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SECONDARY SCHOOL STUDENTS KNOWLEDGE LEVEL OF THE CONCEPTS OF METEOROLOGY AND ENVIRONMENTAL EDUCATION BETWEEN RURAL AND URBAN MOROGORO IN TANZANIA

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ABSTRACT

The study established if there is any significant difference in students' understanding levels on meteorology and environmental education concepts between rural and urban areas. A survey method was used to collect information from a sample of 480 form four students who were randomly selected from 12 schools in both rural and urban Morogoro. It was observed that urban students were significantly more knowledgeable of the basic concepts of environmental education and climate change than rural students. However, there was no significant difference in students' understanding between rural and urban students on some concepts of climate change and the role of man on the environment. Therefore educational stake holders need to ensure that both rural and urban environmental aspects are clearly understood by all students from the two localities for sustainable utilization of the environmental resources.

Keywords: Rural, urban, environmental education, meteorology, climate change

1. INTRODUCTION

1.1. Context

Tanzania launched Primary Education Development Plan (PEDP) 2002-2006 in 2001 with major aim of increasing access to primary education [1]. The plan led to increased number of primary school leavers demanding for secondary education. Therefore the government was obliged to introduce Secondary Education Development Programme 1 (SEDP 1) to accommodate the rapidly increasing number of primary school leavers. Parallel with increasing enrolment in secondary education, the certificate of secondary school curriculum was being reviewed so that the contemporary issues of information and communication technology, HIV/AIDS, environmental degradation and climate change were being accommodated in the curriculum. Generally, the objectives of SEDP I were to improve access with equity, quality, management and delivery of secondary education in Tanzania [2]. But the objectives of improving access with equity and quality has been facing two scenarios of challenges. Firstly, due to the fact that the number of secondary schools has more than tripled between 2004 and 2009 [2] leading to acute scarcity of teaching and learning resources. This challenge may be more critical in rural schools compared to town ones due to lower demand for formal schooling among rural communities than in town areas. Secondly, challenges associated with the content of the reviewed curriculum particularly the content of the environmental aspects that forms the basis for this article.

As cotemporary environmental problems get intensified with climate change it appears that clear understanding of the relationship between environmental degradation and climate change may also need some concepts of meteorology because climate change is experienced on a daily basis through various meteorological aspects such as rainfall, wind, temperature and humidity. This implies that merging the concepts of meteorology and environmental education can be one of the appropriate means of understanding cotemporary environmental problems though it is a challenge to curriculum developers especially where environmental issues and concepts of meteorology have been treated independently in the syllabus like the case of Tanzania.

Also, it should be noted that both rural and urban students face different environments. For instance urban students are at proximity with town pollutions from industries, automobiles and house holds whereas in rural areas students may be more familiar with environmental degradation results mainly from destruction of ecosystems due to agricultural activities, settlements and extraction of forest resources for commercial or direct consumption [3]. Similarly, urban populations experience different magnitude or intensity of meteorological aspects from rural communities. But knowledge on conservation in Tanzania for example, is only useful to urban students if they are aware that urban population survives because of the agricultural activities and water sources from rural environments. This is the reason why research shows that effective solutions to ecological problems must be based upon recognition of the diversity that exists in rural settings around the world [4].

Like wise rural students need to understand that they are supplied with goods resulting from industrial and transportation activities of the urban environment though the same activities are the main sources of environmental pollution. Research shows that environmental degradation aspects surrounding students' immediate environment which are considered into the school curriculum is an important means for reinforcing learning of conservation of that environment [5]; [6]; [7]. Therefore, assuming that teachers can refer their immediate environment when teaching environmental education; students' levels of understanding various environmental aspects can not be uniform for urban and rural students. But the current context in Tanzania is characterized by increasing rate of population growth, urban formation and rural urban migration intensified by the effects of climate change [8]. Since both rural and urban population needs to be knowledgeable about effective environmental management strategies in both rural and urban environments including both climate change mitigation and adaptation means; there is a need of conducting a study to determine if both rural and urban students' level of understanding of various environment management issues is significantly different.

1.2. Theoretical framework

Considering the necessity of environmental management, both rural and urban management strategies are integrated in the geography syllabus of the certificate of secondary education in Tanzania [9]. Although the syllabus is used by both rural and urban students, this does not necessarily mean that both rural and urban students have equal chance of understanding these environmental concepts because, the quality and the effectiveness of education depend on several factors among them are qualitative variables such as characteristics of schools, teachers and classrooms, as well as quantitative variables such as achievement scores [10].

Quantitative and qualitative variables which were prominent challenges during implementation of the reviewed curriculum were like financial difficulties, shortage of teachers, and lack of school buildings, laboratory equipments, computers, and libraries especially due to the increased number of schools and students enrolment [2]. Generally, the challenges faced by urban schools may be less than those of rural areas because rural children may be less interested in attending school due to high opportunity costs and low returns as they may find the curriculum less relevant to their lives [11]. Parents in rural areas often have a relatively low level of education and, as a result, may attach a low value to schooling and be less able to help their children learn. Further, homes in rural areas are often ill equipped to allow children to study, often lacking facilities such as electricity [12].

