

The Status of geography textbooks for teaching and learning of the concepts of meteorology and environmental education in Tanzanian secondary schools

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Abstract

The study was on determining the availability, utility and relevancy of the certificate of secondary education textual materials from randomly selected 12 secondary schools in Morogoro region. It was observed that the most utilized textual materials were those which could often be cited by examiners. Approved textbooks were outdated hence they were least utilized compared to the reference books which were more current according to the syllabus in use. Though the most utilized textbooks covered most of the concepts as specified in the syllabus, they were some unclear concepts regarding the issues of environmental degradation, weather and climate, power use and climate change. Rural students are more likely to be affected by the observed weaknesses in the schools textual materials than urban ones because of the restricted opportunities for information sources in rural areas.

Key words: Geography Textbook, Syllabus, Meteorology, Environmental education

1. Introduction

It has been viewed that climate change is one of the prominent contemporary environmental issue that has the potential to so significantly compromise the sustainability of societies globally (Bardsley, 2007). Climate change is due to the increasing concentration of greenhouse gases resulting from human activities (IPCC, 2007; Pittock, 2003). Since production of greenhouse gases is the result of human activities, mitigation or adaptation of climate change needs awareness on various methods of preventing environmental degradation and utilization of weather and climate information. Therefore integration of the concepts of meteorology and environmental education

which address climate change in the school curriculum is a milestone for raising such awareness. In a Tanzanian context, meteorological and environmental concepts such as weather, climate, climate change, environmental issues, power and energy and human activities are integrated in the geography syllabus. These concepts are addressed either as independent topics or integrated with other topics in different levels of the secondary school curriculum (MOEVT, 2005 pp. 4-124). Integration of the concepts of meteorology and environmental education in the secondary school geography syllabus were the results of 2005's curricular review. This created demand of geography textbooks and other teaching resources to match the amended syllabus. However, this was not a big deal for a country like Tanzania where liberal policy of text book production and utilization was already in operation. Consequently, there have been several textbooks from both outside and within the country which get accessed by both teachers and students provided that such textbooks can help students perform better in their examinations (Kira & Bukagile, 2013). Therefore, as a means of controlling the problems associated with the liberal policy of textbook publishing, Tanzania established Educational Materials Evaluation Committee (EMAC) for evaluating and certifying the textbooks which meet minimum set criteria to be used in secondary schools (MOC, 2005).

Despite the EMAC regulations, Kira and Bukagile (2013) observed that textbook liberal policy in Tanzania is characterized by two main problems; firstly, frequent change of the syllabus which created sudden increase in demand of textbooks to meet the requirements of the new syllabus, piracy and corruption rooted along the entire chain between textbook production and textbook utilization. This implies that policy makers, publishers and some education stakeholders stand at a position where they can easily temper with the quality of the school textbooks for personal economic gains. Secondly, although education stakeholders perceive the aspect of textbook quality as a dynamic issue under market liberalization policy regarding issues related with quality such as relevant content, illustrations, language, printing, designing and editing which can easily be determined upon reading a textbook; rarely they consider pertinent issues which may need rigorous review like content coverage, depth of the addressed concepts, and readability. This means if textbooks can not address environmental problems to the extent of the required depth and accuracy at a particular level of education, the learners can not acquire the intended knowledge and skills to deal with the alarming environmental problems.

Therefore, it is high time that prominent sources of knowledge such as geography textbooks should have solid knowledge well constructed with contextualized examples and questions that consider students' environmental circumstances. This is because it has been observed that when the generation currently passing through the education system is finding its place in society, it is likely to confront an era of risk, characterized not only by impacts of climate change but also by rising accommodation, energy and water costs and depleted environments, as well as the socio-economic inequality and the employment challenges of globalizing economies (Beck, 1995; 2000; Reid, 2001; Stern, 2006). Thus, textual knowledge sources need to equip learners with the necessary skills for early effective responses to climate change that are planned, balanced and reflective of the intensity and scope of change which can minimize negative impacts and maximize potential benefits including personal ability to understand and integrate the broader ecological aspects of sustainability to enable individuals to succeed in a rapidly changing society (Bardsley, 2007).

