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Analysis of climate change primary concepts in science, health and environment textbooks of primary school in Afghanistan

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Abstract

Globalized and interconnected world subject of climate change conditions become crucially vital for individuals and communities in local and international level due to protecting the earth and its livelihoods of species, so students as change agents need to be educated to be conscious, sensible about climate change impacts, adaptations, and mitigations which enabling them to reduce the vulnerability of themselves and their society to risk and contribute to sustainable development. Therefore, the purpose of this study was to analyze the content and illustrations of primary school Science, Health and Environment textbooks based on climate change causes, impacts, and solutions as indicators.

The content analysis has been performed as research method in two sections such as 1) conceptual analysis, and 2) pictorial analysis which the results have been transferred to tables and interpreted. According to the findings, most of the concepts and pictures were assigned to climate change impacts that following with climate change causes, while climate change solutions received less attention in both texts and illustrations. The majority of the concepts have been discussed from biology, physics, and chemistry perspectives rather than climate change point of view which in turn underpinned the explicitly of the concepts. However, the pictorial representations were more explicit and were drawn a clear linkage to climate change trends. Nonetheless, local concerns need to be taken in consideration to reduce the irreversible impacts of climate change on economic, political, social and cultural spheres.

Keywords: Climate change; Causes; Effects; Science textbooks; Primary education

1. Introduction

Many obvious and sensible evidences such as global warming, changes in weather patterns and precipitation, changes in the thickness of the ice sheets, melting polar ice and rising sea levels, change in vegetation and some archaeological and historical confirmations demonstrate the factuality of climate change. Therefore, climate change is a scientific fact which has been confirmed by many scholars. For instance, a survey published in *Environmental Research Letters* reviewed nearly 12,000 articles on human induced climate change in different scientific publications over 20 years (1991-2011). The result revealed that 97.1% of the publications considered the phenomenon as a scientific fact, whereas only 0.7% of researchers rejected the notion, while the other seemed undecided (Baillargeon, 2014; as cited in Langlois, 2019).

The rapidly changing climate proven by scientists is so worrying and due to some argument, that we have entered in a new geological epoch known as “Anthropocene Era” which is defined as the age in that human beings exert as impact over the planet which is so great that it is changing the planet’s own processes and even systems (Langlois, 2019). Thus,

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climate change presents an international challenge of a degree that not previously faced and its impacts have the potential to exacerbate existing tensions and generate new ones, which in turn have consequences for stability and security at both; local and international level (UNESCO Bangkok, 2012). As a result, the impacts of climate change are increasing and are not expected to slow down in a short while. Extremely intense and destructive storms, floods, and hurricanes, suffocating heat waves, the mass extinction of biodiversity, severe droughts, torrential rain, and rising sea levels are the countless examples of catastrophes change in the climate (Langlois, 2019).

Climate change impacts are not equally affecting all countries rather the developing and poor countries are more in danger. Therefore, Afghanistan as a poorest country, is severely at risk of the adverse effects of climate change, which might lead to more intense storm, increased flooding, water shortages in the summer, losing biodiversity and in turn poverty and food shortage across the country. Thomas (2016) stated that Afghanistan has been considered as vulnerable country in terms of socio-economic factors such as: livelihood sensibility and stability, livelihood dependency, education attainment, assets and debts, water infrastructure access, health facility access and food marketplace access to climate shocks. He further argues that almost all Afghanistan households show vulnerability to climate shocks for at least one indicator and more than half of families show vulnerability for at least three indicators (Thomas, 2016). Moreover, it is estimated that more than half of Afghanistan inhabitants is physically exposed to flood risk including 15 percent of them being exposed to high flood risk (IMMAP & USAID; sited in Thomas, 2016).

Nonetheless, article 6 of the UNFCCC directs countries to take in account education, training and public awareness as integral tools to response to the climate change and its intense impacts. Therefore, school curriculum, particularly teaching and learning material are crucially vital in terms of public awareness and sustainable education. So, this research is concerned with the presentation of basic concepts in terms of causes, effects, and solutions of climate change in the textbooks of primary education in Afghanistan. Accordingly, the textbooks of primary school have been analyzed to figure out that to what extent basic concepts of climate change are presented in the primary science textbooks contents and how well the causes, impacts and solutions themes of climate change are visually presented in the primary science textbooks due to science learning has a close link with learning of concepts which are in turn considered of high importance to gain insight in science (Peacock & Weedon, 2002; as sited in Qadeer, 2013).

