

CLIMATE CHANGE AND LITERACY CHALLENGES

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ABSTRACT

The earth is the only planet that supports the existence of life due to the presence of the atmosphere which naturally regulates the flow of energy from the sun and the out-going heat from the earth's surface. The atmosphere creates the climate due to the ceaseless flow of energy from the sun which causes global cycling of air and water and hence distributes materials across the earth. The paper reveals that this ability of the atmosphere to maintain energy balance is altered by man through his activities towards achieving comfort of life, hence resulting in climate change. Climate change impacts negatively on human in various ways but, many people are unaware of the incident of climate change and its impacts on them. The paper attributes this ignorance to the inability of many people (especially in Nigeria) to read and write. It also maintains that though many can read and write and are aware of the incident of climate change but are unwilling to take responsibility for actions geared towards maintaining the earth's energy balance. It concludes that when the capacity to maintain the earth's energy balance is lacked due to the inability of the majority of a population to read and write, knowledge and awareness about climate change and its associated changes will lack and as a result, actions that will lead to climate change mitigation and adaptation may be hindered. The paper suggests various ways through which the illiterates can be made to be aware of and educated about climate change.

Keywords: Atmosphere, Climate, Weather, Climate Change, Literacy, Illiteracy, Environmental Literacy.

1.0 INTRODUCTION

Earth is the third planet from the sun and the fifth largest planet in the solar system with the highest density. It is the only planet that is not named after a Greek or Roman god. However, the Greek equivalent of the earth is Gaia-tera mater meaning "mother earth", and the Roman equivalent is Tellus meaning "the fertile soil". It was formed about 4.5 billion years ago. Earth is currently the only known planet where life is present. This is because the temperatures of the earth are just right for water to exist and for life to evolve (The Nine

Planets, 2020). This unique characteristic feature of the earth is enabled by the presence of the atmosphere. The atmosphere has been described by Orr (1959) in various ways including:

1. a great protective canopy;
2. a roof overhead;
3. envelop of gases;
4. ocean of air;
5. blanket of air worn by the earth;
6. storehouse for nature's secrets; and
7. succession of shell encompassing the earth.

Orr (1959) went further to view the atmosphere as the most precious resource and as a result, a necessity for all living things whose gases permit us to refine our metal ores, run our automobiles, and carry on a hundred and one ordinary daily activities. The atmosphere as a product of the whole process of creation and subsequent geologic events was in the beginning, of the right composition whereby the portions of the sun's rays that would destroy life were cut out, leaving the life-sustaining parts. There is an abundance of water that is picked up in the atmosphere and spread over the land. The air is also in the right composition of oxygen and nitrogen for the needs of our bodies (Orr, 1959; Theis & Tomkin, 2012; Farmer & Cook, 2013). Other chemical components of the atmosphere are shown in the table below:

Chemical Components of the Atmosphere

S/N	Component	Chemical abbreviation	Volumw (%) (Dry Air)
1	Nitrogen	N ₂	78.08
2	Oxygen	O ₂	20.98
3	Argon	Ar	0.93
4	Carbon dioxide	CO ₂	0.039
5	Neon	Ne	0.0018
6	Helium	He	0.0005
7	Hydrogen	H	0.00006
8	Krypton	Kr	0.0011
9	Xenon	Xe	0.00009
10	Methane	CH ₄	0.0017
11	Ozone	O ₃	0.00006

It is the presence of these gases in their right proportions in the atmosphere that thrives life on earth hence Orr's (1959) declaration that where there is no atmosphere, the earth would be sterile without weather, cloud or multi-coloured sunset. From Kerry and Kerry's (2007) view, the atmosphere could be conceived as an envelope within which all other environmental conditions and processes operate, including precipitation, humidity, winds, ocean currents, sea levels and all of the biological and even economic processes affected by these. The atmosphere regulates the quantity and quality of light (sun rays entering and leaving the earth), rainfall, wind, temperature and humidity of the earth. This is why Cunningham and Saigo (2010) describe the atmosphere as a great weather engine in which a ceaseless flow of energy from the sun causes global cycling of air and water that creates our climate and distributes energy and material through the environment.

