

Climate change knowledge among community school students in Sindhuli district of Central Nepal

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Abstract

Knowledge of climate change is a key instrument to combat climate change and raise awareness of society but 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 have reported a rise in temperature (n=67.85%) and increasing rainfall intensity (n=57.85%) over the course of the year. 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 can perform. According to our findings, school education is the best medium for students to learn about climate change. Thus, environmental education programs should be widely promoted and climate change education should be integrated into school curricula to a greater extent.

Keywords: Adolescence, climate change education, global warming, adaptation strategies, school curriculum

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Introduction

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, and limited access to climate change adaptation knowledge, disaster risk reduction, rights, and protection (Plan Nepal, 2012). According to Climate Change Vulnerability and Risk Assessment report, Dhading, Rolpa, Humla, Dolpa, Baitadi, Salyan, and Manang are highly vulnerable district to climate change (MoFE, 2021). Moreover, adolescents, women and marginalized communities of these districts are highly vulnerable because they have least access to relevant information, resources and capacity 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 the student's knowledge and understanding of climate change (Ojala, 2015). Limited studies have attempted to quantify the students' knowledge of the impacts of climate change in Nepal (Devkota & Phuyal, 2017; Gautam *et al.*, 2021). Therefore, this study assessed students' (adolescents') knowledge level of climate change and its impacts on health and biodiversity in the current context in four community schools in Sunkoshi Gaunpalika (Rural municipality) of Sindhuli District. Our research can shed light on community school students' current understanding and knowledge of 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.

Materials and Methods

Study area

Four community schools in the Sunkoshi Gaunpalika (Rural municipality) ($27^{\circ}22'30''\text{N}$ $85^{\circ}53'30''\text{E}$) of Sindhuli District, Nepal (Figure 1), were selected to assess the students' perceptions and knowledge level regarding climate change. Sunkoshi Gaunpalika is located about 150 kilometers east of Kathmandu, Nepal's capital city. The Gaunpalika has a subtropical climate, with major vegetation such as Chir pine (*Pinus roxburghii*), Katus (*Castanopsis sp.*), and Chilaune (*Schima wallichii*). The Gaunpalika has a total population of 18,136 and 4,920 households, with ethnic groups including Brahman, Chhetri, Tamang, Magar, Damai, Kami, and Sarki (CBS, 2021). The Gaunpalika consists of around 21 secondary and lower-secondary level community schools (Sunkoshi Rural Municipality, 2018). Around 64% of the Gaunpalika's area is covered by forests (Sunkoshi Rural Municipality, 2018). The Sindhuli district is 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 are on the plain areas (GON, 2010; Neupane & Dhakal, 2017). Sunkoshi Gaunpalika 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 students at community schools.