Considering the school resources; first, rural schools fail to meet the national standards of learning hours, second, in rural schools, library and computer resources are insufficient to meet the needs of especially economically disadvantaged students in community. third, teachers and administrators are not provided with much opportunity to participate in professional development activities in rural areas, fourth, the geographic distance to the city center and lack of official support make it more difficult to appoint, recruit, and retain well-trained teachers in rural areas [13]; [14]. These observations do not mean that urban schools are free of increasing enrolment challenges as enrollment has increased more rapidly in urban areas than in rural areas [11]. This poses a considerable strain to the availability of school resources such as classrooms and chairs.

Challenges propagating through both rural and urban schools can be related with a study which compared rural and urban students' attitudes on population education and the result was that there was no significant difference in attitude towards population education for rural and urban teachers [15]. The observation can be supported by another study conducted to determine if there is any significant difference in the academic performance of students between rural and urban environment where it was concluded that, all else equal, rural students do not suffer disadvantage in their academic performance simply as the result of their residence in rural areas or their attendance at rural schools [16].

Significantly, activities involving the socialization of children in the space of the household provide an excellent opportunity for teaching environmental values, attitudes and behaviour to children [17]; [18]; [19]. This observation may lead one to conclude that in rural communities where family level environmental activities are more pronounced than in urban setting; where children spend most of their time in schools, may be more aware with environmental aspects that surround their every day life than urban students with limited exposure to the outdoor activities ending at relying mostly on classroom environment.

But some researchers argue that formal environmental education helps students to develop more favorable attitudes towards environment [5]; [20]. This means environmental attitudes are considered as a component of environmental literacy (Roth, 1968), which is perceived to be the primary goal of environmental education [21]. Other studies specify that environmental attitudes are therefore a big concern in significant environmental education research [22]; [23]; [24]; [25]; [26]. This implies that if there is well planned environmental formal education that is more available to urban students than rural one, urban population will be more knowledgeable on environmental issues than rural children.

Other studies relate environmental awareness with Self-esteem, which is often described as a person's "overall self-evaluation or sense of self-worth" [27]. Meinhold and Malkus [28] did find a direct correlation between high self-esteem and pro-environmental attitudes and concerns. The results also showed a possible increase in self-esteem due to pro-environmental actions. Having higher self-esteem was also reported in a study of adaptive perfectionist students to score higher in their Grade Point Average [29]. Students although not directly having high self esteem, but rather through another factor do seem to produce better academic achievement. Self esteem garnered through practices of another adaptive behaviour was shown to aid in their examination grading. This notion was investigated in a study by Ivcevic, Pillemer, & Brackett [30]. This means if achievement scores of the urban students is higher than that of the rural students, urban students will have more responsive environmental behaviour than rural children. But there are some studies which object this; for instance, While Allen and Ferrand [31] found no relationship between self-esteem and "environmentally responsible behaviour"(p. 344) and low examination scoring students also did not have a strong majority of low self-esteem students [32].

The theoretical framework leads one to realize that there are various circumstances in both rural and urban setting that either favor or disfavor both rural and urban students towards learning of environmental issues. This means we can not simply rely on schools' qualitative variables or students' achievement to determine if students understanding level of environmental issues is significantly different between urban and rural students in all localities.

2. METHODOLOGY

The purpose of the study was to determine if there is any significant difference in secondary school students' understanding level between urban and rural areas regarding the concepts of environmental education, meteorology and climate change.
The hypothesis was: There is no significant difference in students' level of understanding the concepts of environmental degradation, meteorology and climate change between rural and urban areas.

In order to test the hypothesis the researcher used random procedure to sample 480 form four students from 12 secondary schools in Morogoro region. Survey was the main method for data collection though some students were also interviewed in order to give some clarifications on some information collected by questionnaires during survey. The questionnaires covered the important concepts of environmental degradation, weather and climate and climate change as they were specified in the certificate of secondary education syllabus in Tanzania. Further more the researcher carried out focus group discussion in order to clarify some of the issues which could not be answered through questionnaires. In every school the researchers worked together in facilitating the discussion and also in recording the necessary information according to the stated hypothesis. A total of 12 focus group discussions were conducted where by in every school one focus group discussion taking about 1-2 hours was carried out.

During analysis, survey data we subjected to the version 16 of the SPSS programme to compute frequencies of the respondents. The same program was used to calculate chi squire statistic at a 0.05 significance level. Questionnaire responses were complemented with responses from focus group discussion and some interview responses in order to provide full picture of the students' level of understanding the concepts under consideration.

3. FINDINGS

Findings are categorized into four sections: Environmental degradation, power use, weather and climate and climate change.

3.1. Environmental degradation

The study revealed that: most students (47.3 per cent from the urban and 41.5 per cent from rural) thought that it is industries and automobiles which contribute the highest concentration of green house gases in the atmosphere than the rest of the other human activities. But following the analysis by Food and Agriculture Organization of the United Nations, agricultural sector contributes greater proportion of green house gases globally than the entire transport industry. Never the less, Table 1 shows that bigger number of students from the urban schools than from the rural thought that industries and automobiles contribute more to the atmospheric green house gases concentrations than the rest of the other sources. However, the other wrong alternatives such as domestic wastes and natural disasters could attract greater number of rural students than urban ones.

