Original Research Article

University Students' Conceptions about Global Warming and Climate Change

ABSTRACT

The aim of this study is to assess the global warming and climate change preconceptions and misconceptions of students. Descriptive survey method was used for the study. The participants of this study were 84 university students who were in the first and last year of their study. Results show that in survey-based conception test first-year geography students scored significantly higher than third-year geography students (mean score of 57.42 to 52.00 and standard deviation 7.10 to 8.50 respectively; MD=5.42, t (82) 3.13, *P*=0.002, α=0.05.). Analyses of gender effect reveals that male students scored slightly higher (M=55.26, SD=8.36) than their female counterparts (M=52.65, SD=8.07) on climate change conceptual knowledge; MD=2.60, t (82) 1.33, *P*=0.186, α=0.05. Findings further indicate that both education levels grip a lot of cause-related and evidence-related misconceptions about the climate change. The mismatch between educational level and environmental conceptual knowledge calls for among others reevaluation of current harmonized modular curricula that help students to acquire deep knowledge about climate change.

Key Words: *Climate Change, Global Warming, Greenhouse Effect, Ozone Depletion, Conceptions, Preconceptions, Misconceptions.*

1. INTRODUCTION

In recent years global climate change has become a big challenge to the world community and scientific society because of its adverse impact on agronomic productivity, the environment, food security and the quality of life. It is projected to have serious environmental, social, and economic impacts on developing countries including such as Ethiopia, particularly on agricultural sector that is the mainstay of the national economy. According to Admassie, Adnew and Tadege [1] climate variability in Ethiopia already impacting considerably food security, water and energy supply, poverty reduction effort and an increase in frequency of occurrence of drought by causing natural resource degradation. A query then is raised: is

this imperative conception being taught sufficiently, if at all, and are students, our future generation, acquiring an understanding of the phenomenon? In another study Aklilu [2] found that not only Ethiopian farmers are suffering from deficiency in the implementation of climate change adaptation and mitigation strategies but also the Ethiopian policy-makers too. Particularly teaching young generation about climate change has the potential to possess far reaching profits by empowering them to adopt appropriate adaptation and mitigation activities which may be transmitted to their families and communities. Regardless of these and other benefits, however, analysis of international studies acknowledged that students lack adequate scientific knowledge about climate change and often approach the phenomenon with misconceptions.

As stated above, analogous findings were reported by Papadimitriou [23]; Gowda [15]; Österlind [22]; Read et al. [25]; Pruneau et al. [24]; Andersson and Wallin [4]; Koulaidis and Christidou [21]; Boyes et al. [7]; Boyes and Stanisstrret [8]; Boyes and Stanisstreet [9] and Rye et al. [26] the presence of misconceptions among the students that viewed stratospheric ozone depletion as a primary cause of global warming and climate change. Similarly, in a study carried out by Read et al. [25], Papadimitriou [23] and Gowda et al. [15] revealed that students of all grade levels hold confusions and misconceptions about weather and climate. Interestingly, studies on pre-service teachers' perception about climate change, greenhouse effect and ozone depletion by Dove [11]; Grove and Pugh [16]; Khalid [19] and Papadimitriou [23] revealed that they held preconceptions and misconceptions regarding above mentioned environmental issues. In addition, not surprisingly Andersson and Wallin [4]; Boyes and Stanisstrret [8]; Koulaidis and Christidou [21] and Gowda et al. [15] found that students associated unrelated air pollution or pollutants' effect into global climate change. Moreover, Boyes et al. [6] and Shepardson et al. [27] argued that students of all ages hold misapprehension about global climate change, its causes, consequences, and cures. Furthermore, Boyes et al. [10] and Andersson and Wallin [4] showed that unexpectedly students failed to recognize the difference between greenhouse effect and global warming.

