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This research ethics clearance application for this project submitted on July,25 2023 has been reviewed and approved by Srinakarinwirot University ethics committee **(**Ref. SWUEC-G-198/2566X**)**. The committee was satisfied with the procedures to ensure participant anonymity, informed consent, confidentiality, and data security. All participants are able to withdraw from, or leave, the study at any point in time. They know the purpose, benefits, risks, and funding behind the study before they agree or decline to join. Personally identifiable data is not collected. Physical, social, psychological and all other types of harm are kept to an absolute minimum.

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Abstract

Climate change is a major threat to the future of today's youth. Education is one of the factors that prepares individuals and communities in climate change mitigation and adaptation processes. However, in order to help people to comprehend the various messages around climate change, it is important to understand the level of climate change awareness of younger people. This study, therefore, examine upper secondary school students' awareness of climate change regarding climate change understanding, climate attitude and climate action. The sample group of this research was 250 students from the school in central Thailand. The climate change awareness assessment consists of understanding about climate change true-false test and climate change awareness five rating scales test. Validity and Reliability of true-false test was the index of Item objective congruence for each of the items was in the range 0.67-1.00. In terms of reliability was .70. The climate change awareness five rating scales test revealed that the item objective congruence for each item ranged from 0.67 to 1.00, and the reliability was 0.97. This study analyzes data using descriptive statistics. The findings revealed that male students are increasingly aware of climate change than female students. We found that students' awareness of climate change is affected by their gender and academic program.

Keyword: Climate change awareness, Upper secondary school

Introduction

One of the most significant concerns facing humanity in the twenty-first century is climate change. Many regions, communities, ecosystems, and industries are impacted by the highly unpredictable effects of climate change, which include altered overall climatic conditions, a higher risk of natural disasters, and an increasing degree of uncertainty regarding future climate (Global Education Monitoring Report, 2022). Many studies have shown that different human activities, such as the industrial revolution and agriculture, are the main factors causing this change (Jones et al., 2023). Humans are currently facing extreme climate change, which includes rising sea levels, warming seas, shorter and warmer winters, melting glaciers, and many other common extreme weather events. In order to shift to a more sustainable future, we need to rethink what, where, and how we teach the values, knowledge, and attitudes that empower each of us to make effective choices and take individual as well as collective action in dealing with local, national, and international crisis situations (United Nations Educational & Cultural, 2022; Venkatramanan, Shah, & Prasad, 2020). UNESCO, as the United Nations' specialized agency for education, is entrusted to lead and coordinate the Education 2030 Agenda, which is part of a global movement to eradicate poverty through 17 Sustainable Development Goals by 2030. Education is essential to achieving all of these goals under the guidance of the education for sustainable development (ESD) approach. Students are empowered to make responsible decisions and take appropriate action to protect the

environment, ensure economic viability, and create a just society for the next generation (United Nations Educational & Cultural, 2023).

The education for sustainable development framework defines climate change awareness as one of the components that are included in the key competencies for sustainability, which is one of the components that are assessed in the program for international student assessment (PISA) (OECD, 2023). The learning objectives for SDG 13 climate action are described in the cognitive, socio-emotional, and behavioral domains(United Nations Educational & Cultural, 2017). Youth's awareness of climate change must be considered in general know-how about the phenomenon, effects generated by change in climate, and causes and impacts of climate change (Abbasi & Nawaz, 2020). Educational organizations suggest that students should be encouraged to become leaders in how to mitigate and prevent climate change, take responsibility for its impacts, and start addressing environmental issues. (Global Education Monitoring Report, 2022; United Nations Educational & Cultural, 2019b) According to related research, it was found that previous research has studied different components of climate change awareness, such as knowledge about climate change, climate behavior, attitudes towards climate change, anxiety about climate change, and interests in the climate.(Ekpo & Olatunde-Aiyedun, 2019; Jürkenbeck, Spiller, & Schulze, 2021; Kuthe et al., 2019; Manosorn & Samiphak, 2022; Oliver & Adkins, 2020; United Nations Educational & Cultural, 2019a). Following a review of related research, this study indicates that there are three primary components to climate change awareness: 1) climate understanding, 2) climate attitude, and 3) climate behaviors. According to study findings, 10.3 million children under the age of 18, or more than 75% of children in the whole nation, are expected to be impacted by climate change. As a result, it is important to promote climate change awareness among children and youths to adapt and find ways to mitigate the impacts of climate change (Esringü & Toy, 2022; Masson-Delmotte et al., 2021).