Table 1: Causes of Green House Gases

school place	Causes of green house gases				Total	Chi-squire value	p-value
	domestic wastes	Industries and automobiles	Agricultural activities	Natural disasters			
Urban	5(1)	227(47.3)	2(0.4)	6(1.3)	240	17.126	0.001
Rural	12(2.5)	199(41.5)	12(2.5)	17(3.5)	240		
Total	17	426	14	23	480		

(Source: Field Data)

(Tabulated numerals represent frequencies with percentages in the brackets)

Chi-square test analysis shows that such a difference was statistically significant (Pearson Chi-square=17.126, df=3, $p<0.05$).

The same applies when determining the level of understanding of the two categories of students on the most important gas for global warming where more students (49.2%) of the urban category were aware of the role played by carbon dioxide in global warming compared to 41.3% of students from rural schools. Also, greater proportions of students from the rural schools than from urban ones were attracted with the wrong alternatives such as carbon monoxide and sulfur dioxide (see Table 2). Nevertheless Table 2 shows that students who thought that methane gas has the most substantial contribution to global warming were from the urban category.

Table 2: The Most Important Gas for Global Warming

school place	Most important gas for global warming				Total	Chi-squire value	p-value
	Carbon monoxide	Sulfur dioxide	Methane	Carbon dioxide			
Urban	89(18.5)	16(3.3)	17(3.5)	118(24.6)	240	10.905	0.012
Rural	105(21.9)	29(6)	7(1.5)	99(20.6)	240		
Total	194	45	24	217	480		

(Source: Field Data)

Chi-square test analysis shows that the difference in the level of understanding between these two categories of students regarding the most important gas for global warming was statistically significant (Pearson Chi-square=10.905, df=3, $p<0.05$).

When determining students' understanding on the main agent for global warming nearly similar trend was observed where proportions of students who could identify human being as the main agent for global warming from both urban and rural categories were 71.7% and 66.3% respectively. Wrong alternatives like natural disaster, micro-organisms and wild animals were selected by more students from rural schools than students of the urban schools (see Table 3)

However, chi-square test analysis shows that such a difference in understanding between the urban and rural students was statistically not significant (Pearson Chi-square=4.683, df=3, $p>0.05$).

Table 3: Students' Responses on the Main Agent for Global Warming

school place	Main agent for global warming				Total	Chi-squire value	p-value
	Natural disaster	Human beings	Micro-organisms	Wild animals			
Urban	57(11.9)	172(35.8)	10(2.2)	1(0.2)	240		
Rural	62(12.9)	159(33.1)	13(2.7)	6(1.3)	240	4.683	0.197
Total	119	331	23	7	480		

(Source: Field Data)

Generally, few students (23.3 per cent) from both urban and rural schools knew two of the easiest means of minimizing wastes formation in our environment by reducing and re-using most of the consumable materials in our everyday life other than re-cycling. But the number is even smaller for students from rural schools than for urban students (see Table 4).

Table 4: Means by which Every One of Us Can Easily Reduce Wastes

school place	Wastes can easily be reduced by:				Total	Chi-square value	p-value
	Re-cycling and re-using of consumables	Re-cycling and reducing of consumables	Reducing and re-using of consumable	Re-cycling and removing of consumables			
Urban	93(19.4)	43(9)	75(15.6)	29(6)	240		
Rural	98(20.4)	47(9.8)	37(7.7)	58(12)	240		
Total	191	90	112	87	480	23.318	0.000

(Source: Field Data)

Chi-square test analysis shows that such a difference was statistically significant (Pearson Chi-square=23.318, df=3, $p<0.05$).

3.2. Power Use and the Environment

Students' understanding on the most utilized non renewable source of power for both urban and rural students was not of a uniform trend. For instance, while 35.4% of students from the urban schools new that oil is the most utilized non-renewable source of power compared to only 23.3% of the rural students, 33.3% of students in the urban schools could not identify that solar energy is not in the category of non-renewable sources of power compared to smaller proportion of students (26.3%) from the rural schools who believed so. However, more students from rural schools indicated wrongly that hydro-electricity and coal are the most utilized sources of power (see Table 5). This also implies that more students from the same category believed wrongly that hydroelectricity is a non-renewable source of power.

Table 5: The Most Utilized Non-Renewable Source of Power

school place	Most utilized source of power				Total	Chi-squire value	p-value
	Oil	Solar energy	Hydro-electricity	Coal			
Urban	85(17.7)	80(16.7)	50(10.4)	25(5.2)	240		
Rural	56(11.7)	63(13.2)	86(17.9)	35(7.3)	240		
Total	141	143	136	60	480	4.683	0.197

(Source: Field Data)

Chi-square test analysis shows that such a difference in understanding between urban and rural students on the most utilized non-renewable source of power was statistically significant (Pearson Chi-square=19.182, df=3, $p<0.05$).