The findings of the above studies suggest that there is a lack of what Driver et al. [12] called curricular continuity, a series of experiences that construct from students' conceptions towardscientific

understanding and eventually scientific literacy. Despite of how these students develop their misconceptions regarding these environmental issues, it is quite likely that they will possess deeply held misconceptions and confused issues that may go unchanged throughout their carrier. Given the extent and harshness of the climate change problem, schools and universities should be able to play a vigorous role in cultivating but also in encouraging students to be activists for their environment and actively participate in positive action towards the environment. For example, Jensen and Schnack [18] in their study stated that a clear understanding of environmental issues is a pre-requisite for taking positive environmental action.Similarly, studies conducted by Aklilu [3] and Gedion [14] indicated that the greater the environmental education attainment of the public the more sustainable utilization of natural resource and better understanding human-environment interaction.Therefore, it is critically important for research in environmental education to continue to expand our understanding of students' conceptions about environmental phenomena and events to recommend standards, curriculum guides, and classroom instruction approaches in Ethiopian education system. This study therefore, was designed to fill this gap, since education is believed to be a key to understand the complex feature of global climate change and the way to ease its impact that we face. Moreover, no similar studies were found in Ethiopia that dealt with aforementioned environmental conceptions at any level, let alone with the university students.

To conduct the present survey and achieve the intended objectives, the study sought to provide answers to the following leading research questions.

- What is the general level of students' knowledge towards global warming and climate change?
- What are students' conceptions of global warming and climate change?
- Are there any misconceptions among students regarding climate change and global warming? If so, how do such misconceptions arise?
- Is there any difference on climate change perception among students' in terms of gender and academic year level regarding causes consequences and mitigations?

The main objective of this study was to assess the level of first and third year geography students' conception and misconceptions regarding the cases, consequences and mitigations of the climate change. Specifically, the study was conducted to determine the degree of students' attained knowledge

about climate change and to compare the similarities and difference in students' conceptions about climate change based on gender and academic year level. Alongside, the ultimate specific aim of this research was to add to the extant literature base on students' conception of global warming and climate change and generate information for curricular development that can have a significant impact on what and how students learn about climate change.

1.1. TERTIARY EDUCATION SYSTEM OF ETHIOPIA IN BRIEF

Following the regime change in 1991 and formulation of a new Education and Training Policy in 1994, the Ethiopian education system has gone through a major reform which resulted in, among other things, a change of the overall educational structure to 8-2-2-3, i.e. eight years of primary, two years of secondary, two years of preparatory education; and three years of tertiary education which leads to a bachelor's degree. The preparatory level (grades 11-12) is meant to prepare students for college education. It is important to note here that students who pass the college entrance exam, which is administered at the end of grade 12, join public universities; and attend classes in one of the various disciplines. Though most of the disciplines require three years of study for a bachelor degree (e.g. Geography, Biology, etc.), there are some disciplines (e.g. Law, Medicine, Engineering, etc.) which require a longer stay in a university to complete a study for the first degree. What is more, students who want to become teachers will be required to get a Postgraduate Diploma in Teaching after earning their first degree in one of the subject area disciplines.

1.2 SIGNIFICANCE OF THE STUDY

Forall level curricula designers, course developers, and policy makers, the study can contribute to demonstrate the literacy level of undergraduate students about climate change, that may help to fill the gap, if any, in the policy in general and curricula materials in particular. In addition, it gives information that may initiate other researchers to investigate comprehensively on the problem. Furthermore, this study is important in that it can contribute a valuable source of information that may be considered by any

environmental protection organizations which aim to have an interest in making learning institutions more productive to address such environmental problems.

2. MATERIALS AND METHODS

2.1. POPULATION, SAMPLE AND SAMPLING TECHNIQUE

This study was aimed to include the entire population considering their total number; consequently no sampling method was employed. The participants' age range from 19 to 23 and all of came straight from high school many of them without work experiences.This provided us with a modest age range (first-year and third-year students who were at the beginning and at the end of their study) and increased the heterogeneity of the sample. The subjects were 84 students, 26 females and 58 males majoring geography at Addis Ababa University. They were targeted for the study for three reasons. Firstly, their field was an appropriate venue for climate change instruction. Secondly, to evaluate how well attained climate change conceptual knowledge is retained overyears by third year students. Thirdly, they are teachers of tomorrow who are assigned to teach the environmental subject in secondary schools.