The earth has other factors which influence human life. The factors according to Sharma (2009) are:

1. Topographic or Physiographic factors include altitude, the direction of mountain chains and valleys, steepness and exposure of slopes, ocean current and depths etc;
2. Edaphic factors deal with the soil formation and its physical and chemical properties; and
3. Biotic factors include living things (human beings, plants, animals and micro-organisms).

These factors and conditions constitute the forces that influence the growth and development of the life of organisms a great deal on the planet by bringing variations in climatic factors. The forces also determine a great deal of comfort for human life, because they are self-regulatory and have got the capacity to regulate and complement each other, when not grievously altered hence the conception of the earth as a life-support/sustaining system. It was against this background that Orr (1959) describes the earth as an evolutionary process that fashioned all species to which man is a child whereby man was moulded to suit the earth and not the other way round. That is, earth not being designed for a man.

Anthropocentrically, the earth has been misconceived to be designed for man, a complete departure from Orr's (1959) conception of the earth and as a result man engages in fierce combat to defeat the earth in order to maximise the use of earth's resources for his comfort. Man, since creation/evolution has been in constant exploration, exploitation and refinement of earth's resources to satisfy his needs thereby tempering with the balance of the factors and forces which influence the growth and development of life on earth by exceeding their homeostatic abilities. This creates more problems for man as he attempts to achieve his desired comfort which also impacts adversely on man causing him to engage in a constant search for true comfort. This is buttressed by Akinpelu (2002, p 34) as he succinctly observed that "as man solves one problem with his newly refined intelligence, new and more intricate problems arise from the acclaimed solution thereby calling for a greater need of intelligence". Among such problems is climate change. Scholars, scientists and environmental activists have proven that climate change is here, affecting all people in all climes both the rich and poor. But how many people are aware of this fact and understand its dynamics? How many people understand how to avoid or live with it? Are there any obstacles to gaining this understanding? This paper is written to address these questions.

2.0 CLIMATE AND CLIMATE CHANGE

The meaning of climate will be enhanced with the understanding of the term "weather" whose change is sometimes mistaken for climate change. Weather according to Cunningham and Saigo (2010) is a description of the physical conditions of the atmosphere while Theis and Tomkin (2012) describe the weather as a short-term state of the atmosphere. Atmospheric conditions which determine the weather of the earth are air, wind, pressure, precipitation, humidity and temperature. Weather is created by the movement of large air masses of differing temperatures and moisture content around the globe, pushed by wind generated by pressure gradient created by the ceaseless flow of solar radiation into the atmosphere. Weather is commonly understood as a change in the atmospheric conditions of the day. But

the change in the atmospheric conditions could occur on a daily, weekly, monthly, yearly or seasonal basis.

Climate according to Orr (1959), is the sum total of all the weather that occurs at any place. Climate is a description of the pattern of weather in a region over a long time period. Climate is the average of the weather. Climate could be seen as the weather of a place averaged over a long period of time with thirty (30) years as the minimum. World Meteorological Organization in Farmer and Cook (2013) succinctly defines climate as "weather over a 30-year period or longer." Measurements of climate include the averages of the daily, weekly, monthly and yearly weather patterns, the seasons and even a description of how extraordinary events, such as hurricanes occur (Theis and Tomkin, 2012). The measurements are taken for at least thirty (30) years before a deduction on the state of the climate could be made. Climate is created by the global cycling of air and water as a result of the ceaseless flow of energy from the sun into the atmosphere. Climate is determined by the following three factors:

1. **Insolation** is a measure of the amount of solar radiation falling on the earth's surface. This is influenced by the state of the earth's orbit and the angle of tilt of the earth's axis of rotation. These determine the distance of the earth from the sun.
2. **Albedo** is a measure of how reflective a surface is. Perfectly white surfaces have an albedo of 1 (effective reflection), while black or dark surfaces have zero or poor albedo. The extent of ice and glacier cover, presence or nearness of mountains and valleys, oceans, vegetation's, etc. wields a great influence.
3. **Composition of the atmosphere.** A perfect composition of the atmosphere that can regulate itself has been given above. Any alteration in the composition affects the weather and by extension, the climate because the entrance and exit of solar radiation in its self-regulating pattern will be distorted.