Focus group discussion revealed that students who could not realize that oil is highly utilized in industries, automobiles and power generation were also unable to discover that they can practice minimizing power consumption at school or in their homes. Thus, proportion of students who could realize that they have a responsibility of minimizing power consumption was bigger for urban students than for students from rural schools. Therefore, more students from rural schools than from urban areas thought that minimizing power use is the responsibility of the government or members of the parliament. However Table 6 shows that slightly higher proportion of students from urban areas thought that it is the responsibility of power experts to minimize power consumption (see Table 6).

Table 6: Who is Responsible for Minimizing Power Use

school place	Responsible for minimizing power use				Total	Chi-squire value	p-value
	Government	Members of parliament	Power experts	Every one of us			
Urban	19(4)	3(0.6)	55(11.5)	163(34)	240	17.872	0.001
Rural	22(4.6)	23(4.8)	52(10.8)	143(29.8)	240		
Total	41	26	107	306	480		

(Source: Field Data)

Chi-square test analysis shows that such a difference in perception about who should be responsible with minimizing power use between urban and rural students was statistically significant (Pearson Chi-square=17.872, df=3, $p<0.05$).

Although proportion of students who could identify two major sources of power responsible for production of green house gases was higher for urban students (56.7%) than for students in rural schools (52.5%), proportions of students between rural and urban schools who have indicated that solar energy is also one of the sources of power that produce green house gases are heterogeneous. For instance, while 33.3% of the rural students considered wrongly that solar energy and hydro-electricity produce green house gases considerably only 16.7% of the students in urban schools believed the same. But higher proportions of students from urban schools than from rural areas indicated wrongly that oil and solar energy or hydro electricity and coal contribute the highest concentrations of green house gases in the atmosphere (see Table 7).

Table 7: Two Major Sources of Power for Producing Green House Gases

school place	Sources of power for green house gases				Total	Chi-squire value	p-value
	Oil and Solar energy	Solar energy and hydroelectricity	Hydroelectricity and coal	Coal and oil			
Urban	26(5.4)	40(8.3)	38(7.9)	136(28.3)	240	4.683	0.197
Rural	15(3.1)	80(16.6)	19(4)	126(26.3)	240		
Total	41	120	57	262	480		

(Source: Field Data)

Chi-square test analysis shows that such a difference in understanding about the two sources of power for green house gases production between urban and rural students was statistically significant (Pearson Chi-square=23.928, df=3, $p<0.05$).

Further justification that the proportion of students in the rural schools who could not relate power production with the release of green house gases was higher than that of urban students is shown in Table 8 where by 16.7% of the rural students indicated that minimizing power use does not prevent global warming compared to only 9.2% of the urban students who indicated the same. Although there was higher proportion of the urban students who believed correctly that agriculture does not prevent global warming compared to the rural students and also less proportion of the urban students who believed wrongly that minimizing production of wastes does not prevent global warming compared to the rural students, there was slightly bigger proportion of urban students who believed wrongly that afforestation does not prevent global warming (see Table 8).

Table 8: Students' Ability to Identify what does not Prevent Global Warming

school place	Does not prevent global warming				Total	Chi-squire value	p-value
	Minimizing power use	Afforestation	Agriculture	Minimizing production of wastes			
Urban	22(4.6)	46(9.6)	138(28.8)	34(7.1)	240		
Rural	40(8.3)	40(8.3)	112((23.3)	48(10)	240		
Total	62	86	250	82	480	10.739	0.013

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in understanding about the factors which do not prevent global warming between urban and rural students (Pearson Chisquare=10.739, df=3, p<0.05).

3.3. Weather and climate

81.7% of students from urban schools indicated that they could only understand some weather forecast information compared to 75.4% of the rural students who indicated the same. But proportion of the rural students who believed that they understood every weather forecast information was higher than that of urban students. Also, more students from urban than from rural schools, believed that they didn't understand any weather forecast information (see Table 9).

Table 9: Students' Extent of Understanding Weather Forecast Information

School place	Extent of understanding			Total	Chi-squire value	p-value
	Every information	Some information	I don't understand any information			
Urban	20(4.2)	196(40.8)	24(5)	240		
Rural	47(9.8)	181(37.7)	12(2.5)	240	15.935	0.001
Total	67	377	36	480		

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in proportions of students who indicated that they understood weather forecast information between urban and rural students (Pearson Chi-square=15.935, df=2, p<0.05).

If one associates the increased proportion of the urban students who understand weather forecast information with the increased rate of seeking for weather forecast, it can be justified by the fact that the rate at which students in urban schools sought for weather forecast was twice that of rural students. Also, the proportion of rural students who never sought for weather fore cast at all or did it rarely was higher than that of urban students although the proportion of rural students who could seek for weather forecast once per day was slightly higher than that of urban students (see Table 10).

Table 10: Students' Rate of Seeking for Forecasting Information

school place	Rate of seeking for forecasting				Total	Chi-squire value	p-value
	Once a day	More than once a day	Rarely	Not at all			
Urban	53(11)	82(17.1)	100(20.8)	5(1)	240	27.222	0.000
Rural	67(14)	42(8.8)	107(22.3)	24(5)	240		
Total	120	124	207	29	480		

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in the rate of seeking for weather forecast between urban and rural students (Pearson Chi-square=27.222, df=3, $p<0.05$).

