



CLIMATE CHANGE AWARENESS DIFFERENCES AMONG PRIMARY SCHOOL STUDENTS IN KOREA AND INDONESIA

Abstract. *The pressing issue of climate change demands an informed future generation, yet how aware are students? This study dives into the varying levels of climate change awareness among 1,079 Korean and 2,507 Indonesian primary school students using a sophisticated survey tool developed by Lee et al. (2021). Surprisingly, while both groups exhibited high levels of awareness, significant cross-cultural differences were uncovered. Indonesian students demonstrated higher levels of action, concern, belief, attention, and policy. This stands in stark contrast to Korean students, who, despite having a higher understanding of causes and effects, showed lower levels of belief and attention to the issue. These findings not only challenge us to rethink our educational strategies but also underscore the critical role of cultural contexts in shaping environmental awareness. This comparative analysis reveals startling insights into the complexities of educating the next generation about climate change, setting the stage for urgent educational reforms.*

Keywords: *climate change education, awareness of climate change, cross-cultural comparison, South Korea, Indonesia, primary school students*

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Introduction

The severity of climate change is gradually increasing. Concerns about the environmental, social, and economic impacts of climate change on the whole world are intensifying (Wheeler & von Braun, 2013), and extensive damage to people's health, property, water, and agriculture is gradually increasing due to the increase in the occurrence of extreme events in nature. Moreover, climate stressors such as heat waves, droughts, and floods resulting from climate change are damaging school education around the world by reducing young students' access to school and impairing their cognitive abilities (Prentice et al., 2024).

One of the key tools in responding to climate change is climate change education, which equips students with the competencies necessary to respond to climate change. Recently, as interest in climate change has increased, in the educational field, research related to climate change education is rapidly increasing (Nepras et al., 2022). In the past, climate change education developed scientific knowledge about climate change (Shepardson et al., 2011). However, in response to the fact that knowledge of climate change science has a low correlation with changes in students' awareness and behaviour of climate change (Dijkstra & Goedhart, 2012), recent climate change education focuses not only on knowledge but also on students' overall awareness, including their attitudes and behaviour. Researchers are deriving a variety of approaches that could have an impact on raising the level. Examples of this approach include, firstly, strategies to make students aware that climate change is directly relevant to them by emphasising its relevance to the region in which they currently live (Hestness et al., 2019; Monroe et al., 2019). Secondly, through strategies for student-centred teaching and learning activities that involve students in real-life scientific activities such as scientific inquiries, discussions, and field experience-based learning (Alexandar & Poyyamoli, 2012; Karpudewan et al., 2015; Karpudewan et al., 2015). These strategies focus on changing students' awareness of climate change rather than achieving knowledge.



Still, raising students' awareness of climate change is not an easy task. Climate change contains great complexity and uncertainty. Regarding climate change, there are various groups with conflicts of interest. This tendency influences the conflict of information among the groups (Lehtonen et al., 2019) as well. Due to its features of extensiveness in space and time, climate change and the delay effect from action are significant, and it is difficult to perceive the phenomenon individually (Moser, 2010). In addition, students lack the will to take climate action and feel despair due to the unforeseen future caused by climate change, and the awareness that it is difficult to improve the future at an individual level leads students in this era to become skeptical of possessing the will to do something for climate change (Stevenson & Peterson, 2015).

Primary school students are the generation that would be most affected by climate change because of previous generations' single work/task/things they have done (Hayden et al., 2011). Consequently, they would have to live through uncertain and unstable times in the future (Lee 2013). To overcome the current tendency and to achieve a sustainable future, young generations must possess a high level of awareness of climate change. They also need to take a leading role in climate change action (Hayden et al., 2011; Stevenson et al., 2019). To do so, starting climate change education at the primary school level is essential. This would assist the students' achievement of knowledge, skill, and attitude, and therefore they would be able to accomplish environmental values (Vecchione et al., 2016).

Awareness of climate change varies depending on the dimension of the individual or group. Awareness of climate change is influenced by various factors such as cultural background (Braun et al., 2018), parent's education level and social status (Stevenson et al., 2019), childhood experiences (Cheng & Monroe, 2012), and behaviour of people surrounding them (Clayton et al., 2014), and awareness of science (Lee et al., 2021). Whilst there are vague expectations that Korean and Indonesian students would possess their own awareness of climate change based on these various background factors, comparing the awareness of climate change held by each group of students could offer an in-depth understanding in relation to the factors that influence the formation of awareness of them. Indeed, it would further provide implications for organizing the direction of future climate change education. In short, to provide effective climate change education, students' awareness should be identified, and appropriate strategies should be developed, accordingly (Zaval & Cornwell, 2017).

To establish a strategy for future climate change education for those young learners, examining current primary school students' awareness of climate change would be the essential starting point. This study aimed to explore awareness of climate change by comparing the awareness of climate change among students in two Asian countries, Korea and Indonesia. Effective climate change education is a key tool to assist students equip themselves with the capabilities in order to respond to climate change. By comparing the awareness of climate change among primary school students in South Korea and Indonesia, this study would like to contribute to the creation of an understanding of the impact of cultural backgrounds on students' awareness formation and lay the foundation for developing more effective climate change education strategies. Comparative studies would be a significant contribution to understanding the cultural elements essential to the global application of climate change education and would be able to provide practical guidance to education policymakers and educators. The specific research question of this study was as follows.

What is the awareness of climate change between Korean and Indonesian students?

Research Methodology

Outline

This is a comparative study on the awareness of climate change between Korean and Indonesian students. The questioning tool applied in this study was a tool to test awareness and attitudes toward climate change developed by Bong-Woo Lee et al. (2021). Data collection was carried out for one month in December 2023 through an online questioning tool. The collected data were quantitatively analysed using statistical analysis for the comparison between the two countries. The results were used to discuss the reasons for the difference in awareness between students in the two countries and the direction of climate change education in each country.

