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Environmental Generation Framework: A Case of Environmental Awareness Among farmers and Senior High School Students for Sustainable Development

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ABSTRACT

Having access to a reliable environmental source of education contributes to pro-environmental behaviors. Yet, it is unclear whether such environmental education should be centered on the current or the next generation. To investigate the possible impact of environmental education on sustainable development and make a comparison between the older and the future generations, this research surveyed 376 household heads (also farmers) from two municipalities and 200 Senior High School students from four municipalities/districts in the Eastern region of Ghana. The results revealed that both farmers and students demonstrated considerable environmental awareness. However, the students showed a higher and acceptable cumulative percentage environmental knowledge score than the farmers. The results from the Linear Probability Model estimates of perceived environmental knowledge indicate that being a male increases the probability of having perceived environmental knowledge by 30.8 percentage points, controlling other demographic characteristics. Whiles being enrolled in a Senior High School (young generation) increases the probability of having perceived environmental knowledge by 30.8 percentage points. Furthermore, over 98% of the students indicated their availability to equip themselves better to confront the deteriorating environment compared to 81% of the older generation. The results revealed that the younger generation has the motivation, readily available to gain more knowledge and skills to become and raise an environmental generation. These meet the three most important elements of the Environmental Generation Framework, which focus on the younger generation to achieve sustainable development.

1. Introduction

Human-driven environmental changes in the ecosystem have affected ecosystem stability, functions, services, and human well-being (Adu, Tetteh, Puthenkalam, & Antwi, 2020). The land transition from non-agriculture to agricultural lands is expected to happen in developing countries, especially on the African continent base on recent estimates by the world bank, where over 200 million hectares of agricultural lands remain unexploited (Byerlee, Stevenson, & Villoria, 2014; Deininger & Byerlee, 2011). In their estimation, global arable land is likely to have a net increase of 6 x 10^6 hectares of land per year (Deininger & Byerlee, 2011). The Intergovernmental Panel for Climate Change's (IPCC) report on land and climate indicates that anthropogenic activities directly affect more than 70% of the global, ice-free land surface (Arneth et al., 2019).

The principal basis to ensure food security, freshwater source, human livelihood and sustainability, and other ecosystem services is the land. The agricultural expansion and intensification rate raises concern about the sustainability of forests, ecosystem function and service, and land degradation (Adu et al., 2020). Despite the application of science and technology in the

agricultural sector, productivity continues to be low denying farmers deserving well-being and impeding sustainable development. With more mouths to be fed, slash and burn agriculture, use of inorganic fertilizer, agrochemicals, intensive agriculture, and farmers' inability to replenish lost nutrients has led to land degradation (Barbier & Hochard, 2018a; Chand, Prasanna, & Singh, 2011). The low productivity and the increase in population bring doubts about achieving sustainable development, food security, and an increase in income on the African continent (Barbier & Hochard, 2018b; Gupta, 2019).

To ensure that food production does not continue to harm the environment and that climate change does not also negatively impact agricultural lands, sustainable agricultural practices have been encouraged especially among small-holder farmers. The capacity to ensure sustainable farming employs the best land-related adaptation and mitigation responses depends on its natural resource endowment, social, cultural, political, and economic conditions (Garrity, 2020; Puthenkalam, 2016). Sustainable agriculture has centered on four major pillars: human well-being, economic profitability and equity, social equity, and environmental health (Castro, Azul, Leal Filho, & Azeiteiro, 2019).

Agricultural land-related strategies for climate and weather risk management include diversifying crops. Drought-resistant perennial crops that enhance the quality of soil and moisture retention are grown as an adaptive mechanism. Most farmers include rearing livestock diversify their enterprise; this increases forage production that adds value to the farm (Agyeman, Asuming-Brempong, & Onumah, 2014). Sustainable land resource management has proven to deal with land stress, such as extended drought, extreme temperatures, and flooding from climate change (Eckstein, Künzel, Schäfer, & Winges, 2019).

Been abreast of environmental issues and their negative impacts on the three pillars of sustainable development could reduce human-related activities that put the earth in danger, increase environmental well-being, and brightens the next generations' chances of a sustainable future. All pathway to reducing the greenhouse gas emission requires land-related strategies but adaptation and mitigation measures have some barriers and limitations (Shukla et al., 2019). Therefore, the need for environmental education is equally important as any other measures to ensure that sustainable development is achieved. Studies on both generations have been conducted, yet, it is unclear whether such environmental education should be centered on the current or the next generation. Moreover, none of the studies analyzes environmental awareness levels on the two generations from the same data source. The present study seeks to fill this gap.

To ensure environmental sustainability, which could translate into increased income, savings, and investments, this paper analyses perceived environmental knowledge of both the current and future generations. Moreover, the study assesses their sense of environmental responsibility, sources of environmental information, and their availability to acquire environmental knowledge to prevent further spreading the current environmental mess.

2. Literature Review

2.1 Sustainable development, environmental education, and the youth

The most commonly used and quoted definition of sustainable development is from the Brundtland Commission report on "The World Commission on Environment and Development: Our Common Future" it defines Sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, Khalid, Agnelli, Al-Athel, & Chidzero, 1987).

The IPCC's (2019) report indicates that 70% of the world's landscape has been affected by human activities and agricultural intensification; these activities generated land degradation (Shukla et al., 2019). Data from the World Bank (2019), indicates that crop production increased by 240% between 1961 and 2017. Agricultural, forestry, and other related land use activities together emit around 13% of carbon dioxide, 44% of methane, and 82% of nitrous oxide during the 2007-2016 period representing a total of 23% of all greenhouse emission caused by anthropogenic factors (Shukla et al., 2019).

