



Promoting adult education through climate change information programme to rural farmers for enhanced adaptation in South East, Nigeria

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Abstract

Rural farmers have suffered significant loss of farm produce, funds, confidence, and farmland due to natural disasters caused by climate change. This study, therefore, aims to promote adult education and climate change information programme to rural farmers for climate adaptation. Descriptive survey and research and development (R&D) design were adopted for the study. The population of the study comprises 449, 632 registered rural farmers. A sample size of 510 registered rural farmers was interviewed for the study, while a questionnaire and Focus Group Discussion (FGD) were used as instruments for data collection. The data collected were analyzed using descriptive statistics such as standard deviation and mean to answer the research questions. Findings of the study revealed that there is a lack of education targeted at adult farmers on the implications of climate change challenges, which extension agents could use to provide climate change adaptation information to rural farmers, among others.

Keywords: Adaptation, adult education, climate change, information, programme, rural farmer

Introduction

A well-developed and structured climate change information programme for communicating climate change information to rural farmers has proven to be a vital strategy for climate change adaptation among rural farmers. This strategy has proven to be key to success in any human endeavour, of which the agricultural practices of rural farmers are not exempt. In the face of alarming threats of climate change facing rural farmers in the South East, Nigeria, it has become important to develop a sustainable programme that could help rural farmers inculcate the knowledge and resilience to deal with the threats of climate change and also improve their agricultural productivity (Agbo, 2022). Agriculture is regarded as the engine of development in most developing countries, including Nigeria, whose economy largely relies on agriculture for survival (Gil, 2019). The Agricultural sector accounts for almost a fifth of greenhouse gas (GHG) emissions, yet, historically, climate experts and policymakers have paid relatively little attention to the agricultural sector in the global effort towards climate change mitigation and adaptation. In developing countries like Nigeria, Agriculture is mainly practiced in rural communities by rural farmers who account for the greater

part of the population. The agricultural activities of rural farmers have contributed significantly to global warming in different ways and have often led to climate change (Climate Change, Agriculture and Food Security (CCAFS), 2014). However, the response and reactions of rural farmers to the observed impact of climate change suggest that there is a gap in communication between the climate change information agents and rural farmers, leading to poor knowledge of climate change and a lack of requisite skills for adaptation.

Adult education

Adult education is a form of education provided to adults to be able to adjust to life-threatening challenges and develop the skills and attitude necessary for their survival, progress and development. Such challenges include the threat of climate change facing rural farmers in rural communities in Southeast Nigeria. Adult education has been variously defined from different perspectives. Notable among these scholars is Nzeneri (2008), who defined Adult Education as any form of education (formal, informal or non-formal) given to adult farmers based on their felt social, economic, political and cultural needs to enable them to adjust fully to

life challenges such as climate change. In the opinion of Obiozor and Obidiegwu (2013), adult education is an aspect of education that specializes in providing educational opportunities to adults who did not have the privilege of passing through formal education, who prematurely dropped out of school and those who completed their schooling but wish to further their education in order to improve their knowledge. In this regard, adult education is education provided to adults who had no opportunity for formal education, geared towards inculcating climate change adaptation knowledge and skills that will help them improve their agricultural practices and adapt to the threats of climate change (Onyemezu, 2012).

Furthermore, adult education is designed to provide adult farmers with skills, techniques and attitudes in order to socially, economically and culturally improve and empower them, enabling them to contribute effectively and cope with challenges such as climate change adaptation. In his own contribution, Onyemezu further viewed adult education as any deliberate and systematically planned educational activity that has the adult farmers as its target and is designed around the interest and self-expressed

concern of adult farmers, with the intention of enhancing their capacity for climate change adaptation. Adult education is also a process whereby persons who no longer attend school on a regular and full-time basis undertake sequential and organized activities with the conscious intention of bringing about changes in information, knowledge, skill, appreciation and attitudes for the purpose of identifying and solving personal or community problems.

In line with the above definitions, adult education is any programme designed to enable adult learners to improve their lives and maximize their potential in whatever profession of their choice, regardless of age and prior level of education. Mbalisi (2010) opined that adult education in the context of climate change adaptation is a purposeful learning activity organized for adult farmers to initiate them into a new way of life by providing them with relevant skills, competencies, knowledge, information and attitudes required to excel in that aspect of life. A close look at all the definitions reveals that adult education is designed to achieve deliberate change in the lives of rural farmers for the improvement of themselves and the community. This requires prompt and adequate provision

of climate change information to boost the ability of rural farmers to solve problems associated with climate change adaptation.

Climate change information

Climate change information is the first and indispensable step required for an effective climate change adaptation process. It has been said often that a steady flow of accurate, understandable and factual agricultural information helps farmers to know and act in accordance with agricultural information (Malanga & Kamanga, 2018). Therefore, how far rural farmers can cope with climate change depends largely upon the availability and access to accurate and reliable climate change information. It is believed that the major setback in climate change adaptation and agricultural production among rural farmers is not the lack of recommended practices needed for economic growth, climate change adaptation and rural transformation, but the problem of disseminating the recommended practices to rural farmers (Sani, 2014). Climate change information is a means of transferring knowledge about climate change events to create better awareness and provide new insights that could transform the lives and experiences of rural farmers (Agbo et al., 2022). Therefore, this necessitates the

need for effective climate change information flow and sharing among agricultural stakeholders for better professional updates and improved output (Jha, 2012). This can best be carried out among researchers, policymakers, and rural farmers who must be well informed by all means in order to enhance better climate change adaptation and their overall agricultural output. It is believed that the provision of adequate information literacy to the grassroots farmers through a climate change information programme will enhance agricultural productivity. In addition, adult education and information programmes become vital for mobilizing rural farmers to take pragmatic steps that will enhance their knowledge capacity in mitigation and their willingness to adapt to climate change. In contrast, the negative response and inability of rural farmers to cope with the observed impact of climate change suggest that there is a gap in information sharing between the information agents and rural farmers, leading to loss of farmland and crops.