Considering various activities which need weather forecasting such as crop cultivation, animal keeping, fishing, transportation, disaster management, construction etc; proportion of the urban students who could identify varieties of such activities that need weather forecasting was higher than that of the rural students. For example, while less than half of the activities that need weather forecasting were identified by 65% of the urban students, 75.4% of the rural students identified less than half of the same activities. Like wise, proportions of the urban students who could identify all activities, more than half of the activities or half of the activities which need weather forecasting were higher than those of the rural students. Also, proportion of the urban students who could not identify any activities that need weather forecasting was lower than that of the rural student (see Table 11).

Table 11: Students' Ability to Identify Activities Needing Forecasting Information

school place	Activities needing forecasting					Total	Chi-squire value	p-value
	All activitie s	Less than half of the activities	About half of the activities	More than half of the activities	None			
Urban	10(2)	156(32.5)	19(4)	51(10.6)	4(0.8)	240	20.965	0.000
Rural	8(1.6)	181(37.7)	9(1.9)	26(5.4)	16(3.2)	240		
Total	18	337	28	77	20	480		

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in understanding about the activities which apply weather forecasting information between urban and rural students (Pearson Chi-square=20.965, df=4, $p<0.05$).

Through focus group discussion the researcher realized that less exposure of rural students to weather forecast limited not only their ability to identify activities that need forecast but also meaning of some terminologies used in forecasting such as forecasting zones, intensity of the elements of weather and symbols or signs used to represent various properties of weather elements. Thus, students generalized a lot of forecasting information; for instance one student in one of the rural schools said: 'Rarely do I bother with weather forecast nowadays as they are mostly liars. When they say it is going to rain heavenly in my region it becomes sunny throughout the day while it rains when they forecast the opposite'.

It means students with such views generalized any forecast information without inquiring for details on specific locations concerned or the factors which may affect the occurrence or intensity of the weather element forecasted. Also, more students from urban than from rural schools indicated that weather forecast is reliable although the same proportion of students from these two categories of schools indicated that weather forecast is very reliable (see Table 12).

Table 12: Students' Responses on Reliability of Weather Forecast

school place	Reliability of weather forecast					Total	Chi-squire value	p-value
	Very unreliable	Unreliable	Somehow reliable	reliable	Very reliable			
Urban	5(1)	17(3.5)	153(31.9)	54(11.3)	11(2.3)	240	3.617	0.460
Rural	10(2.1)	21(4.3)	156(32.5)	42(8.8)	11(2.3)	240		
Total	15	38	309	96	22	480		

(Source: Field Data)

Despite the differences in Table 12, chi-square test analysis shows that there was no significant difference in views about reliability of weather forecasting information between urban and rural students (Pearson Chi-square=3.617, df=4, p>0.05).

But investigation by the researcher indicated that what determine students' decision for finding weather forecast in either rural or urban schools is not about the issue of reliability of the forecast information but rather other factors such as availability of broadcasting media, time or convenient environment for finding the information including also lack of interest due to limited knowledge on some of the terminologies used in forecasting (see Table 13).

Table 13: Students' Reasons for Seeking or not Seeking Weather Forecast

School place	Reasons for seeking or not seeking weather forecast			Total	Chi-squire value	p-value
	Reliable	Other reasons	Not understood			
Urban	1(0.2)	191(39.8)	48(1)	240	37.191	0.000
Rural	0(0)	151(31.5)	89(18.5)	240		
Total	1	342	137	480		

(Source: Field Data)

Further investigation about students' knowledge on forecasting between rural and urban students involved determining students' ability to identify elements used in forecasting from a mixture of weather elements and non-weather elements; such as earth rotation and force of gravity. Proportion of the urban students who could identify that both force of gravity and earth rotation are not used in forecasting was higher than that of students from rural schools. However, more urban students than those from rural schools indicated some elements of weather such as humidity and atmospheric pressure as not used in forecasting (see details in Table 14).

Table 14: Students' Responses on what is not Used in Forecasting

school place	Not used in forecasting					Total	Chi-squire value	p-value
	Force of gravity and earth rotation	Force of gravity	Earth rotation	Elements included	None			
Urban	84(17.5)	28(5.8)	31(6.5)	87(18	10(2.1)	240	36.829	0.000
Rural	44(9.2)	63(13.1)	55(11.5)	64(13.3)	14(2.9)	240		
Total	128	91	86	151	24	480		

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in understanding about the elements used in forecasting between urban and rural students (Pearson Chi-square=36.826, df=4, p<0.05).

Since there were no instruments for measuring the elements of weather either in urban or rural schools, the proportions of students who believed that they could measure the elements of weather when provided with the instruments did not differ considerably between rural and urban students. For example, there were slightly higher proportions of urban students than those from rural schools who thought that they could not measure any element, only temperature or most of the element. But proportions of urban students who thought that they can measure all elements of weather or some of such elements were slightly lower than those of the rural students (see Table 15).