Also, potentiality of textbooks does not only depend on their direct source of knowledge for students but also as the most stable knowledge source for teachers when searching for basic

concepts and in assessing students' learning. This is the reason why contemporary studies advocate that a quality textbook should address various competences which are more demanding than routine procedural knowledge and algorithms, requiring more challenging learning opportunities (Callingham & Watson 2004; de Castro 2008; van Oers & Poland 2007). This should go together with enough number of questions because tests with small numbers of items are inappropriate for making inferences regarding the achievement levels that students in a national educational system may obtain in varied curriculum areas (Carson, 2009; Valverde, 2005, 2009). But such learning opportunities in the textbooks should ensure that they don't shift students away from the intended curriculum because students' achievement levels will increase if the intended curriculum and the implemented one are more closely aligned (UNESCO, 2012).

Therefore, since the review of the secondary school geography syllabus in 2005 led to the integration of some new concepts of meteorology and environmental education in the syllabus; it also resulted into new demand for improved textual materials in schools. Although under liberal policy these materials particularly textbooks could be produced, there are circumstances around the liberal policy which can either limit their availability or distort the quality of the produced materials as discussed in the previous paragraphs. Thus, doing a study in schools to establish the status of the textbooks used to teach the concepts of meteorology and environmental education as integrated in the secondary school geography syllabus can form the basis for improving such materials.

2. Methodology

The purpose of the study was to determine the status of the geography textbooks that are available in schools for teaching and learning the concepts of meteorology and environmental education. In order to do so, the researcher had two specific objectives:

1. To determine the types of geography textbooks available in the sampled schools including the extent of their utilization.
2. To assess the relevancy of the content of the geography textbooks in addressing the concepts of meteorology and environmental education

The researchers sampled a total of 12 schools from Morogoro region whereby 6 schools were randomly selected from both urban and rural wards. From each school, 4 geography teachers were selected for interview. Selection of the teachers ensured that each of the four forms is represented. Thus, a total of 48 teachers were sampled from the 12 schools.

Teachers' interview questions focused on the availability of both the recommended geography textbooks and the reference books including the extent of their utilization. Then the researcher reviewed thoroughly the textbooks which seemed to be used considerably by both teachers and students for teaching and learning of the concepts of meteorology and environmental education. During the review process, each of the selected textbook was reviewed by each researcher by focusing on five main areas: accuracy of the concepts, content coverage, ability of the textbook to relate relevant concepts with one another in different topics or subtopics, ability to provide adequate examples that are well contextualized with students every day life and presence of various questions that cover the major concepts discussed in the textbook. The review results from the three researchers were merged after the review process.

Data from both interview and review of text books were combined and analyzed through content analysis by categorizing the information into five major themes based on: wastes management, preventing environmental degradation, minimizing power use, weather and climate and climate change as shown in the following section of findings and discussion.

3. Findings

Alphabetical letters were used to represent the names of the twelve surveyed schools as: Educare (A), Kihonda (B), Sua (C), Morogoro (D), ST. Denis (E), Kigurunyembe (F), Mtombozi (G), Kisemu (H), Matombo (I), Nelson Mandela (J), Mikese (K) and Bwawani (L).

3.1 Availability of both textbooks and reference books and the extent of their utilization

In the context of this study textbooks were those books approved by the Educational Materials Approval Committee (EMAC) to be used for a given syllabus. Most of the geography textbooks (72%) which were found in secondary schools for form I-IV were those produced by Tanzania institute of education (TIE) from 1987-2004. The rest of the textbooks were those published by the Oxford University Press (OUP) and Ujuzi books (UB). Reference books were those published with Nyambari Nyangwine Publishers (NNP), New East African Educational Publishers (NEAEP) and Longman. Different types of text books observed in the schools are shown in table 4.5 below.

Table 1. Number of Types of Geography Textual Resources in Schools

<i>Textual resources</i>	<i>Observed schools</i>											
	A	B	C	D	E	F	G	H	I	J	K	L
Textbooks	6	2	4	3	3	6	4	2	1	4	4	4
Reference books	2	3	7	4	1	2	4	4	3	1	3	7

Source: Field Data (2012).

Key: Letters in the table (A-L) represent the 12 schools observed.

