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Impacts of Climate Change Communication on Energy Efficiency Utilization Among University Students in Rwanda

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ABSTRACT

The study assessed the potential impacts of climate change communication on energy efficiency utilization among university students in Rwanda. Six objectives were outlined, two research questions answered and five hypotheses tested. The theory of management and change approach to climate change adaptation were utilized. Survey research design was used for the study. The population of the study comprised all the 2022/2023 session third year undergraduate students of three universities in Rwanda with a population of 3503 students. A sample of 350 students was selected to represent 10% of the population using rule of thumb and proportionate sampling techniques. The instrument for the study was a self-developed questionnaire. The research questions were answered using percentages while inferential statistics of t-test Analysis was used to test the hypothesis. The result indicated that climate change communication on energy efficiency utilization among university students in Rwanda raised students' energy knowledge, attitude and intentions positively for both the male and female students.

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1. Introduction

Climate change refers to any significant change in climate metrics (such as temperature, precipitation, humidity, cloudiness or wind) that persists over an extended period (decades or longer). Climate change is primarily caused by an increase in the earth's atmospheric temperature (Chandar, 2010). According to the UNFCC (1992), climate change is a change in climate that is directly or indirectly attributed to human activities, altering the composition of the global atmosphere and occurring in addition to natural climate variability observed over comparable time periods. Climate

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change can be caused by natural factors, such as changes in the intensity of the sun or slow changes in the earth's orbit around the sun; by natural processes within the climate system, such as changes in ocean circulation; or by human activities that alter the conditions of the atmosphere, such as the burning of fossil fuels and deforestation, urbanization and industrialization. Scientific evidence makes it clear that these changes are not driven by long-term natural climate cycles. Instead, their main causes are global warming and the human activities that cause it. They have suggested various methods to check global warming and reduction in greenhouse gases and energy efficiency methods is seen the quickest, cheap and most effective method. Inefficient energy utilization in homes and industries leads to wasteful consumption of fossil fuel. It leads to excessive carbon dioxide emission into the environment. It aggravates greenhouse effect and global warming that are imposing much damage on the world economy, particularly on vulnerable sectors including agriculture, the coastal zones, human morality, and natural ecosystems. The report published by the Intergovernmental Panel on Climate Change (2007) emphasizes that climate change is leading to an increase in the frequency and intensity of extreme weather events. The world is drifting towards a tipping point that could lock the underdeveloped countries under ecological stress and loss of livelihood. Thus, measures to check global warming and reduction in greenhouse gases should be made toward communicating the people to take climate action.

Climate change communication is about educating, informing, warning, persuading, mobilizing and solving climate change causes, risks and solutions. Climate change came on board the public agenda in the early 1980s. This phenomenon seeks public communication of climate change very relevant and most importantly the question of how to effectively communicate this environmental crisis to the people. Communication is a process, a concept of change rather than that of static existence. The various elements involved in this process are the message, encoding, channel, receiver, decoding, and feedback. These elements coordination can be achieved only through effective communication. Effective communication promotes public engagement by helping communities' individuals, and societies understand, care about and act on climate change through their communication with others. In the Paris Agreement, public awareness of climate change and effective communication of climate change information were flagged as critical issues. This agreement was adopted by 195 countries in 2015. Its main goal is to keep global warming this century well below 2°C (compared to pre-industrial levels) and to continue efforts to limit the temperature increase to 1.5°C. The agreement puts forward the principles and areas of work that signatory countries should pursue to achieve this goal.

Despite being known for over a century (Arrhenius, 1896), the possibility of climate warming associated with the burning of fossil energies has only recently attracted attention since scientists first demonstrated its tangible impact and warned the public and governments of the risks of a climatic upheaval (IPCC, 2007). The inefficient energy utilization in homes, industries, and surrounding leads to wasteful consumption of fossil fuel which in turns causes excessive carbon dioxide emission into environment. It aggravates greenhouse effect. These negative effects of using energy especially the fossil fuel on our environment has given rise to a sustained renewable energy research and development. The increasing percentage of CO2 emission in the environment is the major reason for global warming and climate change. Climate models predict that the world's global average temperature will increase in the future.