These factors maintain the energy balance of the earth. Energy balance is the climate-regulating balance between incoming energy from the sun and outgoing heat from the earth (Kerry & Kerry, 2007). Energy balance is instrumental in keeping the earth's surface in a stable state.

Climate change is, therefore, a long-term change in the earth's climate as a result of alteration in the amount of energy that comes from the sun (insolation) and changes in the properties of the earth (albedo and atmospheric gases) that determine how long that energy stays in the earth system. This change according to Sharma (2009), occurs due to an imbalance in the energy flux of the earth which causes the earth's surface to get warmer thereby affecting the elements of the climate system (air, wind, pressure, precipitation, humidity and temperature). Climate change can also be seen as a change in the climatic conditions of the atmosphere over a long period of time occasioned by constant heating of the air and water vapour with the energy from the sun. Climate change has been attributed to a lot of factors such as Milankovitch cycles (periodic changes in the earth's orbit and tilt), volcanic eruptions and human activities such as the burning of fossil fuels (coal, crude oil, natural gas), making of cement, agriculture, etc. These factors result in a change in the distribution and intensity of energy reaching the earth's surface, thus energy imbalance is created. But among other factors, human activities have been blamed most due to the intense use of fossil fuels to power the economy since the 1750 industrial revolution.

2.1 How Humans Have Induced Climate Change

Man, as an evolutionary being has constantly engaged in a struggle for survival as well as comfort. The struggle was boosted by the perception of the earth as a source of life owing to enormous resources (air, water, minerals plants, animals, etc) contained in it but, not without obstacles. This perception led man into the perpetual search for and updating of knowledge and skills required to overcome the natural environmental obstacles that constantly seek to overwhelm him. Success towards this feat was first recorded in the 18th Century (1750) christened the industrial revolution which marked the beginning of an era where human muscles were replaced with machines and coals replaced woods as a source of power and energy. Breakthroughs recorded from the industrial revolution till date are summarized by Mbalisi and Offor (2018) as follows:

1. invention of machines (from crude to modern) for mass production of goods for human consumption;
2. advancements in medical science leading to the discovering of drugs and gadgets for the treatment of ailments that initially seemed impossible to treat, hence reduction in death rate with its attendant population explosion;
3. invention of means of transportation and earth moving machines (from crude to modern such as aeroplanes, ships, vehicles) for construction and fast movement of people, goods and services from one point to another;
4. invention of technical and electronic gadgets (such as computers, air conditioners, mobile phones, refrigerators, cookers, fans, the radio, televisions, etc) for human comfort and happiness;
5. innovations in agriculture through the introduction of machines and chemicals (mechanized agriculture) for mass production of foods.

All the machines invented to date are powered with fossil fuels (coal, crude oil and natural gas) as their source of energy. A major component of fossil fuels is carbon released as carbon dioxide which is likened as a virus by Mbalisi and Offor (2018) due to the destructive roles they play in the natural system as viruses play in human systems with climate change as a result. Carbon plays this destructive role by allowing radiations from the sun access into the earth's surface and hinders heat from the earth's surface from escaping into space (greenhouse effect), hence much heat is trapped on the earth's surface on a daily basis. This leads to energy imbalance resulting in the change in the chemistry of the atmosphere thereby altering climate variability towards warmer global temperatures with a change in natural processes as the result.

In support of this position, Kerry and Kerry (2007) bluntly state that "since the industrial revolution, the greenhouse effect has been significantly amplified by changes in the atmospheric composition brought about by human activities." Theis and Tomkin, (2012) maintain that "the earth system and its biogeochemical cycles were relatively stable from the end of the last ice age until the industrial revolution of the eighteenth and nineteenth centuries initiated a significant and ongoing rise in human population and activities which alters global-scale phenomena such as climate regulation." In an attempt to conquer environmental barriers in his striving for survival and comfort, man has already reached outward toward space and he is learning to live in the upper regions of the atmosphere as well as to navigate it

(Orr, 1959). The result of this achievement of man is what Akinpelu (2002 p34) succinctly expressed thus:

The awe-inspiring and breath-taking scientific explorations into the huge vaults of the heavens have resulted in interference with the ionosphere, the piercing of the ozone layer, and the puncture of the "protective skin" of the earth that is today resulting in highly unpredictable weather and climatic conditions throughout the world, and the consequent threats of destruction, famine and starvation in some parts of it and floods in others.