2. Literature Review

2.1. Causes of Climate Change

Climate change might have anthropogenic or natural causes as Speelman (2009) stated that climate change may either be human- induced or caused by natural process which taking place without human intervention (Speelman, 2009; as sited in Kakaki, 2013). Anthropogenic causes of climate change include emissions of carbon dioxide from the burning of fossil fuels which in turn deplete the ozone layer, leading to global warming. Human made factors also take account of bush burning, smoke releases from industrial plants, chemical process, methane gas from waste, nuclear fusion and fission, quarrying and mining (Kakaki, 2013). Anthropogenic causes of climate change also contain the following factors:

2.1.1. Greenhouses gases

Greenhouses gases such as carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) trap heat in the atmosphere so make the Earth warm enough for humans, animals and plants to live. But for over 100 years onward, human have significantly added greenhouses gases by burning large amount of fossil fuels like coal, oil and natural gas to power factories, vehicles and their homes. Moreover, current agricultural activities both directly and indirectly release greenhouse gases into the atmosphere. For instance, methane is released by cows, humans, rice farms and waste water, while nitrous oxide is coming out from fertilization and pesticides used for crop cultivation. As a result the greenhouses gases caused global warming and in turn, climate change. Because the more greenhouse gases there are in the atmosphere, the more heat is trapping and the higher temperature becomes (Murugarathinam, 2016; FAO, 2014; Mader, 2010; as sited in Kakaki, 2013; Jacqueline Ashby & Douglas Pachico, 2012).

2.1.2. Deforestation

This is the destruction of the forests as a consequence of the activities of human and their domestic animals, or in pursuit of economic benefits (Kakaki, 2013). In another word, deforestation is occurring to make way for agriculture as changing forests to farming lands is also caused global warming as it reduces the number of trees which normally absorb CO₂ from the air and release O₂ instead, thusly reducing the concentration of CO₂ in the atmosphere (FAO, 2014).

2.1.3. Ozone layer depletion

Ozone (O₃) is an unstable triatomic molecule of oxygen at about twenty kilometers above the Earth's surface which is protecting it by deflecting back much of the ultraviolet rays of the sun. As before mentioned it is very unstable and easily giving one of its molecules to gases like carbon dioxide and chlorofluorocarbons (CFCs) which makes it a diatomic molecule (O₂). Therefore, when the ozone is depleted, a hole will form through which ultraviolet rays pass to the atmosphere and increase the temperature. However, this is very evident in heavily industrialized cities like Tokyo, Manchester, Detroit, etc. (Mader, 2010; as cited in Kakaki, 2013).

Although about 97% of climate scientists agree on anthropogenic causes of climate change, some observers claim that climate is not a human-made phenomenon, blaming factors such as solar cycles or volcanic activity (Rebecca M. Henderson, Sophus A. Reinert, Polina Dekhtyar, & Amram Migdal, 2018). However, natural mechanisms which caused climate change include variations in solar radiation, variation in the earth's circuit, mountain construction, volcanic eruptions, continental drift and alteration in naturally radiated greenhouse gases concentrations (Kakaki, 2013).

2.2. Impacts of Climate Change

Climate change affects live conditions of plants, animals and other species, increase evaporation, warming up oceans and melting snow and ice (FAO, 2014). Moreover, climate change poses numerous interconnected challenges such as water security, rising pressures on food chain and food production, health crises, and disaster risks (UNESCO, 2013).

2.2.1. Effect of climate change on weather variability

Studies have shown that the earth's average annual temperature has been increased by 5 degree Celsius which causes hot and dry regions becoming hotter and drier as well as cold regions becoming warmer (Kakaki, 2013). According to Murugarathinam (2016) increase in temperature is one of the most immediate and obvious impact of global warming (Murugarathinam, 2016). IPCC (2007) reported that eleven out of the last twelve years have been the warmest on record since 1850. Moreover, IPCC estimation shown that the average global warming from 1850/1899 to 2001/2005 has increased by 0.760C (UNESCO Bangkok, 2012). Therefore, high temperatures increase the number of people who die in a given day (Kakaki, 2013). Moreover, climate change caused rising sea level, and changing rainfall patterns which in turn causing drought, desertification. Extreme weather events such as floods, storms, cyclones and heat waves are becoming much more frequent and extreme (UNESCO, 2013).

2.2.2. Effects of climate change on agriculture

Although there are still many uncertainties with regards to climate change, small changes in the Earth temperature caused large shifts in the climate and weather. However, agriculture as highly climate sensitive sector is extremely vulnerable. Obviously for many people in developing countries, agriculture is crucially vital for their food production and livelihood security, so changes in the climate conditions strongly threaten their life from different aspects. For example, increase in temperature can make some seeds grow faster because warmer temperatures increase growth, therefore, the faster growth might reduce the amount of time that crops grow and mature, which in turn can reduce yields. Similarly, climate change strongly affects livestock by higher temperature and heat waves which can increase their vulnerability to diseases and reduce fertility and milk production. Moreover, climate change caused extreme weather events such as: drought, wild fires, floods, storms, and hurricanes which damage forests and reduce their productivity (FAO, 2014).

