

# Mediating effects of perceived impacts on student's knowledge and attitudes toward climate change

Janet D. Barrera\*

Barrera JD. Mediating effects of perceived impacts on student's knowledge and attitudes toward climate change. *AGBIR*.2023;39(4):619-623.

Climate change is caused by the burning of fossil fuels, raising animals, and other human activities, resulting in the greenhouse effect and global warming. This research aims to determine the mediating effects of the perceived impacts on students' knowledge and attitudes of climate change to communicate and send message about possible environmental policies to address climate change. The study was conducted among 415 higher education students in selected colleges and universities in Misamis Occidental during the first quarter of the calendar year 2023. The quantitative-correlational research design was used. Standardized questionnaires were adopted and slightly modified to provide the needed information relative to the problems. Data analysis was done with frequency and percentage distribution, weighted average mean, and multiple mediation analysis through SPSS. The study revealed that most participants have a satisfactory level of knowledge on

climate change, understanding that extreme events like hurricanes, drought, and forest fires impact energy infrastructure, and that forest serve as a sink in the carbon cycle. They also have high positive attitudes towards climate change, believing that individuals can make a positive difference in global climate change. The multiple mediation analysis revealed the strength of mediation of the perceived impacts of climate change on the relationship between the participants' knowledge and their attitudes on climate change. It is recommended that participants further their understanding of climate change by taking part in academic project work activities, such as researching environmental issues that have an impact on people's lives and society, such as reforestation, cutting back on firewood use, considerate use of non-renewable energy sources, and solid waste management.

**Key Words:** *Students' knowledge; Attitudes; Perceived impacts of climate change; Non-renewable energy*

## INTRODUCTION

The climate of the Earth has changed and developed over time. While some of these changes were brought on by natural events like volcanic eruptions, floods, forest fires, etc., many of them were brought on by human activity. The burning of fossil fuels, raising animals, and other human activities produce a significant quantity of greenhouse gases. The primary causes of climate change are the greenhouse effect and global warming, which are brought on by this. Climate change has brought complex and significant set of implications. The effects of climate change on the environment, vegetation, infrastructure, lives of the people most especially on human health are not only matters of individual concern but the entire society as well. This particular research is one way of expressing concerns on the recent manifestation of climate change which happened on several municipalities and cities of the province of Misamis Occidental last December 2022. It is the view of the researcher to determine the knowledge, attitudes and perceived impacts of climate change so to communicate and send message about possible environmental policies to address climate change to local legislators and educational institutions.

The students' attitudes towards climate change leaned on the theory of planned behavior of Azjen [1] as cited by Brooks [2]. The theory suggests that an individual's attitudes may be accounted from his experiences in relation to some norms and standards as well as controlling behaviors. From the climate change perspectives, the theory of planned behavior relates to how they behave and manifest their attitudes towards climate change resulting from their knowledge and perceptions of the different impacts on climate change.

### Statement of the problem

It was the intention of the study to establish the mediating role of perceived impact on the relationship between the knowledge and attitudes to climate change among higher education students in selected colleges and universities in Misamis Occidental

## MATERIALS AND METHODS

The quantitative-correlational research design was used in this study. The quantitative research design was utilized to give a detailed description of the attitudes and perceived impacts of climate change on the general health, mental health and well-being and the environment. Moreover, the correlational analysis was applied in treating the test of inference between the knowledge and attitudes of the participants on climate change.

The study was conducted among selected colleges and universities in Misamis Occidental during the first quarter of the calendar year 2023. These colleges include Misamis University in Ozamiz City and Oroquieta City Campuses, Governor Alfonso D. Tan College in Tangub City and La Salle University in Ozamiz City.

Misamis Occidental is a province in the Northern Mindanao region of the Philippines, with a population of over 608,000. It is divided into three cities, Ozamiz, and Tangub, and 14 municipalities. The province's economy is primarily based on agriculture, aquaculture, and agro-industrial activities, with rice, corn, coconuts, bananas, and fruit crops being its main crops. Fish farming and marine resources also contribute significantly to the local economy. Misamis Occidental offers several tourist attractions, Mount Malindang National Park, Belveder Hoyohoy View Deck in Tangub City, and the Sinanduloy Cultural Troupe Festival. The province is accessible by land and air transportation, with Laguindingan Airport serving as the gateway. Road networks connect the province to other parts of Mindanao, with buses and vans providing public transportation services.