The researcher wanted to know which types of books are mostly used by both teachers and students in the surveyed schools when learning the concepts of meteorology and environmental education. It was observed that presence of an EMAC stamp or its absence on a book may not determine the extent of its utilization. For instance, books by NNP though they were in the category of reference books; were observed to be the most preferred ones followed by TIE, OUP, NEAEP and lastly UB. Through interview with teachers the researcher identified that the way examinations were set determined which books to be mostly used. For instance, one of the teachers whose most preferred book was that from NNP revealed that:

'Although the text book does not address all the concepts clearly as it is suggested in the syllabus and that there are some mistakes here and there, I still find the book very useful as most of the concepts explained there in do appear in the final examinations. This is if compared to the rest of the books'.

Another factor is availability: The most available geography books were those produced by TIE. Also, teachers supported that books which can mostly be accessed by students are those books produced by TIE though most of them were out of date and irrelevant to the current syllabus. But the teachers acknowledged that even the other least used books have explained some of the concepts better than the popular books except that they don't follow the syllabus so strictly and that they are least used by school examiners.

Then the researchers examined carefully the books found in secondary schools in order to determine their relevance in describing the concepts of meteorology and environmental education according to the current syllabus. The books were those published by TIE, OUP, UB, NNP and NEAEP. The researcher focused on five characteristics i.e. accuracy of the concepts, coverage/depth, relating concepts from different section/topics, giving relevant examples and how questions given covered the concepts explained. The following sections elaborate the way these characteristics were

observed in the sections/topics related with the concepts of environmental management and meteorology.

3.2 Waste Management

All text books from all publishers have accurately presented the concepts of wastes mismanagement by including them in various sections of environmental pollution. Although the books have included industrial, domestic and wastes from mines, there were no details on wastes from transportation on land and in marine ecosystems although the geography syllabus specifies that students should learn various problems associated with various social economic activities. Also, there were no details on the way eroded soil and the associated debris contributes to the destruction of the aquatic animal life. Further more, these books did not describe the 3Rs i.e. recycling, re-using and reducing of wastes in the environment in the section of wastes management. Although a geography book IV by Kinunda and Msabila (2008: pp. 153-156) from NNP mentions 'recycling' as a means of controlling wastes, concepts of reducing and reusing of materials consumed by individual persons are not involved.

The books treat wastes mismanagement separately from human activities like agriculture, industrial activities, transportation etc. This does not only limit the book readers from reflecting on the opportunity cost of running the productive activities that are unfriendly to the environment but also skip issues of wastes production from activities such as tourism and transfer of technology. The books specified general examples of wastes such as chemicals, solids, and gaseous wastes from industries and domestic environments but without including for instance specific sources of wastes from Tanzanian context. This was also reflected in the questions left as assignments at the ends of every topic as they were general inquiring for causes and effects of land, water and air pollution.

3.3 Minimizing Power Use

The text books have accurately described the major sources of power, methods of acquiring power, uses of power and energy sources and problems facing power and energy production. However, a geography textbook for secondary schools, book II by TIE (2002) considers ultraviolet rays as if they are synonymous with any radiations from nuclear reactors. For instance, it states: '*Improper management of power industries like nuclear power industry at Chernobyl in Russia which busted and emitted some ultraviolet elements has affected millions of people in Russia and world as a whole (p. 115)*'.

Since students study learn from physics that ultraviolet rays are components of electromagnetic waves that originate from the sun (Darielle, 2009), they may think that such rays have the same ionizing power as radiations from radioactive elements and that; they may be equally destructive.

Although the textbooks could address problems facing power and energy production they were just general suggestions and not specific for each source of power. Thus, the reader would not easily identify for instance, the challenges behind effective utilization of environmental friendly energy sources such as solar or wind mills for power production. Likewise the textbooks did not show unnecessary power wastage due to excessive use of industrially manufactured goods like bottles, cans, papers and plastic bags. This would not only develop an idea of reducing and reusing industrially manufactured good in the readers mind but also associate wastes management with reducing power consumption.

Although the textbooks could cite specific countries where environmental friendly energy sources were established, they could not include any projects that are under construction in Tanzania including the challenges involved. Similarly, the questions set in the textbooks as assignments were

those inquiring for students' ability to identify alternative power sources, uses of power and general problems facing power and energy production without focusing on specific energy sources within the country.

