

ENVIRONMENTAL ADULT EDUCATION PROGRAMMES NEEDED TO MITIGATE PLUVIAL FLOODING IN ABA OF ABIA STATE, NIGERIA: AN EMPIRICAL/PARTICIPATORY STUDY

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ABSTRACT: *Pluvial flooding has been causing a lot of devastation in many parts of Abia State of Nigeria for several decades. The efforts made by government and the people of the State to mitigate the menace have been found wanting in many respects, including the lack of environmentally-oriented programmes. The purpose of this study was to identify and authenticate, through an empirical/participatory process involving residents in Aba North and Aba South Local Government Areas of Aba City (the study area) in Abia State, the causes and effects of pluvial flooding in the city, as well as the Environmental Adult Education (EAE) programmes needed to mitigate the causes and the effects. The descriptive survey design was adopted for the study. Three Research Questions and a null hypothesis provided the guide. The population for the study was made up of 2,816 adult residents in Aba out of which a sample of 282 (10%) was selected (154 from Aba North and 128 from Aba South) through the proportionate random sampling technique. Percentages, means, standard deviation and the t-test were the statistical methods adopted. Based on the responses obtained through a questionnaire, five causes and seven effects of pluvial flooding in Aba were authenticated. Five comprehensive EAE programmes were equally identified and confirmed by the resident respondents as needed for mitigation of pluvial flooding in Aba. Appropriate recommendations on the expert development and provision of the needed EAE programmes have been made by the researchers.*

KEYWORDS: environmental adult education, mitigation, pluvial flooding, participatory study.

INTRODUCTION

Human environment has experienced a lot of hazards arising from various natural occurrences and human (*anthropogenic*) environmentally-unfriendly activities. Flooding is known to be among the environmental hazards which have both natural and anthropogenic origins. For instance, flooding has been known to be caused by, among other factors, a combination of excessive precipitation and reduced flow of surface water due to indiscriminate dumping of refuse in waterways, including sewage systems (Eheazu, 2016). Again, in relation to the topic of the study being reported here, it has been recorded that

due partly to increasing human activities within and around its waterway and the effects of global warming, the *Ogbor Hill River* in Aba increased its level to 15.1%, 22.1% and 22.4% in 1991, 2000 and 2005 respectively (Njike, Igbokwe & Orisakwe, 2011). However, there is more to the causes, effects and nature of flooding in Aba which will be subsequently presented in this research Report.

Flooding: Definition, Causes and Types:

Flooding refers to the covering or submerging of a usually dry land area with a large amount of water (Mukhopadhyay, 2010). Flooding may be caused by any of several circumstances. For instance, Njoku, Amangabara, & Duru (2015) agree that flooding may occur when there is high rainfall or when a natural or artificial channel is too small, relative to the discharge or when the land is too level and less permeable to the water that gathers on top of the ground surface. Etuonovbe (2011:1) perceive that flooding could arise as “an extreme weather event naturally caused by rising global temperature which results in rise in sea level, thereby causing salt water to inundate coastal lands”. Aside from these natural causes, flooding could also occur as a result of failure of manmade structures like dams, canals and water reservoirs, leaving vast areas inundated or submerged by flood water.

In terms of their types, floods are usually identified in relation to their causes. Accordingly, there is *fluvial flooding* (when the capacity of the flood plain of a river is exceeded as a result of heavy rainfall, snow or ice melts); *tidal flooding* (resulting from sea or river defenses being broken by high tides), and so on. The concern of this paper is with *Pluvial Flooding*; hence it is given some more space below.

Pluvial Flooding is caused by rainwater run-off on impervious land surfaces with low absorbency (Van-Western, 2013). These impervious surfaces do not allow water to penetrate into the soil and as the rainfall increases its intensity, flood water increases and in the absence of adequate drainage system, the water finds its level into the major roads and streets, markets, schools, residential and business buildings. Pluvial flooding has been described as a major concern as regards the incidence of flooding in urban areas. According to Ifatimehim & Ufiah (2006), pavements and rooftops prevent some rainfall from being absorbed by the soil and this can increase the amount of runoff flooding into low lying areas. The authors argue that development therefore worsens pluvial flooding in the cities and suburbs. Many roads are constructed without good drainage systems and where drainages are built, they are not properly channeled. Thus when there is heavy rainfall, there is no easy flow of runoff water; hence the incidence of flooding. Again, people erect houses on waterways thereby blocking free flow of water. Furthermore, indiscriminate dumping of solid wastes on the streets and drainages worsen the flood situation. Agwu (2012) has recorded the main effects of poor solid waste management in cities as blocked drains, flooding, and erosion among others. The indiscriminate dumping of wastes reduces the capacity of rivers and rivulets to dispose storm runoffs along their drainage channels.