Intergovernmental Panel on Climate Change in Cunningham and Saigo (2010) posits that a balance of evidence that suggests a discernible human influence on global climate abound. Among such activities through which humans impact the global climate are industrialization, urbanization, consumption, agriculture, population growth, etc. It is through these activities, humans generate gases that accumulate in and thicken the atmosphere which permits visible light from the sun into the earth but prevent the heat generated from the visible light from escaping the earth surface, thereby increasing the earth surface temperature. These gases are referred to as greenhouse gases which are carbon dioxide, methane, chlorofluorocarbon, nitrous oxide, water vapour. Among the greenhouse gases, water vapour is the most abundant in the atmosphere, but the weakest of all because it lasts only a few days while carbon dioxide is the strongest among all because it lasts up to one thousand years in the atmosphere before it can disappear. Others like methane last for a few years in the atmosphere. This made Sharma (2009) indict carbon dioxide as the main culprit responsible for global climate change. This indictment was buttressed by Theis and Tomkin (2012 pp509-510) as they maintain that:

Our planetary carbon endowment has provided us with extraordinary powers to bend the space and time to the shape of our desires and convenience, and fill it with cool stuff. Without any single person deciding, or any law passed, or amendment made to the constitution, we have transformed ourselves to planetary managers, now apparently exempted from the evolutionary struggle for survival with other species and with the fate of animals, birds, plants, the atmosphere, and entire ecosystems in our hands. We are carbon beings in our molecular biology; we touch and smell it; we trade, transport and spill it; we consume and dispose of it in the earth and air. The result is altered weather patterns, increasing temperatures, glacial melt, and sharp increases in drought, floods, and wildfires.

The fact that man, through his activities is the architect of global climate change generates huge attention about climate change among world leaders, scientists, scholars, activists in an attempt towards finding a lasting solution to its impacts.

3.0 GLOBAL EFFECTS OF CLIMATE CHANGE

Composite and all-encompassing effects of climate change are catalogued by Farmer and Cook (2013 pp98-99) as follows:

1. Increased humidity in the atmosphere;
2. Increased evaporation of ocean and fresh water and moisture from soils;
3. Increasing frequency and intensity of storms and unusual weather patterns;
4. Melting glaciers;
5. Melting permafrost and release of methane to the atmosphere;
6. Decreasing snow cover in winter;
7. Temperature increases over land and sea;
8. Temperature increases in boreholes;
9. Increase in ocean heat content;
10. Increasing air temperatures in the lower atmosphere (troposphere);
11. Increasing temperature of the upper crust of the solid Earth;
12. Cooling of the stratosphere;
13. Plants and animals shifting to higher latitudes and altitudes;
14. Sea level rising resulting in unusual flooding;
15. Ice sheets, glaciers, and sea ice melting;
16. Spring coming earlier and fall later in the year;
17. Ocean acidification; ocean waters are becoming more acidic;
18. Nights warming more rapidly than days;
19. Outbreaks of pest infestations earlier each year;
20. Increase of animal and plant species extinction;
21. Change in rainfall pattern.

These effects are enormous that man seems to have been trapped in Gerhard Kraus' "Syndrome of the Sorcerer's Apprentice" in Akinpelu (2002 p128) where:

The sorcerer's apprentice (man), in imitation of his master (God) ordered his master's magic broom (human brain or intelligence) to fetch water (provision of 'modern' amenities), but did not know how to stop the broom from fetching more and more water, until he got drowned in the flood of water in his cave (the world).