Context

South Korea is located on the Korean Peninsula in East Asia and belongs to general temperate climate. Recently, the impact of climate change, such as typhoons, heavy rain, droughts, cold waves, and abnormal temperatures, has been growing rapidly. At the same time, this brought an increase in casualties and property damage (Korea

Meteorological Administration, 2023).

Indonesia is the world's largest archipelago country, located widely near the equator. It is one of the countries most vulnerable to climate change and subsequent disasters (Djalante, 2018) and is experiencing various types of disasters caused by climate change, such as sea level rise, floods, droughts, forest fires, and landslides (Sulistiyawati, et al., 2018).

Significant differences exist between Korea and Indonesia not only in the geographical environment but also in education level, culture, society, and economy. These differences may affect the way primary school students are aware of climate change in the two countries.

Participants

The study participants were 3589 in total. 1079 were Korean, and 2507 were Indonesian. Participants of this study were 4th, 5th, and 6th graders in primary schools in two countries (Table 1). In order to decide the appropriate sample size, using the G power software (ver. 3.1.9.7), an appropriate sample size was calculated (Faul et al., 2007; Faul et al., 2009). The appropriate sample size, considering the statistical method of this study, was revealed to be 176 students. Based on this, more than 1,000 students from each country participated to prove both qualitative and quantitative reliability. The total number of participants who participated in the survey was 3,586 (1,079 from Korea and 2,507 from Indonesia). To recruit large-scale students, on-site primary school teachers who participated in training courses (teacher training or graduate programs) at the university to which the researcher of this research belongs were asked for help in distributing the questionnaires in consideration of the even distribution of the regions. During the survey distribution process, we assured all participants and their guardians of the security of their personal information, the anonymization of identifiable data, and the safety of data storage, and we requested their voluntary participation. Data were collected using a snow bowling technique that was extended and delivered to neighbouring schools.

Table 1
Number of Research Participants

Categories		No. of Participants (person)	
South Korea	Gender	Male	525
		Female	554
	Grade	4th graders	183
		5th graders	237
		6th graders	659
	Sub-total (Korean students)		1,079
Indonesia	Gender	Male	1111
		Female	1396
	Grade	4th graders	716
		5th graders	850
		6th graders	941
	Sub-total (Indonesian Students)		2,507
Total number of participants		3,586	

Questioning Tool: Questionnaire

There are varieties of questioning tools that study climate change awareness. However, many of the tools were designed to study changes in awareness before and after a certain educational action to determine its effectiveness. Also, those questionnaires inevitably contain limitations as they only cover some parts of the elements of climate change awareness. Therefore, many questionnaires in those questioning tools could only be able to offer a certain geographical/cultural context.

In this study, to compare students' awareness of climate change in two different countries, the questionnaire

should minimize deviations that may appear due to sociocultural differences between them. The survey also needs to reflect possible elements of awareness of climate change and be easily tested on a large number of students.

Considering this, the “Awareness and Attitude Test Tool for Climate Change” developed by Lee et al. (2021) was selected as a suitable questionnaire for this study. In their study, Lee et al. (2022) used this tool to study and present differences in climate change awareness according to school level and gender among a total of 604 Korean primary, lower-secondary and upper-secondary school students. The content validity I-CVI score for this test tool appears to be appropriate to be applied in studies with young adolescents with an average of 0.96.

For this study, based on Lee et al. (2021, 2022) study, the questionnaire was developed for primary, lower-secondary, and upper-secondary school students. It was reviewed and systematically developed based on several international academic journals that studied students’ awareness of climate change, therefore, it covers various categories of awareness of climate change, such as interest, knowledge, awareness, behaviour, and policy. In addition, since it is structured in the context of a non-educational course, the influence of cultural, linguistic, and geographical factors on students would be less significant.

This questionnaire consisted of 37 questions in 8 categories (Table 2). The 8 categories are interest in climate change (*hereafter* ‘Attention’), responsibility for climate change (*hereafter* ‘Responsibility’), concern about climate change (*hereafter* ‘Concern’), belief in solving the problem of climate change (*hereafter* ‘Belief’), and the effect of climate change (*hereafter* ‘Effect’), causes of climate change (*hereafter* ‘Cause’), climate change policy (*hereafter* ‘Policy’), and climate change action (*hereafter* ‘Action’) (Table 2).

Table 2
Awareness and Attitude Test Tool for Climate Change (Lee et al., 2021)

Category	Code	Statement
I. Attention for Climate Change		
Attention	I.1	Usually, I am interested in climate change.
	I.2	Personally, I perceive climate change or global warming issues as important.
	I.3	I have looked for information about climate change, before.
	I.4	I think people should pay more attention to climate change.
	I.5	I often talk about climate change or global warming issues with my friends.
	I.6	I often talk about climate change or global warming issues with my family.
	I.7	I often talk about climate change or global warming issues in class.
II. Responsibility for Climate Change		
Responsibility	II.1	I have a responsibility to behave not to cause climate change.
	II.2	People have moral responsibilities and duties to stop climate change.
III. Concern about Climate Change		
Concern	III.1	I am concerned about the issue of climate change.
	III.2	People around me are worried about the issue of climate change.
	III.3	Climate change will become increasingly serious in the future.
IV. Belief in Remedy the Problems		
Belief	IV.1	I believe that the problems of climate change will be solved well.
	IV.2	Scientific technology research will assist in solving the problem of climate change.
	IV.3	Personal practice of mine will assist in solving the problem of climate change.
V. The Effects of Climate Change		