Adult education and climate change information programme

Adult education and climate change information programme is designed to inculcate skills and knowledge to rural farmers to enable them to identify,

understand, interpret, create, communicate and solve immediate problems using printed and written materials associated with climate change adaptation (Organization for Economic Co-operation and Development, OECD, 2022). Adult education and climate change information programme, in the context of this study, is a plan which states what both rural farmers and information agents shall do in agriculture to enhance climate change adaptation. The task of the adult education programme for information provision to rural farmers for climate change adaptation is timely, as agriculture is expanding its role as an advocate for environmental sustainability and a provider of food and fibre within the context of society's initiatives towards climate change mitigation and adaptation (Cunningham, 2021).

Therefore, the concept of a well-developed Adult Education and climate change information programme for climate change adaptation is a response to the decline in the quality of instruction and the haphazard approach to communicating climate change information to rural farmers. For instance, the adult education and information programme contains sequential activities that extension agents and rural farmers

will undertake, the duration of each lesson, topics to be discussed at every stage of the learning experience, instructional method, instructional materials, evaluation techniques, etc. The proper application of this programme will help extension agents communicate timely climate change adaptation information to rural farmers effectively (Kluson, 2022). Additionally, a well-developed programme will help extension agents identify areas of climate change adaptation information needed by rural farmers and also reveal the sources from which rural farmers can access this information.

Furthermore, to remedy the threat of climate change facing rural farmers, a well-developed adult education and information programme should contain all the information required by rural farmers to enhance climate change adaptation. These include training programmes, workshops, seminars, symposium etc. organized in a step-by-step teaching and learning format. The programme will help inculcate in rural farmers the knowledge and skills needed to reduce economic and environmental risks threatening global climate stability and to strengthen their resilience against challenges hindering improved rural farming (Gil et al., 2019). Finally, the

adult education and climate change information programme has the ultimate aim of boosting rural farmers' capability and to adapt to and cope with climate variability.

Meaning and history of climate change:

Agriculture is highly dependent on climate patterns and variations, with Solar radiation, temperature, and precipitation serving as the main drivers of crop growth and productivity. Agricultural processes comprise methane emissions, a significant portion of nitrous oxide emissions, and virtually all carbon dioxide emissions associated with land use, which leads to global warming and has a significant adverse effect on agricultural production (Intergovernmental Panel on Climate Change (IPCC), 2022). Since the industrial revolution, human activities have been changing the global climate through the emission of high amounts of greenhouse gases into the atmosphere, resulting in higher global temperatures, altered hydrological regimes and increased climatic variability. Climate change, according to Aryal (2018), is an environmental factor that constitutes a major threat to agricultural production. The patterns of the effects of climate change are dependent on some environmental factors, which include the latitude, altitude and the type of crops

grown in the affected area. The Climate Institute (2010) stated that climate change is a normal part of the Earth's natural variability, arising from interactions among the atmosphere, ocean, and land, as well as changes in the amount of solar radiation reaching the Earth. The geological record of climate change provides significant evidence for large-scale climate changes in Earth's past arising from certain naturally occurring gases, such as carbon dioxide (CO₂) and water vapour (H₂O). Again, the trapped heat in the atmosphere causes a greenhouse effect resulting from human activities such as burning fossil fuels, i.e. coal, natural gas, oil, etc., agricultural practices, i.e. poor land use, application of organic fertilizers, chemicals, livestock residues, emissions from automobiles, industries, deforestation of land for cleaning purposes, etc. (Aguiar et al., 2018).

The evolution of climate change began around 1760 during the Industrial Revolution, which marked a significant transformation in the way human society operates. Early discoveries about climate change that helped explain recent climate change and global Warming emerged in the 18th and 19th centuries. Oniemola (2011, as cited in Agbo,2019) stated that in 1753, Joseph Black, while experimenting with limestone (calcium

carbonate) and 'magnesia alba' (magnesium carbonate) with acids, discovered a concentration of carbon dioxide in the atmosphere. Black gave the name 'fixed air' to the gas he discovered. He later found that carbon dioxide, which he referred to as 'fix air', is present in the atmosphere and is produced during the fermentation of beer. In 1827, Jean-Baptiste Fourier suggested that an atmospheric effect of the concentrated carbon dioxide kept the earth warmer than its normal status, using the analogy of a greenhouse gas emission. In 1896, Svante August Arrhenius, a Swedish chemist, proposed that carbon dioxide emissions from the burning of coal would enhance the Earth's greenhouse effect and lead to global warming. Since then, it has been observed that the Earth's climate has undergone changes over a period of time. For instance, prior to the Industrial era, the medieval climate anomaly and little ice age defined the upper and lower boundaries of the climate's recent natural changes and are a reflection of changes in climate factors, i.e. the sun's variability and volcanic activity. These changes occurred in terms of variations in the Earth's orbit, fluctuations in solar intensity, volcanic eruptions (including aerosol and carbon dioxide emissions), and the climate system's internal variability, which refers

to random changes in the circulation of the atmosphere and oceans.

More so, the challenges of climate change became so pronounced that in 1992, at the Rio Earth Summit, the United Nations Framework Convention on Climate Change (UNFCCC) was signed as the first commitment of the world to control the emission of greenhouse gases (Intergovernmental Panel on Climate Change (IPCC), 2022). The UNFCCC constitutes a forum on climate change for crucial global discussion on the scope and timing of a potential agreement to combat climate change. Consequently, the Kyoto Protocol to the UNFCCC concretize the commitment of the world to bring emissions under control by officially setting standards for GHG emissions in developed countries (Aguilar et al., 2018). In other efforts, world leaders met in Copenhagen for 10 days on a summit designed to replace the historic but hobbled Kyoto Protocol, which began to expire in 2012. It was a culmination of years spent listening, bickering and compromising over various countries' greenhouse gas emissions, which trap heat from the sun and warm up the planet. From the 1972 Stockholm Conference (a precursor to the 1979 First World Climate Conference) to the 2001 COP meeting in Marrakesh, among other small-scale meetings, climate negotiators

have been working for decades to reach this stage of the war on warming resulting in the adoption of climate change adaptation as an alternative solution to the threat of climate variability and improved resilience (Department of Agriculture, 2021).