Warming of 2oC by the end of the century may be unavoidable, and if greenhouse gases continue to increase at current levels, warming of about 4oC (7.2oF) can be expected. Only through rapid action to reduce greenhouse gas emissions will we be able to mitigate some of the projected impacts of climate change. Stout and Best (2001) noted that developing countries such as Rwanda urgently need to transition to a sustainable energy system. Energy affects all aspects of modern life. With the world's population growing exponentially, the demand for energy is also growing exponentially. Renewable energies have been the primary source of energy in the history of the human race. Wood has been used to boil water and heat the environment. As noted by Wulfinghoff (2000), it has been observed that all humans are highly dependent on energy sources.

Energy efficiency is one of the tools to fight climate change. It refers to the ability to achieve the best results in any activity using the least amount of energy resources. It allows reducing the consumption of a specific type of energy and the environmental impact it may have. Broadly speaking, biomass, coal, hydropower, natural gas, oil, uranium, wind and other energy sources are extracted, refined or converted into "energy carriers" such as electricity, gasoline, natural gas, etc., which are then consumed by the end user to provide energy services such as building heating and cooling, industrial motor drive and passenger transportation. Energy use has increased in recent years, but a power generation system to meet the required energy demand has not been added. The high cost of electricity increases circular debt and subsidies, and the use of fossil fuels causes environmental pollution and global warming (Raza et al., 2015). Environmental damage associated with the production, conversion, transport and use of different energy sources was significant in the past and is still not negligible today. The issue of global warming is becoming an important and binding element of world energy policy.

The regulations in the Rwandan Energy Policy (REP, 2015) highlight measures to promote energy efficiency through a combination of approaches such as new laws and standards, the introduction of economic incentives such as subsidies for the installation of solar water heaters and the obligation of industrial end-users of energy. Unlocking programs such as efficiency audits, examining systemic barriers or reducing fragmented incentives for energy-efficient technologies in buildings, and pursuing bulk purchasing strategies such as importing light-emitting diode (LED) lamps. Energy conservation, improved insulation and heat recovery, efficient energy use, process change and improvement, and good maintenance of machinery and equipment are necessary to improve energy efficiency. Rwanda is a developing country and imports most of its fuels to meet the increase in energy consumption. Increasing energy demand and consumption indicate that energy is one of the world's biggest future challenges (Sen, 2004).

Several governmental organizations have been established to promote the implementation of renewable energy technologies to reduce CO2 emissions (Paris Climate Agreement, 2015). How to achieve these targets is a challenge, given energy prices, available resources, and partnerships between countries. Many Rwandans depend on solid fuels such as wood, charcoal, coal, and dung in open fires and inefficient stoves for cooking and heating. Primary energy supply is dominated by wood, which accounts for about 80% of supply, of which 57% is direct supply and 23% is charcoal (Ndegwa et al., 2011). This is due to its accessibility and affordability by the people. It offers a low cost means for cooking and heating but mostly obtained unsustainably, leading to deforestation and desertification.

Harvesting and burning wood creates air, water, and land pollution, which causes environmental problems. For example, carbon dioxide, which is produced from deforestation, and from burning wood is a critical greenhouse gas. Greenhouse gases accumulating in the atmosphere are causing global climate change. Over time, this can lead to serious hazards, causing disasters such as floods, droughts, and disease. Even the combined effects of clearing an old-growth forest for wood can destroy habitats used by many animals. Use of fossil fuels has led to severe deforestation causing environmental stress and degradation, diminishing water sheds or catchments and rising vulnerability towards climate change. However, global climate changes have different impacts in different parts of the world. Some places will warm much more than others, some areas will receive more rainfall, others will experience more frequent droughts, etc. To better comprehend climate change, it is crucial to understand what it means for different people in different parts of the world. Addressing environmental, political, and economic aspects in an integrated way allows for a broader understanding of climate change and ways of dealing with it.