Category	Code	Statement
Effect	V.1	The problem of climate change affects my life.
	V.2	The problem of climate change affects the development of a country.
	V.3	The problem of climate change will affect the lives of my descendants
VI. The Causes of Climate Change		
Cause	VI.1	The problem of climate change is the result derived by human activity.
	VI.2	The use of energy sources such as coal and oil has not affected climate change. (R)
VII. The Policies for Climate Change		
Policy	VII.1	Responding to climate change is a policy that should be implemented preferentially among government policies.
	VII.2	Establishing policies to encourage company participation in solving climate change is needed.
	VII.3	I am in favour of the counter plan of reducing greenhouse gas consumption by taxing greenhouse gas emissions, just as carbon taxes are imposed on gasoline that emits carbon dioxide.
	VII.4	Even though economic losses occur, policies or technologies to reduce greenhouse gases (such as carbon dioxide) should be adopted.
	VII.5	For the responses to climate change, technologies, or patents to cope with climate change (such as carbon dioxide reduction) should be provided free of charge to other countries.
	VII.6	In solving climate change, national policy support is more important than individual practice.
VIII. 'Responsive Action' toward Climate Change		
Action	VIII.1	I turn off the lights when I leave my room.
	VIII.2	I unplug unused electrical appliances.
	VIII.3	I sort waste into categories such as papers, plastics etc when I take them out.
	VIII.4	I carry a personal water bottle.
	VIII.5	I turn off the tap water while I brush my teeth.
	VIII.6	Rather than taking a car, I try to walk or take a bicycle.
	VIII.7	I try to reduce consumption.
	VIII.8	Before I buy something, I think again to affirm if it's necessary.
	VIII.9	I try to reduce the consumption of meat or dairy products.
	VIII.10	I purchase energy-efficient products.
	VIII.11	I tend to buy eco-friendly packed products rather than overpacked ones.

- (R) refers to reverse-scored items

The questioning tool was designed in 8 areas with 37 sub-questions. One reverse scoring question (VI.2) was included. The questionnaires were designed on a 5-point Likert scale: 'Not at all (1 point)', 'Disagree (2 points)', 'Neutral (3 points)', 'Agree (4 points)', and 'Very much agree (5 points)'.

Reliability of the Questioning Tool: Pilot Study

Before data collection, a pilot study was conducted to evaluate the reliability of the questioning tool of this study. The questionnaire was printed out and distributed to 126 fifth graders in Korean primary schools, and 126 responses were returned. Cronbach α , the reliability index of the test tool, was .837 for 'attention', .820 for 'responsibility', .725 for 'concern', .675 for 'belief', .726 for 'effect', .720 for 'cause', .774 for 'policy', and .853 for 'action'. The reliability of each category appeared as reliable, with the overall reliability of each category appearing as .853.

while the reliability of the 'belief' category appeared somewhat questionable. The students were expected to be able to read, understand, and respond to the survey questions in their first language.

Data Collection and Analysis

To compare the awareness of students of the two countries, the questionnaire was translated into the students' native languages. First, the researchers translated the questionnaire into English at a meeting with an English education expert who speaks Korean as her native language. Researchers modified the whole questionnaire to be accurate in its meaning and readable for those young students who joined in the research. Second, the questionnaire, which had been translated into English, was translated into Indonesian by a researcher whose native language is Indonesian.

The questionnaire, translated into Korean and Indonesian, was produced as an online questionnaire by using Google online questionnaire and then distributed to primary school teachers across the regions in both countries. Data collection was conducted over a period of one month in December 2023. As the context and the condition of schools vary, in the cases where access to IoT devices is not easy, students joined an online questionnaire by using their schools' facilities. Also, several questions requested students to answer descriptively, in that case, teachers were assisting them.

SPSS statistical programme (ver. 21.0) was used in all data analysis processes. Descriptive statistics such as mean and standard deviation were conducted for the collected data for basic analysis and to compare the awareness of climate change between Korean and Indonesian primary school students, the overall average and subcategory average of climate change awareness of students from each country were calculated by conducting independent sample t-test. Additionally, an independent samples t-test was conducted for gender comparison.

Research Results

The Comparison of Students' Awareness Toward 8 Categories of Climate Change

To analyse the difference in awareness of climate change between the two countries, Korean and Indonesian students were considered as independent groups. The mean difference was analysed by using an independent samples t-test. Table 3 shows the scores derived from Korean and Indonesian students by 8 categories of awareness of climate change.

Table 3

The Comparison of Students' Awareness Toward Climate Change

Categories	Group				t
	Korea (n = 1079)		Indonesia (n = 2507)		
	M	SD	M	SD	
I. Attention	3.41	0.84	3.89	0.83	-15.464***
II. Responsibility	3.99	0.92	4.02	1.05	-.765
III. Concern	3.92	0.78	4.12	0.91	-6.191***
IV. Belief	3.38	0.87	4.05	0.89	-20.615***
V. Effect	4.10	0.85	3.78	1.11	8.378***
VI. Cause	4.06	0.82	3.50	0.94	16.908***
VII. Policy	3.79	0.74	3.86	0.81	-2.468*
VIII. Action	3.84	0.73	4.27	0.69	-16.628***
SUM	3.81	0.59	3.94	0.67	-5.216***

(* $p < .05$, *** $p < .001$)

As shown in Table 3, the overall average score of Korean and Indonesian students' awareness of climate change

appeared high, over 3.8 points. This represents that students in both countries have a rather high level of awareness of climate change. The overall score was .13 higher in Indonesia (3.94) than in Korea (3.81), which represents that Indonesian students' awareness of climate change is higher than that of Korean students.

According to the analysis results by 8 categories, in seven categories: 'Attention', 'Concern', 'Belief', 'Effect', 'Cause', 'Policy', and 'Action', a significant difference between the two countries showed up. In the categories of 'Effect' and 'Cause', Korean students' scores were higher by a significant difference, and in the 'Action', 'Concern', 'Belief', 'Attention', and 'Policy' categories, Indonesian students' scores were shown significantly higher. Meanwhile, in the 'Responsibility' category, there was no significant difference between the scores of students in the two countries, and both were at a high level.