Causes of climate change

The causes of climate change are mainly attributed to human-related activities, and the observed effects on the human race are severe and will contribute to the increase if proper measures are not taken to mitigate them. Some of these human activities include the traditional and predominant method of clearing farmland through bush burning, the use of firewood as a cooking energy source, which has recently gained prominence in most developing nations. These activities, according to Dirk (2020), increase the concentration of Green House Gas (GHG) in the atmosphere, leading to global warming and eventual climate change.

Greenhouse gases are those gases that emanate from the burning of fossil fuels and other human-related activities, leading to the emission of carbon dioxide into the atmosphere (Agbo, 2019). Again, our ever-increasing addiction to generating electricity from coal-burning power plants, carbon dioxide emissions from burning gasoline for transportation

and other industrial activities release enormous amounts of carbon dioxide into the atmosphere. Methane emissions from animal residue, agricultural produce such as rice paddies, also contribute a lot to increasing greenhouse gas emissions into the atmosphere, which leads to global warming and eventual climate variability (Intergovernmental Panel on Climate Change (IPCC), 2014). Methane is produced when organic matter is broken down by bacteria under oxygen-starved conditions (anaerobic decomposition), as in rice paddies, which are one of the major locally produced staple food crops. The process also takes place in the intestines of herbivorous animals. With the increase in the amount of methane concentrated in livestock production, the level of methane released into the atmosphere increases the rate of global warming and climate change (Abbass et al, 2022).

Deforestation, which is a human activity, is also noted to be one of the major causes of climate change due to the fact that it accounts for the destruction of natural resources, leading to environmental degradation, high temperature, drought and consequently reduces the extent forest help to absorb carbon dioxide. Nigeria's forest, according to the Climate Institute (2010), is being depleted because of rising population,

migration, land scarcity, and people's quest for agricultural land driven by hunger, poverty and starvation. The use of wood from the forests for charcoal, the appetite for paper products, the use of tropical forest land for palm oil plantations, etc., are the major causes of deforestation. Deforestation release great amount of CO₂, as well as reducing the amount of carbon capture on the planet (Intergovernmental Panel on Climate Change (IPCC), 2022).

Another agricultural practice which is inimical to climate change is the increase in the use of chemical fertilizer by rural farmers. Grace Foundation Communication (2021) posits that, in the last half of the 20th century, the use of animal manure dropped in favour of chemical fertilizers which have increased significantly. The high rate of application of nitrogen-rich fertilizers, contributes to greenhouse gas emissions and affects soil heat retention, and the run-off of excess fertilizer creates "dead-zones" in our rivers and oceans. Climate change, according to Yha (2012), poses a direct and growing threat to the livelihoods of people, among whom rural farmers constitute a significant proportion. These rural farmers depend on agriculture and natural resources for their survival. However, these vulnerable rural farmers in rural communities bear a

disproportionate share of the adverse impacts of climate change. It is also noted that this situation does not affect the rural farmers only, but accelerates global warming and drying trends, increasing the frequency and intensity of natural disasters such as floods and droughts, and is expected to have a significant effect on crop production and the lives of rural farmers.

Impact of climate change on crop production and the lives of rural farmers

Climate change could result in a variety of impacts on the agricultural sector, i.e. biophysical, ecological, including a shift in climate structure. Others are changes in agricultural production patterns due to higher temperatures, a boost in agricultural productivity due to increased carbon dioxide in the atmosphere, changing precipitation patterns and increased vulnerability of the poor rural farmers, especially in Southeast Nigeria (Biswas et al., 2022). The direct impact of climate change on agricultural systems and the lives of rural farmers, as witnessed in rural communities, manifests in changes in rainfall patterns and temperatures, which could impact agro-climatic formation, including growing seasons, planting and harvesting calendars, water availability, pest, weed and disease populations. Climate change would also lead to alterations in

evapotranspiration, photosynthesis and biomass production and would also impact the land suitability for good agricultural production (Forino & Von, 2021). Climate Change is increasingly one of the most serious global security threats, having significant impacts on natural resources, ecosystems, biodiversity, triggering food insecurity, human migration (rural-urban), economic and social depression, and environmental and political crisis.

Environmental hazards associated with climate dynamism have had significant effects on rural farmers. Climate change effects on agricultural production and water quality available in some rural communities expose the lives of rural farmers to an unexpected danger, illness and untimely deaths. According to Organization of Economic Community for Development (OECD) (2022), many developing communities are exposed to water pollution mainly from agricultural sources, which include nutrients, pesticides and soil sediments, acidification, salinization, organic materials, biological and heavy metal contaminants associated with agricultural practices, etc. For instance, contamination of water by certain pesticides can be harmful to human health. This factor is a major factor which affects the lives of rural farmers who

depend on these water sources for their everyday lives. Water underpins most aspects of human life, and it is becoming increasingly clear that the availability of water is now a substantial limiting factor on the health and welfare of the global population.