Adeloye & Rustum (2011) posit that urbanization and rapid population increase contribute to pluvial flooding in many Nigerian cities. According to them, the number of people living in urban areas around the world would be five billion by 2030. However, the main challenge there is that of poor urban planning (particularly inadequate drainage system and the range of poorly serviced urban utilities). Absence of adequate drainage system and lack of maintenance of the grossly inadequate available public utilities lead to increase in the amount of runoff water especially during heavy rainfall. Inadequate drainage system has implications for future environmental sustainability. Road construction and rehabilitation accompanied by good drainage system would go a long way to control and manage pluvial flooding in Nigeria's rural and urban areas. Pluvial flooding usually occurs outside of recognized floodplains and because it is caused by localized weather conditions, it is very difficult to forecast. Its onset can also be very rapid and the level of flooding very heavy.

Pluvial flooding is associated with a number of impacts, including widespread infection and vector-borne diseases, social disorders, homelessness (displacement), food insecurity, economic losses (mainly through destruction of farmlands, social and urban infrastructures and traffic congestion. According to Tapsell (2012) pluvial flooding has impoverished hundreds of thousands of people through displacement from homes and loss of tangible properties.

Pluvial Flooding in Abia State of Nigeria

Abia State is one of the five South Eastern States of Nigeria. It falls within the low lying belt of Southern Nigeria and within the Niger and Cross River Basins which are generally below 300 metres. Accordingly, the soils of Abia State fall within the broad group of ferallitic soils of the coastal plain sand and escarpment, as well as alluvial soils found along the low terrace of Cross River and the River Niger. Until climate change became apparent some years back, Abia State used to experience two seasons in a year – the wet (rainy) and the dry seasons. Rainfall was experienced up to 9 months of the year, between March and November with double maxima in June and September respectively. Being located within the tropical rain forest region of Nigeria, Abia State is generally heavily inundated during the rainy season. The heavy rains and the accompanying run offs, which have been exacerbated by global warming and climate change, leave serious impacts; including pluvial flooding in various low-lying areas like Aba (Eheazu, 2011).

According to Abia State Emergency Management Agency (SEMA) Report (2019), lots of lives and properties had been adversely affected through the incidence of flooding in Abia State. As narrated by the said report, in 2017, 65 communities in 14 out of 17 local government areas were affected; in 2016, the State recorded 3 deaths, while 45 communities were affected. Aba South local government area topped the list with 11 communities, while Aba North came second, followed by Obingwa, Osisioma and Ugwuagbo LGAs. In 2012, 6 persons were reported dead while 42,045 persons were displaced from their homes. 1,391 hectares of farmland in 14 out of the 17 local government areas of the State were also affected. The Report further reveals that Abia State

recorded even more flood cases in 2019 than in previous years with 13 deaths and over 70 communities comprising more than 70,000 individuals displaced from their homes.

The effects of pluvial flooding are indeed enormous. Businesses are usually grounded during the flood menace in Abia State. Motorists, cyclists and even pedestrians find it difficult to use the roads which are already inundated by flood water. A lot of cars are damaged as they try to navigate through other roads. As pedestrians attempt to have free access, they make pathways on farms and gardens, thereby damaging crops. Workers and school children are usually trapped in traffic hold-ups on their way to work and school. Apart from the major public access roads, even street lanes are equally submerged by flood water. This also slows down economic and social activities in the affected areas. The National Institute of Urban Affairs (2016) described the effects of flooding in urban areas as including traffic jams; damage to public and private properties; mixing of solid waste in flood waters causing further choking of drains. Those who make a living out of street trading at this time find it difficult to showcase their wares and this has a negative impact on the people's livelihood.

Mitigation of Flooding in Abia State

The government of Abia State has made some notable efforts to address the issue of flooding in the State generally. Accordingly, the Ministry of Works Abia State, cited in Nwoko (2013:3), asserts that "Abia State Government in 2010 embarked on construction of about 27 kilometers of primary and secondary drainage channels which were expected to drain an area of about 2000 hectares of land upon completion." Besides, agencies like Abia State Environmental Protection Agencies (ASEPA) and the State Emergency Management Agency (SEMA), through their programmes and activities, have made efforts to mitigate the causes and effects of pluvial flooding in Abia State. ASEPA formulates policies, coordinates action and executes government plans and programmes towards the rapid environmental transformation of Abia State and their activities include:

- i. Raising of and distribution of variety of seedlings for afforestation purposes;
- ii. Pollution control and environmental sanitation;
- iii. Distilling, waste disposal, water channeling and drainage construction;
- iv. Erosion/flood control and watershed management (Abia State Government, 2015).

On the other hand, SEMA is committed to disaster risk management and times without number, they organized awareness programmes through radio and television talk shows or campaign to sensitize the people and create awareness about the causes and effects of flooding and ways to mitigate the flooding. A close examination of these government programmes would reveal two things; namely, lack of discernible attention to urban pluvial flooding (the focus of this paper), and non-direct involvement of residents (beyond radio and television talk shows) in the mitigation of flooding/pluvial flooding in Abia State.