Table 15: Students' Ability to Measure the Elements of Weather

school place	**Can measure**					**Total**	**Chi-squire value**	**p-value**
	Only temperature	Some of them	Most of them	All of them	None of them			
Urban	83((17.3)	46(9.6)	9(1.9)	3(0.6)	99(20.6)	240	8.432	0.077
Rural	71(14.8)	59(12.3)	8(1.7)	12(2.5)	90(18.8)	240		
Total	154	105	17	15	189	480		

(Source: Field Data)

Chi-square test analysis shows that there was no significant difference in students' believes regarding their ability to measure the elements of weather between urban and rural categories (Pearson Chi-square=8.432, df=4, p>0.05).

3.4. Climate change

Large proportions of both urban students (86.3%) and rural students (84.6%) could not give an idea about the meaning of climate change. Although there was slightly higher proportion of rural students than urban ones who could give an idea of what climate change is, there was no any difference in proportion between urban and rural students who could define climate change appropriately (see Table 16).

Table 16: Students' Ability to Define Climate Change

School place	**Climate change**			**Total**	**Chi-squire value**	**p-value**
	Well defined	Idea given	No Idea			
Urban	0(0)	28(5.8)	212(44.2)	240	10.306	0.067
Rural	5(1)	32(6.7)	203(42.3)	240		
Total	10	60	410	480		

(Source: Field Data)

Chi-square test analysis shows that there was no significant difference in understanding the concept of climate change between urban and rural students (Pearson Chi-square=10.306, df=2, p>0.05).

But the proportions of the urban students who could either identify half or more than half of the activities which are likely to be affected by climate change were higher than those of the rural students. Like wise more students from rural schools identified less than half of the activities which are likely to be affected by climate change than urban students although the number of students from the rural category who could identify all activities exceeded the urban category (see Table 17).

Table 17: Students' Ability to Identify Activities Affected by Climate Change

school place	Activities affected by climate change					Total	Chi-squire value	p-value
	All activities	Less than half of the activities	About half of the activities	More than half of the activities	None			
Urban	5(1)	156(32.5)	31(6.5)	46(9.6)	2(0.4)	240		
Rural	8(1.6)	186(38.8)	13(2.7)	21(4.4)	12(2.4)	240		
Total	13	342	44	67	14	480	27.159	0.000

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in understanding about the activities which are likely to be affected by climate change between urban and rural students (Pearson Chi-square=27.156, df=4, $p<0.05$).

Similar responses were obtained where students were required to state how they could minimize climate change. Greater proportion of the urban students could give an idea about how to minimize climate change compared to the rural category and also there were more students from the rural category who could not show any means of minimizing climate change. But the proportions of students from the two categories who could state how to minimize climate change was the same (see Table 18).

Table 18: Students' Responses on How to Minimize Climate Change

school place	How to minimize climate change				Total	Chi-squire value	p-value
	Stated clearly	An idea given	Unclear idea given	No idea			
Urban	1(0.2)	72(15.6)	115(24)	52(10.8)	240		
Rural	1(0.2)	60(12.5)	104(21.7)	75(15.6)	240	11.609	0.041
Total	2	132	219	127	480		

(Source: Field Data)

Chi-square test analysis shows that there was a significant difference in understanding about how to minimize climate change between urban and rural students (Pearson Chi-square=11.609, df=3, $p<0.05$).

When students were required to identify a measure which is not related with minimizing climate change, responses were uniform such that higher proportions from the urban students were able to identify that increasing the number of wild animals is not a measure against climate change. Also, when compared to rural students, there were less proportions of students from the urban category who were attracted with the wrong alternatives such as decreasing the use of fossil fuel, preventing bush fires or preventing land degradation (see Table 19).

Table 19: Students' Ability to identify what is not a Measure against Climate Change

school place	Not against climate change				Total	Chi-squire value	p-value
	Decreasing the use of fossil fuel	Increasing the number of wild animals	Preventing bush fires	Preventing land degradation			
Urban	22(4.6)	162(33.8)	28(5.8)	28(5.8)	240		
Rural	34(7.1)	138(28.8)	36(7.5)	32(6.7)	240		
Total	56	300	64	60	480	5.758	0.124

(Source: Field Data)

But chi-square test analysis shows that there was no significant difference in ability of identifying a wrong measure against climate change between urban and rural students (Pearson Chi-square=5.758, df=3, p>0.05).

Comparable results were obtained when students were required to identify one of the measures for adapting the effects of climate change where by the urban proportion of students that could identify effective utilization of weather and climate information (right choice) was higher than that of the rural students. Also fewer students from the urban category than from rural one were attracted by wrong choices like effective dilution of green house gases or effective means of identifying clouds cover although effective means of using solar energy (wrong choice) attracted more students from the urban schools (see Table 20).

Table 20: Students Ability to Identify How to Adapt Climate Change

school place	Adapting climate change				Total	Chi-squire value	p-value
	Effective use of weather and climate information	Effective dilution of green house gases	Effective means of identifying clouds cover	Effective use of solar energy			
Urban	102(21.3)	68(14.2)	27(5.6)	43(9)	240		
Rural	84(17.5)	82(17.1)	39(8.1)	38(7.9)	240	7.282	0. 122
Total	186	150	66	78	480		

(Source: Field Data)

Like in Table 19, chi-square test analysis shows that there was no significant difference in understanding an effective means of adapting climate change between urban and rural students (Pearson Chi-square=7.282, df=3, p>0.05).