In addition, climate change will likely lead to other changes such as ecosystem degradation, reduced agricultural land, water quality and food distribution (Biswas et al., 2022). The culmination of these impacts of climate change on vulnerable rural farmers underscores the need for climate change adaptation, a global response to enhance agricultural output. Given the inherent link between agriculture and natural resources, Biswas et al. (2022) posited that agricultural production is highly at the mercy of uncertainties driven by climate variation, including extreme events such as global warming, flooding, drought, etc. According to the authors, long-term environmental changes as well as increased frequency of extreme climate change effects have been widely recognized as an additional factor that, with other conventional challenges, will have a significant impact on the form, scale, spatial and temporal influence on agricultural productivity, mainly among rural farmers. Impacts of climate variability and environmental change on

the agricultural sector are projected to manifest directly from changes in land and water regimes, changes in the

frequency and intensity of droughts, flooding and stem damage, which are most likely (Ginbo & Hoffmann, 2021)

Table 1: Projected impact of climate change on agriculture

Weather and climate events	Possible impacts on agriculture
Warmer and fewer cloud days and nights; warmer and more frequent hot days and nights over most land areas	Increased yields in colder environments, decreased yields in warmer environments, and increased insect pest outbreaks
Warm spells and heat waves are increasing in frequency over most land areas (very likely)	Reduced yields in warmer regions due to heat stress; increased danger to wildlife
Heavy precipitation events are increasing in frequency over most areas	Damage to crops, soil erosion, and the inability to cultivate land due to waterlogging of soils
Increase in drought-affected area	Land degradation and soil erosion, lower yields from crop damage and failure; increased livestock death, increased risk of wildlife; loss of arable land
Extremely high sea level increase in incidence	Salinization of irrigation water, estuaries and freshwater systems; loss of arable land and increase in migration

Finally, the impact of environmental change is projected to be severe in rural communities, given the low climate change information, technological and capital stocks available to rural farmers. The agricultural sector is unlikely to withstand the additional pressures imposed by climate change without a concerned climate change information response strategy

Climate change adaptation

Adaptation is the process of changing one's behaviour to suit a new situation. Adaptation, according to Singh et al. (2022), is the adjustment in natural systems in response to actual or expected climate hazards. Adaptation is usually a cautious long-term livelihood activity and is a continuous process, in which results are sustained and utilizes available

resources efficiently and sustainably. It involves planning and combination of new and old strategies and knowledge, and is focused on finding alternatives to cope with the immediate threat of climate change (Agbo, 2022). Climate change adaptation as an adjustment refers to a strategic shift in processes, practices, and structural approaches to control potential damages or to benefit from opportunities associated with climate change (Ginbo & Hoffmann, 2021). In simple terms, countries and communities need to develop adaptation solutions and implement action to respond to the impacts of climate change that are already happening, as well as prepare for future impacts through a well-developed programme of instruction (Agbo, 2019). Adaptation measures take many shapes and forms, depending on the peculiarity of the community and event. Climate change adaptation can range from building flood defences, adopting early warning systems, using agricultural best practices, improving communication systems and implementing government policies (Hurlimann & Browne, 2021). Many efforts are already being taken to build resilient societies and economies through improved agricultural output, but considerably greater action and ambition will be needed to cost-effectively manage

the risks, both now and in the future, by developing a climate change information programme that will help farmers develop their adaptive capacity to cope with climate change (Wijaya & Nitivattananon, 2020).

There is no gainsaying that effective adaptation to climate change can be enhanced by a well-articulated programme and can also engender an active and sustained engagement of stakeholders, including climate change information agents and rural farmers. It is important to note that the UNFCCC in the Paris Agreement recognized that adaptation is a global challenge faced by countries, of which Nigeria and the Southeast in particular are included. It is a key component of the long-term global response to climate change to protect people and livelihoods (Singh et al., 2022). As a result, climate change adaptation should be based on and guided by the best developed programme, which must be appropriate with contents such as traditional knowledge, approach, skills and knowledge of indigenous peoples and local knowledge systems. According to Lesnikowski et al. (2021), adaptation strategies vary from community to community but require detailed planning involving all the stakeholders in the community. These

strategies include the adoption of agricultural best practices such as afforestation, shifting cultivation, use of organic manure, early warning prediction, use of irrigation, etc. Other measures include the use of early warning systems, erosion control measures, the use of improved seedlings, the use of climate-resistant crops, the use of natural methods of land clearance, etc. (Scott & Moloney, 2022). Finally, the process of effective adaptation to climate change requires rural farmers to be provided with relevant adaptation knowledge, skills and attitude. In other words, it becomes clear that there is a need to provide rural farmers with relevant information on climate change adaptation.

Objective of the study

The purpose of the study is to develop an adult information programme for climate change adaptation among rural farmers. The specific objectives include to:

1. Find out the areas of information needs of rural farmers for climate change adaptation.
2. Develop an adult information programme for climate change adaptation among rural farmers.

Methodology

Design of the study: The study adopted a descriptive survey and Research and

Development (R&D) design. According to Nworgu (2015), a descriptive survey is used in studies that aim at collecting data and describing situations, characteristics, and features of a given population in a systematic way. Again, Research and Development (R&D) design in the view of Gall and Gall and Borg (2007, as cited in Agbo,2019) is an industry-based development model in which the findings of the research are used to design new product and procedures which are scientifically tested in the field, evaluated and improved until they meet a specified desired criteria of effectiveness and quality standard. They advocated ten steps in R&D research design. The ten-faced R&D model of Gall and Gall et al will be modified to a two-faced cycle, which fits into this study. These designs adopted are suitable for this study because they describe the climate change adaptation information needs of rural farmers and developed an adult education and climate change information programme for rural farmers for climate change adaptation.

Area of the study: The study was carried out in Southeast Nigeria. Southeast, Nigeria is made up of five States i.e., Abia, Anambra, Ebonyi, Enugu and Imo State. Southeast Nigeria is located in the southeastern part of the country. The region is shaped by the savanna

rainforest, good climatic condition and good agricultural land, which makes the region viable for farming. Agricultural activities in Southeast Nigeria are mostly practised in rural areas by rural farmers, where most of the population lives and depends on for their livelihood.

The population of the study is 449, 637 registered rural farmers in Southeast Nigeria (Agbo et al., 2022). The sample size of the study is 510. The sample size consists of rural farmers chosen from Enugu and Ebonyi States using a multi-stage sampling technique at an interval of 962. Enugu and Ebonyi States. The sample size was determined using multi stage sampling technique. At the first stage, Enugu and Ebonyi States were chosen purposefully. The two states were chosen because they are the hubs of agricultural production in Southeast Nigeria. At the second stage, 326 rural farmers were chosen from Enugu, while 172 rural farmers were chosen from Ebonyi State using a simple random sampling technique.