2.2. DATA COLLECTION AND ANALYSIS

The survey questionnaires adopted from Groves and Pugh [16] and Boyes et al. [10] and slightly modified by the researcher. This offered an opportunity to determine whether or not common climate change misconceptions identified in previous studies are also held by targeted students. The questionnaire consisted of 36 statements; the first 12 statements deal with conceptions about causes of climate change; the second set of 12 deal with conceptions about the consequences of climate change; while the last 12 conception items focus on ways to mitigate climate change. The Likert scale employed through three steps from ''Agree, Disagree and No Idea''.

To determine the items the researcher assessed the current undergraduate geography courses through content analysis with learning module designers and climate science instructors as panels of an expert. In particular, it was carried out to determine how much statements of objectives and contents related to climate change and global warming are elaborated in the incumbent harmonized geography modules. A pilot study was also carried out to determine the validity and reliability of the instrument used.

Accordingly, a pilot version was administered to second-year geography students who were not included in the study and revised based on their responses. In addition, to check and ensure their face and content validity the instruments were given to 2 geography and environmental education professors of Addis Ababa University and 2 undergraduate geography curriculum developers. Based on their comments and suggestions items modification were made. In addition, analysis of pilot data was conducted to judge the relevance of each item in order to answer research questions. Using the Cronbach Alpha value, the calculated coefficient alpha was equivalent to 0.798 which shows that the test had high reliability. The data collected from respondents were analyzed using inferential statistics like independent sample t-test and descriptive statistics such as percentages, frequency distributions, mean scores, and standard deviations.

3. RESULTS AND DISCUSSION

3.1. ANALYSIS OF GENDER EFFECT ON THE CONCEPTUAL KNOWLEDGE

An analysis of gender effect was not a major aspire of this study. This variable was included in the intention to add scope and breadth to the study. The T-test in Table 1 illustrates that male geography students scored slightly higher (M=55.26, SD=8.36) than their female counterparts (M=52.65, SD=8.07) on climate change conceptual knowledge; MD=2.60, t (82) 1.33, P=0.186, α=0.05. These results suggest that sex has little effect on the level of students' environmental conceptual knowledge. This finding is supported by findings of Groves and Pugh [16] and Kirkeby Hansen [20] who came up with results that showthe boys performed better than the girls on environmental knowledge inventory. The probable reason for this result might be relatively better male students' academic performance than their counterparts. However, this finding contradicts with the conclusions of Fatih and Osman [13] who reported that female students are keener to environmental issues than male students.

Table 1. An Independent Samples T-Test Analyses of Gender Effect on the Conceptual Knowledge of Climate Change

Gender	N	Mean	Std. Deviation	df	t	Sig (2-tailed)	Mean Difference

Male	58	55.26	8.36	82	1.334	.186	2.60
Female	26	52.65	8.07				

3.2. ANALYSIS OF EDUCATION LEVEL ON THE CONCEPTUAL KNOWLEDGE

Unexpectedly, analyses of education level shows that first-year geography students are found to be more knowledgeable about climate change in comparison to third-year geography students. Table 2, depicts that first-year students scored significantly higher (M=57.42, SD=7.10) than third-year students (M=52.00, SD=8.50) on conceptual climate change knowledge; MD=5.42, t (82) 3.13, *P*=0.002, α=0.05. This significant mean difference between two educational levels might be because of the fact in which the climate change and global warming issues more and better treated in first-year geography modules than in year two and three (See Table 3). For the most part, this noticeable result difference exhibited here is due to block course delivery mode and a few number of weeks allotted per semester, which was not accompanied with self- directed and project-related learning approaches. As a result these surface learning eventually lead students to short-term memory. Hence, learning institutions are supposed to create teaching and learning settings which can be exemplify by features as inter- and trans-disciplinarity, participation, self-reflection, problem orientation as well as the linking of formal and informal learning. As stated by Bacon and Stewart [5] material learned at a deep level will be retained longer than material learned at a surface level. Therefore, learning exercisesshould continue beyond any given course and into several subsequent courses, providing students the repetition, cross-course integration, recitation, and as a result increasing depth necessary to develop complex knowledge structures that students will retain for years to come. For these cases, currently, the national educational curricula have, generally, been harshly denounced of being inappropriate by most educators in the country. For example, Aklilu [2] elucidated that inadequate information has been integrated into students' textbook regarding issues under consideration above; and wherever included discussions on matters suffered most.For example, in study conducted by Hattie [17] underscored that more significant value in each curriculum development is the balance of surface and deep understanding, which directs to conceptual clarity. From this evidence one can hence understand how far the current state of higher education in Ethiopia is severely challenged and