Climate change education is a critical tool to help young people understand and address the impacts of climate change. It aims to develop understanding, values and behaviors that can advance collective climate action. It covers both adaptation and mitigation of climate change, with a focus on climate justice and indigenous knowledge when appropriate. Hence, if we understand and adapt the climate change education effectively, there is a need to understand the level of youth's knowledge, attitude, and behavior about climate change and what they think are the causes and effects of climate change and what possible action can be made toward climate change. Moreover, and to determine the factors that influenced their awareness. Specifically, the study aims to identify the factor most accessible to the students and have affected their level of awareness on climate change. The research questions include 1) What is the level of climate change awareness among upper secondary school students in the central region of Thailand, and 2) What factors affect the climate change awareness level of upper secondary school students?

Materials and Methods

The study focuses on the investigating the level of awareness of upper secondary school students in Central region, Thailand and to determine the factors that influenced their awareness. The data for the study were collected by a survey technique that selected students through a multi-stage random selection process. A total of 250 upper secondary school students under the office of the basic education commission in the central region were chosen through a multi-stage random sampling process; the specific random steps are as follows: First, divide the stratified random sampling into four sizes: extra-large (more than 2,500 students), large

(1,500 to 2,499 students), medium (500 to 1,499), and small (less than 500 students). The second step is to use simple random sampling, which uses four central region schools as a representative sample of four sizes of schools. Finally, cluster random sampling was used to select five classrooms from the four school sizes.

The demographic characteristics of the respondents demonstrate in Table 1. For grade level,106 (42.4%) are in Grade 11, 80 (32%) are in Grade 12, and 64 (25.6%) are in Grade 10. 166 (66.4%) of the students' respondents are female. While separated respondents in program of the study, ,166 students (57.6%) studied in the science-mathematics program, while 106 students (42.4%) studied in the arts-mathematics program. Furthermore, for achievements, respondents were classified into three group based on their grade point average (GPA), the results showed that154 (61.6%), 70 (28%), and 26 (10.4%) are within the proficient level (3.51 – 4.00), advanced level (2.52-3.50), and basic level (1.00-2.51), respectively.

Table 1. Descriptive statistics related to the sample of students in central region, Thailand

Variable	Characteristics	Frequency	Percentage
Education level	Grade 10	64	25.6
	Grade 11	106	42.4
	Grade 12	80	32.0
Gender	Male	84	33.6
	Female	166	66.4
Academic program	Science-Mathematics	144	57.6
	Arts-Mathematics	106	42.4
Grade Point Average (GPA)	Advanced (4)	70	28.0
	Proficient (2.5, 3, 3.5)	154	61.6
	Basic (1, 1.5, 2)	26	10.4

The components of climate change awareness in this study include 1) understanding about climate change, 2) climate change attitude and 3) climate change behavior. The instrument to assess youth' s awareness of climate change consisted of true-false items about an understanding of climate change test and five rating scales questionnaires of climate change attitude and behavior. Both test and questionnaire items were evaluated by three experts using Index of Item Objective Congruence (IOC). The IOC results were between 0.67-1.00. Then, the test and questionnaire were pilot with 35 upper secondary school students. The reliability of an understanding test and climate change attitude and behavior questionnaire were 0.70 and 0.97, respectively.

Results

The respondents' level of awareness in each component reveals that student' climate understanding (Mean = 3.02, SD = 4.35), student' climate attitude (Mean = 3.36, SD = 0.58), and student' climate behavior (Mean = 3.33, SD = 0.42) were at needs improvement level as show in Table 2.

Table 2. Descriptive Statistics on Awareness of Climate Change in each component.