Questionnaire and Focus Group Discussion (FGD) were used as instruments for data collection. The instruments were given to five experts from the department of Geography, faculty of Agriculture, experts in Climate Change, Measurement and Evaluation

(Science Education) and library and information science, all in University of Nigeria, Nsukka, who validated the instrument for examination, technical and professional input to ensure the content and face validity of the instruments. They made useful corrections on the objectives, suggested some changes in the item questions and other editorial corrections, among others. Finally, their corrections and input were reflected and integrated into the final draft of the instrument.

Finally, administration and collection of questionnaires were done by the researchers and their research assistants, who were briefed on the purpose, how to distribute and collect the instrument after completion. A tape recorder was used for recording proceedings during the focus group discussion. The researchers also used a research assistant to take minutes during the discussion, noting important points and conclusions. Analysis of data was done using Statistical Package of Social Sciences (SPSS) to analyze the data collected using mean, standard deviation and simple percentage. Again, consensus agreement was used to analyze the Focus Group Discussion (FGD). Responses were organized in a four-point rating scale with response options ranging from Seriously Needed (SN) = 4 points, Highly

Needed (HN) = 3 points, Needed (N) = 2 points and Not Needed (NN) = 1 point. Finally, any response with a mean score of 2.5 and above was accepted as a positive response, while any response with a mean score below 2.5 was rejected as a negative response.

Results

This chapter presents the analysis of the data collected in accordance with the research questions that guided the study.

Table 2: Mean and standard deviation of the ratings of the respondents on the knowledge rural farmers need to adopt in order to deal with climate change challenges

N = 510			
Item Statement	Mean	Std. Deviation	Rating Decision
1. Rural farmers need early warning information on the climate change threat	3.60	.61	1 st HN
2. Rural farmers need agricultural knowledge on proper farm planning to avert the adverse effects of climate change on their farms, such as drought, fire outbreak etc.	3.32	.72	5 th SN
3. Rural framers requires knowledge of improved seedlings vital for improving agricultural productivity	3.32	.75	5 th SN
4. Climate change statistics and updated information can help rural farmers predict and adopt good measures for climate change adaptation	3.06	1.00	8 th SN
5. Rural farmers require adequate knowledge of the appropriate farming system to enhance climate mitigation and adaptation	2.98	.95	9 th SN
6. Knowledge of erosion control will enhance rural farmers' ability to cope with flooding	3.24	.82	6 th SN
7. Rural farmers require proper information on the appropriate use of natural manure	3.38	.79	3 rd SN

8. Farmers need adequate agricultural information on the best agricultural practices that can help mitigate the adverse effects of climate change	3.43	.74	2 nd	SN
9. Good knowledge of artificial irrigation will help rural farmers cope with prolonged drought	3.34	.80	4 th	SN
10. Knowledge of relevant storage facility help rural farmers protect their crops and grains from extreme weather	3.13	.90	7 th	SN
Cluster Mean	3.28	.38		SN

Table 2 shows the mean ratings of the respondents to items 1 to 10, which border on the responses of respondents on the knowledge rural farmers need to adopt in order to deal with the climate change challenge. The mean ratings of the respondents to items 1 to 10 indicate that the knowledge which the rural farmers need includes early warning prediction, agricultural best practices, knowledge of adequate farm planning, use of improved seedlings, relevant storage facilities, use of chemical fertilizer, natural manure, etc. The overall cluster mean of 3.28 and standard deviation of 0.38 imply that this knowledge is seriously needed by rural farmers to adopt in order to deal with climate change challenges.

Table 3: Developed adult information programme for climate change adaptation among rural farmers.

Developing a programme is part of the strategy, which involves different ways of planning how things are going to be achieved, managed and implemented. They are plans, methods, or a series of actions for obtaining a specific goal, such as climate change adaptation. Programme start with a set of initiatives and loosely defined actions which require rural farmers to determine their own course in order to achieve the expected result of combating climate change. In the context of this study, the information programme for climate change adaptation can be used as a tool to enhance the ability of rural farmers to acquire the necessary skills and knowledge to adapt to climate change and improve their agricultural output. The features of the climate change information programme should

indicate the topic of the lesson, the objective of the lesson, the lesson content, the extension agents and rural

farmers' experience, the instructional method, the instructional materials and the evaluation techniques.

Adult education and information programme for information on climate change adaptation among rural farmers.

PERIOD: One lesson per day

TIME: 45 minutes

THEME ONE: Concept of climate change

S/n	Topics	Performance objective	Contents	Learning	Experience	Instructional methods	Instructional materials	Evaluation activities
				Teacher Activity	Learner Activity			
1.	Concept of climate change	By the end of the contacts, rural farmers should be able to: 1. Explain what climate change is all about. 2. Mention at least five cases or incidents of climate change. 3. Appreciate	1. The definition of climate change. 2. Evidence of climate change 3. Cases of climate change within rural communities	1. Explain what you understand and by climate change 2. Mention at least five incidents of climate change 3. Give examples of climate change observed	Participate in the discussion of the meaning of climate change and its incidents within the community.	Discussion and Questioning	Maps, slides, posters, etc.	1. Explain the term climate change 2. Mention five incidents of climate change around you

		e the reality of climate change,		d within your community				
2.	Cause s of climat e chang e.	By the end of the lesson, the rural farmers should be able to: 1. Discuss the remote causes of climate change 2. Mention the effects of rural farming on global warming. 3. Identify some greenhous e activities leading to climate change	1. Outline of major causes of climate change (include e.g.). 2. Contribut ion of local farming methods to global warming 3. Greenhou se gas emission into the atmosphe re	1. The teacher makes an outline of the causes of climate change 2. Extensio n agent enumer ates ways local farming increase s global warmin g. 3. Explains what greenho use activitie s mean	Rural farmers listen attentive ly, ask question s and make some contribut ions to the discussio n	Teaching method, demonstra tion, questionin g and discussion	Posters, Maps, Real objects, Televisio n, etc. Flannel board, indelible markers	1. Outline five major causes of climate change. 2. Mention one of the activities that increases global warming 3. Identify any 3 greenhou se activities
3.	Impac t of climat e chang e on agricu lture	By the end of the lesson, rural farmers should be able to:	1. Impacts of climate change on Agricultur al farms	1. Extensio n agent enumer ates differen t impacts of	Rural farmers participa te in the discussio n, ask question s and note	Discussion method, questionin g and use of examples	Slides, posters, Real objects, chalkboa rd, flannel board,	1. Mention at least five impacts of climate change.

