KNOWLEDGE AND ATTITUDE OF CLIMATE CHANGE ADAPTATION: THE VIEW OF MALAYSIAN UNIVERSITY STUDENTS

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Abstract

Sustainable consumption involves climate change adaptation. International organisations are emphasising and encouraging youth climate change preparation. This study examines undergraduate students' climate change adaptation knowledge and attitudes. A total of 384 undergraduate students from Universiti Malaya, Universiti Putra Malaysia, and Universiti Kebangsaan Malaysia responded to the survey. The findings showed a high level of knowledge and attitude among the students. The study also discovered significant and positive relationships between knowledge and attitude towards climate change. Furthermore, construct basic knowledge has a greater impact on climate change adaptation attitudes than risk perception. Their primary source of information is the internet. In light of these findings, internet information sources have an effect on students' knowledge and attitudes. This study provides an indicator of the youth's knowledge and attitude patterns, in order for policymakers and educational institutions to consider climate change adaptation more effectively.

*Keywords***:** climate change adaptation; sustainable development; youth; belief; understanding

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INTRODUCTION

Children born around 2000 appear to live on a planet that is 0.8 °C to 2.6 °C warmer and where the sea level is 5 cm to 32 cm higher than in 1990 (IPPC, 2013). According to a World Meteorological Organization (WMO) assessment of a global report on climate change, the report found that weather, climate, or water disasters have happened every day for the past 50 years, killing 115 people and costing USD 202 million (WMO, 2021). The context and dimensions of climate change encompass the numerous causes and impacts of climate change on the human environment (Putri Setiani, 2020). Climate change causes landslides, intense monsoon floods, flash floods, droughts, and storms (Syafrina et al., 2017). Additionally, climate change exacerbates preexisting social and economic inequalities and disproportionately affects vulnerable populations (Mohammad Sabri & Ponrahono, 2024).

Malaysia is one of the Southeast Asian nations negatively impacted by El Nino in terms of regional climate anomalies and the socioeconomic well-being of its population (Syafrina et al., 2017). The flood of 2021–2022 was one of the most extreme flood disasters in Malaysian history, with losses of up to MYR 6.1 billion and daily evacuations of approximately 70,000 victims (Tew et al., 2022). These disasters risk affecting lives and livelihoods globally and cause extensive property damage if appropriate adaptation actions are not taken (Evangelista et al., 2017). More significant action is needed to reduce the impact on humans and the environment. Tang (2019) stressed that climate change adaptation in Malaysia is still inadequate and limited at the institutional and individual levels regarding data and public access. Therefore, this study aims to determine the level and relationship of knowledge and attitudes toward climate change among university students.

KNOWLEDGE AND ATTITUDE TOWARDS CLIMATE CHANGE

Public involvement adaption studies have focused on systems rather than individual response aspects (Oakes et al., 2016). Article 12 of the 2015 Paris Agreement reemphasizes the importance of education and communication (UN, 2015). Sustainable Development Goal (SDG) 13 of the UN Agenda 2030 seeks to "improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning" (Cordero et al., 2020; United Nations General Assembly resolution, 2015). Agenda 21 recognises youth and children as one of nine civil society groups committed to sustainable development (Narksompong & Limjirakan, 2015).

Knowledge is one of the best ways to understand oneself and others (Ahmad et al., 2020; Phuoc et al., 2019). Knowledge acquisition includes cognitive characteristics, including perception, memory, learning, and prediction, which are called knowledge (Salas-Zapata & Cardona-arias, 2018; Saad et al., 2018). Attitude is "a condition of mental and nervous preparation that directly

determines a person's behavior toward all objects and events" (Ahmad et al., 2020). Attitude is also a predetermined psychological state, like a thought pattern developed before a person acts (Fishbein & Ajzen, 1975). Ajzen (1991) emphasised attitude evaluation in the theory of planned behaviour (TPB).