In terms of awareness of climate change, the categories in which Korean students scored high were 'Effect' (4.10) and 'Cause' (4.06). The categories with low scores were 'Belief' (3.38) and 'Attention' (3.41). On the other hand, the categories with high scores for Indonesian students were 'Action' (4.27) and 'Concern' (4.12), while the categories with low scores were 'Cause' (3.50) and 'Effect' (3.78). In particular, the 'Effect' and 'Cause' categories were found to be highest among Korean students' responses, while they were lowest among Indonesian students. Additionally, it is also characteristic that the 'Belief' and 'Attention' categories among Korean students were at a low level compared to the rest of the categories.

The comparison of the two countries could be summarised as follows. The overall scores of Korean and Indonesian students' awareness of climate change were both higher than average, and the overall scores of Indonesian students were higher than Korean students' by a significant difference. There was a significant difference in the scores of students in the two countries on each category of awareness of climate change. Compared to Indonesian students, Korean students appeared to possess a higher awareness of 'Effect' and 'Cause', while Indonesian students hold a higher awareness of 'Action', 'Belief', 'Concern', 'Policy', and 'Attention'.

Korean students had a high awareness of knowledge and understanding aspects such as the causes of climate change, while Indonesian students had a high awareness of affective aspects such as interest and positive attitude towards climate change and awareness of climate-friendly behaviour.

The Comparison of Awareness in Climate Change Between Korea and Indonesia in Relation to Gender

Differences in awareness of climate change among Korean and Indonesian primary school students in gender were analysed. First, to analyse gender differences, an independent samples t-test was conducted with male and female students as independent groups in each country. The results are shown in Tables 4 and 5. The gender difference in awareness of climate change among Korean primary school students was significant only in the 'Responsibility' category, with female students (4.08) having a higher rate than male students (3.91).

Table 4
Gender Comparison of Awareness of Climate Change of Korean Students

Category	Group (Korean Students)				t
	Male (n = 525)		Female (n = 554)		
	M	SD	M	SD	
I. Attention	3.37	0.89	3.46	0.80	-1.776
II. Responsibility	3.91	0.99	4.08	0.84	-3.047**
III. Concern	3.90	0.81	3.94	0.75	-.780
IV. Belief	3.43	0.96	3.34	0.78	1.744
V. Effect	4.07	0.90	4.13	0.81	-1.192
VI. Cause	4.02	0.85	4.09	0.79	-1.371
VII. Policy	3.80	0.81	3.78	0.67	.426
VIII. Action	3.82	0.79	3.86	0.67	-.823
SUM	3.79	0.64	3.83	0.54	-1.228

(** $p < .01$)

In the case of Indonesia, there was no significant difference between male and female students.

Table 5
Gender Comparison of Awareness of Climate Change of Indonesian Students

Category	Group (Indonesian Students)				t
	Male (n = 1111)		Female (n = 1396)		
	M	SD	M	SD	
I. Attention	3.87	0.83	3.90	0.82	-.665
II. Responsibility	4.00	1.08	4.04	1.02	-.761
III. Concern	4.14	0.89	4.10	0.92	0.981
IV. Belief	4.04	0.90	4.06	0.89	-.361
V. Effect	3.81	1.10	3.76	1.12	1.118
VI. Cause	3.52	0.98	3.48	0.90	1.082
VII. Policy	3.87	0.81	3.85	0.81	.847
VIII. Action	4.24	0.70	4.28	0.68	-1.481
SUM	3.94	0.67	3.93	0.66	.215

To analyse differences between gender groups, male and female students were separated, and an independent samples t-test was conducted using Korea and Indonesia as independent groups. The results are shown in Table 6 and Table 7. As for male students' awareness of climate change, Indonesian students' awareness of climate change was higher than that of Korean students, and there were differences between categories. In the categories of attention, concern, belief, and action, Indonesian students' awareness was high, and in the category of effect and cause, Korean students' awareness was high.

Table 6
Comparison of Awareness of Climate Change of Male Students of Korea and Indonesia

Category	Group (Male students)				t
	Korea (n = 525)		Indonesia (n = 1111)		
	M	SD	M	SD	
I. Attention	3.37	0.89	3.87	0.83	-11.193***
II. Responsibility	3.91	0.99	4.00	1.08	-1.761
III. Concern	3.90	0.81	4.14	0.89	-5.148***
IV. Belief	3.43	0.96	4.04	0.90	-12.570***
V. Effect	4.07	0.90	3.81	1.10	4.685***
VI. Cause	4.02	0.85	3.52	0.98	10.003***
VII. Policy	3.80	0.81	3.87	0.81	-1.785
VIII. Action	3.82	0.79	4.24	0.70	-10.849***
SUM	3.79	0.64	3.94	0.67	-4.235***

(*** $p < .001$)

In terms of female students' awareness of climate change, Indonesian students' awareness of climate change appeared higher than that of Korean students, and there were differences between categories. Indonesian female students' awareness was high in the categories of attention, concern, belief, and action, and Korean female students' awareness was high in the categories of effect and cause. The gender differences between countries in the

awareness of climate change were shown as similar to the results in Table 3 which represented the comparison of the awareness of climate change between the two countries.