2.2.3. Natural disasters

Climate change caused natural disasters which define as any event or situation that results in harms and losses to people, their environment and property that they and their community are unable to recover from by means of their own resources (UNISDR, 2009; as cited in FAO, 2014). Examples of natural disasters include floods, storms, hurricanes, wild fires, tsunamis, earthquakes, landslides, drought, and trans-boundary animal and plant pests and diseases which can result in large losses and damage to species, agriculture and food production (FAO, 2014).

Health crises

Higher temperatures increase the likelihood of heat-related harm and death (AAAS, 2014; as cited in Henderson et al, 2018). In the course of twenty years (1979-1999), a total number of 3829 deaths in the US were attributed to excessive heat due to extreme weather situations. In the same period of time, a total of 13970 deaths were associated with hypothermia, a weather condition caused by extremely low temperature (Kakaki, 2013). Furthermore, as many as 70000 people have been died in the 2003 European heat wave, and more than 50000 have been died in a 2010 heat wave in Russia (Robine et al, 2014; Alok Jha, 2012; as cited in Henderson et al, 2018).

Loss of biodiversity

Numerous species of plants and animals are already shifting their range northward or to higher altitude because of warming temperatures. However, this becomes a challenge when the rate of climate change velocity is faster than the migrations rate of many organisms, thusly, many animals may not be able to contest in the new climate system and may go to extinction (Murugarathinam, 2016). Nonetheless, climate change also significantly affects numerous natural habitats which put plentiful species at higher danger of extinction in the coming century (Synthesis Report, 2016; as sited in Henderson et al, 2018). Perceiving that current extinction rates of species are 100 times than normal rate, therefore, some scientists predict that the Earth is approached to the sixth mass extinction event in its history (NG, 2015; Jordan, 2015; as sited in Henderson et al, 2018). According to these predicts, by 2100, 30% to 50% of the world's land and marine animal species might be dead (CBDW, 2016; NGW, 2016; as sited in Henderson et al, 2018).

2.3. Solutions of Climate Change

The rapidly changing climate demands decision makers of all types and level including individuals, businesses, and governments taking or planning actions to respond appropriately to climate change. Liable on how much emissions are reduced, the future could bring a relatively mild change in climate or it could deliver extreme changes which could last thousands of years (National Research Council , 2012). The most urgent response to the climate change is cutting down the emission of greenhouse gases which are accounting for the majority of anthropogenic causes of climate change. Therefore, two main ways of responding to climate change are through mitigation and adaptation, which mitigation involves attempting to slow down the rapidly changing of climate by lowering the amount of greenhouse gases in the atmosphere, whereas adaptation relates to how to live with the degree of global warming which cannot be stopped. In another word, adapting to climate change includes developing means of protecting people to impact of global warming and reducing their vulnerability (UNESCO, 2010). Climate scientists suggested some practices and choices to avoid emissions, reduce the impact, and prevent climate change as following:

2.3.1. Afforestation

Planting of trees is an effectual remedy for global warming. Different types of trees and forests which are consuming high amounts of carbon dioxide during photosynthesis should be planted (Kakaki, 2013). Therefore, we can fight global warming and climate change by reducing deforestation and forest degradation, instead managing forests and agriculture should be the top primacy to cut down carbon emissions (Murugarathinam, 2016).

2.3.2. Energy efficiency and renewable energy

Consuming energy more efficiently with using renewable energy such as: wind, solar, hydropower, geothermal and bioenergy would considerably decrease our emission of heat trapping gases (Kakaki, 2013). Using more efficient techniques for insulating, warming, cooling, and lighting buildings; as well as, promoting industrial equipment and processes to be more energy efficient; and encouraging to buying efficient home appliances and vehicles (National Research Council , 2012) are appropriate choices of preventing greenhouse emissions. Moreover, aforementioned renewable sources would create clean energy and have been in use for many years around the world. Thus, these technologies can be deployed quickly, cost-effective and generate jobs opportunities for millions of people (Murugarathinam, 2016). According to the EPA, wind power is the fastest-growing source of energy in the world since 1990. Therefore, wind as source of energy which generate electricity has little to no impact on the environment (EPA, n.d.; as sited in Kaddo, 2016)

2.3.3. Reduce the impact of climate change on agriculture

According to National Research Council (2012) the largest overall source of non-CO₂ greenhouse emission is from agricultur, especially methan which is produced when livestock digest their food, as well as nitrou oxide and methane from manure and nitrogen fertilizer. Therefore, these emissons could be decreased by different ways including by applying agricultural techniques that are helping farmers to minimize the over-fertilization practices which in turn lead to emissions, and by improving livestock waste managemtn systems (National Research Council , 2012). Moreovr, due to vulnerability of agriculture sector FAO (2014) suggested some practice to reduce the impact of climate change on agriculture and food productions such as: flexible planning of crop cultivation, early or late planting and harvesting, selections of crop varieties which are more drought or flood-resistant, combination of trees with crops and livestock, diversification of crops and livestock, and water management through irrigation, mulching and minimum tillage (FAO, 2014).