Land-related adaptation and mitigation strategies continue to change to deal with climate change dynamics. There are limits to these measures and, hence, the need to instill environmentalism in the younger generation to reduce activities that increase greenhouse gas emissions and pollute the environment. The creation of awareness can achieve this through various environmental information transmission systems, especially through the formal education system.

Rural dwellers' livelihood depends mainly on farming, and this is the major link between the dwellers and land. A study to examine farmers' environmental awareness and attitude towards environmental degradation found that perception of the seriousness of environmental degradation had a positive influence on their awareness, concern, and attitude toward environmental degradation (Wu & Mweemba, 2010). Therefore, the greater the level of environmental consciousness among the farmers, the higher their involvement in land management activities. This also enhances their capacity to decide to improve and reverse land degradation (Naidoo & Xollie, 2011; Wu & Mweemba, 2010).

The literature on environmental consciousness/awareness among both generations showed inconclusive results with regards to gender. In research on environmental consciousness/awareness among higher primary school teachers in the city of Mysore,

India, female teachers were found to be more knowledgeable than their male counterparts (Larijani, 2010). An opposite result was reported in a similar study, while results among males and females in other studies did not differ significantly, i.e., gender is reported not to be a significant determinant of environmental knowledge and behavior (Sengupta, Das, & Maji, 2010).

Results from another study to evaluate the impact of urban environmental education programs patronized by high school students in Bronx, New York, in environmental stewardship, environmental skills development, and environmental monitoring indicates a successful outcome in nurturing ecological mindset among the youth (Kudryavtsev, Krasny, & Stedman, 2012). But this is not enough to conclude that the young or the current generation should be targeted without analyzing the two generations using the same parameters from the same data source.

In all the studies conducted, environmental consciousness is on the rise, but all the study was done using different questionnaire and methodology. Studies either gave preference to the younger generation (Delia & Krasny, 2018; Staples, Larson, Worsley, Green, & Carroll, 2019), or the older generation (Van Cauwenberg, De Bourdeaudhuij, Clarys, De Geus, & Deforche, 2019), this does not provide a platform for comparison to make an informed decision as to which of the generations deserves an in-depth environmental education to save the ailing environment.

Assessing the level of environmental consciousness of both generations using the same survey and method lacks the literature. Also, it is not clear whether environmental education should be more centered on the current generation (under whose tenure the environment continues to deteriorate rapidly) or on the next generation who are more curious about the environment. This research explains the role of perception of time using the socioemotional selectivity theory for such comparison.

2.2 Socioemotional selectivity theory and environmental generation framework

In the pursuit of pro-environmental behavior, being young or old plays an important role, as claimed by the socioemotional selectivity theory proposed by Carstensen and colleagues. The theory argues that the perception of time plays a vital role in the selection process and pursuit of social goals; that is; time is viewed as an important factor in the changes that happen across a person's lifetime (Carstensen, 1992; English & Carstensen, 2015).

The theory categorizes social motives into two – those goals related to the acquisition of knowledge and those goals associated with emotional regulation. The theory claims that the younger generation perceives time as more open-minded, and thus the acquisition of knowledge-related goals is prioritized. In contrast, the older generation perceives time as a limited commodity and, as such, prioritize emotion-related goals over the acquisition of knowledge-related goals (Zheng & Wang, 2020).

As is typical in the younger generation, the future is perceived as long and imprecise; therefore, future-oriented motives related to the acquisition of knowledge, gathering information, and expanding horizons are prioritized immediately over emotional glory. Base on this theory, it would be just to say that a youthful generation that is conscious of their environment and the consequences of the human activities towards the environment would prioritize the acquisition and gathering of knowledge to save the environment from deteriorating.

Hence, this study proposes the *Environmental generation framework* that would spark environmentalism among the younger generation or raise an environmental generation. *The environmental generation framework* moves alongside the socioemotional selectivity theory, but it concentrates on the younger generation rather than, the older individuals who mostly prioritize emotion-related goals over knowledge-related goals (refer to figure 1). This does not mean that environmental education towards the older generation should not be encouraged, but rather, the younger ones should concentrate.