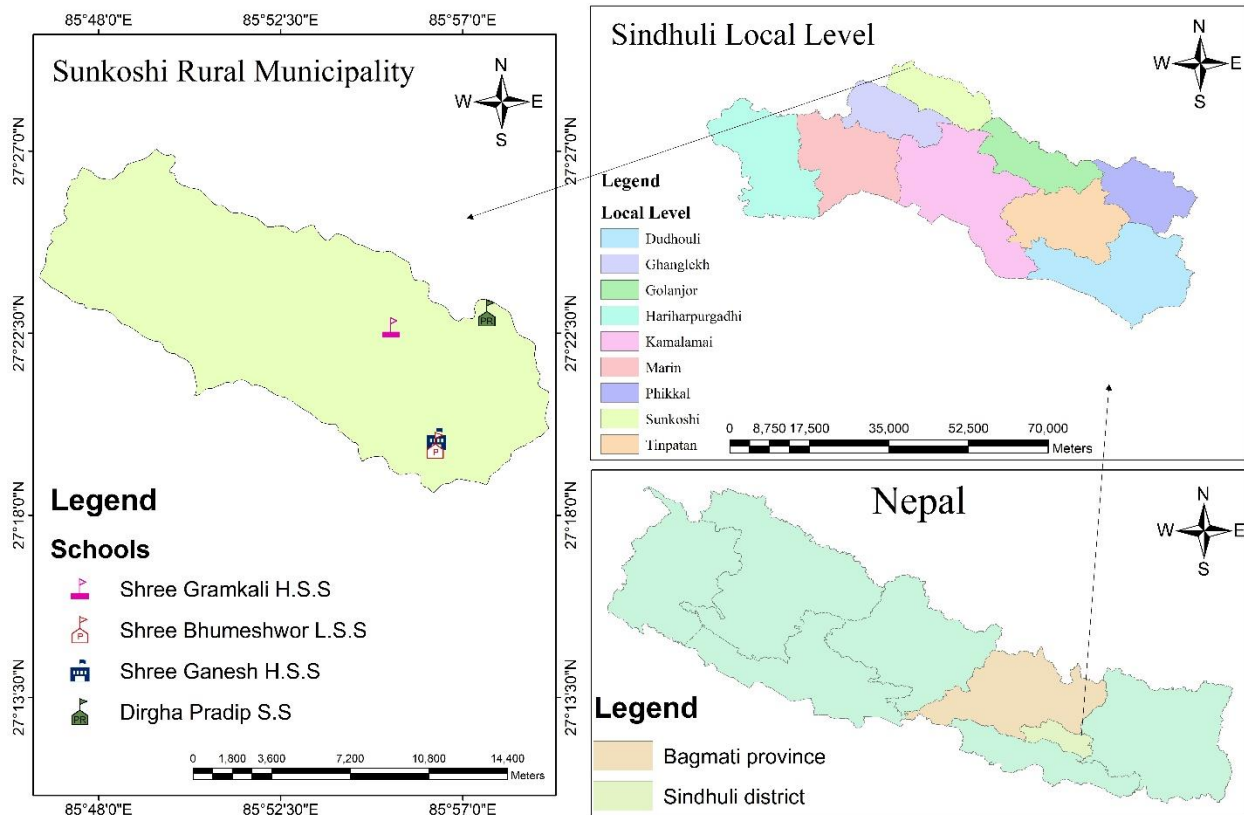


Figure 1. Map of the study area showing the different local level of Sindhuli district and surveyed schools.

Data collection approach

The survey was conducted in September 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 size taken from four different schools was 48 (34% of 140) from Shree Gramkali higher secondary school, 20 (33% of 60) from Shree Bhmeshwor lower secondary school, 31 (23% of 135) from Shree Ganesh higher secondary school and 41 (29% of 142) from Dirgha Pradip secondary school. The appropriate sample of students was taken from the estimated 20,000 students of grades 7, 8, 9, and 10 in the Sindhuli district, following Newey and McFadden formula.

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

Where n = sample size, P = representative population size, q = 1-p, Z =1.96 at a confidence level of 95%, e = margin of error, N= size of the population (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 (De Leeuw, 2008). A standardized questionnaire in Nepali was designed following Özdem *et al.* (2014) and Berse (2017), which consists of both open-ended 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 students were familiar with this specific English term or not. In the remaining questions, we used the Nepali term "*jalabayu paribartan*" instead of the English term to denote climate change.

Table 1. Questionnaire's section and its description that was used to assess the climate change knowledge among community school students

Question 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" were assessed through binary-choice questions (yes/no).
III	Temperature and rainfall trends (Q6 & 7).	The perception over temperature, and rainfall trends assessed through multiple-choice questions.
IV	Observed impacts of climate change (Q8-11)	The observed impacts of climate change were assessed through multiple-choice questions, as well as through binary questions (yes/no) that consisted of four different statements as a single question.

V	Climate change education and understanding about adaptation strategy (Q12-13)	The perceived medium to receive the climate change education was assessed through a multiple-choice question, whereas students' understanding about adaptation strategy was assessed through an open-ended question.
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The whole survey took on an average of 12 minutes to accomplish. The majority of the surveyed students were female (n = 64%), whereas 36% were male. The mean age of the students was 14.1 years (± 1.4 SD) ranging from 11 to 19 years. More than one-third of the surveyed students were from grade 9 (n = 33%), followed by 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
Grade		
7	35	25
8	32	23
9	47	33
10	26	19

Data analysis

Initially, the surveyed data were put into a Microsoft Excel spreadsheet (Professional Plus 2016). The questionnaire data were analyzed using descriptive statistics, cross-tabulations, and chi-square tests. The chi-square test was performed using R studio version 4.1.3 (R Core Team, 2022) to test the association of students' responses to being aware (yes/no) with the term climate change between gender and grades (Haq & Ahmed, 2020; Özdem *et al.*, 2014).

Results

Student's aware of the term "climate change"

The majority of the students (n = 90%) were aware of the term "climate change". The results of the Chi-Square test showed a statistically significant association of students' responses to being aware (yes/no) with the term "climate change" between male and female ($\chi^2=9.487$, $df= 2$, $p=0.0087$), where male students were more aware than female students. Similarly, there was also a statistically significant association of students' responses to being aware (yes/no) with the term "climate change" between different grades ($\chi^2=17.601$, $df= 6$, $p=0.0073$), where students in the higher grade were more aware than those in the lower grade.