2.3.4. Waste management

There is generating a lot of garbage everyday world-widely because of consumerism culture and most of the people don't know how to deal with, where ineffective and irresponsible disposal of wastes can pollute the environment and pose public health problems. Therefore, reducing the use of disposable products instead buying products with minimal packaging which would help to decrease waste recycling such as: papers, plastics, and newspapers (Kakaki, 2013). Abdul-Rahman suggested a comprehensive approach of waste management, which is summarized by the "Three Rs": 1) Reduce; which refers to buy only what we need since a better way to reduce waste is by not creating it at first. 2) Reuse: it means that if we have to acquire goods, it's better to try getting used ones or obtaining replacements. 3) Recycle; it refers to means of discarding our waste. We should find ways to recycle it instead of allowing it go to landfill (Abdul-Rahman, 2014).

2.3.5. Developing low carbon technology

Using low and zero carbon technology is another option of preventing climate change. For instance, shift from coal and oil to natural gas, increasing the usage of nuclear power and renewable sources of energy, capturing and sequestering carbon dioxide (CO₂) from power plants and factories (National Research Council, 2012) are sounding to avoid climate change proficiently. Low carbon technology needs a backup low carbon economy plan which in turn is leading more sufficiently to low and zero carbon technology. So, a key element in the transformation of low carbon economy is investment in the country's human capital (Paulette Bynoe & Denise Simmons, 2014).

2.3.6. Creation of awareness

Word of mouth is The United Nation Framework Convention on Climate Change and its Kyoto Protocol could only succeed if the all people, particularly key stakeholders taking effectual action. Although governments are directly responsible for only a slight amount of greenhouse gas emissions, they must motivate other organizations and people such as business, communities and individuals to change their behaviors align which limit emission and support adaptation (UNEP, 2006). Furthermore, article 6 of the UNFCCC directs countries to contemplate education, training and public awareness as essential way of responding to climate change (UNESCO Bangkok, 2012), so presentations, meetings and discussions over global climate change provide information about feasible solutions to reduce emissions and in turn global warming (Murugarathinam, 2016). Based on Thomas (2016) analysis one of the major constraints in way of translating policies, strategies and programs into tangible outcomes is low level of awareness on climate change from governmental to local level. He suggests that raising awareness should not be limited to government level; furthermore, climate change activities should be integrated into educational curriculum at primary, secondary, and tertiary level in order to expand community responsiveness of the issue (Thomas, 2016).

2.4. Climate Change and Environmental Issues in the Textbooks

A study has been conducted in textbooks of 14 countries from Europe, Africa and Middle East by consideration of "Human as guest vs. Human as owner of nature" axis to evaluate presentation of Ecosystems and Cycles, Pollution and Use of Resource in 128 textbooks. Their analysis showed that the axis "Human as owners vs. Human as guests of nature" appears in three aforementioned sub-topics (Pollution, Use of Resource, and Ecosystem), however not in Biodiversity. So, textbooks of junior secondary school pupils (12-15 years old) are the ones presenting more all subtopics Pollution, Use of Resources, Ecosystem and Cycles than those for primary (6-11 years old) or senior secondary school (16-18 years old) pupils. In the other hand, aesthetic, ethical, and cultural aspects of education for sustainable development are inadequate. They conclude that examined textbooks tend to defend the ecocentric outlook where humankind are consider as guests of nature rather owners, but poorly referred aspects of aesthetic, ethical and cultural restraining the education for sustainable development (Rosa Branca Tracana & Graca S. Carvalho, n.d.).

Awasthi & Agarwal have been analyzed various aspects of environmental concern in NCERT science textbook of grade 8th based on ten formulated categories of environmental concern in the form of content, tables, figures and activities. Their findings revealed that more weightage is given to environmental structure (29.48%) and human health and hygiene (26.59%) rather than environmental balance (1.65%) in the content. Moreover, maximum numbers of figures represented environmental structure and agriculture where no figure is assigned to impact of population on environment. Nonetheless, very less tabular presentation of environmental concern is the utmost downside of the text. However, students' activities are not evenly distributed to the different aspects of environmental concern, but are encouraging and useful (Malini Awasthi & Reena Agrawal, 2013).