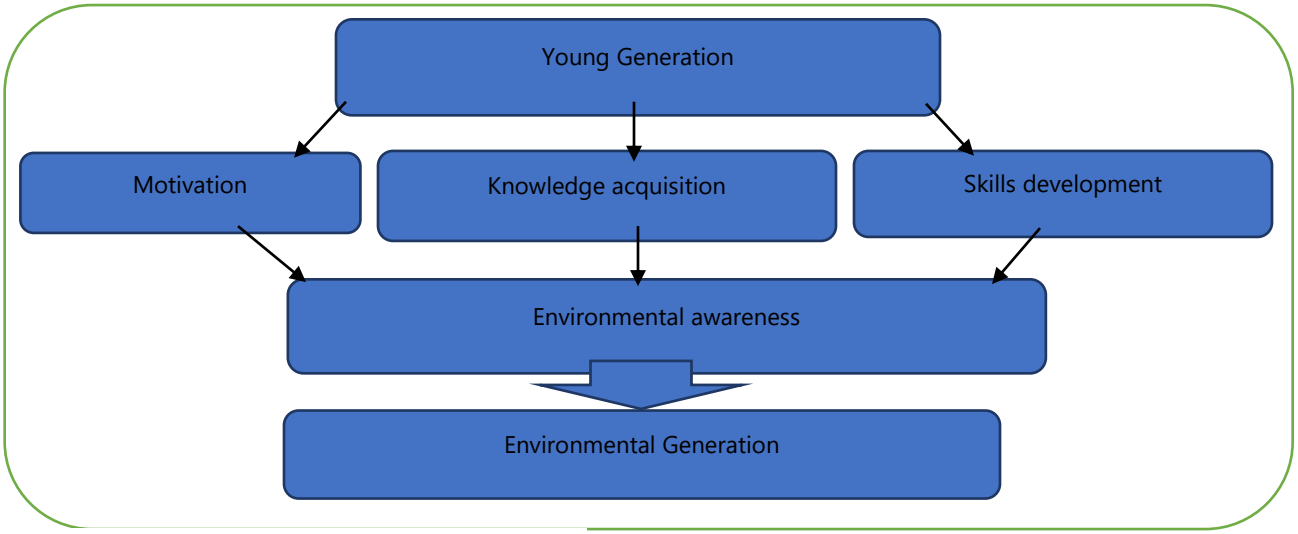

Figure 1: Environmental Generation framework

3. Material and Method

Data were collected through the administration of a questionnaire to respondents of the study area. Abuakwa North and South Municipalities is home to a mixture of people from diverse backgrounds. The household was sampled from 20 communities, 10 from each municipality. The study area was stratified into electoral areas to represent the communities fully and the household was randomly selected. Therefore, the stratified random sampling method was employed to identify the 388 households with 376 questionnaires fully completed and all questions fully answered. The overall valid response from the respondents/household sampled is 97 per cent based on the 388 administered. In this way, sampling the population of the two municipalities was divided into smaller groups or is partitioned into subpopulations known as strata. In this research, the strata are referred to as the electoral areas in the district and municipal administration of Ghana and members of this strata shared the same or similar characteristics or attributes. The same questionnaire was administered to 200 Senior High School Students (SHS) from four SHSs.

In applying this new framework, the author tests the hypothesis derived from the Environmental Generation Framework regarding the effect of an educated younger generation on environmental awareness, environmental responsibility, and level of preparedness to reverse and restore environmental degradation. Using a Likert scale, the survey collected data on their general perceived environmental knowledge, their views on laws and regulations about the environment, and their sense of environmental responsibility. Analysis of the data was performed using Microsoft Excel, SPSS, and STATA.

3.1 Linear Probability Model of Perceived Environmental Knowledge

To determine what drives perceived environmental knowledge of the sampled population, we used the Linear Probability Model (LPM). The variables used in the Ordinary Least Square or the Linear Probability Model specification are perceived environmental knowledge as the dependent variable with age, gender, level of formal education, years of farming experience, marital status, religious denomination, ethnicity, municipality, and income as covariates in the household heads (farmers) group as shown in table 1 The covariates used in the SHS group are age, gender, the region of origin, the program of study, ethnicity, religious denomination, parents' educational level and SHS grade as shown in table 2. The dependent variables take the value of 1 if the farmer/SHS student meets the acceptable score of perceived environmental knowledge and 0 otherwise. The parameters of interest among both groups are the coefficient of age, gender, and level of formal education. The OLS in the LMP equation used is as follows:

$$y_i = \beta_0 + \beta_1 x_i + \cdots + \beta_k \mathrm{X_i} + u_i \qquad (1)$$

where y_i is a dummy variable equal to 1 if farmer/SHS student i meets the acceptable score of perceived environmental knowledge and 0 otherwise, while u_i is the error term.

3.2 Cumulative percentage of the performance of perceived level of environmental knowledge

In assessment studies and /or experience surveys, one of the most appropriate and useful measures to deal with ordinal scale data is the cumulative percentage (Al Rubaish, 2010). Based on deductions from assessment studies conducted towards the furtherance of academic programs and taking inspiration from the National Commission for Assessment and Academic Accreditation (NCAAA) and some global repute institutions, Al Rubaish, Wosornu, and Dwivedi (2011), adopted the cumulative percentage as the more appropriate measure. As an advantage over the arithmetic means, median, and the first quartile, it is a simple and straightforward measure, easy to understand, and clearer to non-statisticians (Al Rubaish, 2011a). It also helps to quantify any improvement or otherwise in performance over some time and finally, it assists in identifying where improvement is needed (Al Rubaish, 2011a, 2011b).

To determine an acceptable score, parametric and non-parametric measures such as arithmetic mean, median, first quartile, and cumulative percentage have been used as analytical tools in such assessment. But for analysis using the linear probability model, the good and excellent scores were combined and named as the acceptable score. The overall performance was described in three bands as follows:

Less than 60%	Improvement required (Poor)
60%-79%	Acceptable (Good)
80% & above	High quality (Excellent)

4. Results

4.1 Demographic characteristics

Below is the demographic information on the two cohorts. Tables 1 & 2**Error! Reference source not found.** present the household heads and SHS students' demographic features. Of the total, male households' heads are 312, representing 82.98%, with 64 been female representing 17.02%. Universally, males are known to be the head of a household though females also assume this role in the absence of the male or where the female is either a widow or never married but has children. The age of household members was grouped into four categories, namely: 18 to 40 years, 41 to 60 years, 61 to 80 years, and above 80 years. Those in the age bracket of 18-40 represent 16.49%, with the 41-60 years been 42.02% of the sampled farmers, 38.30% were within the age bracket of 61-80 years, whiles those above 80 years were 3.19%. 83.51% of the respondents are farmers above 40 years. This suggests that older people are more involved in the agrarian sector of the study area than the younger ones. It is expected that they might have worked on their farms for so many years and should know the effects of their work on the environment and vice versa. Among the household heads/farmers cohort, 14.63 per cent had no formal education, 43.35 per cent had primary level of education, whilst 22.61 per cent had junior high school education. Also, 16.49 per cent of the respondents had senior high school education, with only 2.93 per cent having had tertiary education.