The study involved the participation of 415 higher education students who were selected at random to ensure that the sample adequately represents the student population.

Standardized questionnaires were adopted and slightly modified to provide the needed information relative to the problems. The items in the questionnaires were subjected to face validity from the pool of experts in

*Department of Teacher Education, J.H. Cerilles State College, Dumingag Campus, Dumingag, Zamboanga Del Sur, Philippines*

**Correspondence:** Janet D. Barrera, Department of Teacher Education, J.H. Cerilles State College, Dumingag Campus, Dumingag, Zamboanga Del Sur, Philippines, E-mail: janetlarabarrera0430@gmail.com

**Received:** 01-Jul-2023, Manuscript No. AGBIR-23-105987; **Editor assigned:** 03-Jul-2023, Pre QC No. AGBIR-23-105987 (PQ); **Reviewed:** 17-Jul-2023, QC No. AGBIR-23-105987; **Revised:** 24-Jul-2023, Manuscript No. AGBIR-23-105987 (R); **Published:** 31-Jul-2023, DOI:10.35248/0970-1907.23.39.619-623



This open-access article is distributed under the terms of the Creative Commons Attribution Non-Commercial License (CC BY-NC) (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits reuse, distribution and reproduction of the article, provided that the original work is properly cited and the reuse is restricted to noncommercial purposes. For commercial reuse, contact [reprints@pulsus.com](mailto:reprints@pulsus.com)

the field of environment and biology. Prior to the instrument distribution, pilot testing of the same was done. The questionnaire set was pre-tested to 30 students from J.H. Cerilles State College, Dumingag Campus, Zamboanga del Sur. Internal consistency was determined using the Cronbach alpha coefficient. Each item underwent coefficient determination. Items with Cronbach alpha coefficient of less than 0.70 were revised.

In the analysis of the data, the participants were asked of their perceptions on a five-point Likert scale. The participants were made to express their views on the impacts of climate change as well as their attitudes to climate changes using the response options of strongly disagree, disagree, fairly agree, agree and strongly agree, strongly disagree being the lowest level and strongly agree being the highest level. In terms of interpreting the impacts of climate change, the scales of interpretation included: 4.21-5.00, Very High; 3.41-4.20, High; 2.61-3.40, Average; 1.81-2.60, Low; and 1.00-1.80, Very Low. As regards interpreting the attitudes of the students toward climate change, the scales of interpretation are as follows: 4.21-5.00, Very Good (VG); 3.41-4.20, Good (G); 2.61-3.40, Average (A); 1.81-2.60, Poor (P); and 1.00-1.80, Very Poor (VP).

The researcher elicited answers from the participants through google form. The researcher explained the objectives of the research undertaking. In addition, stipulated in the google form, aside from the items relevant to the research problem, are the ethical consideration provisions. The researcher ensured that all information gathered was carefully handled and the greatest level of confidentiality was kept. For the purpose of keeping the identity of the participants, they were allowed not to disclose their personal identification as their names were left optional.

A link was distributed to key participants, and likewise dispatched the same link to the vast number of participants in the different schools. The participants' responses were checked to ensure that all items were responded. Spreadsheets were downloaded for the data analysis.

Data analysis was done with frequency and percentage distribution and weighted average mean. Average variance extracted and composite reliability was established as testing for convergent validity. The multiple mediation analysis using SPSS was also done to determine the extent of mediation of the perceived impacts of climate change to the relationship between the knowledge and attitudes of the participants to climate change.

## RESULTS AND DISCUSSION

Majority of the participants have satisfactory level of knowledge on climate change. Out of 415 participants, 237 or 57.11 percent revealed satisfactory level of knowledge; followed by 103 or 24.82 percent got average. The participants have good knowledge on why the forests are important for mitigating climate change, on how extreme events impact energy infrastructure, on how are warming ocean temperatures impacting fish and other marine mammals, and what is greenhouse effect. Caranto and Pitpitunge [3] affirmed that high school students have moderate level of knowledge and hold misconceptions on climate change basic concepts, impacts on different systems and adaptations strategies (Table 1).

The attitudes of the participants on climate change are reflected in Table 2. It can be observed that the participants have good attitudes on climate change. This is revealed in the overall mean of 3.81 which is interpreted as "Good." The participants were very concerned on global climate change including its impacts.

The very good attitudes of the participants were also noted on how they placed high regard on the environmental problems and issues as well considering them to play an active role in preserving this environment for the future generation.