Surmeli et al conducted a study aimed to evaluate environmental issues in science textbooks of grade 6th, 7th and 8th prepared for 1992, 2000 and 2004 curriculum visually and conceptually. Their findings revealed that the most frequency mentioned concept among examined science textbooks was ecosystem. Alongside ecosystem, air pollution

was also mentioned frequently in science textbooks of 1992 publication. It can be seen from the findings that more environmental issues concepts appear in textbook of 2004 curriculum. In the other hand, the concept of air pollution was more mentioned comparing with other concepts in 1992 curriculum textbook. In spite of some new concepts added in 2004 program, the greenhouse effect which considered as the most environmental problem in recent years was not mentioned. However, the ratio rate of pictures related to environmental issues were increased in science textbooks of 2004 program comparing to 1992 program. Moreover, in the textbooks of 1992 and 2000 curriculum, drawing pictures was preferred which was less preferred in 2004 textbook curriculum (Hikmet Surmeli, Mehtap Yildirim, & Fatma Sahin, 2007).

Four sixth grade science textbooks adopted in the state of California have been analyzed by consideration of textbooks' language of climate change themes. Their findings demonstrated that the language in science textbooks addressing climate change incorrectly represents a low level of consensus among scientist about climate change occurrence and does not adequately deliberate the human causes of this phenomenon. They concluded that the message was that climate change is perhaps happening, that human activity may or may not be causing it, and we do not necessarily need to take instant mitigation action (Diego Roman & K.C. Bush, 2015).

Choi et al. (2010) evaluated seven earth and environmental science textbooks to figure out to how extend science textbooks contribute to student misunderstanding about climate change. Their finding suggests that many of students' misconception could be mapped onto similar misrepresentation of or inadequate converge of climate change within the texts (Choi et al, 2010; as sited in Diego Roman & K.C. Bush, 2015).

A study carried out by Al-Jamal and Al-Omari (2014) to analyze Jordanian EFL textbooks in light of ecological education themes. Their findings demonstrated that only more than one third of EFL textbook content involved types on sensitivity to ecological problems (34.57%) and ecological skill development (33.33%) respectively. Moreover, about 19.75% of the content represented ecological knowledge and 12.35% of the content reflected ecological contribution themes (Dina A. Al-Jamal & Wesal Al-Omari, 2014).

3. Research method

This research aimed to investigate the climate change issues in primary school Science, Health and Environment textbooks visually and conceptually, so content analysis has been performed for data collection and analysis. In present study three Science, Health and Environment textbooks of grade 4th, 5th, and 6th which were recommended by Ministry of Education, have been used as research corpuses. The data collection and analysis were done in two sections. First, the concepts of textbooks were counted, categorized, and analyzed base on indicators such as causes, impacts, and solution of climate change which were designed based on local and international concerns. Besides, the number of pages in which the related concepts appeared has been counted to figure out their textual coverage. In the second section, figurative typology created by Clement was used to define visual frame of textbooks (Clement 1996; Yildirim, 2007; sited in Surmeli et al, 2007). The typology extent of picture related to climate change issues were measured to find out their covering spaces. Finally, the results have been transferred into tables and interpreted qualitatively.

4. Results

4.1. Content Texts Analysis Findings

The Science, Health and Environment textbooks of primary school were analyzed based on number of concepts related to climate change education such as causes, impacts and solution. The result of content texts analysis shown in the below tables.

Table 1 show the related concepts of causes of climate change in the examined textbooks, which energy (41.38%), industry (20.27%) and burning of fossil fuels (15.62%) are the most mentioned concepts of anthropogenic causes of climate change with large coverage, whilst fertilization and deforestation are less mentioned concepts. In the other hand, natural causes of climate change were not mentioned at all across textbooks. However, the concepts are mostly presented from biology, physic, health and environment perspective rather than explicitly climate change perspective. For instance, concept of energy, which is highly presented, mostly discussed from physic perspective, thusly under title of "*Heat Sources*" and "*Light Sources*" and was barely referred to energy as causes of climate change, as well as industry.

Table 1 Causes of climate change in content texts

Educational level	Grade 4		Grade 5		Grade 6		Total
	pages	Frequency	pages	Frequency	Pages	Frequency	
Burning of fossil fuels	15	41	20	63	23	118	15.62
Deforestation	2	5	1	1	1	3	0.63
Livestock	10	45	5	10	1	1	3.94
Fertilization	0	0	0	0	2	2	0.14
Transport	10	31	5	10	17	48	6.26
Energy	26	167	48	293	16	128	41.38
Industry	17	66	6	14	44	208	20.27
Building	12	30	8	18	19	35	5.84
Agriculture	5	9	5	7	3	4	1.40
Refuse cycle	9	14	14	33	11	17	4.50
Variation in solar radiation	0	0	0	0	0	0	0
Variation in the earth's orbit	0	0	0	0	0	0	0
Volcanic eruptions	0	0	0	0	0	0	0