Their ages were grouped into 14-15 years, 16-17 years, and 18-20 years. The highest number of respondents representing 66.50% were students between 16-17 years, followed by the age group 18-20 years, with 26% and 14-15 years with 7.5%. Males represent 52% and females were 48%. The student respondents were studying seven (7) different programs, namely: general arts (17%), business studies (17%), general science (17%), home economics (16.5%), visual arts (17%), agricultural science (7.5%) and technical studies (8%). There were fifty (50) students each from Ofori Panin SHS in the Abuakwa North Municipality, Kyebi SHS in the Abuakwa South Municipality, Presbyterian SHS Fanteakwa North District, and Presbyterian SHS in the Fanteakwa South District, all of the Eastern Region of Ghana. It is expected that parents' educational level would impact their ward's level of environmental knowledge significantly. In this regard, data on parents' educational level was collected as follows: 28%, 34.5% and 26% of the student's father had completed junior high, senior high, and the tertiary respectively as against 32.5%, 36%, and 13.5% of their mothers who had completed for Junior high, senior high and the tertiary respectively.

Table 1: Demographic characteristics of sampled household heads of Abuakwa North and South municipalities

Parameter	Frequency	Percent
Total respondent	376	100.00
Gender: Male	312	82.98
Female	64	17.02
Age		
18-40	62	16.49
41-60	158	42.02
61-80	144	38.30
81+	12	3.19
Level of Education		
None	55	14.63
Primary school	163	43.35
Junior High	85	22.61
Senior High	62	16.49
Tertiary	11	2.93
Marital Status		
Single	32	8.51
Monogamously Married	270	71.81
Polygamously Married	14	3.72
Widowed	43	11.44
Separated/Divorced	17	4.52
Religious Denomination		
No religion	12	3.19
Orthodox Christians	98	26.06
Protestant Christians	44	11.70
Pentecostals Christians	101	26.86
Charismatic Christians	71	18.88
Other Christians	28	7.45
Islam	13	3.46
Traditionalist	4	1.06
Others	5	1.33
Ethnicity		
Akan	247	65.69
Ewe	51	13.56
Ga-Dangme	53	14.10
Dagbani	1	0.27
Frafra/Grusi	5	1.33
Nzema	1	0.27
Wali/Dagari	7	1.86
Others	11	2.93

Data is presented as a figure and percentage.
Source: Created by the author from fieldwork (2019)

Table 2: Demographic information of sampled Senior High Schools students

Parameter	Frequency		Percent	
Total respondent	200		100	
Age:				
14-15	15		7.50	
16-17	133		66.50	
18-20	52		26.00	
Gender:				
Female	104		52.00	
Male	96		48.00	
Regions:				
Eastern	98		49.00	
Greater Accra	48		24.00	
Central	13		6.50	
Western	1		0.50	
Volta	21		10.50	
Bono	4		2.00	
Northern	1		0.50	
Upper East	7		3.50	
Ashanti	7		3.50	
Senior High Schools				
Ofori Panin SHS	50		25.00	
Kyebi SHS/Tech	50		25.00	
Presby SHS, Begoro	50		25.00	
Presby SHS, Osino	50		25.00	
Program of study:				
General Arts	34		17.00	
Business Studies	34		17.00	
General Science	34		17.00	
Home Economics	33		16.50	
Visual Arts	34		17.00	
Agricultural Science	15		7.50	
Technical	16		8.00	
Religious Denomination				
Orthodox Christians	103		51.50	
Pentecostals Christians	45		22.50	
Charismatics Christians	16		8.00	
Other Christians	19		9.50	
Islam	14		7.00	
Traditionalist	1		0.50	
Others	2		1.00	
Parent's Education	**Father**	**Mother**	**Father**	**Mother**
None	7	15	3.50	7.50
Primary education	12	19	6.00	9.50
Junior High School	56	65	28.00	32.50
Senior High School	69	72	34.50	36.00
Tertiary	52	27	26.00	13.50
Others	4	2	2.0	1.00

Source: Author's own from fieldwork. Data is presented as a figure and percentage

4.2 Independent sample t-test of household heads and SHS students

An independent samples t-test was conducted to compare the means of two independent groups, i.e., male and female, on ten environmental dimensions to determine whether there is statistical evidence that the associated population means are significantly different. The null hypothesis (H_0) that there is no significant difference between males and females will be rejected if the value of the observed T-Test exceeds the critical values. Tables 3 &4 presents the results of the independent T-Test of the two groups.

Among the household heads group, the female (N= 64) was associated with a performance M= 2.48 (SD= 0.713). By comparison, the male (N=312) was associated with a numerically better performance M= 2.73 (SD= 0.820). Levene's test for equality of variances showed no violation, F (374) = .015, p=.902. The independent samples t-test was associated with a statistically significant effect, t (374) = 2.27, p= 0.024. Thus, males were associated with statistically significant knowledge of environmental issues and problems than females. The effect size of comparing two means is measured by Cohen's D, which was estimated at .33. A similar interpretation is given to all the other nine dimensions.

Also, an independent sample t-test was conducted to examine gender differences in the level of knowledge on environmental issues and problems among SHS students. The assumption of homogeneity of variances was tested and satisfied via Levene's F Test, F (198) = 3.14, p= .078. Results indicates that males (M= 3.45, SD= .780) scored higher than females (M=3.19, SD= .725), t (198) = -2.40, p= 0.017, Cohen's D= .35. The results among the SHS students confirm the trend in the household heads. The overall results are contrary to some earlier reports that suggest that gender is not a significant determinant of environmental knowledge and behavior (Sengupta et al., 2010). But it also confirms previous findings that males report higher environmental awareness than females.