The table shows that all statements pertaining to the attitudes of the participants to climate change registered factor loadings of equal to or greater than 0.55. Some statements were discarded as its factor loadings were below 0.55. In SEM analysis, factor loading 0.55 or above are acceptable [4].

The Average Variance Extracted (AVE) of the attitudes of the participants on climate change was 0.373. This value is below 0.50 which is the standard measurement of the AVE result. This implies that there is a need to have another approach to assess convergent validity. This could be done by going through an assessment of composite reliability. Composite Reliability (CR)

and Cronbach's alpha values must be more than or equal to 0.70 to show good dependability [5]. As shown in the table, the attitudes of the participants on climate change yielded CR of 0.885 and all values of Cronbach's alphas were all greater than 0.70. These measures satisfied the internal consistency and shown that all structures had high level reliability (Table 2).

The participants perceived that climate change have very high impact on health. This is shown in the overall mean of 4.30, interpreted as "very high". The participants affirmed that prolonged high temperature could result to dehydration of humans and other animal species. Dehydration occurs when an individual use or lose more fluids than taken in and the body don't have enough water and other fluids to carry the normal body functioning. There is a high risk of dehydration when it is hot and humid as sweat cannot evaporate and cool the body as it normally does, leading to increased body temperature and the need for more fluids. Likewise, exposure to high temperature for a long time could lead to problems related to respiratory and circulation.

Mental health and well-being are also impacted with climate change. This is evident in the responses of the participants when asked on their perceptions of the mental health and well-being impacts on climate change. In fact, the impacts were considered as very high from the participants' perspectives. The manifestations of climate change experienced by a lot of students last December 2022 have caused trauma and emotional stress to individuals who happen to live in those areas devastated by continuous raining and flooding, strong winds, and high coastal water levels. The participants revealed that continuous flow of floodwater and rains have caused the population on the area of the stud to feel anxious, depress, experienced sleep disorder and poor concentration. The World Health Organization (WHO) [6] concluded that climate change poses serious risks to mental health and well-being urging countries to include mental health support in their response to the climate crisis. Along this line, the new WHO policy brief recommends that government should include in its initiatives integrating climate considerations with mental health programs, integrating mental health support with climate action, build upon global commitments, develop community-based approaches to reduce vulnerability, and close the large funding gap that exists for mental health and psychosocial support [6].

The environmental impacts on climate change were also considered by the participants as high. The impacts on climate change were manifested on the water contamination which resulted to health problems among the affected population through effects of supply and quality of water.

The table also shows that all indicators of the health, mental health and well-being and environmental impacts of climate change registered factor loadings of greater than 0.55. In SEM analysis, factor loading 0.55 or above are acceptable [4].

The Average Variance Extracted (AVE) of the perceptions on health impacts, mental health and well-being and environmental impacts of climate change of the participants were 0.348, 0.491 and 0.479. These values are below 0.50 which is the standard measurement of the AVE result. This implies that there is a need to have another approach to assess convergent validity. This could be done by going through an assessment of composite reliability. Composite Reliability (CR) and Cronbach's alpha values must be more than or equal to 0.70 to show good dependability [5]. As shown in the table, the perceptions of the participants yielded CR values of 0.871 for health impacts, 0.871 for mental health and well-being and 0.846 for environmental impacts on climate change and all values of Cronbach's alphas were all greater than 0.70. These measures satisfied the internal consistency and shown that all structures had high level reliability (Table 3).

Several attributes could relate to the participants' attitudes toward climate change. This means that the attitudes of the participants, in this case, the students of selected higher educational institutions have attitudes resulting from several factors. The results of the multiple mediation analysis revealed that mediating variables like the perceived impacts of climate change on health, mental health and well-being and environment significantly mediate the relationship between the participants' knowledge and their attitudes toward climate change. The Yale Program on Climate Change [7] emphasized that public awareness and understanding are important components of an effective response to climate change. The individual understands that global warming is occurring, and that it poses serious risks for human societies and natural ecosystems could help them (Table 4).