From a theoretical standpoint, TPB, Akrofi et al. (2019) found that environmental attitudes indicate climate action motivation. Climate change awareness and knowledge will influence these behaviours. Genc and Akilli (2019) suggested that education could increase knowledge and attitudes regarding new developments. As a result of the literature study, the researcher discovered that the construct for domain knowledge that has to be measured is basic knowledge and risk perception towards climate change adaptation. Attitude's realm is belief and experience. The researcher developed this study's conceptual framework (Figure 1).
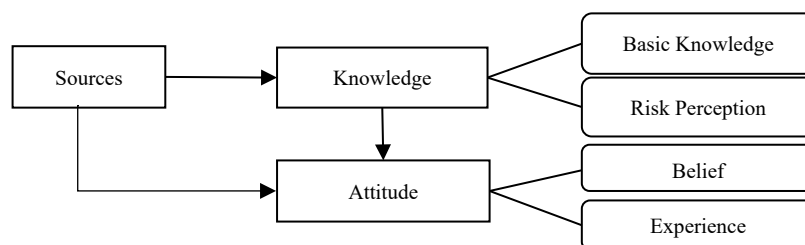

Figure 1: Research Framework

RESEARCH METHODOLOGY

Universities provide climate information to make social and cultural reforms for climate adaptation and mitigation (Barreda, 2018; Nursey-Bray et al., 2019). Thus, Universiti Malaya, University Putra Malaysia, and Universiti Kebangsaan Malaysia were chosen as study sites. These universities were chosen because QS World University Rankings ranked them highly in Malaysia (2021). Krejcia and Morgan (1970) estimated a sample size of 382 for a population of 75,000 but less than one million. The study population was selected using stratified sampling. This study requires undergraduate students aged 19–25 in their first, second, third, and fourth (if applicable) years of Bachelor's Degree studies. Table 1 shows the study's sample size by institute.

Table 1: Population and sample size

	Institute	Population	Sample Size
1.	Universiti Malaya	31,416	31,416x384/83,690 = 144
2.	Universiti Putra Malaysia	26,053	26,053x384/83,690 = 119.5 (120)
3.	Universiti Kebangsaan Malaysia	26,221	26,221x384/83,690 = 120
	Total	**83,690**	**384**

Knowledge and attitude questions were answered on a Likert scale (strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree). The total number of items was adjusted based on the results of a validity test conducted by three experts, followed by Cronbach's alpha value derived from 30 samples from other colleges. According to Majid Konting (1990) and Malhotra (1996), a Cronbach's alpha value that is above 0.6 has high reliability and can measure the research concept. The results revealed that all variables' Cronbach's alpha values exceeded 0.6: basic knowledge (α= 0.896), risk perception (α= 0.668), belief (α= 0.775), and experience (α= 0.718).

ANALYSIS AND DISCUSSION

This study includes 117 males (30.5%) and 267 females (69.5%). About 324 students (84.4%) were Malay, followed by 23 Indians and 23 Bumiputras from Sabah and Sarawak (6.0%) and 14 Chinese (3.6%). While 116 (43.2%) third-year undergraduates responded, followed by 96 (25%) second-year and 82 (21.4%) first-year students, about 39 (10.3%) and 1 (0.3%) fourth-year and fifth-year students, respectively. Next, most respondents were Muslims, with 340 (88.5%) students, followed by Hindu respondents, with 19 (4.9%) students. The remaining respondents were Buddhists and Christians, with 13 (3.4%) and 12 (3.2%) students, respectively.

Sources of Information about Climate Change

The highest results indicated that 332 students sourced information through internet sources (social media, Google Chrome, blogs, YouTube). The study by Anderson (2017) on the effects of social media on attitude, knowledge, and behaviour indicated there is some evidence that information sharing through social media could enhance awareness and inspire more environmentally friendly behaviour in people. From the 384 students, 178 and 154 sourced information from school/university and family/public, respectively. This result indicates that approximately only half of them acquired knowledge about climate change at their place of study.

In addition, there are also youth who obtain knowledge about climate change via radio, scientific books, and magazines/news, as shown from this study's respondents, with 109, 86, and 49 students, respectively. A total of 14 respondents chose other sources to obtain information, such as television, forums, and conferences about climate change. In conclusion, the internet is the dominant source for disseminating information about climate change. On the other hand, news and articles on social media enable communication to spread exceptionally quickly and cheaply (Aleksandrina et al., 2019). Al Yuosuf (2016) showed that education best predicts climate change awareness.