Orr (1959) emphasize that knowledge and modern technology are tools that can deliver man from drowning in this flood of the effect of climate change. In consonance with Orr, Akinpelu (2002 p34) admits that "in all of this whirlwind of change and optimistic expectation of progress, it is the adult that is expected to make change happen and direct the course of change." To direct the course of change, the adult must continuously seek to improve himself through the sharpening of his intelligence by grabbing any opportunity to improve himself in all aspects of his living (Akinpelu, 2002). This indicates that the course of change toward mitigation of or adaptation to climate change and its effects would be determined by the literacy levels of adults.

4.0 THE CONCEPT OF LITERACY

Literacy according to Keefe and Copeland (2011) was first defined in 1957 by UNESCO when they stated that "a person is a literate who can with understanding both read and write a short simple statement on his/her everyday life." Reading according to Macia (1990) is making sense (or meaning) from written symbols while writing is the use of a system of signs to convey meaning. This type of literacy is referred to as "native or low literacy" by Wagner in Akinpelu (2002) while Akinpelu (2002) refers to it as "alphabetic literacy" and Street in Aderinoye (2018) refers to it as "autonomous literacy" suggesting that other forms of literacies which it is fundamental to existence. This view is buttressed by Hanemann (2016) as she remarks that literacy consists of a set of essential, foundational or general skills and competencies for the 21st century which has opened the door to a proliferation of new combinations of the term literacy, adding knowledge areas such as digital literacy, ICT literacy, computer literacy, media literacy, environmental literacy, financial literacy, critical literacy, health literacy, legal literacy, etc. The new combinations made literacy pluralistic and corroborate with UNESCO's observation that understanding of literacy has expanded from 'a simple process of acquiring basic cognitive skills to using these skills in ways that contribute to socio-economic development to developing the capacity for social awareness and critical reflection as a basis for personal and social change' (UNESCO, 2016). Following this observation, OECD in UNESCO (2016) defines literacy as 'the ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals and to develop one's knowledge and potential.' Literacy is the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts (UNESCO, 2018). What seems to be a more comprehensive definition of literacy was given by Hanemann (2016) as the (cap)ability to put knowledge, skills, attitudes, values, dispositions and motivation into action effectively when dealing with (handwritten, printed or digital) text in the context of ever-changing demands. This definition properly placed literacy as a predictor of environmental literacy which is required for understanding and finding solutions to environmental issues such as climate change.

4.1 Literacy Challenges for Understanding the Dynamics of Climate Change

Literacy from the above definitions is fundamental to the understanding of climate change. The capacity to interpret the relative health of environmental systems with the intention of taking appropriate actions to maintain, restore or improve them is a function of the ability to read, understand and interpret texts containing information on environmental issues in which climate change is part. Unfortunately, with reference to Nigeria, 35% of the adult population is illiterate which translates to about sixty (60) million adults. This figure swells up yearly as Nigeria's Minister of Education Mr Adamu Adamu confirms to Sahara Reporters in 2019 that sixteen (16) million children and youths drop-out of primary and secondary schools. As if this is not enough, Aderinoye (2018) reveals that it is only about twenty (20%) per cent of young Nigerian adults who have completed primary education can read. This implies that the rest eighty (80%) relapses into illiteracy hence putting the illiteracy rate constantly on the rise with its humongous consequences on the environment and development. Even the twenty (20%) percent who can read and write loses the knowledge about the environment which they may have acquired through the insertion and/or infusion of environmental themes across their grade levels while they were in schools due to lack of reinforcement. Hungerford, Volk and

Ramsey in Mbalisi (2013) corroborate this as they assert that “as students grow older and receive no reinforcement, they tend to back away from citizenship behaviours as they lose teacher support and a social support system.”