working against the sustainable development of the country. Furthermore, the effect of a modular curriculum on these learning outcomes is an important area for future research.

Table 2. An Independent Samples T-Test Analyses of Education Level Effect on the Conceptual Knowledge of Climate Change.

Level of Education	N	Mean	Std. Deviation	df	t	Sig (2-tailed)	Mean Differences
First Year	38	57.42	7.10	82	3.13	0.002	5.42
Third Year	46	52.00	8.50				

Table 3. Modules that are Including Climate Change Issues in their Courses

Level of Education	Module Name	Course Related to Climate Change	No. of Allotted Weeks Per Semester	Course Delivery Mode
Year One	Climatology and Hydrology	Introduction to Climatology	2.7	Block
		Applied Climatology	2.7	
		Environmental Hydrology	2.7	
	Landform Studies	Geomorphology	2.7	Block
		Soil Geography	2.7	
		Biogeography	2.7	
Year Two	Mapping Techniques	None	2.7	Block
	Geography of Economic Development	None	2.7	Block
	Socio-Political Geography	None	2.7	Block
	Research Methodology	None	2.7	Parallel
Year Three	Spatial Data Acquisition and Analysis	None	13.5	Block
	Geography of Spatial Planning	None	5.4	
	Sustainable Resource Management And Livelihood	None	6.48	
	Environmental Studies	Environment and Sustain Development	2.7	

Research Work	None	2.7	Parallel

3.3. ANALYSIS OF INDIVIDUAL ITEMS

Under this sub-topic sample statements with the high percentage of correct and incorrect responses were selected from three categories (causes, consequences and cures) of the climate change for analysis.

a. Causes of the Climate Change

Preconceptions and misconceptions about causal factors was manifested by erroneous responses regarding hole in ozone layer (1), acid rain (4), global warming and tilt of Earth's axis (7), correlation between air pollution and climate change (8), linkage between incoming solar radiation and climate change and statement 12, about association between ozone layer hole and climate change (Table 4). For statement 1, disappointingly only very few first-year (5 %) and third-year (4%) students could give correct responses. The result showed that the students appear to have misconceptions of the nature of the ozone and its depletion; effects of air pollution and acid rain; and the nature of radiation balance. This finding is supported by the conclusion of Groves and Pugh [16] who came up with result that reveals incorrect conceptions of college students regarding causal relations between ozone holes and increased greenhouse effect. Similarly, in a study carried out by Koulaidis and Christidous [21] not a few students responded that increased greenhouse gases will cause air pollution. Boyes et al. [10] suggested that a reason for this common misconception is learning in this area cannot be experimental. The findings reveal that students displayed misconceptions while responding to statements because they draw a parallel among all three environmental issues (global climate change, ozone layer depletion and incoming solar radiation) and realize they are causative of each other. Many misconceptions are existing in the mind of student that the climate change is a phenomenon entirely anthropogenic (first-year 82% and year-three 87%). Unacceptably, both batches strongly endorsed that human activities are the sole causes of climate change. Here, more likely the role of the media in causing confusion than clarification cannot

be ruled out. Dove [11], Papadimitriou [23] and Boyes et al. [10] reported similar cause-related misconceptions while studying understanding level of student teachers and secondary school students on greenhouse effect and ozone layer damage respectively.