Climate change poses risks to humanity, but for many these risks are still 'virtual' rather than real. In this regard, ‘people are thus liberated to argue from, and act upon, pre-established beliefs, convictions, prejudices, and superstitions’ (Adams, 2007). This makes climate change a cultural phenomenon rather than a purely scientific one. Widespread misinformation and disinformation on climate change are major obstacles to progress in tackling climate challenges. Deceptive or misleading content distorts perceptions of climate change, creates confusion, and often leads to delays or even harmful actions. The deliberate undermining of science through climate change misinformation has contributed to a misperception of scientific opinion and an underestimation of risk and urgency (IPCC, 2007). Climate change is often described as an intergenerational issue. As a result, education, and training institutions, from secondary schools to universities, appear to play an important role in effectively communicating responsible scientific and policy developments on climate change (Ward, 2008).

Climate scientists are trying to understand these processes, develop and test scientific theories, and develop more effective communication strategies to find solutions to this climate change problem. Changes in the understanding of science communication have also contributed to rethinking climate change communication. In this context, Hulme (2007) argues that the task of communicating about climate change goes beyond raising people's awareness of what he calls “lowercase climate change,” i.e. H. that climate change is a physical reality. Advancing climate change caused by the depletion of non-renewable natural resources and anthropogenic greenhouse gas emissions needs to be addressed urgently, effectively and in a coordinated manner at global and local levels. Science has largely failed to adequately consider climate change outside the traditional fields of physics or meteorology. As a result, great opportunities to inform and train students in other areas such as biology or economics are lost. Beyond improving the curriculum, universities can do much to ensure that issues related to climate change are included in teaching (Eagan et al., 2008; National Wildlife Federation, 1998; Rappaport and Creighton, 2007). For instance, it is important for teachers to explore the connections between their subject areas and climate change. Contrary to popular belief, climate change is not just a matter for climate modelers or physicists. Furthermore, the magnitude of climate change means that it will be of interest and relevance to teachers, economists, and biologists, to name a few. If long-term

changes in attitudes and behavior are to be expected and new technologies are to be developed, it is important that climate change is anchored in university curricula.

It is against this backdrop that this study was conducted to assess the potential impacts of climate change communication on energy efficiency utilization among university students in Rwanda. There has been numerous climate change information, education, sensitization advocacies that are aimed at improving knowledge, attitudes and intentions to improve peoples' perceptions of climate change and climate change mitigation. According to Johnson (2012), communication includes three main strategies: persuading individuals to change their own energy consumption and adaptations, taking action to promote collective action to change the behavior of individuals and institutions, and negotiation and joint effort in order to solve problems to identify and solutions. Communication can include communicating facts, discussing which values are foregrounded and what impact they have on action, and a range of other ways, either individually or collectively, through authoritative scientific information, debate and mobilization, three important areas of the climate change communication.

1.1. Statement of the Problem

As the topic of a public communications or policy campaign, climate change is like any other campaign; The messenger is just as important as the message. People listen to people they can trust and act on the information they receive. Trust is important because action on climate change requires difficult political decisions and personal behavioral changes. Since 1995, the Conference of the Parties (COP), the highest body of the United Nations Framework Convention on Climate Change, has strengthened the international response to climate change, with the most recent COP26 meeting in Glasgow in 2021. Rwanda's Energy Policy (REP, 2015) highlights the Highlights measures that need to be taken to promote energy efficiency through a combination of approaches such as regulations, new laws and standards and the introduction of economic incentives. Rwanda's energy policy was adopted in response to climate change and focused on restrictive climate and energy policies.

Despite the widespread concern about climate change and the Rwanda Energy Policy adopted in response to addressed climate change, the implementation remains low. The challenge is how to accomplish these goals while contemplating energy prices, the availability of resources, and cross-country partnerships. In tackling energy and environmental problems, various measures have been taken, but the results were not very satisfactory. This could be partly explained due to the difficult policy choices and personal behavior changes. Research evidence from across the globe shows that climate change affects the developing countries like Rwanda most. This is because the poor people live in sub- standard housing that are highly exposed to climate change impacts such as floods, droughts Increased rainfall, changes in the availability of food and freshwater, loss of biodiversity and nature etc. Thus, developing countries are particularly vulnerable to the impacts of extreme weather.