These populations of children, youths (who are out of school) and those who relapsed to illiteracy will add up to the population of adults who would eventually be illiterates. These adults both literate (in reading and writing) and illiterates usually constitute the greatest percentage of economically productive and active members of the society whose activities, lifestyle and behaviour put the environment into danger and consequently affect human well-being as well as deny the future generations access to quality environment and its resources required for the advancement of their life (Eheazu, 2016; Mbalisi 2016). Climate change and other environmental issues have been blamed for the decisions and activities of adults who explore and manage the resources of the environment on a daily basis for the benefits of humanity. While ignorance of the link between human activities and climate change could be blamed for this awful event, one may be tempted to argue that literate adults may not be ignorant of the impact of human activities on the environment and how that can result in climate change as well negatively impact human lives. While some literate ones may not have been bothered about reading publications with a focus on the environment and its associated issues such as climate change and others may have read, but refused to take responsibility due according to Kelly and Kelly (2007) to “powerful interest.” They are therefore referred to as “functionally environmental illiterate” adults. They are referred to as functionally environmental illiterate adults because they failed to apply their reading and writing skills to analyze, interpret and evaluate various perspectives through which human activities result in global warming and climate change as well as make decisions and mobilize for actions towards mitigating climate change impact such as emission reduction. The adults who have not acquired the skills for reading and writing are referred to as “nominally environmental illiterate adults” because they cannot read anything concerning the environment and its associated challenges as Banda and Mpolomoka (2016) succinctly advise that “if you cannot read, forget about the other skills.” They lack a basic understanding of the dynamics of climate change. They are also not aware of and sensitive to climate change, factors leading to it and its impact on human beings.

Most of these adults dwell in the rural areas, engaging in artisanal, handicraft and agricultural activities whose livelihoods are affected at one point or the other by climate change events. As a result of their inability to read and write which should have empowered them to gain knowledge and awareness of climate change, they tend to suffer from the following:

1. Lack of knowledge and awareness of climate change incidence;
2. Lack of knowledge of how they contribute to the incidence of climate change;
3. Lack of information on appropriate period to start farming due to changes in rainfall pattern;
4. Lack of information on when flooding may likely occur for early harvesting of crops to prevent loss of crops to flooding;
5. Superstitious belief linking changes in climate systems to the wrath of the gods;
6. Lack of information on action strategies for adaptation and mitigation measures;

This shows that illiteracy poses a great challenge to the understanding of the dynamics of climate change

5.0 THE WAY FORWARD

Literacy, from Hanemann's (2016) definition is a predictor of responsible environmental behaviour serving as an evidence of environmental literacy acquired through environmental education. Responsible environmental behaviour according to Hungerford and Volk in Mbalisi (2010) is the feeling of concern for the environment which results in considering the health and quality of the environment before engaging in any activity. Roth (1992) defines environmental literacy as the capacity to perceive and interpret the relative health of the environmental systems and take appropriate action to maintain, restore, or improve the health of those systems. It involves becoming environmentally knowledgeable and skilled and dedicated to working individually and collectively toward achieving and/or maintaining a dynamic equilibrium between quality of life and quality of the environment. It is the ability to understand the natural cycles of life on Earth and its ecosystem thereby living life in harmony with nature in order to have a sustainable life (Ozge, 2015). Environmental education according to Stapp, Havlick, Bennett, Bryan Jr, Fulton, MacGregor, Nowak, Swan and Wall (1969 p34) is "education aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve the problems and motivated to work toward their solutions." The goal of environmental education according to Hungerford and Tomara in Roth (1992) is the development of an environmentally literate citizenry. That is a citizenry that is both competent to take action on critical environmental issues (such as climate change) and willing to take that action. Environmental education achieves this goal by developing in the environmentally literate individual knowledge of issues (such as climate change), knowledge of action strategies, a strong internal locus of control, positive attitudes and a strong sense of responsibility, which should manifest in the form of observable behaviours (responsible environmental behaviour) (Roth, 1992) such as living in harmony with nature. Living in harmony with nature implies attempts to benefit from and manage ecosystem services without causing damage to the ecosystems and Earth system that will reduce their value in the longer term.

In meeting the literacy challenge hindering understanding of the dynamics of climate change as well as slowing action in the implementation of mitigation and adaptation measures to curtail the impact of climate change on humans, environmental education should be organized in the formal, non-formal and informal education contexts. In the formal education context, contents and themes capable of educating pupils and students on climate change and its impending disastrous impacts should be inserted and infused across subject areas at all educational levels. The aim will be to make them be aware of and sensitive to climate change issues, develop in them an attitude of concern for the environment, knowledge of action strategies for cutting emissions and skills and motivations for taking actions that will ensure the maintenance of the earth's energy balance. When this is successfully done, the students will leave school with greater dispositions and motivation for participation in actions targeted toward mitigation of and adaptation to climate change.