Regarding correct responses, a large majority of first-year (95%) and third-year (83%) students were sure that littering in the streets, dumping rubbish in water bodies and decaying wastes made worse climate change. In addition, overwhelmingly (95%) first-year and (87%) third-year students aware that rising greenhouse gases contribute considerably to the climate change. Similarly, high percentage of first-year (97%) and third-year (96%) students recognized that deforestation and land use change contribute considerably to global climate change. Furthermore, about 92% of first-year and 61% of third-year students were knowledgeable of the fact that gases from livestock manure and artificial fertilizers enhance climate change. Undistinguishable observations were reported by Boyes et al. [6] and Reye et al. [26] while studying knowledge level of students on greenhouse effect and global warming respectively.

Table 4. The frequency (f) and percentage (%) distribution of first-year (N=38) and third-year (N=46) students responses about the causes of the climate change

	Statements	Education Level	Correct		Incorrect	
			f	%	f	%
1.	Holes in the ozone layer contribute significantly to the global climate change because the hole lets in more solar radiation	First-year	2	5	36	95
		Third-year	4	9	42	91
2.	Deforestation, forest degradation and land use changes contribute to global climate change	First-year	37	97	1	3
		Third-year	44	96	2	4
3.	Littering in the streets, dumping rubbish in water bodies and decaying wastes made worse climate change	First-year	36	95	2	5
		Third-year	38	83	8	17
4.	Acid rain contribute significantly to the climate change	First-year	2	5	36	95
		Third-year	5	11	41	89
5.	Carbon dioxide that increases progressively in the atmosphere because of hydrocarbon combustion aggravating the global climate change	First-year	35	92	3	8
		Third-year	36	78	10	22
6.	The global warming and climate change is a phenomenon entirely anthropogenic (Human-caused)	First-year	7	18	31	82
		Third-year	6	13	40	87
7.	Recent global warming is happening due to natural causes	First-year	7	18	31	82

	such as tilt of Earth's axis	Third-year	13	28	33	72
8.	Air pollution and aerosols are directly related to global climate change	First-year	2	5	36	95
		Third-year	2	4	44	96
9.	Rising greenhouse gases including ground-level ozone contribute considerably to the climate change	First-year	36	95	2	5
		Third-year	40	87	6	13
10.	Increased incoming solar radiation to earth over past years made worth the climate change	First-year	10	26	28	74
		Third-year	5	11	41	89
11.	Gas from livestock manure and artificial fertilizers /Nitrous Oxide (N_2O)/ enhances climate change	First-year	35	92	3	8
		Third-year	28	61	18	39
12.	Ozone layer depletion causes climate change	First-year	4	11	34	89
		Third-year	4	9	42	91

b) Consequences of the Climate Change

The data pertaining to students' perceptions about possible effects of the climate change are presented in Table 4. The results of the study revealed substantial misconceptions over the association of the climate change to skin cancer (16), acid rain (17) and food poisoning (18). Disappointingly, only 5% of first-year and 7% of third-year students responded correctly, hence revealing a strong conviction that the increased climate change might cause holes in the ozone that will let more ultraviolet rays which augments the incidence of skin cancer. Similarly, both groups erroneously correlated climate change with acid rain (first-year97% and third-year 89%). They also thought that there would be food poisoning if climate change effect increases (first-year 89% and third-year 91%). More shockingly, 87% of the first-year and 78% of the third-year students affirmed that climate change causes earthquake. Furthermore, unacceptably, they appear to confuse about weather and climate distinction. Correspondingly, they wrongly associated short-term and local weather events with global climate change. Probably this might be that students claimed to have personally witnessed evidence of climate change from memorable weather events such as current droughts in the country. The result of this study and the studies conducted by Papadimitriou [23]; Gowda et al. [15]; Groves and Pugh [16]; Dove [11]; Boyes et al. [10] and Read et al. [25] are discouraging and clearly show that a number of cause-related and evidence-related misconceptions are at work. On the other hand, the results of the study reflected that both batches were possessing a bit better knowledge about some of possible consequences than causes of the climate change such as climate change would