These omissions become very serious in a situation where, according to Cline (2016), there is widespread notion in Nigeria that floods are inevitable phenomena which can never be

fully constrained within the natural environment. This wrong popular notion obviously brings to the fore the need to adequately sensitize and educationally empower the people who are directly affected by pluvial flood menace to participate in the process of mitigating the menace through adoption of environmentally-best practices. The authors of this paper strongly believe that Environmental Adult Education (EAE) would provide the needed sensitization and educational empowerment, especially if, as in the case of the study being reported, the experience-based opinions of the affected populations are sought in the determination of the requisite EAE programmes; a process which is in line with the “Participatory Research” (PR) Methodology advocated for research in Environmental Adult Education (Eheazu, 2016, pp. 154-155).

Role of Environmental Adult Education

The term *environment* usually conjures up several mental images, ranging from surrounding flora and fauna to more complex imaginations regarding forces and factors which influence man’s actions and thinking; including the type and variety of his intentions, economic activities, as well as his beliefs, attitudes, hopes and visions (Eheazu, 2016). Practically, the environment is so important to life and living that a good knowledge about it is necessary. People ought to be sensitive about the dangers faced by the environment as a result of the interplay of nature and human activities and so fashion out ways of saving it from destruction. This is why there is need for environmental education, so that people will be able to use the knowledge and skills they gain to create situations that enhance the maintenance of essential ecological processes as life-support systems by ensuring sustainable utilization of species, the ecosystem and overall sustainable development (Ausiegbe, 2015). It is in this wise that Martins (2015) defines environmental education as the education that persuades people to accept measures that will improve the quality of the environment through the acquisition of environmentally-friendly knowledge, habits, attitudes, skills, beliefs and technology.

Environmental adult education (EAE) is that form of environmental education that has its specific focus on the adults. The focus of EAE on *Adults* has arisen from statistical inferences from global demographic dynamics, such as those contained in CIA World Fact Book (2012), whereby it has been established that adults (no matter the criteria by which they are identified in time and in space) are, invariably, the largest groups of humans to impact on the environment through their socio-economic activities (such as farming, road construction, building of estates, use of fossil fuels for transportation and industrial activities) which could bring about tremendous anthropogenic (manmade) environmental degradation phenomena like deforestation, disequilibrium of the ecosystem, land degradation, environmental pollution, global warming and so on. According to Sumner (2003, p. 39), Environmental Adult Education is recognized as a “hybrid outgrowth of the environmental movement and adult education, combining an ecological orientation with a learning paradigm to provide a vigorous educational approach to environmental concerns”. In their own view, Eheazu and Ezeala (2017, p. 99) see Environmental Adult Education as “a consciously organized environmental education for adults” which will enable them to

act individually and collectively in harmony with the forces and elements that surround them, as they engage in their daily activities for survival.

As indicated earlier here, pluvial flooding could have both natural and anthropogenic (manmade) causes. The anthropogenic causes arise usually from human actions, attitudes, behaviour and/or nonchalance that are environmentally unfriendly, such as blockage of sewage systems and waterways with solid wastes and building on floodplains. The human-induced causes of flooding could be modified through appropriate EAE programmes. Methodologies to be involved are numerous, but should be situation-specific, recognizing specific characteristics and levels of education of the beneficiaries. Accordingly, formal, non-formal and informal modes could be adopted to disseminate EAE to the literate, semi-literate and illiterate clienteles respectively.

Area of Study

Aba, a major urban city in the southern part of Abia State, is the area of focus for this study. Aba has two Local Government Areas (LGAs); namely, Aba North and Aba South Local Government Areas.

Aba North LGA had a population projection of 140,000 by 2016, according to Nigeria's National Population Commission. It occupies an area of 23.0 sq. km with a population density of 6,087 per sq. km and has its headquarters at Ezicama-Uratta. Aba North comprises 7 sub-urban towns which include Ogbo, Umuola-Egbelu, Umuola-Okpolor, Ezicama, Osusu, Umuokpoji and Uratta.

Aba South LGA, on the other hand, has a population projection of 559,900 by 2016, according to the National Population Commission of Nigeria. It occupies an area of 49.0 sq. km with a population density of 11,427 per sq. km. Its headquarters is in the Aba urban city centre. Aba South comprises 14 sub-urban towns; namely, Akoli, Amanfuru, Asaeme, Ihieorji, Ndiegoro, Nnetu, Ohabiam, Umuagbai, Umuosi, Abaukwu, Ariaria, Asaokpuaja, Eziukwu and Obuda. Aba South is the main commercial heartbeat of Abia State where Ariaria International Market is located.