Table 2 Impacts of climate change in content texts

Educational level	Grade 4		Grade 5		Grade 6		Total
	Pages	Frequency	Pages	Frequency	Pages	Frequency	
Weather	13	36	22	101	2	2	3.60
Precipitation	5	8	6	26	7	12	1.19
Drought	4	6	0	0	0	0	0.15
Storm	2	2	1	1	0	0	0.08
Flood	6	8	0	0	1	1	0.23
Heat waves	0	0	0	0	0	0	0
Air pollution	3	4	3	5	7	34	1.11
Food chain	42	336	20	55	18	62	11.72
Natural disasters	4	5	4	7	2	2	0.36
Unsteady food production	3	12	1	2	0	0	0.36
Diseases	14	114	14	44	19	147	7.89
Carrier	17	61	19	194	18	89	8.90
Drugs	1	1	7	79	13	135	5.56
Prevention	14	21	6	13	12	33	1.73
Assets and services	13	24	11	16	11	20	1.55
First aids	14	105	0	0	0	0	2.71
Sanitation	28	78	8	16	23	71	4.27
Ecosystem & Biodiversity	57	213	55	242	37	93	14.18
Habitat	34	166	44	200	35	141	13.12
Natural resources	33	121	38	241	52	459	21.25

Table 2 displays the presentations of climate change impacts related concepts in the textbooks that natural resources, ecosystem & biodiversity, habitat, and food chain are the most mentioned concepts respectively which appeared frequently either. In the other hand, concepts of storm, drought, flood, and natural disaster are less mentioned with less frequency concepts. However, heat wave as impacts of climate change is not mentioned in all three textbooks. Although the impacts related concepts of climate change to some extent were presented frequently, there has not been a clear linkage between most of aforementioned concepts and climate change. So, the aforesaid concepts barely shown the clear impacts of climate change on weather variability, precipitation inconsistency, natural resources depletion, food chain reduction and unsteady food production, ecosystem and habitat destruction, air pollution, and disasters induces and contaminations.

Table 3 Solutions of climate change in content texts

Educational level	Grade 4		Grade 5		Grade 6		Total
	Pages	Frequency	Pages	Frequency	Pages	Frequency	
Wind energy	0	0	1	3	3	6	4.79
Solar energy	2	2	0	0	3	4	3.19
Water energy	0	0	2	4	4	8	6.38
Bioenergy	0	0	0	0	0	0	0
Nuclear energy	0	0	3	20	0	0	10.64
Forests and forests protection	8	13	0	0	2	26	20.74
Verdures and verdures planting	8	32	5	5	2	2	20.74
Trees and trees planting	5	7	2	2	3	11	10.64
Reasonable use of energy	0	0	0	0	6	18	9.57
Waste disposal	5	9	1	1	8	15	13.29

According to Table 3, forests (20.74%), verdures (20.74%), and waste disposal (13.29%) are the most mentioned concepts related to the climate change solutions whereas, solar (3.19%), wind (4.79%), and water (6.38%) are the less mentioned concepts. Though, the concept of nuclear bioenergy is not mentioned at all. Even though the textbooks are hardly contain the concepts of climate solutions, but there were rather clear linkage between above mentioned concepts and their contributions to adaption and mitigation of climate change. Some of the concepts are not clearly related to the solution of climate change rather discussed based on physic and chemistry point of view. For example, the concept of nuclear which had been talked about to explain the atom's structure rather than the contribution of nuclear power on mitigation of climate change.

4.2. Pictorial Analysis Findings

Images are influential tools for learning, providing important opportunities for analysis, argument, and group activities (Mowat, 2002; as cited in Graca S. Carvalho et al, 2011). Further, images in the textbooks, illustrate what is written in the texts and usually they are better memorized rather than texts itself (Korfiatis et al., 2004; Myers, 1990; Pozzer & Roth, 2003; as cited in Graca S. Carvalho et al, 2011). Therefore, all the illustrations of the science, health and environment textbooks of primary school have been analyzed based on climate change causes, impacts, and solutions according to current study indicators which transferred into table 4.

Based on table 4, most of the illustrations (66.55%) allocated to causes of climate change where not as much of them (25.83% and 7.62%) were assigned to climate change causes and solutions respectively. So, in terms of climate change causes, most of the pictures were presenting energy (24.54%), transport (22.39%), fossil fuels (15.80%), and industry (15.42%), whereas, none of the picture represent fertilization and only (0.53%) of the pictures were presenting agriculture as causes of climate change. Furthermore, (25.31%) of the pictures illustrated ecosystem and biodiversity, (11.71%) presented habitat and (11.03%) of them were depicted food chain, whereas none of the pictures were assigned to natural disasters, and only (0.25% and 0.28%) were depicting flood and heat waves respectively. In terms of climate change solutions, majority of the pictures were depicted forests (22.54%), water (21.20%) as renewable sources of energy, (13.61%) were displayed waste disposal, and (10.81%) were illustrated reasonable use of energy,

while infrastructure and low carbon technology were not revealed in the pictures of all textbooks and less picture were shown wind (5.58%) as renewable source of energy and verdures (5.63%). However, the illustrations have been shown more clearly the climate change causes, impacts, and solution rather than textual presentation.