Communicating climate change is a contribution toward meeting the goal of the Paris Agreement. Many climate issues are communicated using climate change communication, education, sensitization, and advocacies on convincing the public of the reality of climate change. These strategies aimed at improving knowledge, attitudes and

intentions that necessitate a change in individual behavior and energy consumption practices. It has been suggested that investing to reduce climate-related risks will provide great opportunities to achieve sustainable development in economic, social, and environmental aspects.

1.2. Objectives of the Study

The objectives of the study are to assess the:

1. Communication strategies used by the university on knowledge of climate change on energy efficiency utilization among university students
2. Communication strategies on knowledge of climate change on energy efficiency utilization among university students
3. Use of authoritative scientific information strategy on the knowledge of climate change on energy efficiency utilization among university students
4. Discussion/conveyance of facts strategy on the knowledge of climate change on energy efficiency utilization among university students
5. Mobilize action/good practice strategy on the knowledge of climate change on energy efficiency utilization among university students
6. Gender difference on the knowledge of climate change on energy efficiency utilization among university students

1.3. Research Questions

The following research questions were answered:

1. What are the communication strategies used by the universities on knowledge of climate change on energy efficiency utilization among university students
2. What are the climate change communication strategies on knowledge of climate change on energy efficiency utilization among university students

1.4. Hypotheses

The following hypotheses were tested:

Ho_1: Communication strategies used by the universities will not significantly raise knowledge of climate change on energy efficiency utilization among university students of Rwanda

Ho_2: Use of authoritative scientific information strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Ho_3: Conveyance of facts/discussion strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Ho_4: Mobilize action strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Ho_5: There is no significant gender difference in the knowledge of climate change on energy efficiency utilization among university students

1.5. Conceptual framework

Climate change communication the independent variable has three basic domains which includes; authoritative scientific information, conveyance of facts/discussion and mobilize action/ good practice. Use of authoritative scientific information is an important aspect of climate change communication because misinformation and disinformation are widespread on the issue of climate change. Lack of information and understanding explains the lack of public engagement, and that therefore more information and explanation is needed to move people to action. Conveyance of facts and figures must come from a reliable source, which is science-based with trusted messenger. Discussing the problems and the solutions by explaining the scale of the climate crisis is very important. Invariably to convey a hopeful message focused on the solutions, helping people feel empowered and motivated to engage. The fear and visions of potential catastrophes as a result of inaction would motivate audiences to action. While mobilize action guarantees the reduction of causes of climate change by moving students' audiences to action. Thus, climate change communication is the most effective way to reach audiences on this issue. Student's social media platforms also make provision for these three domains of climate change communication which are information, discussion, and mobilization.

This independent variable (climate change communication) was assessed to ascertain the knowledge on energy efficiency utilization among university students in Rwanda which is dependent on it. However, the theoretical bases for this framework were discussed using management theories that create structure we can follow to better implement solutions. The theory of change to climate change was used in identifying positive step towards making sustainable, transformative action towards climate change adaptation and mitigation. All hands are needed on deck.

2. Methodology

A survey research design was used for the study. The population of the study comprised all the 2022/2023 session third year undergraduate students of three universities in Rwanda with a population of three thousand five hundred and three (3,503) students. A sample of three hundred and fifty (350) students was selected to represent 10% of the population using rule of thumb and proportionate sampling techniques. Multistage sampling technique was adopted to select respondents for this study. Students from faculty sciences were exempted from the study because they offer courses on climate change and energy. Simple random sampling technique was used to select three (3) universities from twelve (26) universities in Rwanda as follows; University of Lay Adventists of Kigali (UNILAK), Kigali Independent University (ULK) and University of Technology and Arts of Byumba (UTAB), for the study. Proportionate sampling technique using 10% across the whole sample was used to assign numbers of questionnaire to each university. Purposive sampling was used to select these undergraduate students from these universities. Accidental sampling was used to identify respondents from these universities. This is unavoidable owing to the fact that the students run different programs, day, weekends and holidays and on different intakes. Thus, the population is non-cohort and divergent.