		1. Discuss the climate change impacts on agriculture. 2. Point out some observed impacts of climate change in their farms. 3. Distinguish climate change effects and superstitious beliefs in witchcraft's impacts on agriculture	2. Drought, erosion, flooding, waterlogging, pest and plant disease, loss of agricultural farms, loss of crops, etc.	climate change on agriculture, i.e., drought, flooding, loss of crops, etc. 2. Extension agent explains to rural farmers the negative impacts of climate change and gods of witchcraft	important points.		marker, etc.	2. Point out at least three observable impacts of climate change in your community
4.	Impact of traditional agricultural practices on global warming, i.e. land	By the end of the lesson, rural farmers should be able to: 1. Give instances of clearing land through	1. Global warming and its causes 2. Effects of bush burning and application of chemical fertilizer.	1. The extension agents explain the implications of bush burning and the use of chemical	Rural farmers participate in the discussion and ask questions. 2. Rural farmers take note of	Discussion, Examples, etc.	Posters, Charts, Flannel board photos, etc.	1. Mention at least five implications of bush burning to climate change.

	clearance through bush burning, use of chemical fertilizer etc.	bush burning 2. Differentiate between chemical fertilizer and farmyard manure. 3. Outline the effects of bush burning and the use of chemical fertilizer on climate change	3. Emission of carbon dioxide (CO ₂) into the atmosphere	fertilizer to climate change 2. Define and explain what global warming means and how it can cause climate change. 3. Give learners instances of carbon dioxide emissions.	important points			2. Mention 3 effects of chemical fertilizer warning to global warming
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THEME TWO: Climate change adaptation information

S/n	Topics	Performance objective	Contents	Learning	Experience	Instructional methods	Instructional materials	Evaluation activities
				Teacher Activity	Student activity			
1.	Concept of climate change adaptation	By the end of the lesson, the rural farmers should	1. Definition of climate change adaptation.	1. Extension agents explain the meaning	1. Rural farmers answer questions and participate in	Discussion, Questioning, use of examples, gestures, etc.	Slides, posters, maps, real objects, etc.	1. Define climate change adaptation.

		be able to: 1. Explain what they understand by climate change adaptation. 2. Mention various adaptation skills 3. Apply adaptation skills to improve agricultural productivity	2. Skills/methods of climate change adaptation 3. Application of climate change adaptation skills for improved agricultural output	g of climate change adaptation. 2. Extension agents mention and explain various skills for adaptation. 3. Extension agent ask question on how adaptation skills can be applied	the discussion			2. Mention 5 skills you can apply to cope with climate change.
2 a.	Strategies for improved climate change adaptation	By the end of the lesson, rural farmers should be able to: 1. Understand different strategies they can use for	1. Different strategies for climate change adaptation. 2. Use of improved seedling pest control, shifting cultivation, mixed farming,	1. Extension agent explains various strategies that can be used for climate change adaptation. 2. The teacher explains	1. Rural farmers participate in the discussion by asking and answering questions. They also listen to the	Demonstration, Questioning, Examples, Storytelling	Films, slides, posters, etc.	1. Explain any three strategies that can be used for climate change adaptation. 2. Mention practical ways

		climate change adaptation. 2. Mention practical ways they can adapt to climate change. of other safe farming methods.	use of farm yard manure, clearance of land through bush burning, etc. 3. Benefits of using safe farming methods to reduce global warming.	how to apply the various strategies in farming 3. Teacher enumerate different benefits of adopting safe farming	extension agent and note important points			you can apply any of the strategies. 3. Identify at least five benefits of using the improved farming method
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2 b.	Communication of climate change adaptation information to rural farmers	1. Understand some skills of communication of climate change adaptation information. 2. Explain in detail what climate change is all about. 3. Teach some lessons on climate change adaptation.	1. Communication skills. 2. How to impact climate change adaptation knowledge on rural farmers. 3. Selection of appropriate language in teaching rural farmers.	1. The extension agent explains some communication skills to leaders. 2. Mention what climate change means and how to impact its knowledge. 3. Organizes the training materials and	1. Sit down and interact with one another and the training materials 2. Participate in the discussion and ask questions. 3. They practice how to teach and commu	Demonstration, Repetition, Questioning etc.	Flannel board, Indelible marker, maps, Television, Poster, Slides, etc.	1. Let one person from each group come out and teach us what he understands about climate change adaptation. 2. Mention any 5 skills one can use to impact climate change
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				prepares the venue 4. Share them in groups and appoint teachers among themselves	nicate climate change adaptation knowledge among themselves. 4. learners discuss among themselves			knowledge to rural farmers.
2c.	Afforestation	By the end of the lesson, rural farmers should be able to: 1. Understand the meaning of afforestation 2. Appreciate Forest conservation as a means of mitigating climate change 3. Mention the advantages of	1. Definition of afforestation 2. Different methods of afforestation 3. Benefits of afforestation to Agriculture	1. Extension agents explain the meaning of afforestation 2. Extension agent describes different methods of afforestation 3. The extension agent mentions some benefits of afforestation	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points.	Questioning, demonstration, Examples etc.	Radio, Television, Slides, posters, pictures, etc.	1. Explain in their own words what you understand by afforestation 2. Mention at least two methods of afforestation and state their benefits.

		afforestation in agriculture.						
2d	Method of farm clearance	By the end of the lesson, rural farmers should be able to: 1. Understand the different ways of clearing farm land without bush burning 2. Prefer the use of the natural method of clearing land to bush burning 3. List the advantages of afforestation in agriculture.	1. Concept of land clearance 2. Different methods of land clearance 3. Benefits of using the natural method of land clearance 4. Understand the implications of bush burning to climate warming	1. Agent explain methods of land clearance 2. Extension agent describes different methods of land clearance 3. The extension agent mentions some advantages of the natural method of land clearance	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points.	Questioning, planned repetition, Examples etc.	Slides, posters, pictures, etc.	1. Explain in their own words what you understand by afforestation 2. Mention at least two methods of afforestation and state their benefits.