3.4 Preventing Environmental Degradation

Various concepts on prevention of environmental degradation like management of soil erosion, management of water resources and conservation techniques have accurately been presented in the text books. Likewise, the textbooks could link concepts of environmental degradation with human activities such as agriculture, industrial activities, transportation, mining and sustainable utilization of the environmental resources. For instance, geography for secondary schools book II by NNP showed that air pollution can cause acid rain which may pollute underground water; the same pollution may be caused by poor wastes disposal and oil spills (Msabila, 2005). But it could not also show that any investment along the coast that causes inland flow of saline marine water may also cause underground water pollution as revealed by research (Ehrhart & Twena, 2006).

The textbooks explained the agents of soil erosion appropriately and identified prevention of deforestation as one of the most important means of preventing land degradation but did not include how beach erosion may be human activities or the role played by the vegetation along the coast such as mangrove species in biodiversity conservation. Similarly, the observed text books for form II students except those produced by TIE could identify environmental problems associated with tourism. But such books could not link the environmental problems with the growing trade of searching for biological products in the conserved environments known as bio-prospecting (Rangarajan & Shahabuddin, 2006). Also, although all textbooks could identify afforestation and reforestation as the most effective means of conserving the environment, they did not explain any thing about the negative environmental impact due to introduction of exotic plant species especially those with genetically modified genes. For instance, genetically modified plants which are resistant to common pests may compete successfully with the natural plant species; leading to their extinction or may result into evolution of new pastes which are resistant to commonly used pesticides (ABNE, 2010).

3.5 Weather and Climate

All textbooks could provide the description and diagrams for the apparatus used to measure and record the elements of weather but did not provide enough explanation on how weather forecasting is done. For instance, they did not show how statistics for the elements of weather are established and used in forecasting or the frequency of taking the readings for more reliable forecasting. Also, they could provide a list of some activities which apply weather information but without enough details on why such information is necessary. Although the books had some descriptions on how to measure the elements of weather, such descriptions were less consistent and incomplete in the most used geography text books for form I by NNP and TIE. For instance, while geography course book for secondary schools book I by TIE (1991) 3rd edition did not show how humidity is measured and recorded, Juma and Maringo (2005) geography for secondary schools book I by NNP give some explanation on how to read and record relative humidity that: "exact values of relative humidity may be obtained from tables prepared on the basis of the temperature values of wet bulb and dry bulb thermometers (see fig. 4.12)" (p. 85). The shown fig. 4.12 was only a diagram showing the wet and dry bulb thermometers without any table of values from which relative humidity can be calculated. The same book by NNP provided explanation on the use of a thermometer with alcohol for recording temperature but there was no similar explanation for a thermometer with mercury (p.

82). Likewise if one considers the explanation in the same book on how to use the six's thermometer, it shows that:

'While the mercury on the right hand side raises it pushes the metal index upward until the highest temperature is reached. This temperature is read from the scale on the right hand side when temperature falls, the alcohol on the left hand side contracts; this pushes the mercury downward and up by the mercury..... (p. 82).'

Since such explanation is not clear it may be quite ambiguous for readers at that junior level who may not be well knowledgeable with the expansion properties of the two liquids in the thermometer. For instance, such readers may take a lot of time thinking of why alcohol should move towards the indicated direction. Mapunda (1996)'s text book for ordinary level students by Peramiho Printing Press could provide some examples on the measured elements of weather when air is saturated or hot including windy speed when it is calm or windy.

Also, there is an example of a bar chart showing maximum and minimum rainfall in Bukoba region for the form I text book by TIE (p. 47). However, although this book explains how the daily range temperature, mean daily temperature or annual range of temperature are calculated, it does not show examples of such calculations. The same examples based in Tanzanian context in a book by NNP for the elements of weather were rare. For example, it showed that, speed of wind is obtained by the number of rotations which are recorded on a meter" without showing any units with which wind speed is recorded. The same book shows different parameters which can be calculated from data of rain gauge such as total monthly rainfall, total annual rainfall, the mean monthly rainfall and the mean annual rainfall but no examples on how such calculations are carried out or recorded or where and how such data are used. Also, examples of terms like: heavy, average, or below average rainfall are not given though mentioned in the topic of weather and climate.