4.3 Cumulative percentage of the performance of perceived level of environmental knowledge

The overall cumulative performance of perceived environmental knowledge results shows that 23.67%, 31.91%, and 44.41% of households' heads had a poor, good, and excellent performance, respectively. Compared to SHS students performance of 20.50%, 26.50%, and 53%, the SHS students performed better.

Drawing inspiration from the fact that environmental awareness largely depends on motivation, knowledge, and skills, the available data from tables 5 and 6 revealed that the younger generation has a higher level of environmental awareness. Besides, a summation of the acceptable score (good and excellent scores) of both groups shows SHS students obtained a higher score of 79.50% compared to 76.32% of the household heads. Even among the household heads, scores show that the younger age group of 18-40 demonstrated a high level of knowledge with an acceptable score of 83.87% compared to 75.32% of the older 41-60-year group, much older 75% of the 61-80-year group and 66.66% of the oldest group of the above 80 years. Using the cumulative percentage performance criteria, it can deduce that the younger generation is more knowledgeable than the older. As the performance of the SHS students is driven by their level of knowledge acquired through the formal education system strengthened by motivation, household heads (farmers) derived most of their knowledge from the continuous practices of farming activities. The results from table 5 revealed that those with no formal education had a higher acceptable score of 85.64% (sum of good and excellent scores) compared to those who had received a formal education- primary with 77.3%, JHS with 72.95%, SHS with 72.58%, and tertiary with 63.63%.

Table 3: Independent sample t-test of household heads

Dimension	***Levene's Test***		***Gender***	***Mean***	***Standard Deviation***	***P-value***	***t***	***Cohen D***
	F	***Sig***						
Environmental issues and problems	.015	.902	Male	2.73	.820	.024	2.266	0.33
			Female	2.48	.713			
Land degradation	1.110	2.93	Male	2.81	.852	.002	3.070	0.43
			Female	2.45	.834			
Urban Sprawl	.013	.908	Male	2.76	.825	.015	2.447	0.36
			Female	2.48	.734			
Water Pollution	.536	.465	Male	2.77	.878	.009	2.641	0.37
			Female	2.45	.853			
Air Pollution	2.106	.148	Male	2.86	.829	.002	3.151	0.43

			Female	2.50	.836			
Biodiversity	.868	.352	Male	2.81	.850	.001	4.017	0.57
			Female	2.34	.801			
Sustainability	.059	.808	Male	2.73	.825	.020	2.336	0.34
			Female	2.47	.712			
Watershed management	1.561	.212	Male	2.81	.848	.001	3.761	0.51
			Female	2.38	.826			
Conservation of natural resources	.001	.980	Male	2.71	.822	.029	2.191	0.31
			Female	2.47	.734			
Wetlands	.045	.833	Male	2.63	.909	.032	2.155	0.31
			Female	2.36	.843			

Source: Author's own from fieldwork
Level of significance p<0.05

Table 4: Independent sample t-test of SHS students

Dimension	***Levene's Test***		***Gender***	***Mean***	***Standard Deviation***	***P-value***	***t***	***Cohen D***
	F	***Sig***						
Environmental issues and problems	3.141	.078	Male	3.45	.780	.017	-2.402	0.35
			Female	3.19	.725			
Land degradation	2.779	.097	Male	3.49	.725	.004	-2.908	0.41
			Female	3.20	.674			
Urban Sprawl	3.583	.060	Male	3.45	.806	.030	-2.191	0.31
			Female	3.21	.720			
Water Pollution	1.513	.220	Male	3.06	1.084	.025	-2.265	0.32
			Female	2.73	.988			
Air Pollution	1.011	.316	Male	3.13	1.084	.001	-3.595	0.37
			Female	2.73	1.076			
Biodiversity	.951	.331	Male	3.19	1.059	.001	-4.269	0.61
			Female	2.54	1.088			
Sustainability	3.488	.063	Male	3.47	.739	.009	-2.644	0.38
			Female	3.20	.688			
Watershed management	.265	.607	Male	3.20	1.062	.001	-4.326	0.61
			Female	2.55	1.060			
Conservation of natural resources	.547	.461	Male	3.15	1.015	.003	-2.959	0.42
			Female	2.73	.968			
Wetland	1.50	.699	Male	3.17	1.033	.001	-3.622	0.52
			Female	2.63	1.043			

Source: Author's own from fieldwork
Level of significance p<0.05

Table 5: General Environmental Knowledge of Household heads stratified by demographic characteristics