Aba North and Aba South LGAs are geographically located between latitudes $5^{\circ}05'1''\text{N}$ to $5^{\circ}30'1''\text{N}$ of the Equator and Longitudes $7^{\circ}15'1''\text{E}$ to $7^{\circ}40'1''\text{E}$ of the Greenwich Meridian. Accordingly, the study area falls within the humid tropical rainforest climate region. The average rainfall for the area is about 2285 mm and falls from March to November, as explained earlier here. Most parts of the study area are flooded during the rainy season due to poor drainage system. This, coupled with the preponderance of ferallitic soils of the coastal plain and alluvial soils found within catchments in the LGAs of Cross River and other rivers, promote the incidence of pluvial flooding in the area. There is also the additional problem of indiscriminate disposal of refuse from homes and business centres along the streets, drainages and undesignated sites which exacerbate pluvial flooding in the two local government areas. Historically, the first major incidence of devastating pluvial flooding in Aba could be traced back to 1980 in Ndi-Egoro community in Aba North Local

Government Area where dozens were killed and several families were rendered homeless. Below are two plates which illustrate the current magnitude of pluvial flooding in Aba North and Aba South LGAs.

Plate 1



Powerline Road (off Faulks Road) in Aba North

Plate 2



Omuma Road, Eziukwu-Aba in Aba South

Problem of the Study

Pluvial flooding has been taking a toll on the economy, residential buildings, office complexes, markets, roads, community squares, farm lands and so on in Aba North and Aba South LGAs of Abia State. Measures usually taken to reduce the causes and effects of the phenomenon are usually short-lived and momentary. Thus, as soon as the floods abate, people tend not to bother any more about them until the next incidence. The residents in the area of study appear to lack the necessary environmental knowledge, skills, attitude and behaviour that would predispose and motivate them to engage in requisite practices to mitigate the menacing pluvial flooding. The probable lack of these necessary attributes of environmental education could be affecting the people's level of response towards mitigation of pluvial flooding in the LGAs.

Given the above recorded failure of government and the people's efforts to substantially mitigate the incidence and effects of pluvial flooding in Abia State (including Aba North and Aba South LGAs) without adoption of any environmentally-oriented education programmes, the need has arisen for an investigation to establish, through involvement of the affected adult residents, what EAE programmes would be needed to mitigate the causes, incidence and effects of pluvial flooding in Aba North and Aba South LGAs of Abia State. The problem of this study therefore was to satisfy this need.

Purpose and Objectives of the Study

The purpose of the study was to identify, through an empirical/participatory process, the environmental adult education programmes needed to mitigate pluvial flooding in Aba

North and Aba South Local Government Areas of Abia State. Specifically, the objectives of the study were to:

- i. Confirm through the opinions of the resident participants the causes of pluvial flooding in Aba North and Aba South LGAs of Abia State.
- ii. Authenticate through the views of the resident participants, the effects of pluvial flooding in Aba North and Aba South LGAs.
- iii. Establish, from the responses of the resident participants, what environmental adult education programmes would be needed to enhance the people's contribution towards the mitigation of the causes and effects of pluvial flooding in Aba North and Aba South LGAs.

Research Questions (RQs)

The research Questions that guided the study were:

- i. What are the causes of pluvial flooding in Aba North and Aba South Local Government Areas (LGAs) of Abia State?
- ii. What are the effects of pluvial flooding in Aba North and Aba South LGAs?
- iii. What environmental Adult Education Programmes would be needed to mitigate the causes and effects of pluvial flooding in Aba North and Aba South LGAs of Abia State?

The Study Null Hypothesis (Ho)

The Null Hypothesis (Ho) for the study posited that there is no significant difference between the responses of residents from Aba North LGA and those of the residents from Aba South LGA on the Environmental Adult Education Programmes needed to mitigate the causes and effects of pluvial flooding in their respective LGAs.

Research Design

The descriptive survey design was adopted for this study as it was found relevant for ascertaining and interpreting the obtained data on existing conditions, including opinions of the respondents relating to the causes and effects of pluvial flooding in the area of study and the environmental programmes needed to mitigate them.

Population of the Study

The population of the study consisted of 2,816 registered members of ten (10) Community Based Organizations (5 in each of Aba North and Aba South LGAs) as shown in table 1 below.

Sample and Sampling Technique

The sample of this study consisted of 282 (10%) of the 2,816 registered members of ten (10) community based organisations in Aba North and Aba South LGAs who constituted the population of the study. A proportionate random sampling technique was used to select the said 10% of the total population of the study in agreement with experts' view on study

population and sampling (Beverly, 2014). The selected population and sample were all adults whose ages ranged from 20 to 60 years and above. Table 1 below also shows the sample distribution.

Table 1: Population and Sample Distributions of the Study Subjects from Aba North and Aba south LGAs

Local Government Area	S/N	Names of Community Based Organisations (CBOs)	Population	Sample
Aba North Local Government Area	1	Youth Alive Initiative	294	29
	2	Omuma F. C. A. Corporative society limited	298	30
	3	Lifeline Aba North Multipurpose Co-operative	310	31
	4	Ezinne Women Cassava group Processing Co-operative	326	33
	5	Youth & Women Rehabilitation Initiative (YAWRI)	308	31
Sub-Total			1,536	154
Aba South Local Government Area	1	Magnacarta Peace Development Initiative	254	25
	2	People Rights Organization	235	24
	3	Spotless Farmers Multipurpose Co-operative Society	269	27
	4	Human Community Restoration Organization	254	25
	5	Social and Bros Photo Organization	266	27
Sub-Total			1,280	128
Grand Total			2,816	282

Source: Data from Departments of Social Welfare Aba North and Aba South LGAs, 2018.