cause a decline in agricultural productivity and loss of biodiversity (first-year 95% and third-year 91%); climate change would cause the amount and pattern of rainfall (first-year 87% and third-year 83%); climate change would lead to an increase in pests, insects, crop diseases and weeds in warmer areas (first-year 89% and third-year 80%); climate change could cause the sea level to rise (first-year 92 % and third-year 70%); an increase in greenhouse effect could cause more environmental refugees (first-year 97% and third-year 83%); They also strongly endorsed that increase in the global warming results in much more deserts and fewer fishes in the rivers (first-year 92% and third-year 89%). The knowledge these students have tended, however, to be not only very general but also surface and uncritical. For example, as stated by Boyes and Stanisstreet [9] if people do not know the exact causes of the problem, they cannot come up with proper cures to alleviate it.

Table 5. The frequency (f) and percentage (%) distribution of first-year (N=38) and third-year (N=46) students responses about the effects of the climate change

	Statements	Education Level	Correct		Incorrect	
			f	%	f	%
13.	Climate change causes decline in crop productivity, loss of biodiversity and even extinction of some plant and animal	First-year	36	95	**2**	**5**
		Third-year	42	91	4	9
14.	Climate change causes earthquake	First-year	5	13	33	87
		Third-year	10	22	36	78
15.	Climate change causes changes in rainfall patterns (frequent droughts and fires in some areas, flooding in	First-year	33	87	5	13
		Third-year	38	83	8	17
16.	Climate change causes skin cancer	First-year	2	5	36	95
		Third-year	3	7	43	93
17.	Climate change causes acid rain	First-year	1	3	37	97
		Third-year	5	11	41	89
18.	If climate change increases, people will be poisoned from heavy metals and photochemical smog	First-year	4	11	34	89
		Third-year	4	9	42	91
19.	Accelerated melting of glacial ice is the effect of climate change	First-year	30	79	8	21
		Third-year	34	74	12	26
20.	Climate change increases pests on crops, crop diseases, and weeds in warmer areas and spread of tropical diseases	First-year	34	89	4	11
		Third-year	37	80	9	20
21.	Weather anomalies (extreme weather events) are	First-year	1	3	37	97

evidences and effect of climate change	Third-year	8	17	38	83
22. Climate change causes the sea level to rise	First-year	35	92	3	8
	Third-year	32	70	14	30
23. If climate change increases, there will be more environmental refugees and increased migration	First-year	37	97	1	3
	Third-year	38	83	8	17
24. Climate change can result in much more deserts, less fresh water and epidemics on the earth	First-year	35	92	3	8
	Third-year	41	89	5	11

c) Mitigations of the Climate Change

The responses of both batches to the possible remedial actions of climate change displayed in Table 5. The data of the present study revealed some misconceptions of the students about how climate change can be mitigated, however, overall, they achieved better score than on the prior two categories; this difference is highly significant with a p-value much lower than 0.05. This result is consistent with the finding of Groves and Pugh [16] who came up with result that reveals evaluated students scored better on cures of the greenhouse effect than on causes and consequences statements. A majority of the first and third year geography students were aware of the common mitigation actions such as, generating electricity from renewable energy source (first-year 97 % and third-year 85%); conserving and preserving flora and fauna (first-year 84% and third-year 85%); recycling and reusing practices (first-year 79% and third-year 91%); promoting carbon trading practice (first-year 84% and third-year 57%); reducing poverty and starvation (first-year 87% and third-year 76%); efficient use of electricity (first-year 84% and third-year 72%), and developing a green economy (first-year 92% and third-year 87%). Similarly, majority of the students rightly recognized that planting more trees across the globe can made the climate change effect lesser (first-year 89 % and third-year 78%). Nevertheless, one concern of this study is that the above findings did not convincingly show if these students have critical knowledge of why these measures are considered useful. Similarly, in a study carried out by Boyes et al. [10] argued analogous observations while studying the understanding level of student teachers and secondary school children on greenhouse effect. However, they were unaware of many commonly adopted techniques and ideas which could help to reduce the causative agents of climate change such as using nuclear power stations instead of coal (first-year 21% and third-year 13%).The probable reason may be that Ethiopia generates most of its electricity from cleaner renewable energy (hydropower, geothermal power, and wind power) and in turn the influence of state media. Furthermore, unexpectedly majority of the students (first-year 76% and third-

year 70%) believe that government, NGO's and environmental experts are more responsible by being deeply skeptical about the contribution of individuals and community in combating climate change.