Parameter	Improvement Required (Poor)	Acceptable (Good)	High Quality (Excellent)
Total Respondents	89(23.67)	120(31.91)	167(44.41)
Gender: Male	63(20.19)	98(31.41)	151(48.40)
Female	26(40.63)	22(34.38)	16(25.00)
Age: 18-40	10(16.13)	17(27.42)	35(56.45)
41-60	39(24.68)	47(29.75)	72(45.57)
61-80	36(25.00)	52(36.11)	56(38.89)
81-100	4(33.33)	4(33.33)	4(33.33)
Educational level: None	8(14.55)	13(23.64)	34(61.82)
Primary	37(22.70)	49(30.06)	77(47.24)
Junior High	23(27.06)	41(48.24)	21(24.71)
Senior High	17(27.42)	12(19.35)	33(53.23)
Tertiary	4(36.36)	5(45.45)	2(18.18)
Marital Status: Single	6(18.75)	12(37.50)	14(43.75)
Monogamously Married	56(20.74)	88(32.59)	126(46.67)
Polygamously Married	2(14.29)	6(42.86)	6(42.86)
Widowed	19(44.19)	10(23.26)	14(32.56)
Separated/Divorced	6(35.29)	4(23.53)	7(41.18)
Religious Denomination			
No Religion	0(0.00)	4(33.33)	8(66.67)
Orthodox	23(23.47)	29(29.59)	46(46.94)
Protestant	15(34.09)	12(27.27)	17(38.64)
Pentecostal	26(25.74)	33(32.67)	42(41.58)
Charismatics	16(22.54)	24(33.80)	31(43.66)
Other Christians	4(14.81)	7(25.93)	16(59.26)
Islam	0(0.00)	9(69.23)	4(30.77)
Traditionalist	1(25.00)	2(50.00)	1(25.00)
Others	3(60.00)	0(0.00)	2(40.00)
Ethnicity: Akan	62(25.10)	80(32.39)	105(42.51)
Ewe	12(23.53)	18(35.29)	21(41.18)
Ga-Dangme	12(22.64)	11(20.75)	30(56.60)
Dagbani	0(0.00)	1(100.00)	0(0.00)
Frafra/Grusi	1(20.00)	3(60.00)	1(20.00)
Nzema	0(0.00)	1(100.00)	0(0.00)
Wali/Dgari	0(0.00)	3(42.86)	4(57.14)
Others	2(18.18)	3(27.27)	6(54.55)

Data is presented as a figure with the corresponding percentage in parenthesis
Source: Author's own from field-work.

Table 6: General Environmental Knowledge of Household heads stratified by demographic characteristics

Parameter	Improvement Required (Poor)	Acceptable (Good)	High Quality (Excellent)
Total Respondents	89(23.67)	120(31.91)	167(44.41)
Gender: Male	63(20.19)	98(31.41)	151(48.40)
Female	26(40.63)	22(34.38)	16(25.00)
Age: 18-40	10(16.13)	17(27.42)	35(56.45)
41-60	39(24.68)	47(29.75)	72(45.57)
61-80	36(25.00)	52(36.11)	56(38.89)
81-100	4(33.33)	4(33.33)	4(33.33)
Educational level: None	8(14.55)	13(23.64)	34(61.82)
Primary	37(22.70)	49(30.06)	77(47.24)
Junior High	23(27.06)	41(48.24)	21(24.71)
Senior High	17(27.42)	12(19.35)	33(53.23)
Tertiary	4(36.36)	5(45.45)	2(18.18)
Marital Status: Single	6(18.75)	12(37.50)	14(43.75)
Monogamously Married	56(20.74)	88(32.59)	126(46.67)
Polygamously Married	2(14.29)	6(42.86)	6(42.86)
Widowed	19(44.19)	10(23.26)	14(32.56)
Separated/Divorced	6(35.29)	4(23.53)	7(41.18)
Religious Denomination			
No Religion	0(0.00)	4(33.33)	8(66.67)
Orthodox	23(23.47)	29(29.59)	46(46.94)
Protestant	15(34.09)	12(27.27)	17(38.64)
Pentecostal	26(25.74)	33(32.67)	42(41.58)
Charismatics	16(22.54)	24(33.80)	31(43.66)
Other Christians	4(14.81)	7(25.93)	16(59.26)
Islam	0(0.00)	9(69.23)	4(30.77)
Traditionalist	1(25.00)	2(50.00)	1(25.00)
Others	3(60.00)	0(0.00)	2(40.00)
Ethnicity: Akan	62(25.10)	80(32.39)	105(42.51)
Ewe	12(23.53)	18(35.29)	21(41.18)
Ga-Dangme	12(22.64)	11(20.75)	30(56.60)
Dagbani	0(0.00)	1(100.00)	0(0.00)
Frafra/Grusi	1(20.00)	3(60.00)	1(20.00)
Nzema	0(0.00)	1(100.00)	0(0.00)
Wali/Dgari	0(0.00)	3(42.86)	4(57.14)
Others	2(18.18)	3(27.27)	6(54.55)

Data is presented as a figure with the corresponding percentage in parenthesis
Source: Author's own from field-work.

4.4 Linear Probability Model estimates

Tables 7 and 8 show the results from the Ordinary Least Square (OLS) or Linear Probability Model (LPM) estimates of household heads (farmers) and SHS students, respectively. Among the household heads group, age, level of formal education, years of farming experience, marital status, religious denomination, ethnicity, and income are unrelated to their perceived environmental

knowledge score. This means that age, level of formal education, years of farming experience, marital status, religious denomination, ethnicity, and income are not important factors in predicting the household head's perceived environmental knowledge score. However, the coefficients of "male" are statistically significant at a 5% level of significance for the household heads model specification. The results indicate that being a male increases the probability of having perceived environmental knowledge by 30.8 percentage points, controlling other demographic characteristics. The coefficient of age is positive but not statistically significant due to the small sample size. Education among the household heads was also positive but not significant due to the large number of farmers who have either no education or a lower level of education.