Instrument

The instrument used for data collection for the study was a twenty-seven (27) items structured questionnaire designed by the researchers and titled, “Environmental Adult Education for Mitigating Pluvial Flooding Questionnaire” (EAEMPFQ). The questionnaire had two parts, A and B. Part A contained personal data of the respondents, while part B contained itemized questions drawn to provide answers to the research Questions and for testing the null hypothesis. Reliability of the questionnaire was established using the test-retest method the result of which was correlated by applying the Pearson Product Moment Correlation Statistic (PPMCS). This yielded a correlation coefficient index (r) of 0.75, thus confirming the reliability of the instrument. The questionnaire was structured on a modified four point Likert ratio scale with i) Strongly Agree (SA) = 4 points; ii) Agree (A) = 3 points; iii) Disagree (D) = 2 points; iv) Strongly Disagree (SD) = 1 point.

Data Collection and Analysis

The data were collected through the use of the questionnaire administered to the 282 selected sample of resident respondents with the help of four research assistants locally recruited and trained to explain in local dialects (where necessary) some items of the questionnaire. The researchers and their assistants also engaged the subjects in focus group discussions to familiarize them with the concept, content and potentials of Environmental Adult Education for solution of environmental problems. With the help of the research assistants, all the 282 copies of the questionnaire administered (154 in Aba North and 128 in Aba South) were properly completed by the respondents and duly retrieved.

Statistical measures used to analyze the data in answer to the research questions were based on response frequencies and means, while the T-test statistic was used to test the null hypothesis. Since the items were rated on a four-point scale (modified Likert-type), the criterion mean of 2.5 was used in taking decisions. Thus item responses that received a mean (\bar{X}) equal to or greater than 2.5 were considered to be positive, while items that scored below 2.5 were considered negative. The 2.5 criterion mean was arrived at by adding the weighted scale responses and dividing the total by 4 as in the example below:

$$\text{Criterion } \bar{X} \text{ of responses} = \frac{\text{Total sum of weights}}{\text{Total number of options}}$$

$$\begin{aligned} \text{i.e. } \frac{SA+A+D+SD}{4} &= \frac{4+3+2+1}{4} = \frac{10}{4} \\ &= 2.50 \end{aligned}$$

FINDINGS/RESULTS

i) *Research Question One (RQ1)*

RQ1 was posed to ascertain what the respondents believe are the causes of pluvial flooding in Aba North and Aba South LGAs of Abia State. Table 2 below contains the data used to answer RQ1.

Table 2: Mean Analysis of the resident respondents' opinions on the causes of pluvial flooding in Aba North and Aba South LGAs

S/ N	ITEMS What is your opinion about the following being the causes of pluvial flooding in your LGA?	ABA NORTH N = 154						DECISI ON	ABA SOUTH N = 128						DECISION
		SA 4	A 3	D 2	SD 1	TOT AL	\bar{X}		SA 4	A 3	D 2	SD 1	TOT AL	\bar{X}	
1	frequent and heavy rainfall	60 240	41 123	29 58	24 24	154 445	2.91	Agree	47 188	51 153	20 40	10 10	128 391	3.05	Agree
2	Rapid urbanization in the area	59 236	54 162	30 60		154 469	3.04	Agree	21 84	35 105	50 10 0	22 22	128 311	2.43	Disagree
3	Inadequate drainage system in the rural and urban areas	41 164	63 189	26 52	24 24	154 429	2.79	Agree	52 208	44 132	13 26	19 19	128 385	3.01	Agree
4	Poor maintenance of the existing drainage system	75 300	39 117	28 56	12 12	154 485	3.15	Agree	36 144	51 153	20 40	21 21	128 358	2.81	Agree
5	Indiscriminate dumping of refuse in the waterways	43 172	68 204	33 66	10 10	154 452	2.94	Agree	55 220	46 138	7 14	20 20	128 392	3.06	Agree
Pooled/Aggregate Mean		2.97						Agree	2.87						Agree

As table 2 above shows, all the mean scores for the five itemized causes of pluvial flooding in both Aba North and Aba South LGAs, except the mean score for item 2 (rapid urbanization) under Aba South, are greater than the criterion mean of 2.50. Some even show strong agreement (as in the cases of items 2 & 4 for Aba North and items 1, 3 & 5 for Aba South) with mean scores above 3.00. In other words, the respondents virtually agreed, overall, that the five listed causes of pluvial flooding were prevalent in the two LGAs of Aba. This is further confirmed by the respective pooled/aggregate means of 2.97 & 2.87. The differential mean scores for item 2, as noted above, are explained under the Discussion Section of this paper below.

ii) *Research Question Two (RQ2)*

RQ2 sought to find out the respondents' opinions on what are usually considered the effects of pluvial flooding with reference to their respective LGAs. Table 3 below provides the data used to answer RQ2.