3.6 Climate Change

Issues of climate change were explained more in Kinunda & Msabila (2008) geography for secondary schools book IV by NNP and in TIE (2004) geography for secondary schools book III by MOEC. Although these books could address causes and effects of climate change the researcher could identify several areas which can raise a lot of questions among the readers. If a book by MOEC is considered, it mentions solar radiation on earth as the effects of climate change and adds that:

'The earth climate is so sensitive to any change of temperature, amount of moisture, strength of wind or even acidity that such change in any of these aspects can change the establishment of climatic equilibrium and may affect global' (p. 83).

Such a statement can not bring out a clear meaning to the reader because it does not clarify what is wrong with solar radiation or what can cause changes in temperature, amount of moisture or strength of wind; instead they were treated as if they are not the aspects of climate.

The same book indicates the contribution of gases like sulfur dioxide and water vapor from volcanic eruptions in increasing temperature that leads to climate change but without further explanation on how such gases can increase global temperature. This statement may also overemphasize the role of volcanic eruptions in causing global warming as it may be contradicting research observations that global warming is mainly due to human activities (Aizebeokhai, 2009). Although the book showed clearly that global warming causes climate change, it defined global warming as: *'A gradual increase in temperature of the atmosphere described as green house effect; a green house is a hut made of grass which allows sunlight to warm the air, plants and soil in the green house' (p. 84).*

Since no further elaboration is given, this statement views *green house* as a physical entity rather than a hypothetical conception. Thus, book readers especially at that elementary level may be wondering about where is that ‘hut of grass’ located on earth or even ask how it looks like! Also, the book highlighted that:

‘When acidic gases are thrown in the atmosphere they react with rain water and form acidic condition as a result both rain and snow falls can be acidic and cause adverse conditions to the living things. This means the environment is no more experiencing the normal condition of weather and climate’ (p. 86).

Such explanation unless followed by a clear elaboration on the relationship between plants survival and acid rain formation, may likely develop an idea that formation of acid rain can directly cause climate change.

The book further considers ozone layer depletion as one of the causes of climate change although it does not give any further details on how ozone layer depletion is associated with climate change. This is the reason why the book further stressed on the causes of climate change as: “many diseases, parasites and decrease of immune system will occur more frequently than before. Cancer, tumor formation, lung and respiratory diseases will be a product of ultraviolet rays.....” (p. 87). Such explanation may likely convince readers that global warming is mainly due to destruction of ozone layer and miss the fact that global warming may still persist even if the ozone layer is intact as long as green house gas emissions continue (Lindsey, 2010). It added that: *‘Planktons are sensitive to ultraviolet rays and die because they live on ocean surfaces; killing these creatures will not only release carbon dioxide to the atmosphere but also increase global warming’* (p. 87).

These statements may likely make a reader interpret that death of planktons can directly cause global warming and the release of carbon dioxide in the atmosphere causes a significant destruction in the atmosphere apart from global warming.

The other book by NNP showed the percentage contribution of the human activities to green house gases as: “burning of fossil fuel 49%, industrial processes 24%, deforestation 14% and agriculture 13%” (p. 179). Such data are unclear because they were not accompanied by further explanation on if agriculture excludes deforestation completely or the possibility of having industrial activities and burning of fossil fuel separately because most industries run by using fossil fuel.

The book described clearly the effects of climate change as melting of the ice in different parts of the world followed by a relevant example of retreating glaciers on Mount Kilimanjaro. But its effect was not explained beyond that of raising sea levels due to melting ice from the poles of the earth. This means book readers could not associate retreating glaciers with decreasing volume of water that feed some streams down the slopes of the mountain (Hemp, 2005). The book also outlined other consequences of climate change like: *‘cold areas have become warm such that tropic crops are grown successfully and that global warming has caused the occurrence of precipitation in other areas which used to be dry due to changes in hydrological cycles’* (pp. 180-181).

But such explanation is not accompanied by any examples to demonstrate the validity of such a statement.