Table 7*:* Linear Probability Model (LPM) estimates of perceived environmental knowledge of household heads/farmers

Variables	**Perceived Environmental Knowledge Score**
Age	**0.00016**
	(-0.0067)
Male	**0.308****
	(-0.138)
Education	**0.0591**
	(-0.0454)
Years of farming experience	0.00085
	(-0.0072)
Marital Status	0.108
	(-0.101)
Religious Denomination	0.00321
	(-0.0255)
Ethnicity	-0.0277
	(-0.0258)
Municipality	0.0703
	(-0.0975)
Income	-0.0221
	(-0.0937)
Constant	0.691**
	(-0.281)
Observations	376
R-squared	0.054
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Source: Author's own from field-work (July/August 2019)

4.5 Linear Probability Model estimates

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Table 8: Linear Probability Model (LPM) estimates of perceived environmental knowledge of household heads/farmers

Variables	Perceived Environmental Knowledge Score
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	(-0.0067)
Male	**0.308****
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Education	**0.0591**
	(-0.0454)
Years of farming experience	0.00085
	(-0.0072)
Marital Status	0.108
	(-0.101)
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	(-0.0937)
Constant	0.691**
	(-0.281)
Observations	376
R-squared	0.054
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Source: Author's own from field-work (July/August 2019)

4.6 Environmental responsibility

Using a five-point Likert scale with 1= strongly agree, 2= agree, 3= neutral, 4= disagree, and 5= strongly disagree, the 376 farmers and the 200 students were asked to identify who they think should take up the responsibility of finding solutions to the environmental problems in the Municipality/Ghana. Tables 9 and 10 summarizes respondents' choices. 64.10% of farmers (household heads) strongly agree that the greater responsibility should be placed on the head of the central government and the municipal authorities, followed by individual citizens with 50.27%. The farmers put the major environmental responsibility on the government rather than the individual citizens, business and industry, and agriculture and forestry that created the environmental mess.

In another twist, 65.5% of the students think the individual citizens should rather take the leading role in addressing the environmental challenges. They placed the environmental responsibility on government/municipal authority after the individuals followed by agriculture and forestry. Their choice indicates that they are more ready to correct the mess created than to rely on the central and municipal governments for a solution. Moreover, given 64.5% to the central/municipal government and 65.5% to the individuals reveals their belief in stakeholder approach to environmental sustainability.

Table 9: Household heads sense of Environmental responsibility

Environmental responsibility	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Business and Industry	112(29.79)	139(36.97)	8(2.13)	64(17.02)	53(14.10)
Government/Mun. Ass.	241(64.10)	109(28.99)	0(0.00)	21(5.59)	5(1.33)
Individual citizens	189(50.27)	153(40.69)	0(0.00)	24(6.38)	10(2.66)
Agriculture and forestry	172(45.74)	155(41.22)	4(1.06)	34(9.04)	11(2.93)

Source: Author's own from field-work (July /August 2019).
Data is presented as a figure with the corresponding percentage in parenthesis

Table 10: SHS students' sense of Environmental responsibility

Environmental responsibility	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Business and Industry	60(30.00)	90(45.00)	1(0.50)	35(17.50)	14(7.00)
Government/ Mun. Ass.	129(64.50)	60(30.00)	2(1.00)	8(4.00)	1(0.50)
Individual citizens	131(65.50)	59(29.50)	1(0.50)	6(3.00)	3(1.50)
Agriculture and forestry	70(35.00)	93(46.50)	8(4.00)	21(10.50)	8(4.00)

Source: Author's own from field-work (July /August 2019).
Data is presented as a figure with the corresponding percentage in parenthesis

4.7 Sources of environmental information

Table 11 shows a summary of the environmental information sources provided by the two groups surveyed. There were variations between the two groups when they were asked to choose their sources of environmental education. They were to choose from education. Table 11 shows a summary of the environmental information sources provided by the two groups surveyed. There were variations between the two groups when they were asked to choose their sources of environmental education. They were to choose from education, newspaper, ration/TV, internet, and other sources. Among the farmer-based group, radio/TV came out on top with 57.98%, followed by education with 32.71% and newspaper with 8.51%. The internet as a source of environmental information was chosen by only 0.27%. The results show that the older generation is glued to traditional information sources. The choice of the environmental information sources of the SHS students was evident as 64% choose education as their primary source, followed by radio/TV with 22% and internet with 11%. Only 1% of SHS students choose newspapers as their source of environmental information.

Table 11: Sources of Environmental information

Sources	Household heads (%)	SHS students (%)
Education	32.71	64
Newspaper	8.51	1
Radio/TV	57.98	22
Internet	0.27	11
Others	0.53	2

Source: Author's own from field-work. (July /August 2019)

4.8 Opinion on Ghana's environmental condition in the next five years

The results of the question relating to Ghana's environmental condition in the next five years is given in table 12, 81.91% and 94% of farmers and students respectively opine that Ghana's environment in the next five years is likely to worsen compared to 18.09% and 6% of household heads (farmers) and students, respectively, who think otherwise.

4.9 Availability to equip oneself to save the ailing environment

In assessing the respondents' readiness to avail themselves to be trained and be equipped to face the environmental challenges, table 13 presents responses from respondents. 81.65% and 98.5% of farmers and students indicated that they would avail themselves to be well equipped to attend to the environment.

Table 12: Opinion on Ghana's environmental condition in the next 5 years.

Condition	Household heads	SHS students
Better	18.09%	6.00%
Worse	81.91%	94.00%

Source: Author's own from field-work. (July /August 2019)

Table 13:Availability to equip oneself to save the ailing environment.

Availability for training	Household heads	SHS students
Yes	81.65%	98.50%
No	18.35%	1.50%

Source: Author's own from field-work. (July /August 2019)

5. Discussion

The small number of farmers with tertiary education suggests that the higher the educational attainment of a farmer the less he/she depends on farming activities as they may have other formal jobs as a source of income. This reflects a weeding culture in the Ghanaian school system where weeding is used as punishment in schools. This has created the notion that the higher one climbs the educational ladder, the higher the possibility of substituting farming for a more formal and higher income-generating job.