Table 3: Mean Analysis of the resident respondents' opinions on the effects of pluvial flooding in Aba North and Aba South LGAs

S/N	ITEM	ABA NORTH N = 154							ABA SOUTH N = 128						
		SA 4	A 3	D 2	SD 1	TOT AL	\bar{X}	DECISION	SA 4	A 3	D 2	SD 1	TOTAL	\bar{X}	DECISION
	What would you say about the following being the effects of pluvial flooding in your LGA?														
1	Human movement is made difficult by pluvial flooding	33 132	29 87	57 114	35 35	154 368	2.41	Disagree	14 56	27 81	46 92	41 41	128 270	2.11	Disagree
2	Vehicular movement becomes difficult	69 276	54 162	15 30	16 16	154 484	3.14	Agree	58 232	36 108	20 40	14 14	128 394	3.08	Agree
3	Perishable goods are often destroyed in transit	72 288	47 141	25 50	10 10	154 489	3.18	Agree	43 176	51 153	25 50	9 9	128 384	3.00	Agree
4	Psychological fear and trauma	44 176	53 159	31 62	26 26	154 423	2.75	Agree	35 140	15 45	42 84	36 36	128 305	2.40	Disagree
5	Shops/offices are shutdown throughout the period of the flood	81 324	27 81	30 60	16 16	154 481	3.12	Agree	48 192	52 156	19 38	9 9	128 395	3.11	Agree
6	Residential houses are defaced by mud-water	68 272	39 117	40 80	7 7	154 476	3.10	Agree	61 244	26 78	33 66	8 8	128 396	3.10	Agree
7	Nearby farms are damaged by flood	34 136	73 219	28 56	19 19	154 430	2.80	Agree	45 180	37 111	26 52	20 20	128 363	2.84	Agree
Pooled/Aggregate mean							2.93	Agree	2.81 Agree						

The mean scores in table 3 above show that the respondents from both Aba North and Aba South LGAs agreed with items 2, 3, 5, 6 & 7 as the effects of pluvial flooding in the LGAs. Both groups of respondents disagreed with item 1 with a mean score of 2.41 for Aba North and 2.11 for Aba South. Again, respondents from Aba South LGA disagreed (with a mean score of 2.40) that item 4 is one of the effects of pluvial flooding in Aba South. More light is thrown on these differential responses in the discussion section of this paper below. It should be however observed that the pooled/aggregate means of 2.93 & 2.81 depict overall virtual agreement by the respondents that all the itemized seven effects of pluvial flooding exist in the two LGAs of Aba.

iii) *Research Question Three (RQ3)*

RQ3 was posed to find out the environmental adult education programmes the resident respondents would identify with as needed for pluvial flood mitigation in the light of their experiences (including the focus group discussions they had with the researchers). Data used to provide answer to RQ3 are contained in Table 4 below.

Table 4: Mean Analysis of resident respondents' opinions on environmental adult education programmes needed for mitigating pluvial flooding in Aba North and South LGAs of Abia State

S/N	ITEM	ABA NORTH (N ₁ = 154)					\bar{X}_i	DECISION	ABA SOUTH (N ₂ = 128)					\bar{X}_{ii}	DECISION
		SA 4	A 3	D 2	SD 1	TOTAL L			SA 4	A 3	D 2	SD 1	TOTAL L		
1	Creation of public awareness on the danger of flooding through town hall meetings/seminars, radio and television jingles, and other no-formal/informal education parameters.	49 196	60 180	22 44	23 23	154 443	2.8 8	Agree	51 204	47 14	26 52	4 4	128 401	3.1 3	Agree
2	Knowledge inculcation on improved land reclamation and drainage construction and maintenance techniques.	45 180	69 207	17 34	23 23	154 444	2.9 0	Agree	20 80	33 99	53 10	22 22	128 307	2.4 1	Disagree
3	Modification, through environmental education, of people's negative attitudes and behaviour regarding waste disposal in improper sites, such as water drainages, roadsides and flood plains	50 200	82 246	13 26	9 9	154 481	3.1 2	Agree	54 216	42 12	14 28	18 18	128 388	3.0 3	Agree
4	Provision of skills development programmes for the public to promote environmental conservation, protection and restoration of degraded wet-lands and floodplains,	39 156	64 192	31 62	20 20	154 430	2.8 0	Agree	40 160	53 15	22 44	13 13	128 376	2.9 4	Agree
5	Encouragement of public participation in decision-making processes and training programmes concerning mitigation of causes and effects of flooding and prevention and protection of the environment.	76 304	43 129	11 22	24 24	154 479	3.1 1	Agree	66 64	31 93	20 40	11 11	128 408	3.2 1	Agree
Pooled/Aggregate Mean							2.9 6	Agree (P\bar{X}1)						2.9 4	Agree (P\bar{X}2)