Table 7

Comparison of Awareness of Climate Change of Female Students of Korea and Indonesia

Category	Group (Female Students)				t
	Korea (n = 554)		Indonesia (n = 1396)		
	M	SD	M	SD	
I. Attention	3.46	0.80	3.90	0.82	-10.569***
II. Responsibility	4.08	0.84	4.04	1.02	.832
III. Concern	3.94	0.75	4.10	0.92	-3.686***
IV. Belief	3.34	0.78	4.06	0.89	-16.591***
V. Effect	4.13	0.81	3.76	1.12	7.067***
VI. Cause	4.09	0.79	3.48	0.90	13.893***
VII. Policy	3.78	0.67	3.85	0.81	-1.753
VIII. Action	3.86	0.67	4.28	0.68	-12.548***
SUM	3.83	0.54	3.93	0.66	-3.107**

(** $p < .01$, *** $p < .001$)

The analysis indicates that the difference in awareness of climate change between Korean and Indonesian students according to gender appeared similar to the result of the cross-country comparison. Based on these results, it can be perceived that the difference in awareness of climate change according to gender is not significant.

The Comparison of Awareness in Climate Change Between Korea and Indonesia in Relation to 37 Questionnaires

In order to compare Korean and Indonesian primary school students' awareness of climate change specifically, the differences in 37 questions about research participants' awareness of climate change were analysed. To do so, Korean and Indonesian students were considered as independent groups, and an independent samples t-test was conducted. Table 8 shows the results of comparing the scores of Korean and Indonesian students for each sub-question of the 'attention' category. In the category of 'attention', in all seven questions, significant differences were observed between the scores of students of the two countries. In questions 1, 2, 3, 5, 6, and 7, Indonesian students' scores were higher than Korean students by a significant difference. In question 4, Korean students' scores were more significant than those of Indonesian students.

Questions 1, 2, and 3 are related to the students' own interest in climate change, and question 4 is about the general interest of people from the awareness of the student. From these results, it could be considered that Korean students perceive that Koreans have an overall lack of interest in climate change. On the other hand, Indonesian students' awareness of Indonesian people's interest in climate change appeared significant. Indonesian students' responses scored relatively high on question 2, "The issue of climate change or global warming is personally important to me," indicating that they believe the issue of climate change is as close as their personal issue. Additionally, the scores for questions 5, 6, and 7 demonstrated that climate change is a social concern in Indonesia, but in Korea, the interest in climate change appeared relatively low.



Table 8*The Results of Comparing the Scores of Korean and Indonesian Students of the 'Attention' category*

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
I. Attention	I.1	3.37	1.15	3.83	1.27	-10.118***
	I.2	3.72	1.13	4.27	1.06	-14.062***
	I.3	3.39	1.29	3.84	1.20	-10.036***
	I.4	4.38	0.89	4.29	1.04	2.464*
	I.5	2.68	1.31	3.65	1.23	-21.324***
	I.6	2.93	1.34	3.68	1.23	-16.354***
	I.7	3.44	1.19	3.63	1.22	-4.296***

(* $p < .05$, *** $p < .001$)

Table 9 shows the results of comparing the scores of Korean and Indonesian students for each sub-item of the 'responsibility' category among awareness of climate change. In the 'responsibility' category, there was a significant difference between the scores of students from the two countries in all two questions.

In question 1, Indonesian students' scores were significantly higher, while in question 2, Korean students' scores were significantly higher. There was no significant difference between the scores of students in the two countries in the 'Responsibility' category (Result 1) because the differences in scores for each question were summed up.

Question 1 was "I have a responsibility to act to prevent climate change." and Question 2 was "We have a moral responsibility and obligation to stop climate change." The two questions could be differently understood in the different use of subject expressions such as 'I' and 'We'. The nuances were also different as question 1 was about preventing climate change occurrence and question 2 was about remedying climate change that has already occurred. In terms of 'responsibility', while Indonesian students considered it important to "prevent climate change from occurring" with "I" as the centre, Korean students focused on "we" and believed that "We will solve climate change that has already occurred." seemed to be considered important.

Table 9*The Results of Comparing the Scores of Korean and Indonesian Students of the 'Responsibility' Category*

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
II. Responsibility	II.1	3.91	1.06	4.14	1.15	-5.597***
	II.2	4.08	0.98	3.91	1.30	3.901***

(***) $p < .001$

Table 10 represents the results of comparing the scores of Korean and Indonesian students for each sub-question of the 'Concern' category. In the 'Concern' category, Indonesian students' scores were shown significantly higher in question 2, and Korean students' scores were significantly higher in question 3.

Question 2 was "People around me are worried about climate change issues," and the score of Korean students was 3.30. This indicates that Korean students seem to perceive Korean people as less concerned about climate change. On the other hand, regarding question 3, "Climate change will become increasingly serious in the future," the awareness of students in both countries was significantly high. In particular, Korean students' awareness was higher compared to Indonesian students.

Table 10

The Results of Comparing the Scores of Korean and Indonesian Students of the 'Concern' Category

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
III. Concern	III.1	4.07	1.05	4.12	1.11	-1.374
	III.2	3.30	1.15	4.05	1.11	-18.261***
	III.3	4.39	0.86	4.18	1.14	5.410***

(***) $p < .001$

Table 11 indicates the results of comparing the scores of Korean and Indonesian students for the three sub-items of the 'belief' category on awareness of climate change. In the 'Belief' category, Questions 1, 2, and 3 all referred to how much faith they have in solving the climate change problem and whether they consider science and technology would support solving the climate change problem. Indonesian students' scores were significantly higher in all three questions. This could be interpreted that Korean students recognise that the problems of climate change would not be resolved easily and consider future climate change in a rather negative way.

Table 11*The Results of Comparing the Scores of Korean and Indonesian Students of the 'Belief' Category*

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
IV. Belief	IV.1	2.84	1.25	4.24	1.02	-35.190***
	IV.2	3.56	1.12	4.07	1.10	-12.517***
	IV.3	3.75	1.09	3.85	1.17	-2.204*

(* $p < .05$, *** $p < .001$)

Table 12 illustrates the results of comparing the scores of Korean and Indonesian students for the three sub-questions of the 'Effects' category. Each question in the 'effect' category asks about the rate of climate change effects on individuals, individuals' countries, and individuals' descendants. In the 'Effect' category, Korean students' scores appeared significantly higher in questions 1 and 3. This represents Korean students' higher degree of awareness of the 'Effect' of climate change.