Table 4 Causes, impacts, and solutions of climate change in illustrations

Education level	Grade 4		Grade 5		Grade 6		total
Indicators	No. Pictures	Area cm2	No. Pictures	Area cm2	No. Pictures	Area cm2	%
Causes of climate change	70	2655.49	44	1153.21	17	1060.42	25.83
Impacts of climate change	157	5661.82	119	4333.5	91	3618.5	66.55
Solutions of climate change	13	371.2	6	127.51	36	1476.1	7.62

5. Discussion

Afghanistan is ranked among the most vulnerable countries across the world to the climate change adverse impacts (DARA, 2012; GWCCRI, 2013; NDGAI, 2014; as sited in INDC, 2015). Hence its temperature based on the optimistic (RCP4.5) scenario will increase approximately 1.5° C until 2050 which will be followed by a period of steadiness and then further warming of about 2.5 °C until 2100, whereas the pessimistic (RCP8.5) scenario indicates extreme temperature increase across the country nearly 3 °C until 2050 with additional warming by up to 7 °C by 2100 (NEPA & UNEP, 2015). The report further argues that the high temperature will decrease precipitation during springtime which is projected to take place in the areas with the highest agricultural productivity (East, North, and Central Highland). Thus, the combination of overall increase in temperature and related increase in evapotranspiration across the country will negatively affect the hydrological cycle, agricultural productivity, and availability of water resources (NEPA & UNEP, 2015). Moreover, according to NBSAP (2014) report, climate change has the capacity to plummet many more Afghanistan people into poverty (NBSAP, 2014), therefore, climate change is a serious issue that has irreversible and catastrophic damage to ecosystem, natural resources, habitat, air condition, livelihood, health, socio-economic condition, and poverty traps.

UNESCO sector notes indicated education as an essential strategic element of the global response to climate change. The notes further stated that climate change education address the challenges of climate change and sustainable development encountering both developed and developing countries, and it help learners to realize the causes and impacts of climate change, and fosters the attainment of skills and disposition which individuals and societies need to attain low-carbon and climate resilient development (UNESCO, 2013). Therefore, textbooks as core content of climate education in Afghanistan encompass the causes, effects and solution of climate issues, but the concepts have been presented under title of crosscutting themes which in some cases underpin the explicitly of climate change concepts and their urgency.

Climate impacts are the most mentioned (70.60%) concepts and most illustrated (66.55%) objects of pictorial presentation across textbooks, where climate change causes and solutions related concepts and pictures were constituted (25.96% and 3.43%) of texts and (25.83% and 7.62%) of illustrative presentation respectively. Although climate causes related issues such as energy, industry, and burning of fossil fuel are the most presented issues in both texts and illustrations which meet the local and international concern, but according to NEPA and ADB (2007) report the most important sources of CO₂ emissions in Afghanistan are from land-use change, forestry and energy sectors (NEPA & ADB, 2007; as sited in INDC, 2015), in terms of CH₄ and N₂O emissions, the agriculture sector is the main contributor (IBID, n.d.; as sited in INDC, 2015) where current research findings demonstrated deforestation, agriculture and fertilization as the less presented issues across textbooks.

Analysis of concepts related to impacts of climate change revealed that natural resources, ecosystem & biodiversity, habitat, and food chain are the top presented issues in all textbooks which also reflect the local and in turn international concern of climate change impacts. According to INDC (2015) report the majority of Afghanistan's population livelihoods directly or indirectly relies on the availability of natural resources that with ongoing climatic change the foundation of the country's economy, stability, and food security is in risk (INDC, 2015). Moreover, Afghanistan's varied topography with its numerous types of habitats is the home of different types of species that uniquely adapted to their

ecosystems ranging from desert to monsoon forest, thus are vulnerable to the effects of climate change. According to Convention on Biological Diversity, Climate Change and Biodiversity report, human activity, particularly habitat fragmentation, is the primary cause of biodiversity distinction, therefore climate change is expected to become the single prevalent global cause of biodiversity loss before the end to the century (CBD, 2015; as cited in NEPA & UNEP, 2015, p. 21). Nonetheless, storm, drought, flood and natural disasters are among the less depicted issues which are recorded as potential threat of climate impacts in different reports. For instance, Savage et al (2009) stated that drought related, including associated dynamics of desertification and land degradation are the most likely adverse of climate change impacts in Afghanistan, particularly drought which is likely to be considered as the norm by 2030 rather than as a passing or cyclic event (Matthew Savage et al, 2009). Furthermore, the US Department of Agriculture world map depicting threat of human-induced desertification shows that most of Afghanistan to be in the very high-risk category, further most of the remainder of the country is already classified as desert (NBSAP, 2014).