2 e.	Effects of deforestation on climate variability	By the end of the lesson, rural farmers should be able to: 1. Ckomprenhend the concept of deforestation 2. Avoid deforestation as an agricultural practice 3. List the disadvantages of deforestation.	1. Meaning of deforestation 2. Dangers of deforestation as a practice in agriculture 3. Understand the implications of deforestation on climate change	1. Agent explain meaning of deforestation 2. Extension agent explains the dangers of deforestation 3. Extension agent lists the disadvantages of deforestation	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points.	Planned repetition, Questioning skill, Examples etc.	Slides, posters, pictures, etc.	1. Describe in their own words what you understand by afforestation 2. List at least two methods of afforestation and state their benefits.
2f .	Use of natural manure in farming	By the end of the lesson, rural farmers should be able to: 1. Understand what constitutes natural manure 2. Differentiate between	1. Concept and types of natural manure 2. Benefits of the use of natural manure. 3. Differences between natural and artificial manure	1. Agent define natural manure and also mention types of natural manure 2. Extension agent illustrates the benefits of the use of natural manure	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questio	Planned repetition, Questioning skill, Illustrations etc.	Slides, posters, pictures, objects, etc.	1. Define in their own words what they understand by natural manure 2. List at least five types of natural manure.

		natural and artificial manure 3. List the advantages of using natural manure in farming.		3. Extension agent lists the advantages of the use of natural manure	ns and noting vital points.			
2g.	Use of chemical fertilizer	By the end of the lesson, rural farmers should be able to: 1. Understand what chemical fertilizer is 2. Avoid the use of chemical fertilizer in farming 3. List the disadvantages of the use of chemical fertilizer in farming	1. Meaning of chemical fertilizer 2. Dangers of using chemical fertilizer in farming. 3. Implications of the use of chemical fertilizer in farming	1. Agent explain meaning of chemical fertilizer 2. Agent explain the dangers of deforestation 3. Extension agent enumerates the disadvantages of deforestation	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points	Planned repetition, Questioning skill, Examples, demonstration, etc.	Slides, posters, pictures, etc.	1. Explain in their own words what you understand by chemical fertilizer 2. Mention at least two disadvantages of the use of chemical fertilizer
2h.	Erosion control, etc.	By the end of the	1. Causes of erosion	1. The information agent	1. Rural farmers ask	Questioning skill, Examples	Slides, posters,	1. What do you understand

		lesson, rural farmers should be able to: 1. Understand the causes of erosion and its control measures 2. Avoid activities that cause erosion 3. Enumerate ways to control erosion	and ways to control erosion 2. The implications of blocking natural waterways 3. Activities that can cause erosions 4. Erosion control measures	explains the meaning of erosion 2. Agent explain the implications of blocking natural waterways 3. Extension agent enumerates the activities that can cause erosion and erosion control measures	questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points	, demonstration, etc.	pictures, etc.	and by erosion 2. Mention at least two cases of erosion you have seen and their causes 3. Mention five ways through which erosion can be controlled
2i	Climate change prediction	By the end of the lesson, rural farmers should be able to: 1. Understand climate change early warning prediction.	1. Definition of climate prediction 2. Kinds of early warning climate prediction 3. Benefits of early warning prediction	1. Extension agents explain the meaning of climate prediction. 2. The extension agent describes different forms of climate	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering	Teaching methods, Questioning, Examples etc.	Radio, Television, Slides, etc.	1. Explain in their own words what you understand by early warning prediction. 2. Mention at least two

		2. Appreciate the early warning prediction of climate change. 3. Analyze or interpret early warning prediction	n to Agriculture	change prediction. 3. The extension agent mentions some benefits of early warning prediction	ng questions and noting vital points.			forms of early warning prediction and state their benefits.
2j.	The importance of early warning prediction	By the end of the lesson, rural farmers should be able to: 1. Understand the importance of early warning prediction. 2. Maximize the opportunity of early warning prediction of climate change.	1. Explanation of the importance of early warning prediction 2. Importance of early warning and prediction 3. Application of early warning prediction	1. Extension agents explain the importance of early warning prediction for climate change adaptation. 2. Extension agent explains ways farmers can apply early warning prediction	1. Rural farmers listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points.	Teaching methods, Questioning, Examples etc.	Radio, Television, Slides, etc.	1. Mention at least five important aspects of early warning prediction. 2. Mention at least two ways you can apply early warning prediction in agriculture

2k .	Resources that can be used for early warning prediction	By the end of the lesson, rural farmers should be able to: 1. Understand the resources that can be used for early warning prediction. 2. Mention types of resources that can be used for early warning prediction of climate change. 3. Demonstrate how some resources can be used for early warning prediction	1. Description of the resources that can be used for early warning prediction 2. Type of materials and human resources that can be used for early warning prediction 3. Utilization of human and material resources for early warning prediction	1. The agent explains different resources that can be used for early warning prediction 2. The agent mentions type of materials and human resources that can be used for early warning prediction 3. The agent explains different ways human and material resources can be utilized for early warning prediction	1. Rural farmers listen to the extension agent, make contributions and ask questions 2. Rural farmers participate in the lesson by answering questions and noting vital points	Teaching methods, Questioning, Examples etc.	Radio, Television, Slides, pictures, etc.	1. Mention at least five resources that can be used for early warning prediction. 2. Mention at least two advantages of using these resources for early warning prediction in agriculture
2L .	Application of early	By the end of	1. Explanation	1. Extension	1. Rural farmers	Teaching methods,	Radio, Televi	1. Mention