The same book highlights means of mitigating climate change as: modification of the combustion system in the machines in order to attain efficient fuel burning and cut off massive release of green house gases especially carbon dioxide. This suggestion may not necessarily lead to mitigating climate change because, if the same fossil fuels are used, efficient burning of the fuel can only decrease production of soot but not reduction of carbon dioxide gas production. This is due to the fact that end product of burning any hydrocarbon is production of carbon dioxide and water (Duncan, 1999). Further more, the book suggests for reduction in large scale cultivation of rice in

order to cut off the release of production of methane gas as a means for mitigating climate change. But there is no justification that methane contributes substantially to global warming and that rise production produces substantial concentrations of methane in the atmosphere.

4. Discussion and Implications

This study has revealed that utilization status of the geography books in schools was not determined by whether it was a text book or a reference book but rather it depended on its availability and the way it is written; i.e. if it is written according to the syllabus in use and if it could provide many direct answers to the examination questions. Thus, issues pertinent to the quality of a text book as specified by UNESCO (1989) such as accuracy of the concepts, logical presentation of the concepts or appropriate illustrations were not the factors for the geography books popularity in schools. Since both teachers and students were selecting a textbook after having information from others about the characteristics of a particular book, the least popular books were not read so often by either teachers or students. This observation supports Pennac (1994, p. 24) who noted; reading material that is not popular will not be read.

This means the most popular books and or the most available ones were mostly the most selected geography books despite their shortcomings. Although these books could give the general concepts of meteorology and environmental education as specified in the geography syllabus, the observed weaknesses are pertinent and need to be worked upon by all educational stakeholders. This is because schools have a vital role to play in preparing our young people to take their place as informed, engaged, and empowered citizens who will be pivotal in shaping the future of our communities, our province, our country, and our global environment (Ontario Ministry of Education, 2007, p. 1). This implies that students have potential capabilities for environmental management which needs to be developed. This is against the observed books as they were focusing only on giving knowledge on environmental issues without much consideration on developing students' attitudes and skills on individual actions of reducing wastes in the environments or reusing industrially manufactured goods as strategies not only for minimizing wastes but also minimizing power use. This means students and teachers who will be reading these books may tend to think that environmental protection is mainly the responsibility of the government or environmental experts.

Research on environmental management shows that in order to be able to determine the extent of the relationship between toxic exposure and disadvantaged status in the society one should include the sitting of pollution sources, illegal dumping, poor enforcement of environmental regulations, and inadequate response to community complaints (Maantay, 2002). According to Maantay (2002), such orientation of text books would give students opportunity to evaluate the validity of people's complaints on environmental pollution, relevancy of the existing policies on environmental management or extent of violation of laws in the country. The observed popular books were only giving general examples of sources of pollutants without for instance sitting specific mining or manufacturing industries in Tanzania and the way they were detrimental to peoples' lives. This could even be done by giving questions which require students' ability to look for vivid examples within the country. Failure of the school text books to expose students and teachers to the pollution sources within their immediate environment make it difficult for them to realize that disadvantaged communities encounter greater exposure to environmental toxicants such as air pollution, pesticides, which lead to a variety of outcomes, including asthma, cancer, and several other health problems (Northridge, Stover, Rosenthal, & Sherard, 2003).

None of the books specified for Form One had detailed explanation on weather forecasting. But the geography syllabus specifies that teachers should guide students to prepare a summary on weather

forecasting and its importance after presentation by the expert in meteorology (p. 22). This means both teachers and students should depend entirely on the information given by the expert and nowhere to refer either for further elaboration or justification of any issues in case an expert makes a presentation on weather forecasting. In case no possibility for the school to invite an expert there is greater chance that students may not learn such a section because it was not found in the textbooks available in schools or it will depend on the individual effort of finding such information from sources other than those available in schools. However such a possibility is even more unlikely for rural students who are limited from accessing alternative textbooks, web materials or information from broadcasting media.