The instrument for the study was a self-developed Climate Change Communication Questionnaire (CCCQ) in line with the objectives of the study. The questionnaire was divided into five sections. Section A solicited information on demographic characteristics of the respondents. Section B, elicited information on communication strategies used by the university on knowledge of climate change on energy efficiency utilization among university students. Section C, elicited information on communication strategies on knowledge of climate change on energy efficiency utilization among university students. Section D, elicited information on the use of authoritative scientific information strategy on the knowledge of climate change on energy efficiency utilization among university students. Section E, elicited information on discussion/conveyance of facts strategy on the knowledge of climate change on energy efficiency utilization among university students. While, Section F, elicited information on mobilizes action strategy on the knowledge of climate change on energy efficiency utilization among university students. The questionnaire adopted the four-point Likert scale mode of knowledge of action format; Always True (AT), Sometimes True (ST); Rarely True (RT); and Not True (NT). The instrument was validated by two experts in the area of sciences as well as other two in measurement and evaluation. The four experts were requested to validate the instrument in terms of: i) Clarity of instruction to the respondents, ii) Proper wording of the items and iii) Appropriateness and adequacy of the items in addressing the objective of the study.

Their recommendations served as guide to modification of items in the instrument. The validated questionnaire was tested on Institut D'enseignement Superieur de Ruhengeri (INES-Ruhengeri) students for its reliability. Split-half method was used to determine the reliability of the instrument. The results from the pre-test were correlated and the reliability was determined using the Pearson Product Moment Correlation Coefficient. The reliability of the instrument was established by pilot testing using (20) students of (INES). Split-half technique was used for the pilot test that determined the reliability of the instrument of 0.80r that was considered highly reliable. Descriptive statistics was used to describe the demographic data of the students. The research questions were answered using percentages while inferential statistics of t-test Analysis was used to test the hypotheses at 0.05 alpha level of significance.

3. Results and Discussions

The findings of the study are represented in accordance with the research questions and hypotheses that guided the study.

Table 1. Demographic characteristics of respondents

S/No	Variables	Responses	Respondents	Percentage (%)
1	Age	20-29	297	84.9
		30-39	42	12.0
		40 and above	11	3.1
2	Gender	Male	168	48.0
		Female	182	52.0
3	University	UNILAK	105	30.0
		UTAB	118	33.7
		ULK	127	36.3
Total			**350**	**100.0**

Table 1 showed that 297 (84.9%) of the respondents were between the age bracket of 20-29years, 42 (12%) of the respondents were between the age of 30-39years and 11 (3.1%) of the respondents were between the age of 40 and

above years. While 168 (48%) of the respondents are male and 182 (52%) females. With regards to universities, 105(30%) of the respondents were from UNILAK, 118(33.7%) of the respondents were from UTAB and 127(36.3%) were from ULK.

3.1. Research Question 1: What are the communication strategies used by the universities on knowledge of climate change on energy efficiency utilization among university students.

Table 2. Communication strategies used by the universities on knowledge of climate change on energy efficiency utilization among university students.

Variables	Always true	Sometimes true	Rarely true	Not true	Total
Authoritative scientific information	25(7.1%)	23(6.6%)	23(6.6%)	29(8.3%)	100(28.6%)
Conveyance of facts	38(10.6%)	36(10.3%)	31(8.9%)	30(8.6%)	135(38.6%)
Mobilize action	32(9.1%)	31(8.9%)	29(8.3%)	23(6.6%)	115(32.9%)
Total	95(21.1%)	90(25.7%)	83(23.7%)	82(23.4%)	350(100%)

Table 2 showed that 38(10.6%) discussion/conveyance of facts strategy was always used by the universities than authoritative scientific information and mobilize action on knowledge of climate change on energy efficiency utilization among university students.