In the non-formal context, adults who engage in different life endeavours and whose decisions and activities affect the environment and consequently result in climate change are

targeted. They are made to be aware of climate change, its consequences, human contributions to the incidence and are prepared to take actions for its mitigation and adaptation. Knowledge and capacity of school graduates on climate change are reinforced through this medium. Outreach activities could be organized as a medium to reach, educate, and organize the unreached in their respective villages, suburbs and towns on climate change issues as well as for climate change actions. They are through this medium made to be climate literate. That is, they are made to understand how they contribute to climate change events through their day to day businesses, vocations and/or livelihood activities. Environmental education extension agents should be trained for effective implementation of the programme since they are the ones who are trained with skills to interface with the people (especially grassroots people) and can educate them on climate change and other issues associated with it. Non-governmental organizations promoting climate change education and awareness creation across all categories of adults with different backgrounds (education, economic, social, political) should be encouraged to emerge by providing a conducive framework for their emergence, continued existence and operations. The non-governmental organizations can organize and facilitate seminars, workshops, conferences, symposiums, clinics, etc as a means of reaching their target audiences at a given time.

In an informal context, handbills, billboards, posters containing messages meant for creating awareness on climate change can be developed, distributed, mounted and posted at strategic points for passersby to read and grasp the message. But, this is for those who have acquired basic reading and writing skills. Lectures and talk shows for education and awareness creation on climate change can be organized and delivered through the radio and television. In the present era of the social media explosion, messages and videos on climate change can be written, developed and delivered through various social media handles such as Facebook, WhatsApp, you-tube, Instagram, telegram, messenger, etc. These media provide an opportunity for both lettered and unlettered adults to read the write-ups, listen to and watch the audio and video messages delivered through them.

Education and awareness creation programmes meant for mitigating or adapting to the impact of climate change would seek to develop people who according to Roth (1992) would be able to take the following actions:

1. Altering consumer and work practices to make them ecologically sound;
2. Consciously limiting the size of the family, he or she engenders consistent with the limited resources of the biosphere;
3. Working to maintain diversity in the total environment (both natural and man-made);
4. Demonstrate a willingness to curtail some individual privileges, even rights to certain resources, for the long-range public good;
5. Expressing concerns and opinions to appropriate officials;
6. Suggesting and/or participating and supporting appropriate legislation;
7. Initiating and/or participating in group activities and encouraging others to identify and take action on environmental issues (especially climate change);
8. Supporting appropriate organizations with time and/or money.

Hopefully, the above actions are expected to result in the following outcomes:

1. Invention of technologies (local/improvised and modern/improved) for emission reduction for remedying the harms already done;
2. Reduction in greenhouse gas emissions leading to the maintenance of the earth's energy balance which keeps earth's surface temperature stable;
3. Development and utilization of cleaner energy sources;
4. Engagement in sustainable farming and fishing practices;
5. Production of more healthful foods;
6. Growth and development of healthier people with cleaner air;
7. Development of robust activists' activities targeted at environmental protection with climate change mitigation and adaptation as major objectives;
8. Robust self-help/local activities toward climate change mitigation and adaptation by concerned citizens;
9. Election of leaders with an orientation toward environmental protection.

6.0 CONCLUSION

Literacy as the ability to put knowledge, skills, attitudes, values, dispositions and motivation into action effectively when dealing with (handwritten, printed or digital) text in the context of ever-changing demands correlates with responsible environmental behaviour in individuals. This implies that literacy is very significant in developing individuals who can become environmentally literate because it empowers them with the capacity to perceive and interpret the relative health of the environmental systems in order to take appropriate actions to maintain, restore, or improve the health of those systems. With this capacity, they are better equipped to engage in actions that would lead to environmental protection with climate change mitigation and adaptation intentions. When this capacity is lacked due to the inability of a majority of a population to read and write, knowledge and awareness about climate change and its associated changes will lack and as a result, actions that will lead to climate change mitigation and adaptation may be hindered.

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