As data in table 4 above reveal, the respondents from Aba North LGA agreed that all the five listed environmental adult education programmes are needed for mitigating pluvial flooding with mean scores of 2.88, 2.90, 3.12, 2.80 and 3.11 respectively. Respondents from Aba South LGA, on the other hand, dissented in the case of item 2 with mean score of 2.41. However with pooled/aggregate means of 2.96 and 2.95 respectively for Aba North and Aba South LGAs, it could be inferred (using the criterion mean of 2.50) that overall, all the five EAE programmes listed in table 4 were needed for mitigating pluvial flooding in Aba North and Aba South Local Government Areas of Abia State. The actual level of congruency in the responses of the two groups of residents would be made clear by the result from the test of the Ho of this study below.

Test of the Null Hypothesis (Ho)

The Ho for this study posits that there is no significant difference between the responses of residents from Aba North LGA and those of the residents from Aba South LGA on the Environmental Adult Education Programmes needed to mitigate the causes and effects of pluvial flooding in their LGAs. The respective mean responses (\bar{x}_i and \bar{x}_{ii}) of the two groups of resident respondents, including the pooled/aggregate means ($\bar{P}\bar{X}1$ and $\bar{P}\bar{X}2$) in table 4 above are used to test the Ho, using the T-test statistic.

Adopting the Standard Deviation (SD) formula,

$$SD1 = \sqrt{\frac{\sum (\bar{x}_i - \bar{P}\bar{X}1)^2}{N1}} \quad \text{for Aba North; and}$$

$$SD2 = \sqrt{\frac{\sum (\bar{x}_{ii} - \bar{P}\bar{X}2)^2}{N2}} \quad \text{for Aba South,}$$

- i. The SD for Aba North data (SD1) = 0.00081
- ii. The SD for Aba South data (SD2) = 0.00177

Applying the SDs (1 and 2) for t-analysis of the difference in pooled/aggregate mean responses in tables 4 ($\bar{P}\bar{X}1 = 2.96$ and $\bar{P}\bar{X}2 = 2.94$) and using the formula,

$$t = \frac{\bar{P}\bar{X}1 - \bar{P}\bar{X}2}{\sqrt{\frac{N1SD1^2 + N2SD2^2}{N1 + N2 - 2} \left(\frac{N1 + N2}{N1N2} \right)}},$$

where $N_1 = 154$ and $N_2 = 128$, the T-test result is shown in table 5 below.

Table 5. T-test of the significance of the difference in the pooled/aggregate mean responses of subjects from Aba North and Aba South LGAs regarding the EAE programmes needed for mitigation of pluvial flooding in Aba.

N1	N2	$\bar{P}X_1$	$\bar{P}X_2$	SD1	SD2	df	t-cal	t-crit	P	Decision
154	128	2.96	2.94	0.00081	0.00177	280	3.419	1.960	0.05	Reject H_0

As table 5 reveals, the calculated t (t-cal) = 3.419, while the table t (t-crit) = 1.960 with degree of freedom (df) = 280 and the probability level of significance (p) = 0.05. The H_0 is thus rejected as the t-cal > t-crit ; i.e. there is significant difference between the responses of the two groups of residents from Aba North and Aba South LGAs of Abia State regarding the EAE programmes needed to mitigate pluvial flooding in Aba, in spite of the fact that the pooled/aggregate means of their responses are obviously quite close, with a difference of only 0.02.

DISCUSSION OF FINDINGS

This study was designed to establish, through an empirical/participatory process (involving residents' opinions), the causes and effects of pluvial flooding in Aba and what environmental adult education programmes are needed to mitigate the menace, especially in view of past failed non-environmentally-oriented efforts. Accordingly, the findings of the study are described under related headings as laid out below.

i. *Causes of Pluvial Flooding in Aba*

The causes of pluvial flooding in Aba are as listed and confirmed by the subjects of the study in table 2 in response to RQ1. As the data in table 2 show, the mean scores of the respondents and the pooled means from both Aba North and Aba South LGAs virtually confirmed the existence in the LGAs of all the five itemized causes of pluvial flooding; namely, frequent and heavy rainfall; rapid urbanization; inadequate drainage systems; poor maintenance of existing drainage systems and indiscriminate dumping of refuse in the waterways. However, the disagreement with item 2 (rapid urbanization) by respondents from Aba South with a mean response of 2.43, as well as the differentials in what constitute the highest causes of pluvial flooding for Aba North (indiscriminate dumping of refuse in waterways) and for Aba South (poor maintenance of existing drainage systems), could be attributed to the rates of urbanization in the two LGAs which, as indicted earlier in this paper, is less rapid in Aba South than in Aba North.

