The higher-level of awareness regarding the term “climate change” among the school students in our survey might be due to formal education in schools and informal education through different media platforms (Parajuli, 2016). Even in modern societies, women are typically more involved in household management (Daminger, 2019). In Nepal, female students are not well exposed to the outside environment in comparison to male students as the former are, moreover, limited within their homes from their early age. It is, therefore, not surprising that female students have less awareness regarding the term “climate change”. In contrast, a similar study conducted by Liarakou *et al.* (2011) showed no statistically significant difference between the male and female Greek secondary school students regarding their level of knowledge regarding the same. On the other hand, our study found a statistically significant awareness among the different grades regarding the term “climate change”, which could be associated with the increased level of exposure, experience, and incorporation of environmental studies in school curricula with the increase in grades (CDC, 2020). A better awareness level on the term “climate change” with the increase in grades was also observed in other surveys (Carr *et al.*, 2015; Liarakou *et al.*, 2011; Oruonye, 2011). Our study showed that the students were more familiar with the trends of rising temperatures and rainfall over the years. This result corresponds with the climatic data on the yearly precipitation and the mean temperature of Nepal where the yearly precipitation has increased by 8.7mm/year and the mean temperature by 0.03°C/year (Shrestha *et al.*, 2019). Similar findings have been claimed by a number of other researchers, such as Khanal *et al.* and Adhikari *et al.* (2021).-

This study demonstrated a good deal of awareness regarding the impacts of climate change among the surveyed school students, which is consistent with the similar studies of Punter *et al.* (2011) and Liarakou *et al.* (2011). This study revealed a good

level of awareness among the students and reported that all the issues *viz.* forest destruction, drought, heavy storms, and water scarcity, were the impacts of climate change. A fundamental foundation of climate knowledge appears to have been built in the students’ mind through years of personal experiences and environmental science education in schools. Besides physical impacts, students were also able to examine other aspects of climate change, as more than half of the surveyed students (52.87 %) reported diarrhea, malnutrition, and malaria as major health issues caused by climate change.

Majority of the surveyed students were aware of forest fires and wildlife shifting/migration as the impacts of climate change in the biodiversity sector. Also, they were aware of pests in agricultural crops and low agricultural production as the impacts of climate change in the agricultural sector. These findings are consistent with those of Punter *et al.* (2011) and Liarakou *et al.* (2011), which could be because the students might have witnessed the impacts of climate change in their everyday life as well as through their curriculum books. In our study, more than half of the surveyed students (n=55 %) preferred their own curriculum books to pursue climate change education. A slightly more than one-fourth of the surveyed students (n=27.86 %) preferred awareness and outreach programs as an effective means of building climate change knowledge, which might be due to the lack of effective non-curricular climate-related programs among the students of the surveyed schools. In contrast to our findings, the study conducted by Liarakou *et al.* (2011) found “television” as a major source to receive information regarding climate change, followed by “classrooms” in Greek schools. About 28 % of the surveyed students remained clueless when we asked them to list one action that they could perform at their level to reduce the effects of climate change in their communities. Around 44 % of the surveyed students thought that plantation and forest conservation were important adaptation strategies that they could implement in their communities. The study conducted by Gautam *et al.* (2021) in Nepal also found a similar result, with majority of the students citing afforestation as the prime adaptation measure against climate change.

Overall, our study found that majority of the surveyed students were aware of general information about climate change but lacked a detailed understanding about the issue. Nepal, being sensitive to the impacts of global climate change, needs the integration of practical and solution-centric climate change education more urgently. Hence, this study provides the current knowledge status on how students perceive climate change, its effects and impacts, the best medium to pursue climate change education and learn about their role in climate change mitigation.

Conclusion

School education can be a strategic step towards climate education and social awareness as students can inform their parents and communities about new knowledge regarding the same. A good deal of awareness towards the impacts of climate change and less awareness towards the adaptation strategies for climate change, found in our study, emphasizes for solution-centric courses that focus on the adaptation and mitigation aspects of climate change. This study shows that curriculum books are also a decent medium for receiving climate change education for school students. Besides, the findings of this study are expected to guide the concerned educational institutions in developing strategies and curriculum resources for improving students' knowledge and skills about climate change in days to come.

Conflict of interest

No conflict of interest is declared by the authors.

Acknowledgements

We are grateful to the Korea Safety Health Environment (SHE) Foundation, Seocho-gu, Seoul for funding our climate change adaptation project under the Global Seed Grant 2020. We are thankful to the principals of all the selected schools for granting us permission to undertake our survey. Furthermore, we are obliged to all the teachers of the selected schools for their enormous efforts during our questionnaire survey. Last but not the least, we would like to thank all the students who helped us in accomplishing our

survey successfully in their schools.

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