Table 12*The Results of Comparing the Scores of Korean and Indonesian Students of the 'Effects' Category*

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
V. Effects	V.1	4.08	1.07	3.88	1.27	4.592***
	V.2	3.88	1.10	3.96	1.23	-1.847
	V.3	4.35	0.94	3.52	1.40	17.835***

(***) $p < .001$

Table 13 displays the results of comparing the scores of Korean and Indonesian students for the two sub-questions of the 'Cause' category among awareness of climate change. In the 'Cause' category, Korean students' scores appeared significantly high. Question 1 was "Climate change is a result induced by human activities." Korean students seem to have a higher awareness that climate change is caused by human activities, such as greenhouse

gas emissions. Question 2 was a reverse scoring question: “The use of energy such as coal and oil is not related to climate change.” Indonesian students’ scores remained at the average level. This seems to represent that the Indonesian students seem to possess a low understanding of the correlation between greenhouse gas emissions and climate change caused by energy usage.

Table 13

The Results of Comparing the Scores of Korean and Indonesian Students of the ‘Cause’ Category

Category and Statement	Group				<i>t</i>	
	Korea (<i>n</i> = 1079)		Indonesia (<i>n</i> = 2507)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
VI. Cause	VI.1	4.23	0.99	4.00	1.22	5.491***
	VI.2	3.89	1.28	3.00	1.48	17.066***

(*** $p < .001$)

Table 14 shows the results of comparing the scores of Korean and Indonesian students for the six sub-questions of the ‘Policy’ category among awareness of climate change. In the category of ‘Attention’, which was previously discussed in Table 8, there was a significant difference between the scores of students from the two countries in all three questions.

In the category of ‘Policy’ (Table 14), In questions 3 and 6, Indonesian students’ scores were higher by a significant difference, and in question 5, Korean students’ scores were higher by a significant difference. Question 3 was “I am in favour of reducing greenhouse gas use by imposing a tax on greenhouse gas emissions, such as imposing a carbon tax on gasoline that emits carbon dioxide.” Indonesian students were highly aware of the effectiveness of government policies such as charging carbon tax. Question 6 was “National policy support is more important than individual action in solving climate change problems.” Similar to question 3, question 6 contains the importance of governmental action in responding to prevent climate change.

These results show that Indonesian students possess a higher awareness of government policies than Korean students. Question 5, “In order to respond to climate change, technologies and patents to respond to climate change, such as carbon dioxide reduction, should be provided free of charge to other countries.” refers to the importance of science and technology and international cooperation in responding to climate change. The Korean students’ response to this question was significantly high with a significant difference.

Table 14

The Results of Comparing the Scores of Korean and Indonesian Students of the ‘Policy’ Category

Category and Statement	Group				<i>t</i>	
	Korea (<i>n</i> = 1079)		Indonesia (<i>n</i> = 2507)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
VII. Policy	VII.1	3.95	0.98	3.97	1.18	-.473
	VII.2	4.03	0.94	4.11	1.10	-1.906
	VII.3	3.79	1.09	4.01	1.14	-5.405***
	VII.4	3.86	1.00	3.80	1.19	1.403
	VII.5	3.62	1.04	3.34	1.36	6.029***
	VII.6	3.47	1.14	3.92	1.20	-10.474***

(*** $p < .001$)

Table 15 shows the results of comparing the scores of Korean and Indonesian students for the 11 sub-questions of the ‘Action’ category among awareness of climate change. In the ‘Action’ category, significant differences were found between the scores of students from the two countries across all 11 questions. In questions 1, 2, 4, 5, 6, 8, 9,

10, and 11, Indonesian students' scores were higher by a significant difference, and in questions 3 and 7, Korean students' scores were higher by a significant difference.

Indonesian students scored high on questions related to energy and water. In the case of Korean students, question 3, "I separate and collect paper, glass, plastic, etc." the score was significant as the practice of separate recycling has become a habit in daily life in Korea. In addition, Korean students also scored high on question 7, "I try to reduce consumption." which is thought to be due to Korean students having more chances to consume much in their daily lives.

In question 9, the awareness of students in both countries appeared low compared to the rest of the questions in the category. This could be considered as the students were not able to relate livestock farming to greenhouse gas emissions.

Table 15

The Results of Comparing the Scores of Korean and Indonesian Students of the 'Action' Category

Category and Statement	Group				t	
	Korea (n = 1079)		Indonesia (n = 2507)			
	M	SD	M	SD		
VIII.1	4.36	0.98	4.55	0.92	-5.523***	
VIII.2	3.62	1.29	4.52	0.96	-23.080***	
VIII.3	4.36	0.94	4.28	1.08	1.998*	
VIII.4	4.21	1.16	4.57	0.90	-10.056***	
VIII.5	4.36	1.04	4.46	0.98	-2.705**	
VIII. Action	VIII.6	3.63	1.28	4.26	1.05	-15.428***
VIII.7	3.81	1.10	3.72	1.26	2.096*	
VIII.8	3.83	1.19	4.45	0.95	-16.535***	
VIII.9	3.16	1.25	3.32	1.36	3.254**	
VIII.10	3.45	1.17	4.36	0.98	-23.700***	
VIII.11	3.43	1.12	4.43	0.96	-27.209***	

(* $p < .05$, ** $p < .01$, *** $p < .001$)

As a result of comparing the responses of Korean and Indonesian students according to the eight categories, significant differences were found in almost all questions between the students of the two countries. Contrary to expectations, the high and low scores of each category were shown in both countries. The result of taking a close look at the awareness of primary school students in Korea and Indonesia in detail for each question, several characteristics could be found as follows.