ii. *Effects of Pluvial Flooding in Aba*

What are commonly known as the effects of pluvial flooding in Aba are as listed and authenticated by the resident respondents in table 3 in response to RQ2. Except in the

case of item 1 (namely, that human movement is made difficult by pluvial flooding) which is disagreed with by the respondents from both Aba North ($x = 2.41$) and Aba South ($x = 2.41$) and the disagreement by Aba South with item 4 (psychological fear and trauma being an effect of pluvial flooding) with a mean response of 2.40, all the other mean responses (including the pooled/aggregate means of 2.93 and 2.81) give an overall impression of a general agreement and authentication of the seven listed effects of pluvial flooding (table 3) in Aba North and Aba South LGAs.

iii. ***Environmental Adult Education Programmes needed to Mitigate the Causes and Effects of Pluvial Flooding in Aba***

Table 4 of the study lists five Environmental Adult Education (EAE) programmes confirmed by the respondents as needed for mitigation of pluvial flooding in both Aba North and Aba South with the respective pooled/aggregate means being above the criterion mean of 2.50 ($PX1 = 2.96$ and $PX2 = 2.94$). Again, except in the case of item No 2 (knowledge inculcation on improved land reclamation and drainage construction and maintenance techniques) which respondents from Aba South disagreed with ($\bar{x}_{ii} = 2.41$), all the other EAE programmes were positively authenticated by the two groups of respondents with mean responses \bar{x}_{xi} and \bar{x}_{xii} above the criterion mean of 2.50. In the light of the above results, one could assert an overall agreement by the resident respondents that the following five EAE programmes are needed for mitigation of the causes and effects of pluvial flooding in Aba:

1. Creation of public awareness on the danger of flooding through town hall meetings/seminars, radio and television jingles, and other non-formal/informal education parameters.
2. Knowledge inculcation on improved land reclamation and drainage construction and maintenance techniques.
3. Modification, through environmental education, of people's negative attitudes and behaviour regarding waste disposal in improper sites, such as water drainages, roadsides and flood plains.
4. Provision of skills development programmes for the public to promote environmental conservation, protection and restoration of degraded wet-lands and floodplains.
5. Encouragement of public participation in decision-making processes and training programmes concerning mitigation of causes and effects of flooding and prevention and protection of the environment.

Congruency/Concordance of the Views of the Resident Respondents on the EAE Programmes Needed for Mitigation of Pluvial Flooding in Aba

To further confirm the congruency/concordance of the above discussed views or opinions of the respondents on needed EAE programmes, the researchers posited a relevant null hypothesis (H_0) that there is no significant difference (at $P = 0.05\%$) between the responses of residents from Aba North and those of residents from Aba South on the EAE programmes needed to mitigate the causes and effects of pluvial flooding in their respective

LGAs. Using data in table 4 to arrive at those in table 5, the t-test was performed to ascertain the difference between the pooled/aggregate means ((PX1 = 2.96 and PX2 = 2.94) in table 4. The t-cal (3.419) was found to be higher than the t-crit (1.960). H_0 is therefore rejected at $P = 0.05\%$ level of significance ($df = 280$). In other words, there is significant difference in the perceptions/views of the two groups of respondents on the EAE programmes needed to mitigate pluvial flooding in Aba; though the pooled/aggregate means (with a difference of just 0.02) show overall agreement by the two groups of the need for the five EAE programmes listed above. The apparent non-commonality of the views could be explained with the vagaries of the differences in mean responses in table 4 which are reflected in their standard deviations ($SD1 = 0.00081$; $SD2 = 0.00177$) in table 5. Nonetheless, the fact still remains that the two groups of respondents under reference very much agreed that the EAE programmes listed above are needed to mitigate the causes and effects of pluvial flooding in Aba North and Aba South LGAs.

SUMMARY AND CONCLUSION

This study has shown (with confirmation from adult residents) the various causes and effects of pluvial flooding in Aba, as well as the Environmental Adult Education (EAE) programmes needed to improve and galvanize the otherwise ineffective efforts so far made by government and the people towards mitigating the menace of pluvial flooding. Given the potentials of the confirmed EAE programmes, the researchers have found it pertinent to conclude that if the right education experts are mobilized to implement the programmes, there will be tremendous improvement in the mitigation of the causes and impacts of pluvial flooding in the area of this study.

Recommendation

Given the obvious urgency for the provision of the needed Environmental Adult Education (EAE) programmes for mitigating pluvial flooding in Aba, the researchers hereby recommend that the Local Government Education Authorities (LGEAs) in Aba North and Aba South LGAs should liaise with the Abia State Ministry of Education to employ the professional services of existing University Departments of Adult and Non-Formal Education with EAE Units (like that of the University of Port Harcourt) to develop and run the desired EAE programmes for residents of Aba. The programmes could also be extended to other parts/cities of Abia State, nay of Nigeria, which experience pluvial flooding; provided that appropriate support mechanisms are made available by the various Nigerian Superintending Education Authorities/Ministries at the Local, State and Federal levels.

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