When students were asked to indicate who should be responsible with climate change, responses were not far from those in Table 20 because; greater proportion of students who indicated every body in the society (right response) was from the urban schools and smaller proportion from the same category of students responded it is the responsibility of weather and climate experts. However greater proportions of students who indicated that it is the responsibility of the government or environmental experts (wrong responses) were from the urban category (see Table 21).

Table 21: Students' Responses on who should be Responsible for Climate Change

school place	Responsible for climate change				Total	Chi-square value	p-value
	The government	Environmental experts	Weather and climate experts	Everybody in the society			
Urban	5(1)	8(1.7)	47(9.8)	180(37.5)	5(1)		
Rural	2(0.4)	5(1)	63(13.1)	170(35.4)	2(0.4)	4.591	0.204
Total	7	13	110	350	480		

(Source: Field Data)

Similarly, chi-square test analysis shows that there was no significant difference in understanding about who should be responsible with climate change between urban and rural students (Pearson Chi-square=4.591, df=3, p>0.05).

4. DISCUSSION

Generally, urban students' level of understanding concepts of both environmental education and meteorological concepts was higher than that of rural students. The reason could be attributed with the minimized opportunities of formal education for rural children as clarified in the theoretical framework [12]; [13]; [14]. Also, urban students can easily access various sources of information such as radio, televisions, newspapers, books, internet etc. Such information sources are also opportunities to the urban teachers who eventually benefit their students.

However there are specific cases where such level of understanding between urban and rural students was not significant. For instance, in determining the main agent for global warming where the right response was "human beings". For this case it may be associated with the fact that human beings role on the environment are common aspects for rural students' life. For example, they see human beings destroying environment through various ways such as deforestation, wild fires and in establishing settlements. This supports the observation that rural children may be more aware with environmental aspects that surround their every day life as they get socialized in the space of their house holds through various activities than what they may get from formal environmental education which they may give it less emphasis [17]; [18]; [19]. The same argument can be related with Table 16 where students were supposed to give the meaning of climate change and it was observed that there was no significant difference in understanding the concept of climate change between urban and rural students. Where urban students could mostly rely on various sources of information including formal environmental education as a source of their knowledge on climate change, rural students experience the effects of climate change through other ways such as decreased forest thickness and agricultural productivity due to floods, insufficient rainfall or drought.

Similar observation is shown in Table 19 where there was no significant difference in ability of identifying a wrong measure against climate change between urban and rural students as the wrong measure (right answer) which was "increasing the number of wild animals"; i.e. considering the context of rural environment, rural children may be more familiar with the role of wild animals on the environment than urban students. Further more, less exposure of rural students to the direct circumstances of power use such as industrial and automobile activities could be associated with the observation that urban students were more knowledgeable on all aspects concerning with power use and the environment than rural students (Table 5-8).

5. CONCLUSION

Although both urban and rural students use the same syllabus and are taught by teachers who are from the same teacher training institutions, still there is a significant difference in students' level of understanding of various concepts of meteorology and environmental education. But effective management of environmental resources under the contemporary environmental problems requires every body to understand clearly both rural and urban activities responsible for environmental degradation including the conservation strategies in both localities. For instance, urban population can prevent exhaustion of rural biodiversity and town water supply if they limit the use of charcoal and wood as a major source of power. Likewise, rural population can limit production of green house gases in towns if they know how to decrease consumption of industrially manufactured goods through various ways such as practicing the 3Rs i.e Recycling, Reusing and Reducing. Therefore, education stake holders should ensure that both rural and urban students have equal chance of understanding concepts of meteorology and environmental education for sustainable utilization of environmental resources under the prevailing condition of climate change.

6. REFERENCES

[1] MOEC 2004. Secondary Education Development Programmeme (SEDP) 2004-2009. Dar es Salaam: MOEC.

[2] MOEVT 2010. Secondary Education Development Programmeme II (2010-2015). Dar es Salaam: MOEVT.

[3] M. Rangarajan and G. Shahabuddin, "Displacement and relocation from protected areas: Towards a Biological and Historical Synthesis", An Interdisciplinary Journal Exploring Linkages between Society, Environment and Development, 2006, 4 (3), 359-378.

[4] Keller, J. W. 2014. The importance of rural development in the 21st century - persistence, sustainability, and futures. Manhattan: The Regional Institute Ltd.

[5] C. J. Bradley, M. T. Waliczek and M. J. Zajicek, "Relationship between environmental knowledge and environmental attitude of high school students", The Journal of Environmental Education, 1999, 30(3), 17-21.

[6] E. Kira, S. Komba, "Perspectives on the status of traditional medicine in Tanzania", Eurasian Journal of Anthropology, 2012, 3(1), 21-31.

[7] Simone 2002. Back to the basics: student achievement and schoolyard naturalization. Unpublished master's thesis. Trent University, Peterborough, Ontario.