Level of Knowledge and Attitude

Table 2 shows that items 1 to 9 represent the basic knowledge construct, while items 10 to 14 represent youth risk perceptions of climate change. The results indicated that all the mean levels for basic knowledge are high because they exceed 3.66, with 4.43 (Item 2) being the lowest and 4.65 (Item 7) being the highest out of 5. The youth understand that technology and environmental, ecological, social, and economic aspects impact climate change. They also realize that deforestation, forest burning, CFC use, and fossil fuel combustion cause an increase in carbon dioxide (CO2). Youth also understand climate change's impacts on people, ecosystems, and future generations. They also understand the physical risks, such as ozone depletion, sea level rise from ice melting, and prolonged droughts and floods.

The mean value for the risk perception construct shows that one item is at a moderate level (item 14) with a mean value of 3.38 out of 5. Meanwhile, the other four items show a high level of perception, with a mean value between 3.82 to 4.60 out of 5. The risk perception indicator shows youth concerns about climate change. Based on the results, youth agreed that developed countries cause climate change and developing countries are also affected. The results show that most youths agree that climate change has affected Malaysia but are unaware of its impacts on poverty and unemployment. Khan et al. (2020) found that climate change affects impoverished agricultural and rural communities in developing nations due to their low income and inability to adapt. Kamaruddin et al. (2021) state that while climate change affects everyone, people experiencing poverty and those in low-income countries take it more seriously. Climate variability has made livelihoods and poverty elimination more difficult (Aniah et al., 2019; Adzawla et al., 2020).

Table 2: Frequency and mean distribution of knowledge

Item	Mean	Standard Deviation
1. Climate change is a global phenomenon that affects both humans and ecosystems.	4.50	0.58
2. The relationship between technology, nature, society, and the economy is what causes climate change.	4.43	0.65
3. The threat posed by climate change to future generations.	4.48	0.67
4. Deforestation and forest burning lead to climate change.	4.63	0.57
5. Climate change is caused by chlorofluorocarbons (CFCs) such as insect repellents.	4.53	0.64
6. Carbon dioxide (CO^2) emissions are caused by the combustion of fossil fuels (coal, gasoline, and natural gas) by automobiles and industry.	4.53	0.65
7. The depletion of the ozone layer increases the global temperature.	4.65	0.57
8. Rapid sea level rise caused by the melting of glacier saddles.	4.49	0.70

Item	Mean	Standard Deviation
9. Droughts, heavy rain, and extended flooding are the results of climate change events.	4.54	0.68
10. The effects of climate change will be more severe for developing nations (Malaysia, Indonesia, Thailand, Russia, etc.) than for developed nations (the United States, Norway, Australia, etc.).	3.82	0.95
11. Globally, developed nations are accountable for the consequences of climate change.	4.17	0.85
12. Humans are responsible for climate change.	4.60	0.58
13. In Malaysia, the effects of climate change are already being felt.	4.43	0.61
14. Climate change has increased poverty and unemployment.	3.38	0.93

Table 3 illustrates the mean distribution of attitude for items 1 to 11 in the belief construct and 12 to 15 in the experience construct. The results show that item 10 in the belief construct has a moderate mean value (3.30). Conversely, the other items are at a high level, between 3.91 to 4.61 out of 5. This result shows that the youth believe they are responsible for reducing the effect of climate change. They are also ready to adapt to climate change, such as using public transport. The youth also believe that natural resource exploitation affects future generations' health. Thus, the current generation must preserve natural resources for future generations. Strengthening the legislation and making green products companies accountable can help combat climate change. The respondents also believe climate change affects their family life but are unsure how it will change their lifestyle. All items predicting experience have high mean values of 3.95 to 4.41 out of 5. This situation indicates that youth agree that climate change is causing malaria, increasing temperature, and affecting physical health, stress, and anxiety. Previous research has shown that the detrimental effects of pollution on human health are intimately linked to a dirty environment, which reduces the quality of life (Sahrir et al., 2022). Communities that rely on these ecosystem services can sustain their livelihoods from efforts to adapt, conserve, and preserve essential habitats. According to Kamaruddin et al. (2021), adaptation measures will help reduce greenhouse gas emissions, improve human health and welfare, and create green jobs by gradually shifting to a lower culture.