Furthermore, MAIL (2006) National report stated that desertification in Afghanistan already affects more than 75 % of the total land area in different parts of the country such as northern, western, and southern regions where extensive grazing and deforestation have diminish vegetation cover and catalyzed faster land degradation (MAIL, 2006; as cited in NBSAP, 2014). In addition, it is estimated that more than half of Afghanistan inhabitants is physically exposed to flood risk including 15 percent of them being exposed to high flood risk (IMMAP & USAID; cited in Thomas, 2016), therefore, floods due to untimely precipitation and general increase in temperature are of secondary importance impacts of climate change (Matthew Savage et al, 2009). Notwithstanding, nearly all of Afghanistan's 34 provinces according to Savage (2009) have been hit with one or more natural disasters including flooding, landslides, drought, and extreme heat waves and freezing weather (Matthew Savage et al, 2009).

In terms of climate solutions, afforestation and waste disposal are the most mentioned and most illustrated climate issues, while neither texts nor pictures are presenting bioenergy and low-carbon technologies as solutions of climate impacts. However, climate adaptation and mitigation are not well presented in both texts and illustrations of examined textbooks which will worsen the fragile situation in the future. For example, Aich et al (2017) study shown that in addition to the already existing insufficiency in adaptation of current climate changes, the condition will be worsened in the future, mainly in the areas of water management and agriculture (Valentin Aich et al, 2017). Moreover, fewer attentions have been paid to renewable energy in both conceptual and pictorial presentations. NEPA & UNEP (2015) reported that although Afghanistan has considerable potential for hydropower development, the uncertain impacts of climate change on the obtainability of water sources and intensified risk of natural disasters, such as floods, raises questions about the safety and sustainability of hydropower dams (NEPA & UNEP, 2015). Besides the country according to NEPA & UNEP (2015) reports, has substantial capacity for renewable energies including solar, wind, and biomass, particularly if implemented in a decentralized way for rural areas which there is not accessible power grids. This in turn has clear benefits for climate change mitigation and adaptations, as well as significant development and poverty reduction (NEPA & UNEP, 2015).

As a result, presentations of climate change in the textbooks due to recognition of written issues are optimal way of raising awareness about climate adaptations and mitigations. It is obvious that people's preparedness to embrace the urgency of climate change action does not simply follow from scientific consent, rather attitudes towards the need for climate change action involve more broader set of notions, attitudes and emotions about non-scientific scopes like morality, politics, economics and culture (Norgaard, 2011; as cited in Culloty et al, 2019). Nonetheless, primary education is conducive to bring change in the attitude and behavior of children due to their age. Further children are powerful agent of change, so when empowered and educated on climate change, they can reduce the vulnerability of themselves and their society to risk and contribute to sustainable development (unicef, n.d.).

6. Conclusion

Climate change evidences such as global warming, variability of weather patterns and precipitation, rising sea level, change in vegetation, natural disasters, intensive weather events including floods, droughts, and storms demonstrate the factuality of climate change. So, globalized and interconnected world subject of changing climatic conditions become vital for individuals and communities, locally and internationally due to protecting the earth and its livelihoods of species. This research intended to analyze the presentation of climate change issues in the textbooks of primary education to figure out how and to what extent textbooks contained climatic issues to ensure quality education and public raising awareness. Hence the texts and illustrations of Science, Health and Environment textbooks of primary school have been analyzed with performing content analysis method based on local and international climate change concerns indicators.

The findings revealed that most of the concepts and illustrations were presenting climate impacts across the textbooks, which were following by climate change causes and solutions related issues respectively. Although textbooks contents and illustrations, to some extent have been met the local and international concern of climatic change, according to literature there were some serious threats of climate change impacts in Afghanistan which were not presented at all or over glanced across textbooks. For instance, findings revealed that issues related to fertilization, deforestation, agriculture, storms, droughts, flood, natural disasters, renewable energy, and low-carbon technologies in terms of climate change causes, impacts and solutions were not presented well, which were among the top concerns from local standpoints. Moreover, most of the concepts have been presented based on biology, physics, and chemistry perspectives rather than climate change lens.

To conclude, textbooks and other learning materials are close related to students' heart and mind which in turn have substantial contributions in transforming students' attitude and behaviors toward climate change adaptations and mitigations. So, the following recommendations are suggesting to the textbooks contributors and teachers to take in account while textbooks revisions and teaching process:

- Including climate change issues in both texts and illustrations of the textbooks more explicitly by consideration of local and international trends and concerns
- Integrating climatic issues as pedagogical system of the textbooks, students' activities and textbooks lessons' inquiries
- Discussing climate concepts from climate change point of view with a clear linkage to current trends
- Referring students to their parents in textbooks activities and inquiries due to sharing climate change issues with them to build concern among family and people

Compliance with ethical standards

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The authors declare that they have no conflict of interest.

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