Climate change awareness	N	Total score	Min	Max	Mean	SD	Level of climate change awareness
Climate Understanding	250	10.00	0.00	10.00	3.02	4.35	Needs improvement
Climate Change Attitude	250	5.00	2.13	4.00	3.36	0.58	Needs improvement
Climate behavior	250	5.00	2.48	3.90	3.33	0.42	Needs improvement

When compared by gender, it is showed that the mean scores of male climate change awareness (M = 4.23, S.D. = 2.59) were higher than female (M = 3.90, S.D. =2.39) as show in Table 3.

Table 3. Mean score of male and female on climate change awareness.

Gender	N	Total score	Min	Max	Mean	SD
Male	84	20.00	1.54	9.30	4.23	2.59
Female	166	20.00	1.49	9.32	3.90	2.39

The comparison between academic program, the mean score of Science-Mathematics and Arts-Mathematics program on climate change awareness are presented in Table 3. It showed that the mean scores of students in Science-Mathematics program (M = 4.94, S.D. = 2.43) were higher than Arts-Mathematics program (M = 3.34, S.D. =2.01) as show in Table 4.

Table 4. Mean score of Science-Mathematics and Arts-Mathematics program on climate change awareness.

Academic program	N	Total score	Min	Max	Mean	SD
Science-Mathematics program	144	20.00	1.43	9.41	4.94	2.43
Arts-Mathematics program	106	20.00	2.68	8.72	3.34	2.01

The comparison between grade point average, the mean score of grade point average on climate change awareness are presented in Table 5. It showed that the mean scores of students in advanced level (M = 10.24, S.D. = 0.53) were higher than proficient and basic level (M = 7.97, S.D. =0.56), (M = 4.27, S.D. =0.63).

Grade Point Average (GPA)	N	Total score	Min	Max	Mean	SD
Advanced	70	20.00	4.23	16.43	10.24	0.53
Proficient	154	20.00	2.68	12.58	7.97	0.56
Basic	26	20.00	1.83	6.39	4.27	0.63

The correlation coefficient between climate change attitude and behavior was a positive relationship (0.662). In particular, the correlation coefficient between climate change understanding and attitude as well as behavior was close to zero (0.022, 0.044). There is an unrelated relationship shown in Table 5.

Table 6. Correlation analysis

Variables	Climate change Understanding	Climate Change Attitude	Climate Action
Climate change Understanding	1.00	-	-
Climate Change Attitude	0.022	1.00	-
Climate Behavior	0.044	0.662	1.00

**Correlation is significant at the 0.01 level

Discussion

In order to mitigate its effects and prepare for future challenges, Gönen, Deveci, and Aydede (2023) investigated human behavior and knowledge on climate change, particularly in relation to adaptation and mitigation to climate change issues. We can better prepare for the effects of changes in long-term climate patterns and temperatures by understanding the basics of climate change and how it affects the climate. In this study, the results reveals that upper secondary school students in Central Region, Thailand climate change awareness were at needs improvement level. Male students were better than female students, which result is similar to that gender had significant effects on climate change awareness (Ratinen & Uusiautti, 2020; Shrestha & Baral, 2018). In addition, students in science stream are better than art stream. This might because of science students had learn about climate change more than art students (Jurek et al., 2022). For climate change understanding, students understand that the greenhouse effect as a natural phenomenon caused by an insulating layer of greenhouse gases, which is consistent with previous findings (Nantsou & Tombras, 2022; Wróblewska & Okraszewska, 2020). However, the correlation results indicated that understanding has no correlation with attitude and behavior which is consistent with other research study that claim knowledge may not be the main concern in raising students' awareness (Choi et al., 2021; Parant et al., 2017). In another meaning, understanding climate change cannot change an individual's environmental

attitudes and behaviors. As a result, when overseeing climate change education, concentrate on attending to more than only the cognitive aspects. As, attitudes affect learner behavior more than cognition, it is more important to support the development of learners' attitudes. The government has to launch public awareness programs that focus on the causes of climate change, the adverse impacts on human health, and its effects on various socioeconomic activities.

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