3.2. Research Question 2: What are the climate change communication strategies on knowledge of climate change on energy efficiency utilization among university students?

Table 3. Communication strategies on knowledge of climate change on energy efficiency utilization among university students?

Variables	Always true	Sometimes true	Rarely true	Not true	Total
Authoritative scientific information	31	35	25	9	100
	(8.86)	(10.00)	(7.14)	(2.57)	(28.57)
Conveyance of facts	46	46	43	0	135
	(13.14)	(13.14)	(12.29)	(0.00)	(38.57)
Mobilize action	32	39	34	10	115
	(9.14)	(11.14)	(9.71)	(2.86)	(32.86)
Total	109	120	102	19	350
	31.14	34.29	29.14	5.43	100.00

Table 3 indicated that the use of conveyance of facts 46(13.14%) is a preferred communication strategies on knowledge of climate change on energy efficiency utilization compared to authoritative scientific information and mobilize action strategy.

3.3. H_{o1}: Communication strategies used by the university will not significantly raise knowledge of climate change on energy efficiency utilization among university students.

Table 4. Summary of One-sample t-test Analysis on communication strategies used by the university on knowledge of climate change on energy efficiency utilization.

Variables	Mean	SD	df	t	P-value	Decision
Knowledge of climate change on energy efficiency utilization	3.77	0.82	349	61.691	0.000	Significant
Constant mean	2.50					

t = 61.691 df = 349; (p> 0.0001), Key * significant at 0.05

Table 4 contains information on knowledge of climate change on energy efficiency utilization. One-sample t-test applied to test the null hypothesis. The result showed that communication strategies used by the university significantly raise knowledge of climate change on energy efficiency utilization among university students ($p< 0.05$), hence the null hypothesis was rejected.

3.4. H_{o2}: Use of authoritative scientific information strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Table 5. Summary of One-sample t-test Analysis on use of authoritative scientific information strategy to raise knowledge of climate change on energy efficiency utilization.

Variables	Mean	SD	df	t	P-value	Decision
students' subscription to handset	3.68	0.73	349	82.321	0.000	Significant
Constant mean	2.50					

Table 5 contains information on use of authoritative scientific information strategy to raise knowledge of climate change on energy efficiency utilization. One-sample t-test applied to test the null hypothesis. The result showed that use of authoritative scientific information strategy significantly raises knowledge of climate change on energy efficiency utilization among university students ($p< 0.05$), hence the null hypothesis was rejected.

3.5. H_{o3}: Conveyance of facts/discussion strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Table 6. Summary of One-sample t-test Analysis on conveyance of facts strategies on knowledge of climate change on energy efficiency utilization among university students

Variables	Mean	SD	df	t	P-value	Decision
Conveyance of facts strategies on knowledge of climate change on energy efficiency utilization	3.53	0.91	349	77.789	0.000	Significant
Constant mean	2.50					

Table 6 contains information on influence of conveyance of facts strategies on knowledge of climate change on energy efficiency utilization among university students. One-sample t-test applied to test the null hypothesis. The result showed that conveyance of facts/discussion strategy significantly raise knowledge of climate change on energy efficiency utilization among university students ($p< 0.05$), hence the null hypothesis was rejected.

3.6. H_{o4}. Mobilize action strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students

Table 7. Summary of One-sample t-test Analysis on mobilize action strategy on knowledge of climate change on energy efficiency utilization among university students.

Variables	Mean	SD	df	t	P-value	Decision
Mobilize action strategy raise knowledge of climate change on energy efficiency utilization among university students	3.07	0.73	349	32.673	0.0001	Significant
Constant mean	2.50					

Table 7 contains information on influence of mobilize action strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students. One-sample t-test applied to test the null hypothesis. The result showed that mobilize action strategy significantly raise knowledge of climate change on energy efficiency utilization among university students ($p< 0.05$), hence the null hypothesis was rejected.

3.7. H_{o5}. There is no significant gender difference in the knowledge of climate change on energy efficiency utilization among university students.