	warning prediction	the lesson, rural farmers should be able to: 1. Understand the importance of applying early warning prediction. 2. Develop the skills for effective application of early warning prediction. 3. Take necessary action based on early warning prediction.	on of the need for the application of early warning prediction 2. Skills for the application of early warning prediction 3. Application of early warning prediction	agents explain the need for the application of early warning prediction for climate change adaptation. 2. Mention some skills for the application of early warning prediction 3. Extension agent explains ways farmers can apply early warning prediction	listen to the extension agent and ask questions. 2. Rural farmers participate in the lesson by answering questions and noting vital points. 3. Farmers mention ways they can apply early warning prediction	questioning, examples etc.	sion, Slides, pictures, etc.	at least five resources that can be used for early warning prediction. 2. Mention at least two ways you can apply resources for early warning prediction in agriculture
2 m .	Irrigation as a measure to cope with long drought	By the end of the lesson, the rural farmers should be able to: 1. Understand what	1. Definition of irrigation. 2. Different types of irrigation. 3. Benefits of	1. The extension agent explains what irrigation is all about. 2. The extension agent	1. Rural farmers ask questions about irrigation. 2. Rural farmers practice	Field tips, Questioning, Example, Demonstration, etc.	Hoe, digger, Cutlases, posters, photos, etc.	1. Explain the term irrigation 2. Mention five benefits of

		irrigation means 2. Rural farmers should be able to practice irrigation. 3. Adopt irrigation as an alternative source of water for improved agricultural output	irrigation to agriculture	mentioned different types of irrigation 3. He enumerated benefits of irrigation	irrigation with the extension agent 3. They mention at least 5 benefits of irrigation.			irrigation. 3. Make 3 ridges of rice with irrigation application.
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Discussion of results

Responses of respondents in Table 1, which border on the knowledge rural farmers need for climate change adaptation. Their responses showed that the knowledge which the rural farmers need includes early warning prediction, knowledge of adequate farm planning, use of improved seedlings, agricultural best practices, relevant storage facilities, use of chemical fertilizer, and natural manure, among others. In other words, the respondents agreed that climate change adaptation information is highly needed for rural farmers with respect to item 1, while their mean ratings to items 2 to 10 were within the mean range of 2.50 to 3.49, implying that the

respondents agreed that climate change adaptation information is seriously needed for rural farmers. These responses had a mean score of 3.60, 3.32, 3.32, 3.06, 2.98, 3.24, 3.38, 3.43, and 3.34, respectively. In agreement with these responses, Medugu (2009) and Dirk (2020) assert that knowledge of rural farmers on these areas will help mitigate the activities which seldom increase the concentration of carbon dioxide in the atmosphere, leading to climate change.

Unanimously, the rural farmers during the focus group discussion agreed that they all require climate change adaptation information in the aforementioned areas to improve climate change adaptation. Their responses further showed that over

the years, the traditional and predominant method of agricultural practices, such as clearing farm land through bush burning, use of chemical fertilizer, animal rearing and deforestation, are some of the major causes of climate change. Therefore, rural farmers require information on these areas to boost their ability to adapt to climate change and improve agricultural productivity. Some of the farmers are of the opinion that early warning prediction before the farming season will help them prepare adequately to cope with climate change. Some are of the opinion that early prediction will determine the type of farm system, crop seedlings, etc., that the farmers will adopt. In reaction to the effect of early warning prediction, some farmers regrettably claim to have lost a lot of crops to erosion and flooding, which they could have planned for had early prediction been provided. For instance, one of the farmers during the discussion pointed out that he lost three hectares of his cucumber farm to flooding in early August 2017. According to him, he could have planted another crop that could have survived such a flood if there had been a forecast of such an incident.

Finally, the discussion of the results in Table 2, which borders on the programme

that can be used by information agents for climate change adaptation information to rural farmers, focused on the programme which can be used to improve the inculcation of knowledge, skills and attitude to rural farmers for climate change adaptation. The programme contains a set of plans, methods, or a series of actions, topics, teachers and farmers' activities, evaluation techniques, instructional method and materials, etc., for achieving a specific goal, such as inculcating climate change adaptation information to rural farmers for improved agricultural productivity. In line with this programme, Agbo (2022) stated that a well-articulated information programme is a strategy which is different ways of planning how things are going to be achieved, managed and implemented. Suarez (2016) stated that any programme for climate predictions at the local levels will be embedded in a larger process aimed at (a) seeking to facilitate the flow of forecast content, strengthening the local understanding of strengths and limitations in climate predictions, identifying and addressing the bottlenecks in the process of communication and use of forecasts, while exploring opportunities to address the root causes of vulnerability. Corroborating these facts during the

focus group discussion, participants pointed out that there is no consistent tool, such as a developed programme, used by information agents during climate change events and interactions. This necessitated their suggestion for the need to develop a climate change adaptation information programme for instruction.

Conclusion

The development of adult education and climate change information programme occupies a central position in improving the climate change adaptation ability of rural farmers, not only in Southeast Nigeria, but across the globe. This study developed an adult education and climate change information programme for climate change adaptation. The result of the data analysis revealed that there is a lack of adult education and climate change information programmes available for extension agents to facilitate the provision of climate change adaptation to rural farmers in Southeast Nigeria. This necessitated the need for

the development of an adult education and information programme for climate change adaptation to address the climate change information needs of rural farmers for effective adaptation.

Recommendations

1. Government and non-governmental organizations should use the developed climate change adaptation information programme in communicating climate change information to rural farmers. These will ensure a consistent and well-organized pattern of training rural farmers on climate change adaptation.
2. Any developed climate change adaptation programme should identify and focus on the areas of climate change information needs of rural farmers. This will help inculcate the right type of knowledge, skills and attitude in rural farmers adapt to climate change, etc.

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