Firstly, the awareness of climate change has grown in both country primary school students' surroundings. As shown in the 'Attention' and 'Concern' categories, Korean students perceived that their neighbours have little attention or concern about climate change, while Indonesian students perceived that their surroundings have strong attention and concern about climate change. This could be interpreted as reflecting the experiences students experience about the people around them in their daily lives. Secondly, Korean students seemed to perceive the possibility of solving future climate change problems to be low (2.84), while Indonesian students perceived it to be quite high (4.24). Thirdly, Indonesian students generally appeared to retain a high level of awareness of climate change, but they perceived the relationship between fossil fuel use and climate change shown low (3.00) compared to the rest of the causes of climate change in the questionnaire. Indonesian students recognise that climate change is related to human activities, but it seems that they mainly consider various other causes as well.

Although it was difficult to determine the cause of the reason of low expectations of Korean students about the possibility of solving future climate change problems, it is worth exploring the causes of Korean students' exceptionally low beliefs later, as the awareness of belief plays an important role in forming a perceived subject in solving the climate change problem.

Discussion

Studies comparing students' awareness of climate change internationally are rare. Oliver and Adkins (2020) analysed secondary data from PISA targeting 15-year-old students and analysed the relationship between awareness of climate change and other variables. Nepras et al. (2023) analysed 473 Czech, British, and Portuguese students' survey responses on knowledge and attitudes toward climate change. These previous studies revealed that there were differences in people's awareness of climate change according to national diversity. Therefore, this study is significant as it explored the awareness of climate change among primary school students in two countries of Asia: Korea and Indonesia, which have never been comparatively studied before. The focus of this study was on the differences in awareness of climate change between students in the two countries.

Comparison of Korean Students' and Indonesian Students' Climate Change Awareness

Firstly, significant differences, in terms of differences in awareness of both country students, were observed between Korean and Indonesian students. Awareness of climate change was influenced by not only socio-economic factors such as difficult economic conditions (Weber, 2010) and GDP growth rate (Shum, 2012), but also political factors such as political orientation (Capstick et al., 2015) and political events (Leiserowitz et al., 2013). In addition to this, various factors such as fatigue due to frequent mention of climate change (Pidgeon, 2012) also influenced.

Secondly, in terms of gender comparison between the two countries, no significant result was spotted. Several studies previously done by analysing students' awareness of climate change have shown that gender, age, and grade are meaningful factors influencing awareness of climate change (Hermans & Korhonen, 2017; Nepras et al., 2022; Stevenson et al., 2014; Stevenson et al., 2019). In particular, compared to males, females were highly aware of various aspects of climate change awareness, such as willingness to act, attitude, and concern (Hermans & Korhonen, 2017; Lehnert et al., 2020; Ratinen & Uusiautti, 2020). Not like the previous studies, in this study, there was no significant difference according to gender.

Comparison of Factors that Influence Those Students' Climate Change Awareness

Socioeconomic and Cultural Factors

Previous studies have shown that socioeconomic level and cultural background are correlated with a positive interest in climate change of people and sustainability (Braun et al., 2018; Stevenson et al., 2019). School curriculum and education systems have appeared to be also related to 'Attention' to climate change (Curin & Mikolasikova, 2021; Jurek et al., 2022).

Generally, the threat of climate change is perceived to be much greater in developing countries (Lee et al., 2015). Indonesia, a developing country, may have a relatively large number of people with low financial sufficiency, and this may influence their awareness of the effects of climate change to be vulnerable (Djalante & Thomalla, 2012). People of rural residents and low-income people could be considered more vulnerable to climate change compared to other groups on the opposite side and, therefore, tend to perceive climate change as a more immediate and proximate phenomenon (Brügger et al., 2021). This would be one of the ways to explain the differences between the two countries of this study. Additionally, Indonesia is one of the countries highly exposed to the threat of climate change (Djalante, 2018). Indonesia's major industries, fisheries and agriculture, are greatly affected by climate change (Glaeser & Glaser 2010) and are experiencing various disasters caused by climate change, such as sea level rise, floods, droughts, forest fires, and landslides due to their geographical location and climate (Sulistiyawati et al., 2018). Large cities such as Jakarta, located on the coast, are under threat of flooding due to the changes in the groundwater level (Sulistiyawati, et al 2018). Furthermore, according to Sofiyani et al. (2019), most schools in Indonesia are in disaster-prone areas, so students are becoming more vulnerable to climate disasters. These direct damages affect people's awareness of climate change. Research results on Brügger et al.'s (2021) study on residents of high-altitude areas in the Andes and Lavrillier's (2013) study on residents of Siberia reported the changes in residents' awareness due to climate change, and this study revisited their points.

Unlike Indonesia, which is directly and multifacetedly affected by climate change, Korea has relatively few disasters caused by climate change. For Korean students, climate change may be perceived as a distant phenom-

enon that occurs in places far from their daily lives. If the effects are not directly felt, Korean students' interest in climate change may decrease, and it may be thought that there is no need to be concerned (Antronico et al., 2020). In other words, the phenomenon of long-term climate change, which is not significantly recognisable, is thought to have had a strong impact on students' awareness.