Table 3: Frequency and mean distribution of attitude

Item	Mean	Standard Deviation
1. It's great that I'm working to reduce global climate change.	4.50	0.57
2. Climate change is real.	4.62	0.55
3. I am willing to work towards climate change adaptation.	4.17	0.79
4. I am ready to take the necessary actions to reduce the effects of climate change.	4.33	0.68

Item	Mean	Standard Deviation
5. I believe that consuming more natural resources will endanger the health and well-being of people	3.93	1.12
6. I believe that legislation should be strengthened in order to protect the environment.	4.57	0.61
7. Public transportation is enjoyable for me.	4.10	0.95
8. We should ensure that future generations experience the same quality of living as we do today.	4.52	0.73
9. I believe businesses are accountable for minimising the use of packaging and discarded items.	4.52	0.63
10. My family has been impacted by global warming.	3.30	1.16
11. My lifestyle will alter due to climate change.	3.91	0.91
12. Malaria and other hazardous diseases are affected by climate change.	3.95	0.85
13. Climate change contributes to the rise in warm temperatures.	4.41	0.62
14. My physical health is likely to be affected by climate change.	4.22	0.78
15. The effects of climate change on my stress, anxiety, and depression are significant.	4.06	0.94

Relationship between Knowledge and Attitude

The Pearson correlation test determined the relationship between knowledge and attitude. The results demonstrate a moderate and significant positive association between knowledge and attitude with a correlation value of $r=0.608$ ($p=0.000$) (Table 4). Basic knowledge and risk perception are significantly related to belief and experience. Risk perception shows a weak positive relationship with belief ($r=0.499$) and experience ($r=0.455$). Thus, basic knowledge affects attitude more than perception in the knowledge construct.

Table 4: Pearson Correlation between knowledge and attitude

		Attitude
Knowledge	Pearson Correlation	0.608
	Significant (2-tailed)	0.000

Table 5: Pearson Correlation to all construct.

		Basic Knowledge	Risk Perception	Believe	Experience
Basic Knowledge	Pearson Correlation	1	0.497**	0.520**	0.408**
	Significant (2-tailed)		0.000	0.000	0.000
Risk Perception	Pearson Correlation	0.497**	1	0.499**	0.455**
	Significant (2-tailed)	0.000		0.000	0.000

A simple linear regression analysis was examined to determine a variable's connection, effect, and dominance variance. A summary model in Table 6 illustrates how much knowledge explains attitude variance. The result found the values of R squared ($R^2 = 0.370$) and adjusted R squared ($R^2adj = 0.368$). Therefore, the total variance is 37%, and the knowledge factor explain 36.8% over attitude. Table 7 shows that the overall regression model is statistically significant in predicting a relationship between the knowledge factor and attitude with a significant value ($p = 0.000$, $p < 0.05$).

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.608[a]	0.370	0.368	0.35540
a. Predictors: (Constant), Knowledge				

Table 7: ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
	Regression	28.279	1	28.279	223.889	0.000[b]
1	Residual	48.250	382	0.126		
	Total	76.529	383			
a. Dependent Variable: Attitude						
b. Predictors: (Constant), Knowledge						

The coefficient table (Table 8) displays the standardized coefficient beta ($= 0.608$) and its significant value ($p = 0.000$). This result means that knowledge is positively related to attitude and is a significant predictor of attitude, with a beta value of 0.608 or 60.8%. The linear regression equation that can be formed is DV = Constant + B x (Knowledge) [Attitude = 1.418 + 0.632 x (Knowledge)].

Table 8: Coefficients

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.418	.187		7.587	.000
	Knowledge	.632	.042	.608	14.963	.000
a. Dependent Variable: Attitude						

This research proves Ahamad and Ariffin (2018), Mohiuddin et al. (2018), Songlar et al. (2019), and Ahmad et al. (2020) findings that knowledge and attitude are statistically related. Ahamad and Ariffin (2018) stated that environmental knowledge is crucial for fostering an environmentally conscious attitude, and the two concepts are intimately interrelated. Mohiuddin et al. (2018) found that business students' environmental knowledge and awareness correlated

with their positive attitude toward environmentally efficient vehicles. In the study by Songlar et al. (2019), it was discovered that participants' knowledge was also a factor in their positive attitudes toward earthquake safety and security. While, in Ahmad et al. (2020), consumer views towards green fashion innovation were positively influenced. This study found that basic knowledge influences youths' climate change attitudes more than risk perceptions.