Table 6. The frequency (f) and percentage (%) distribution of first-year (N=38) and third-year (N=46) students responses about the solutions to alleviate the climate change

	Statements	Education Level	Correct f	Correct %	Incorrect f	Incorrect %
25.	Planting more trees across the globe can make the climate change effect lesser	First-year	34	89	4	11
		Third-year	36	78	10	22
26.	Using nuclear power stations instead of coal will aggravate the effect of global warming and climate change	First-year	8	21	30	79
		Third-year	6	13	40	87
27.	Generating electricity from renewable energy source (solar, the wind, flowing water, waves, tides etc…) can make lesser effects of climate change	First-year	37	97	1	3
		Third-year	39	85	7	15
28.	Conserving and preserving plant and animal species will reduce effects of climate change	First-year	32	84	6	16
		Third-year	39	85	7	15
29.	Recycling and reuse practices can diminish the consequence of climate change	First-year	30	79	8	21
		Third-year	42	91	4	9
30.	The problem and concern of climate change mitigation efforts should be left to government, NGOs and climate change experts only than individuals and community.	First-year	9	24	29	76
		Third-year	14	30	32	70
31.	Reducing the use of private vehicles can made the climate change effect lesser	First-year	30	79	8	21
		Third-year	32	70	14	30
32.	Carbon trading can contribute significantly to climate change mitigation efforts	First-year	32	84	6	16
		Third-year	26	57	20	43
33.	Reducing poverty and starvation in developing countries, including Ethiopia can make the climate change consequence lesser	First-year	33	87	5	13
		Third-year	35	76	11	24
34.	Efficient use of electricity can made the climate change effect smaller	First-year	32	84	6	16
		Third-year	33	72	13	28
35.	Producing and using more fuel-efficient vehicles/machines make worse the climate change	First-year	6	16	32	84
		Third-year	4	9	42	92
36.	Developing a green economy and community awareness creation can make the climate change consequence much more lesser	First-year	35	92	3	8
		Third-year	40	87	6	13

4. CONCLUSION

The evidence from this survey exhibits that many concepts regarding the basic concepts, cases, effects, mitigation and adaptation of the climate change were not well understood by geography first and third year students. Moreover, some cause-related and evidence-related misconceptions were common. These results largely mirror previous studies conducted elsewhere. For example, the wrong associations of the climate change to extreme weather events, skin cancer, acid rain and food poisoning. According to Groves and Pugh [16], these misconceptions can appear from ''untutored beliefs'' and scarce understanding, rather than from scientific interpretation. For example, Bacon and Stewart [5] stated that material learned at a shallow mode will not be remembered longer as material learned at a profound manner. Hence, miserable modular curricula, most teachers without deeper knowledge and low priority to this topic, are basic sources of the climate change misconceptions in various countries including Ethiopia. The findings presented in this study and similar international studies are either not encouraging or totally disappointing. For the most part, these common misconceptions can be alleviated, if not entirely solved, by implementing project-based learning at all levels. Perhaps projects and other experiences help students develop critical knowledge and avoid misconceptions. For these reasons, adopted modular curricula should be reevaluated, revised in detail and the contents of the courses and classroom instructional approach should be revisited at the public universities and teacher training colleges. It might be also useful to link the conceptual problems to hands-on experiences when possible that could easily be illustrated through students experiment or teacher demonstrations to dispel these misconceptions in their minds. The effect of a modular national curriculum on these misconceptions is an important area for future research.

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