Unless vivid examples are given it is likely for a book reader to believe that if textbooks indicate presence of suitable places for agriculture though they were unsuitable for some crops formally due to coldness, then climate change may not be accompanied by any net negative effect associated with agricultural productivity. The same interpretation for the case of water availability may be made; for instance if there will be enough precipitation in originally dry areas as it was explained in the observed books, one may think that life may simply shift from the dry zones towards the wet ones. Or another view may be, if Northern regions could have enough precipitation, water may flow downstream and compensate for the water shortage in the drier areas. If such views are developed they will be misleading because research shows that, due to climate change, the timing of rains will become less predictable and their intensity, more volatile (Agrawala et al. 2003, 13; IPCC, 2003). Also seasonal variations will become accentuated, with a 6 per cent decline in rainfall between June and August (traditionally the 'dry' season), and a 16.7 per cent increase between December and February (the main rainy season) (Agrawala et al. 2003, p. 13).

The suggestion given in one of the textbooks that rice production should be minimized as a means of controlling emission of methane gas does not seem to be logical because it contradicts percentage contribution of green house gases given in the same book (p. 176) that: carbon dioxide contributes 64%, methane 19%, CFCs 11% and nitrogen oxides 6% but among all other activities agriculture contributes only 13% to the greenhouse gases. It means contribution of methane gas from rice cultivation to global warming may be insignificant if it is also considered that rice is only one of the crops among several other species capable of producing the same green house gases when they decay.

5. Conclusion

Two of the textbooks investigated could address most of the concepts of meteorology and environmental education as suggested in the geography syllabus. However, there were some weaknesses observed in various sections/topics with regard to accuracy, content coverage, examples given, relating various concepts with one another, and questions given. This implied that the responsible authorities did not thoroughly review the observed geography textual materials before their approval for utilization in schools. Hence, since textbooks are the most reliable sources of information for both students and teachers the stated objectives in the syllabus on the concepts of meteorology and environmental education can not be thoroughly achieved. This is exacerbated by the observation that what determined utilization status of textual materials in schools may include other factors different from those concerning with the quality of the book content. It is also logical if one argues that the observed weaknesses in the textual materials are likely to affect more of the rural teachers and students as they have fewer opportunities for accessing alternative sources of information when compared to their urban counterparts. Therefore, in order to understand the magnitude of the problem fully, another study needs to be carried out to determine if there is any

relationship between the observed weaknesses in the textual materials and any perceived students' misconceptions.

References

- African Biosafety Network of Expertise (ABNE) (2010). *Environmental issues related to genetically modified crops*. Retrieved February 9, 2012, from <http://www.nepadbiosafety.net/forregulators/resources/subjects/environmentalbiosafety/environmental-issues-gm-crops>.
- Agrawala, S. A., Moehner, A., Hemp, M., van Aalst, S., Hitz, J., Smith, H., ... Mwaipopo, O U. (2003). *Development and climate change in Tanzania: Focus on Kilimanjaro*. Paris: Organization for Economic Co-operation and Development.
- Aizebeokhai A. P. (2009). Global warming and climate change: Realities, uncertainties and measures. *International Journal of Physical Sciences*, 4 (13), 868-879.
- Bardsley, D. K., & Bardsley, A. M. (2007). A constructivist approach to climate change teaching and learning. *Journal of Geographical Research*, 45(4), 329–339.
- Beck, U. (1995). *Ecological Enlightenment: Essays on the Politics of the Risk Society*. New Jersey: M.A. Ritter, Trans. Humanities Press.
- Beck, U. (2000). *The Brave New World of Work*. Cambridge: Polity Press.
- Callingham, R; Watson, J. (2004). A Developmental Scale of Mental Computation with Part-Whole Numbers. *Mathematics Education Research Journal*, 16(2), 69-86.
- Carson, T. R. (2009). Internationalizing curriculum: Globalization and the worldliness of curriculum studies. *Curriculum Inquiry*, 39 (1), 145-158.
- Dancan, S. (1999). *More about why to consider Ozone Therapy /Oxygen Spa as an alternative treatment Plano Fort worth?* Retrieved May 16, 2011, from <http://www.holisticbodyworker.com/dallas-holistic-healer/more-info-on-ozone-therapy/>
- Darielle (2009). *The science and history of ultraviolet light*. Retrieved April 10, 2012, from <http://goodchangesnowblog.com/the-science/>.

de Castro, B. V. (2008). Cognitive models: The missing link to learning fraction multiplication and division. *Asia Pacific Education Review*, 9 (2), 101-112.