Table 8. Summary of t-test Analysis on gender difference in the knowledge of climate change on energy efficiency utilization

Gender	N	Mean	df	t	P-value	Decision
Male	168	3.17	349	2.159	0.34	Not significant
Female	182	3.34				

Table 8 contains information on influence of gender difference on knowledge of climate change on energy efficiency utilization among university students. Independent t-test applied to test the null hypothesis. The result showed that there is no significant gender difference in the knowledge of climate change on energy efficiency utilization among university students ($p>0.05$), hence the null hypothesis was retained.

The following findings were made at the completion of analysis of results for the study.

1. Conveyance of facts/discussion strategy was always used by the universities than authoritative scientific information and mobilize action on knowledge of climate change on energy efficiency utilization among university students.
2. Conveyance of facts is a preferred communication strategies on knowledge of climate change on energy efficiency utilization compared to authoritative scientific information and mobilize action strategy.
3. Communication strategies used by the universities significantly raise knowledge of climate change on energy efficiency utilization among university students.
4. Use of authoritative scientific information strategy significantly raise knowledge of climate change on energy efficiency utilization among university students.
5. Conveyance of facts/discussion strategy significantly raise knowledge of climate change on energy efficiency utilization among university students.
6. Mobilize action strategy significantly raise knowledge of climate change on energy efficiency utilization among university students.
7. There is no significant gender difference in the knowledge of climate change on energy efficiency utilization among university students.

While answering the research question 1, the analysis showed that discussion/conveyance of facts strategy was always used by the universities than authoritative scientific information and mobilize action strategy on communication of climate change for energy efficiency utilization. The results of the study showed that

communication on the topic of climate change was extremely successful. This is consistent with Marx et al. (2007) find that almost everyone in the surveyed population in all countries has at least heard of this problem and most can identify at least some significant impacts of climate change. Ockwell et al. (2009) argue that communicating the facts about climate change is only part of the bigger picture and that raising awareness and discussing an issue does not directly lead to behavioral change or policy action.

Research question 2, confirmed that discussion/ conveyance of facts is a preferred communication strategies on knowledge of climate change on energy efficiency utilization among university students. This finding is consistent with (Lorenzoni et al. 2007; Moser 2009b; Moser and Dilling 2007; NRC 2002), which suggest that knowledge dissemination can successfully bridge the gap between science and action; This is done by promoting public participation in climate change. This includes a cognitive, emotional, and behavioral dimension; that is, people engage mentally with the subject and understand it; experiencing an emotional response such as interest, concern, or worry; and respond actively through climate-related behavioral changes or political action.

Hypothesis 1, states that communication strategies used by the universities will not significantly raise knowledge of climate change on energy efficiency utilization among university students. It was found that the communication strategies used by the universities significantly raise knowledge of climate change on energy efficiency utilization among the students. The use of authoritative scientific information, discussion and mobilize action communication strategies have aimed to raise awareness of embracing a low-emission economy. Thus, provide great opportunities to achieve sustainable development in economic, social and environmental aspects. The universities and their students use wide variety of channels and social media platforms, from text and talk, images and artistic installations, to films, documentaries and fun activities enjoyed by students to achieve effective climate change communication on energy efficiency utilization. Although this finding is inconsistent with findings that designated higher education institutions have largely failed to adequately address climate change (Eagan et al., 2008; National Wildlife Federation, 1998; Rappaport and Creighton, 2007), it lies outside the traditional fields of physics or meteorology. This means that great opportunities to inform and educate students in other areas such as biology, sociology or economics are lost.