Knowledge on temperature and rainfall trends

Majority of the students (n = 67.85%) have reported that the temperature has been increasing over the years, followed by a decreasing temperature trends (n = 24.28%). However, a few students (n = 7.87%) reported that the temperature has not been rising or decreasing over the years (Figure 2). In the case of rainfall, the majority of students (n = 57.85%) have reported that the rainfall intensity has been increasing over the years, 32.15% of students reported decreasing intensity, and 10% of students reported neither increasing nor decreasing rainfall intensity (Figure 3).

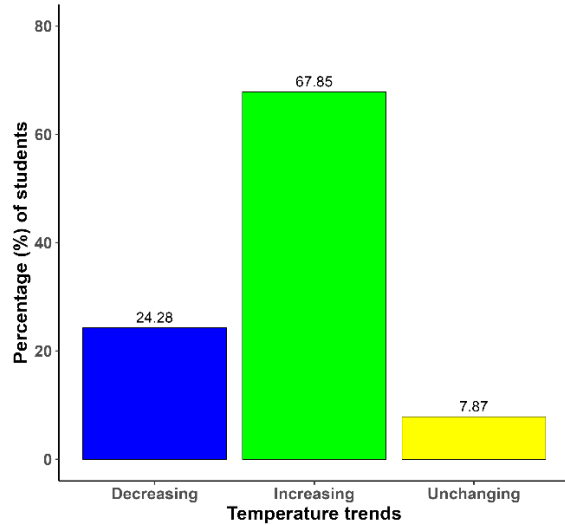


Figure 2. Percentage of students who had reported the temperature trends over the years as increasing, decreasing and unchanging.

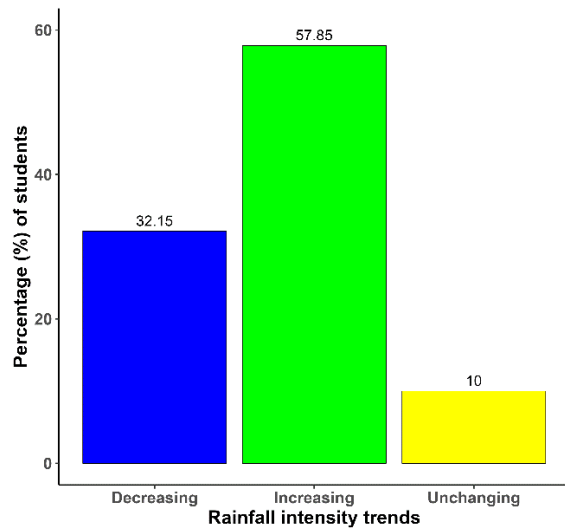


Figure 3. Percentage of students who had reported the rainfall intensity trends over the years as increasing, decreasing and unchanging.

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 climate change impacts (Table 3). More than half of the surveyed

students (n=52.87%) observed climate change-related health issues as diarrhea, malnutrition, and malaria. Most students believe that climate change is causing forest fires (n=69.30%), habitat shifting and wildlife migration (n=61.50%), pests in agricultural crops (n=81.45%), and low agricultural productivity (n=90%).

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

<i>S.N.</i>	<i>Statement</i>	<i>Response</i>
1.	What is/are the impacts of climate change? a) Drought; b) Forest destruction; c) Heavy storms; d) Water scarcity; d) All of them	a) Drought=15.7% b)Forest destruction=19.28% c) Heavy storms=2.85% d) Water scarcity=8.57% e) All of them= 52.85%
2.	What is/are the health issues caused by the climate change? a) Diarrhoea; b) Malnutrition; c) Malaria; d) All of them	a) Diarrhea= 34.28% b) Malnutrition= 7.85% c) Malaria= 5% d) All of them=52.87%
3.	What do you think about the following, are they 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%, No=10%

Perceived medium to receive the climate change education

More than half of the surveyed students (n=55%) would like to receive the climate change education through their own school-curriculum books whereas, 27.86% of students preferred

awareness and outreach programs, and only 17.14% of students preferred radio and television programs as the best medium (Figure 4).