Relationship between source of information, knowledge, and attitude
Table 9 correlated sources of information with climate change adaptation knowledge and attitudes. The Internet had a significant negative connection with knowledge (r = -0.208, p = 0.000) and attitude (r = -0.177, p = 0.000). Ahamad and Ariffin (2018) found that social media, followed by television and newspapers, was the best source of environmental education for students. According to Anderson (2017), a study found that sharing information on social media may raise awareness and inspire pro-environmental behaviour.

Table 9: Relationship between source of information with knowledge and attitude

Source of knowledge		Knowledge	Attitude
Internet	Pearson Correlation	-0.208[**]	-0.177[**]
	Significant (2-tailed)	0.000	0.000
Radio	Pearson Correlation	-0.004	-0.044
	Significant (2-tailed)	0.942	0.385
Scientific Book	Pearson Correlation	-0.086	-0.033
	Significant (2-tailed)	0.094	0.513
Magazine/News	Pearson Correlation	-0.089	-0.140[**]
	Significant (2-tailed)	0.082	0.006
School/University	Pearson Correlation	-0.161[**]	-0.080
	Significant (2-tailed)	0.002	0.117
Family/Public	Pearson Correlation	-0.116[*]	-0.010
	Significant (2-tailed)	0.023	0.840
Others	Pearson Correlation	-0.012	0.067
	Significant (2-tailed)	0.813	0.192

However, Gronlund and Berrocal (2020), Shen et al. (2020), Valois et al. (2020), and McKenzie (2021) found that science and environmental understanding only sometimes enhance concern or action. School/university information sources had a strong relationship with knowledge but not attitude (r = -0.161, p = 0.002). According to Thomas et al. (2015) and Barreda (2018), positive or negative attention to climate change drives knowledge. Salehi et al. (2016) demonstrated that existing knowledge could greatly impact students' ability to accept new understanding and affect how they evaluate, judge, and memorize. Mahat et al. (2017) and Cordero et al. (2020) added that environmental preservation should be taught early to establish attitudes, values, responsibilities,

and skills. Family/public also negatively affects knowledge (r = -0.116, p = 0.023). Saptutyningsih et al. (2020) found that friends and family can help people learn about adaptation and assess climate change risks.

Dirani et al. (2021) found that public relations can help small family farmers implement sustainable climate change adaptation practices. This study supports Nor Diana et al. (2022) finding that family members influence farmers' climate change adaptation knowledge. In addition, Attitude also negatively correlates with magazine/news reading (r = -0.140, p = 0.006). Rode et al. (2021) explained that motivated reasoning can occur in information selection (e.g., news sources) and information processing (i.e., how one's beliefs change in response to new information). According to Chen et al. (2019), mass media organisations, including newspapers, magazines, radio, and television, are significant market voices offering society news and reports fundamentally different from firm-initiated advertising messaging.

RECOMMENDATION AND CONCLUSION

Abdul Malek et al. (2022) state that in the Malaysian context, most young people are under the impression that they can make small adjustments at the community level, while a small number of them are of the opposite opinion. Thus, future research can investigate the practices or behaviours of youth to determine how they can adapt to climate change. This study only used a quantitative methodology to describe their perspectives based on the instrument developed. In future studies, it is advised that future research develop instruments based on present issues that are more in-depth about climate change adaptation. Monroe et al. (2017) also proposed that a survey of research publications cannot adequately describe the state of climate change education and policy. However, more research is needed to comprehend the response of nations to climate change and the benefit or expense of a national curriculum that determines how this issue will be delivered.

In conclusion, this study contributes to understanding the relevance of understanding university students' views on climate change adaptation. This study's findings support the advancement of knowledge on climate change adaptation. In addition, politicians, institutions, and non-governmental organisations can embrace it as a guide to enhance the knowledge and attitude of Malaysian youth on climate change.

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