**TABLE 1**  
**Knowledge level of the participants on climate change**

Knowledge level	Frequency	Percentage
Very satisfactory	72	17.35
Satisfactory	237	57.11
Average	103	24.82
Low	3	0.72
Very low	-	-
Total	415	100

**TABLE 2**  
**Attitudes of the participants on climate change, factor loadings, average variance extracted, composite and cronbach alpha coefficients for reliability**

Statements	WAM	Interpretation	Factor loadings	Cronbach alpha coefficient
I am concerned about global climate change	4.84	Very Good	0.569	0.758
I believe there is evidence of global climate change	4.38	Very Good	0.565	0.754
Global climate change will impact future generations	4.53	Very Good	0.627	0.763
We cannot do anything to stop global climate change	2.97	Average	0.615	0.739
I can do my part to make the world a better place for future generations	4.44	Very Good	0.609	0.753
Knowing about environmental problems and issues is important to me	4.46	Very Good	0.599	0.756
Things I do have no effect on the quality of the environment	3.25	Average	0.562	0.721
It is a waste of time to work to solve environmental problems	2.48	Poor	0.745	0.726
There is not much I can do that will help solve environmental problems	2.84	Average	0.635	0.723
Climate change is inevitable because of the way modern society works	4.06	Good	0.649	0.748
People should be made to reduce their energy consumption if it reduces climate change	4.05	Good	0.577	0.739
I would only do my share to reduce climate change if everyone else did as well	3.33	Average	0.623	0.733
The government should provide incentives for people to look after the environment	3.93	Good	0.55	0.735
Overall Mean	3.81	Good		
Average Variance Extracted (AVE)			0.373	
Composite Reliability (CR)			0.885	

**Note:** 4.21-5.00-Very Good (VG); 3.41-4.20-Good (G); 2.61-3.40-Average (A); 1.81-2.60-Poor (P); 1.00-1.80-Very Poor (VP)

**TABLE 3**  
**Perceived impacts on climate change, factor loadings, average variance extracted, composite and cronbach alpha coefficients for reliability**

Statements	WAM	Interpretation	Factor loadings	Cronbach alpha coefficient
<b>Perceived health impact on climate change</b>				
Prolonged exposure to extreme heat can result to dehydration	4.45	Very high	0.558	0.879
Prolonged exposure to extreme heat can result to exacerbation of respiratory, cardiac, and other illnesses associated with extreme heat	4.33	Very high	0.595	0.876
Longer growing seasons and longer pollen season can cause allergies/ asthma in terms of timing, frequency and severity	4.13	High	0.583	0.878
Air temperature and UV radiation can result to acute respiratory symptoms, lung inflammation and scar tissue, chest pain, coughing, throat irritation, congestion and bronchitis	4.22	Very high	0.632	0.873
Drought, dust, smoke can result in respiratory symptoms, lung damage, adverse chronic and acute cardiovascular and respiratory health outcomes	4.36	Very high	0.6	0.876
Molds and airborne allergens from moisture and humidity can cause allergies, asthma, and respiratory symptoms	4.28	Very high	0.568	0.878

**Barrera.**

Overall mean	4.3	Very high		
Average Variance Extracted (AVE)			0.348	
Composite Reliability (CR)			0.871	
<b>Mental health and well-being impact</b>				
Extreme weather events such as flooding and continuous heavy rain can cause anxiety, and emotional stress	4.28	Very high	0.635	0.921
Extreme weather events such as flooding and heavy rain can cause acute traumatic stress and post-traumatic stress disorder	4.24	Very high	0.719	0.915
Extreme weather events such as flooding can cause chronic psychological dysfunction	4.14	High	0.727	0.915
Extreme weather events such as flooding and hurricanes can cause depression, poor concentration and sleep disorders	4.2	High	0.737	0.914
Extreme temperatures such as prolonged cold or heat can cause chronic stress	4.2	High	0.711	0.916
Extreme temperatures such as prolonged cold or heat can cause poor physical and mental health	4.18	High	0.733	0.915
Extreme temperatures such as prolonged cold or heat can increase the risk of diseases and even death	4.24	Very high	0.635	0.922
Overall mean	4.21	Very high		
Average Variance Extracted (AVE)			0.491	
Composite Reliability (CR)			0.871	
<b>Environmental impact of climate change</b>				
Increased concentration of effluent pathogens in wastewater treatment plants can result to waterborne pathogens	4.15	High	0.636	0.898
Contaminated water supply from flooding and storm surge can cause vomiting, diarrhea, and wound/skin infections	4.31	Very high	0.695	0.892
Contaminated water supply from flooding and storm surge can cause famine and dehydration	4.17	High	0.611	0.901
Pathogenic organisms from water temperature can cause diarrhea and neurotoxic or respiratory effects from toxic algae	4.24	Very high	0.791	0.88
Rising sea levels threatens coastal communities and ecosystems	4.09	High	0.7	0.892
Warmer temperature increases the frequency, intensity and duration of heat waves which bring health risks to people	4.12	High	0.707	0.899
Changes in the patterns and amount of rainfall can affect supply and quality of water	4.23	Very high	0.635	0.922
Overall mean	4.19	High		
Average Variance Extracted (AVE)			0.479	
Composite Reliability (CR)			0.846	
<b>Note:</b> 4.21-5.00-Very Good (VG); 3.41-4.20-Good (G); 2.61-3.40-Average (A); 1.81-2.60-Poor (P); 1.00-1.80-Very Poor (VP).				