Furthermore, Dilling and Farhar (2007) noted that no matter how much communicators encourage individuals to use less energy, such efforts can fail if people have no alternatives, for example, to heat their homes or get to work on time. Communicating the benefits of efficient energy use will only produce results if easy ways to implement these changes are provided. In support of this, Moser and Dilling (2007) quoted “In short, communication for social change must consist of efforts to increase the motivation to make a change and help to lower the barriers to realizing it”

Hypothesis 2, states that the use of authoritative scientific information strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students. It was found that authoritative scientific information strategy does raise knowledge of climate change on energy efficiency utilization among university students. This is because science communication has contributed to rethinking climate change communication as

well. According to IPCC (2007) widespread on the issue of climate change are based on misinformation and disinformation that are major obstacles towards progress in tackling the climate crisis. Many scientists and policymakers agreed that the public needed to be educated by experts and that knowledge and consensus would increase through more effective public participation by scientists. Furthermore, Marx et al. (2007) found that trust in the messenger is particularly important in the context of an issue such as climate change, which is invisible and uncertain, appears distant in time and space, is scientifically and morally complex, and places significant demands on the scientific work of the world Citizens can face literacy and behavior.

Hypothesis 3, states that conveyance of facts strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students. This hypothesis was rejected in view of the fact that discussion/conveyance of facts strategy do raise knowledge of climate change on energy efficiency utilization among university students. The lack of direct experience makes climate change a problem that, at least for now, essentially requires those with expert knowledge to signal, illustrate, and explain to those without. Therefore, more information and explanations are needed to mobilize people (Bak 2001). However, Gardner and Stern (2002) argue that there is evidence that better knowledge about climate change does not necessarily raise concerns and that even a better understanding of possible solutions does not necessarily lead to effective behavior.

Hypothesis 4, states that mobilize action strategy will not significantly raise knowledge of climate change on energy efficiency utilization among university students. The finding from this study showed that mobilize action strategy significantly raise knowledge of climate change on energy efficiency utilization among university students. The students identified that mobilize action strategy do raise their knowledge of climate change on energy efficiency utilization. The standard goal of most climate change communications is not only to reach the target audience, but also to actively engage them. There is a need to combine knowledge about climate change with practical actions that everyone can take to ensure their contribution to the problem-solving process. It is also important to ensure the success of emissions reduction and trading systems, which are some examples of future global efforts to curb climate change. Some researchers have suggested that physical or physical exposure to a hazard motivates actions, suggesting that high room temperature and humidity can increase the validity of climate change simulation (Zaalberg et al. 2009). Moser (2009) states that the best service to people in a democratic society is to actively engage with a problem, make their voices and values heard, and help create social responses. Imposing a barrage of scientific facts and technocratic solutions on a population without debating them and understanding the risks and choices is likely to lead to resistance and opposition.

Hypothesis 5, the null hypothesis was retained. It was concluded that there is no gender difference in knowledge of climate change on energy efficiency utilization among university students. Climate change is not a matter of concern exclusive to some people. This is due to the fact that it does have implications on every irrespective of sex.

4. Conclusions

Based on the findings of the study, it is concluded that: The communication strategies used by the university will significantly raise knowledge of climate change on energy efficiency utilization among students. As a result, great opportunities to communicate and educate students from other fields. Integrated communications and engagement on climate change by organizing workshops, active campaigns, social media platforms and advocacy to raise students' energy knowledge and attitude. Knowledge is important but insufficient to change behavior. Communicating about the benefits of energy-efficient utilization will not produce results if easy ways to implement these changes are not provided. Our universities must therefore explore research, science and innovation to develop curricula that address issues related to climate change. If long-term changes in attitudes and behavior are to be expected and new technologies are to be developed, it is of great importance to integrate climate change into university curricula.

Based on the conclusions of the study, the following recommendations are made:

1. The universities should provide mobilize action/good practice strategies for climate change communication on energy efficiency utilization among students, which apply to climate action.
2. Conveyance of facts by framing emissions reduction in terms of both poverty and climate change solutions and actionable policy recommendations
3. Disseminate authoritative scientific information about climate change challenges and solutions to be inclusive and accessible to all students.
4. Mobilize action to increase motivation of energy efficiency utilization by students in the university and beyond.
5. Integrated communications and engagement on climate change and gender issues by organizing workshops, active campaigns, social media platforms and advocacy to raise students' energy knowledge, attitude, and intentions positively.

Declaration of Competing Interest and Ethics

The author declares no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for this manuscript published in OPS Journal belongs to the author.

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