In this research, students in both countries appeared to have a high level of awareness. However, among 8 categories, in some categories, relatively low awareness was observed. Korean students showed low scores in the 'belief' category. The 'belief' category concerns beliefs and expectations about solving the problem of climate change, and despite one's interest, it is reported that this is due to low expectations, helplessness, pessimistic feelings, and despair about solving the problem (Stevenson & Peterson, 2015). The awareness of 'belief' is highly related to participation action in climate change (Li & Monroe, 2019). This appears when there is no effort from the personal, regional, and governmental level to address climate change and when problem solving is perceived as separate from the students themselves (Karsgaard & Davidson, 2023; Ross et al., 2021). The awareness of 'belief' is influenced by its ability to achieve real change at the individual, local, and governmental levels (Ross et al., 2021). Therefore, in order to increase awareness of 'belief', people need to first recognise the climate change issue as a serious problem related to themselves and recognise actions that can be taken personally regarding the climate change problem, thereby strengthening self-efficacy (Anderson, 2012). Additionally, 'efforts' at the government and societal level must be actively promoted. One of the ways could be conducting education to alleviate negative emotions such as fear or anger about climate change (Trott, 2022). Through this, students would be able to form a recognised subjectivity on climate change issues.

Educational Factors

In this study, Indonesian students showed low scores in the 'Cause' category. The 'Cause' category is related to understanding the causes of climate change. As the Earth's climate system is complex, many students have various alternative concepts in understanding climate change-related scientific concepts (Shepardson et al., 2011; Varela et al., 2020). This various awareness could be re-formed through the inflow of new knowledge and experience.

In Korea, the relationship between climate change and human activities is mainly taught at the high school level because it requires an understanding of the basic principles of the carbon cycle and the greenhouse effect (Littrell et al., 2020). Until then, students hold their awareness of climate change. Having an accurate conceptual understanding of the causes of climate change influences informed behaviour and willingness to act (Bord et al., 2000; Hung, 2022; Shepardson et al. 2009). Blind behaviour without accurate understanding would be connected to indifference, and if these misunderstandings are not corrected and persist for a long time into adulthood, they may be difficult to eliminate (Hung, 2022). Therefore, it is necessary to provide a school curriculum on climate change appropriate for the primary school level. An explicit guide in relation to the causes of climate change needs to be taught.

As discussed above, there were differences in the areas of vulnerability of students in Korea and Indonesia in terms of their awareness of climate change. So, it is important to adjust the content and methods of climate change education to be suitable for the students and the context (Zaval & Cornwell, 2017). To support students' awareness of climate change, appropriate educational strategies need to be designed according to the suggested 8 categories.

Limitations

The limitation of this study is the data collection period. Data was collected in December 2023. Korea experienced a cold wave during this period. To Korean students, cold waves tend to be considered something far from abnormal weather phenomena such as heat waves and floods. Therefore, experiencing low temperatures is reported to be related to skepticism about climate change issues (Capstick et al. 2015; Zaval et al., 2014). Inevitably, the timing of data collection, depending on the climate in Indonesia and Korea, may have influenced the research results.

Conclusions

The research question of this study was about the awareness of climate change between Korean and Indonesian primary school students. The results of this study revealed that students in two Asian countries, Korea, and Indonesia, possessed relatively high awareness of climate change.

Compared to Korean students, in the case of Indonesian students, they were holding higher awareness of climate change. In the 'Cause' category, the scores of Korean students were higher by a significant difference, and in the 'Action', 'Concern', 'Belief', 'Attention', and 'Policy' categories, the scores of Indonesian students were higher by a significant difference. There was no significant difference according to gender. By comparing each question, the differences between the two countries are also compared at a specific level.

In order to compare Korean and Indonesian primary school students' awareness of climate change specifically, the differences in 8 categories and 37 sub-questions about research participants' awareness of climate change were analysed.

Regarding the 'Attention', the overall scores of Korean and Indonesian students' awareness of climate change were both higher than average, and the overall scores of Indonesian students were higher than Korean students' by a significant difference. In the 'responsibility' category, there was a significant difference between the scores of students from the two countries in all two sub-questions. In the 'Concern' category, Indonesian students' scores were shown significantly higher in question 2, and Korean students' scores were significantly higher in question 3. In the 'Belief' category, Indonesian students' scores were significantly higher in all three questions. In the 'Effect' category, Korean students' scores appeared significantly higher in questions 1 and 3. In the 'Cause' category, Korean students' scores appeared significantly high. In the category of 'Attention', there was a significant difference between the scores of students from the two countries in all three questions. In the 'Action' category, significant differences were found between the scores of students from the two countries across all 11 questions. In questions 1, 2, 4, 5, 6, 8, 9, 10, and 11, Indonesian students' scores were higher by a significant difference, and in questions 3 and 7, Korean students' scores were higher by a significant difference. Gender comparisons were also conducted, and no significant meaning was found.

Overall, in this study, Indonesian students' awareness of climate change was significantly higher than that of Korean students. Characteristically, Indonesia is strongly affected by climate due to its geographical characteristics, so it turns out that there is not a strong perception of the causal relationship between energy use and climate change. Since the influence of climate change goes beyond national geographic characteristics, it is necessary to explain the climate change phenomena of various countries related to various geographic characteristics should be explicitly aware.

From these differences, each country's climate change circumstances and geographic background could affect the climate change awareness of people. Therefore, it is necessary to design appropriate climate change education strategies for each country. This study provides a deep understanding of awareness of climate change in both countries. Through this, in the era the seriousness of climate change is gradually emerging as an international concern, specified strategies in the national level and local level could be developed. The results of this study suggest that climate change education should be customised in consideration of students' regional and cultural contexts and provide important basic data for developing and evaluating future educational strategies.

Climate change is getting serious. Many countries have started to recognise the seriousness of climate change and its influence on them and the world. The negative influence caused by climate change will gradually intensify. Therefore, educators and policymakers should understand that students' perceptions may change as the impact of climate change increases and that climate change education strategies must change accordingly. It is necessary to regularly diagnose students' perceptions of climate change and establish an effective educational strategy based on them.

Declaration of Interest

The authors declare no competing interest.

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