**TABLE 4**  
**Results of multiple mediation analyses of attitudes of participants towards climate change**

Independent variable	Mediating variables	Dependent variable	Effect of IV on M	Effect of M on DV	Direct effect	p-value	Decision
Very high	Perceived impact on health	Very high	0.303	0.281	0.24	0.009	Significant
	Perceived impact on mental health and well being		0.298	0.246	-	-	-
	Perceive impact on environment		0.275	0.232	-	-	-

Students realized the significance of their knowledge on climate change and its impact so they could be more empowered to fight and adapt the impacts of climate change. With the beliefs on the health, mental and well-being as well as environmental impacts of climate change, students have more open perspectives on what they could contribute to safeguard the environment through participation in diverse range of sustainability and environment-protection related activities. Their perceived impacts paved a way for the students to be more conscious and resilient to climate change. With open minds on the relative impacts, the students will be actively participating in initiatives relative to climate change [8,9].

#### CONCLUSION

The study revealed that most of the participants have satisfactory level of knowledge on climate change for knowing that extreme events like hurricanes, drought, and forest fires impact energy infrastructure through water shortages, power outage, and higher electricity and gas prices; and that forest serve as a sink in the carbon cycle. The participants have high positive attitudes towards climate change as they were concerned about global climate change and its impacts on the future generation. They were very positive about the idea that individuals can make a positive difference in global climate change. The participants believed that climate change has impacts on the health of people like prolonged exposure to extreme heat which can result to heat-related illnesses and death, including heat cramps, heat exhaustion, heatstroke, and hyperthermia; and prolonged exposure to extreme heat can result to dehydration. Day et al., affirmed the findings saying that the interplay among the several components of the environment could bring serious implications for the health of the people in the community. Mental health and well-being of people can also be affected by extreme weather events such as flooding and hurricanes causing anxiety, and emotional stress. Contaminated water supply from flooding and storm surge can also result in some cases to people's vomiting, diarrhea, and wound/skin infection. The multiple mediation analysis revealed the strength of mediation of the perceived impacts of climate change on the relationship between the participants' knowledge and their attitudes on climate change.

Glasgow et al., highlighted the need to address the knowledge gaps of all groups of residents about the significant implications of climate change on the environment and the community.

#### RECOMMENDATIONS

It is recommended that participants further their understanding of climate change by taking part in academic project work activities, such as researching environmental issues that have an impact on people's lives and society, such as reforestation, cutting back on firewood use, considerate use of non-renewable energy sources, and solid waste management.

#### REFERENCES

1. Ajzen I. From intentions to actions: A theory of planned behavior. In *Action control: From cognition to behavior* 1985; 11-39. Springer Berlin Heidelberg.
2. Brookes E. *The theory of planned behavior: behavioral intention*. 2023.
3. Caranto BF, Pitpitunge AD. Students' knowledge on climate change: Implications on interdisciplinary learning. In *Biology Education and Research in a Changing Planet: Selected Papers from the 25th Biennial Asian Association for Biology Education Conference 2015*; 21-30. Springer Singapore.
4. Hair JF. *Multivariate data analysis*.
5. Nunnally J, Ira B. *Psychometric theory*. New York: McGraw-Hill. 1994.
6. World Health Organization (WHO). *Climate action must include mental health*. 2022.
7. Yale Program on Climate Change. 2023.
8. Day O, Van Proosdij D, Campbell D, et al. *Building capacity for coastal ecosystem-based adaptation in small island developing states*. 2016.
9. Glasgow L, Langaigne B, Thomas C, et al. *Public knowledge and attitudes towards climate change and its impacts on ecosystems in Grenada*. *Am J Clim Change*. 2018; 7(4):600-610.