Ehrhart, C., & Twena, M. (2006). *Climate change and poverty in Tanzania realities and response options for CARE*. Retrieved July 2012 from http://www.care.dk/multimedia/pdf/web_english.

Hemp, A. (2005). Climate change-driven forest fires marginalize the impact of ice cap wasting on Kilimanjaro. *Global Change Biology*, 11(7), 1013-1023.

IPCC (The Intergovernmental Panel on Climate Change) (2007). *Climate Change 2007: the Physical Science Basis: Summary for Policymakers*. IPCC Secretariat: Geneva.

IPCC (The Intergovernmental Panel on Climate Change), (2007). *Climate Change 2007, the Physical Science Basis: Summary for Policymakers*. Geneva: IPCC Secretariat.

Kinunda, J., & Msabila, D. T. (2008). *Comprehensive geography for secondary schools book IV*. Dar es salaam: NNP.

Kira, E; Bukagile, G. (2013). Perceptions of Education Stakeholders on the Implications of Textbook Liberalization Policy in Tanzania. *Journal of Education and Practice* 4(1) 136-143

Lindsey, R. (2010). *Are the ozone holes and global warming related?* Retrieved April 14, 2012, from <http://earthobservatory.nasa.gov/blogs/climateqa/are-the-ozone-hole-and-global-warming-related/>.

Maantay, J. (2002). Mapping environmental injustices: pitfalls and potential of geographic information systems in assessing environmental health and equity. *Environ Health Perspect*, 110(2), 161–171.

Mapunda, D. M. (1996). *Geography for book for ordinary level students*. Dar es salaam: Peramiho Printing Press.

MOEC (Ministry of Education and Culture) (2005). *Education Materials Approval Committee, Circular No.7*. MOEC: Dar es Salaam.

- MoEVT (Ministry of Education and Vocational Training). *Geography syllabus for secondary schools: Form I-IV*. Dar es Salaam: Tanzania institute of education.
- Msabila, D. T. (2005). *Geography for secondary schools book II*. Dar es salaam: NNP.
- Northridge, M. E., Stover, G. N., Rosenthal, J. E., Sherard, D. (2003). Environmental equity and health: understanding complexity and moving forward. *Am J Public Health*, 93, 209–214.
- Ontario Ministry of Education (2007). *Shaping our schools, shaping our future*. Retrieved September 27, 2012, from <http://www.edu.gov.on.ca/eng/teachers/enviroed/ShapeTomorrow.pdf>.
- Pennac, D. (1994). Reads like a novel. *A review essay: Better than life. ALAN Review*. Retrieved September 23, 2010, from http://www.warriorlibrarian.com/LIBRARY/qual_vs_pop.html.
- Pittock, B. (2003). *Climate Change: an Australian Guide to the Science and Potential Impacts*. Canberra: Australian Greenhouse Office.
- Rangarajan, M., & Shahabuddin, G. (2006). Displacement and relocation from protected areas: Towards a Biological and Historical Synthesis. *An Interdisciplinary Journal Exploring Linkages between Society, Environment and Development*, 4 (3), 359-378.
- Reid, A. (2001). Environmental change, sustainable development and citizenship. *Teaching Geography* 26, 72–76.
- Stern, N. (2006). *Stern Review: the Economics of Climate Change*. London: Her Majesty's Treasury.
- Tanzania Institute of Education (TIE) (2011). *Geography teacher's manual for ordinary secondary education*. Dar es salaam: TIE.
- UNESCO (1983). *The elaboration of school textbooks methodological guide*. Bangkok: UNESCO.
- UNESCO (2012), *Primary school curricula on reading and mathematics in developing countries*. Montreal: UNESCO Institute for Statistics.
- Valverde, G. A. (2005). Curriculum policy seen through high-stakes examinations: Mathematics and Biology in a selection of school-leaving examinations from the Middle East and North Africa. *Peabody Journal of Education*, 80 (1), 29-55.

van Oers, B., Poland, M. (2007). Schematizing activities as a means for encouraging young children to think abstractly. *Mathematics Education Research Journal*, 19 (2), 10-22.