[8] Paavola, J. 2005. Livelihoods, Vulnerability and Adaptation to Climate Change in the Morogoro Region, Tanzania. A working paper for Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia, Norwich NR4 7TJ, UK.

[9] MoEVT 2005. Secondary school geography syllabus. Dar es salaam: TIE

[10] Amoo, A. Sikiru, and A. Disu, B. keem, "School Environmental Factors and Mathematics Teaching Effectiveness: Implication for ELearning", Library Philosophy and Practice (e-journal), 2012, Paper 837.

[11] Mulkeen, A. 2005. Teachers for rural schools a challenge for Africa: A paper based on country case studies done in conjunction with the World Bank in Lesotho, Malawi, Mozambique, Uganda and Tanzania, during 2005.

[12] Mulkeen, A. and Chen, D. 2008. Teachers for rural schools. Washington, D.C: The International Bank for Reconstruction and Development/The World Bank.

[13] T. Gedikoğlu, "Avrupa Birliği sürecinde Türk eğitim sistemi: sorunlar ve çözüm öneriler", Mersin University Journal of the Faculty of Education, 2005, 1 (1), 66-80.

[14] UNESCO 2004. Educating rural people: a low priority. Education today, 9. The Newsletter of UNESCO's Education Sector.

[15] Harshwardhan 1995. Study of attitude of rural and urban teachers in the context of population education. Ph.D. (Edu.), Bundelkhand University.

[16] F. A. Bosede and A. A. Emiloju, "Rural and urban differential in student's academic performance among secondary school students in Ondo State, Nigeria", Journal of Educational and Social Research, 2013, 3(3), 213-217.

[17] Fleer, M. and Hardy, T. 2001. Science for children: Developing a personal approach to teaching, 2nd Ed. New South Wales: Prentice-Hall.

[18] Malone, K and Tranter, P. 2003. Children's environmental learning and the use, design and management of school grounds. Retrieved 30th November, 2014 from http://colorado.edu/journals/cye.

[19] N. M. Wells, "At home with nature: Effects of "greenness" on children's cognitive functioning", Environment and behavior, 2000, 32(6), 775-795.

[20] E. C. Ramsey and E. R. Rickson, "Environmental knowledge and attitudes", The Journal of Environmental Education, 1976, 8(1), 10-18.

[21] Arcken, M. M. 2001. Environmental literacy: Re-examining the justifications and objectives of environmental education in the context of a risk society. Paper presented at the teaching for scientific literacy: Context, competency, and curriculum: 2nd International Utrecht/ICASE Symposium, Utrecht, The Netherlands.

[22] M. C. DiEnno and C. S. Hilton, "High school students' knowledge, attitudes, and levels of enjoyment of an environmental education unit on nonnative plants", The Journal of Environmental Education, 2005, 37(1), 13-25.

[23] J. F. P. Eagles and R. Demare, "Factors influencing children's environmental attitudes," The Journal of Environmental Education, 1999, 30(4), 33-37.

[24] B. E. Lee, “Environmental attitudes and information sources among African American college students”, The Journal of Environmental Education, 2008, 40(1), 29-42.

[25] M. Sarkar, “Secondary students’ environmental attitudes: the case of environmental education in Banglades,” International Journal of Academic Research in Business and Social Sciences, 2011, 1(special issue), 106-1116.

[26] E. K. Kira and S. Komba, “Comparison between the understanding levels of boys and girls on the concepts of environmental degradation, meteorology and climate change in Tanzanian secondary schools”, Journal of Education and e-learning Research, 2015, 2(4) 79-86

[27] Myers, D. G. 2010. Social psychology (10th ed.) 52; 57; 124-125. Retrieved 28th November, 2014 from http://info.psu.edu.sa/psu/maths/Myers%20Psychology%2010th%20txtbk.pdf

[28] L. J. Meinhold, and J. A. Malkus, “Adolescent Environmental Behaviour-Can Knowledge, Attitudes, and Self-Efficacy Make a Difference? Environment and Behaviour”, 2005, 37(4), 511-532.

[29] A. A. Elion, B. R. Slaney, T. K. Wang and H. B. French, “Perfectionism in African American students: Relationship to racial identity, GPA, self-esteem and depression. Journal of Cultural Diversity and Ethnic Minority Psychology, 2012, 18(2), 118-127.

[30] Z. Ivcevic, B. D. Pillemer and A. M. Brackett, “Self-Esteem Memories and School Success in Early Adolescence”, Applied Cognitive Psychology, 2010, 24, 1265-1278.

[31] B. J. Allen and L. J. Ferrand, “Environmental locus of control, sympathy, and proenvironmental behaviour: A test of geller’s actively caring hypothesis”, Environment and Behavior, 1999, 31(3), 338-353.

[32] C. A. Zhi, “Understanding our students: does high self-esteem produce good academic achievement among undergraduate”, International Journal of Research in Humanities, Arts and Literature, 2014, 2(3), 19-26.

[33] FAO 2008. Climate change adaptation and mitigation in the food and agriculture sector. Technical Report Released in March 2008 by FAO, Rome.