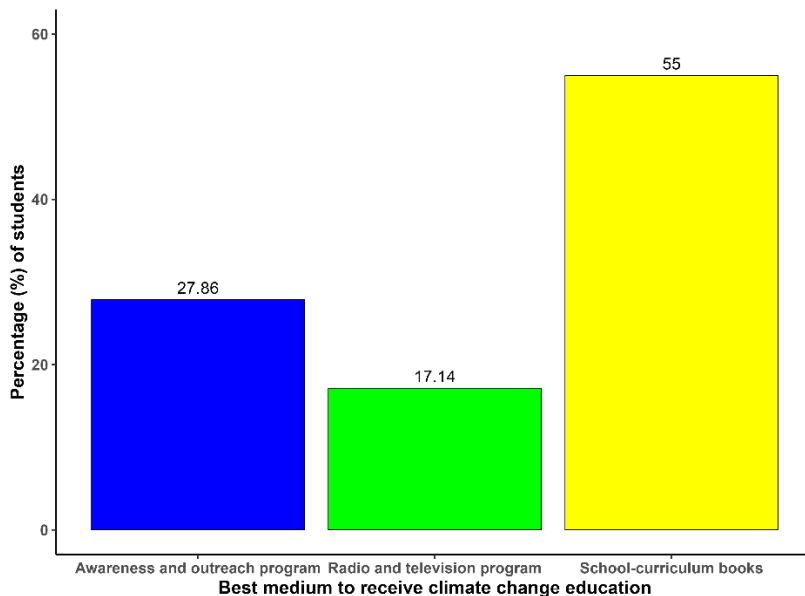


Figure 4. Percentage of students who prefer the best medium to receive the climate change education.

Understanding the adaptation strategy

72% of the students were able to answer the one action that they can do from their own level to minimize the impacts of climate change in their community (Table 4). Among 72% of the answered students, 44.27% of the students stated that they will perform plantation, followed by environmental cleanliness (n=9.88%) and water source conservation (n=7.85%).

Table 4. Students’ understanding on adaptation strategy

<i>Statement</i>	<i>Responses</i>
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% Water sources conservation=7.85% Awareness to community people=7.14% Organic farming=2.85%

Discussion

Our study concerning the awareness of the term climate change showed a higher awareness among school students which corresponds with a similar study conducted in Nigeria (Oruonye, 2011). The higher level of awareness among school students of the term climate change 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 (Damingler, 2019). Female students in Nepal are not well exposed to the outside environment in comparison to male students because they are occupied at home from an early age. It is therefore not surprising that the female students have less awareness of the term climate change. In contrast, a similar survey among Greek secondary school students revealed no statistically significant difference in knowledge levels between male and female (Liarakou *et al.*, 2011). Our study found a statistically significant awareness of the term climate change between different grades which could be associated with the increased level of exposure, experience, and incorporation of environmental studies into school curricula with an increase in grades (CDC, 2020). A better awareness level of 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 climatic trends of rising temperatures and rainfall over the years. This result corresponds with climatic data of the yearly precipitation and the mean temperature of Nepal where yearly precipitation has increased by 8.7mm/year and the mean temperature increased by 0.03°C/year (Shrestha *et al.*, 2019). Aligning results have been

argued by multiple literature in different places of Nepal including the Chitwan (Khanal *et al.*, 2019), and Mustang (Adhikari *et al.*, 2021).

This study demonstrated a good deal of awareness of 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 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 students through years of personal experiences and environmental science education in schools. Beyond 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.

The majority of surveyed students were aware of forest fires; wildlife shifting and migration; pests in agricultural crops; and low agricultural production as the impacts of climate change in the biodiversity and agricultural sectors, respectively. This finding is consistent with the similar studies of Punter *et al.* (2011) and Liarakou *et al.* (2011), which could be because students have witnessed the impacts of climate change in their everyday lives 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 receive climate change education. Similarly, only 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 a lack of effective non-curricular climate-related programs among school students. In contrast to our findings, the study by Liarakou *et al.* (2011) found TV as a major source to receive information regarding climate change, followed

by their school's classroom 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 community. About 44.27% of the surveyed students thought that plantation and forest conservation were important adaptation strategies that they could implement in their community. The study conducted by Gautam *et al.* (2021) in Nepal also found a similar result, with the majority of the students citing afforestation as the prime adaptation measure against climate change.

Overall, our study found that the majority of students were aware of general information about climate change but lacked a detailed understanding of 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 receive climate change education, and their role in climate change mitigation.

Conclusions

School education can be a strategic step towards climate education and social awareness as students can inform their parents and community about new knowledge. A good deal of awareness of the impacts of climate change and less awareness of the adaptation strategies for climate change emphasizes 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. This study guides concerned educational institutions in developing strategies and curriculum resources for improving students' knowledge and skills about climate change.

Conflict of interest statement

No conflict of interest is declared by the authors.

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