Dedicating a subject dubbed "Environmental Studies" in Ghana primary schools has significantly influenced their awareness of environmental issues. Moreover, the redesigning subjects called "Our World Our People" and "Citizenship Education" for the lower and upper primary, respectively, and social studies for the JHS and SHS levels would further broaden their knowledge in environmental issues. The inclusion of environmental education in the most recent education curriculum and environmental reporting segment on TV/radio stations across the country has made the younger generation more attentive to the possible threats that await them as they prepare themselves to inherit the already deplorable environment which may threaten their survival.

In targeting the younger generation to improve their environmental awareness, newspapers should not be the targeted medium as most students hardly read newspapers compared to other sources of environmental information. The most important medium to spark environmentalism among the younger generation is through formal education; it is more effective when basic and secondary education is free. This permits all children of school-going age to be enrolled and access such education.

The results from the survey indicate that males in the farmer and SHS students group have more awareness/consciousness about environmental issues than their female counterparts. It is expected that females become more knowledgeable than males due to their active engagement in household-oriented pro-environmental activities. Moreover, females' socialization pattern is expected to influence a higher level of knowledge in the environment, but this survey proves otherwise. The socialization orientation of males coupled with their desire to dominate the environment could be a reason for higher awareness. Also, females are not likely to take leading roles or to have a higher interest in pro-environmental public behaviors but their male counterparts usually lead to such endeavors.

Interestingly, other studies found pollution to be the number one environmental concern and the most commonly talked about (Heaton & Burns, 2014). The younger generations' availability to equip themselves to face what awaits them in the future is enough to bring environmental education to another level. Having accepted to be trained through education signifies that improved access to education with environmental content is the surest way to deal with future uncertainties to ensure sustainable development.

The cumulative percentage performance analysis revealed that SHS students scored higher in environmental knowledge (79.50%) than the older generation (76.32%). Even among the household heads, scores show that the younger age group of 18-40 demonstrated a high level of knowledge with 83.87% compared to 75.32% of the older 41-60-year group, much older 75% of the 61-80-year group, and 66.66% of the oldest group of the above 80 years. Using the cumulative percentage performance, age plays an important role.

Other results indicate that 65.5% of the younger generation would like to take the leading role in addressing the environmental challenges as they place environmental responsibility on the shoulders of the individual citizens rather than the local/municipal authority. On the other hand, 64.10% of farmers (household heads) strongly agree that it is the responsibility of the central government and the municipal authorities. This suggests that the younger generation is more motivated and exposed to the reality of environmental issues and problems.

The Linear Probability Model indicates that being a male and a farmer residing at Abuakwa North Municipality increases the probability of household head (farmers) having a higher perceived environmental knowledge score controlling other demographic characteristics. Also, the coefficients of "female" and "SHS grade" are statistically significant at a 5% and 1% level of

significance for SHS group model specification, respectively. The results indicate that being a female decrease the probability of having perceived environmental knowledge controlling other demographic characteristics. Whiles being enrolled in an SHS increases the probability of having perceived environmental knowledge controlling other demographic characteristics.

The younger generation appeared to be more responsible and are ready to take up the mantle of giving a new face to the environment by opting to place the environmental responsibility on their shoulders rather than putting on the central government, municipal and local authorities. Furthermore, over 98% of the students indicated their readiness to acquire the needed skills and knowledge to change the negative environmental outlook to a positive one. The linear probability model shows that being enrolled in an SHS increases the probability of having perceived environmental knowledge controlling other demographic characteristics.

In response to the results above and in the spirit of achieving environmental sustainability, it is obvious that the younger generation has the motivation, improved environmental awareness, and is available to gain more knowledge and skills to become and raise an environmental generation. These meet the requirements of the three most important elements of the Environmental Generation Framework. A youthful generation that is conscious of their environment and the consequences of human activities towards the environment would prioritize acquiring and gathering knowledge and skills to save the environment from deteriorating. The introduction of the Environmental Generation Framework is apt to spark environmentalism among the younger generation or to raise an environmental generation to achieve sustainable development. This will serve as policy support in administering policies towards the younger generation (Naidoo & Xollie, 2011; Öktem, 2010).

6. Conclusion

One of the possible ways of mitigating and adapting to climate change is through environmental education. The current and next generations have been the target, but it is still unclear whether the main focus should either be on the current or the next generation. Despite advances in this area of studies, it is unclear whether such environmental education should be centered on the current or the next generation. Moreover, none of the studies analyzes environmental awareness levels on the two generations from the same data source. This paper analyses perceived environmental knowledge of both the current and future generations, assesses their sense of environmental responsibility, sources of environmental information, and their availability to acquire environmental knowledge to prevent further spreading the current environmental mess.

Linear Probability Model estimates of perceived environmental knowledge indicate that being a male increases the probability of having perceived environmental knowledge by 30.8 percentage points, controlling other demographic characteristics. Whiles being enrolled in a Senior High School (young generation) increases the probability of having perceived environmental knowledge by 30.8 percentage points. Furthermore, over 98% of the students indicated their availability to better equip themselves to confront the deteriorating environment compared to 81% of the older generation. The results revealed that the younger generation has the *motivation*, readily available to gain more *knowledge and skills* to become and raise an environmental generation. However, the coefficient of age is positive but not statistically significant due to the small sample size. Education among the household heads was also positive but not significant due to the large number of farmers who have either no education or a lower level of education and the small sample size.

At this point, it was evident that the younger generation has the motivation, improved environmental awareness, the basic environmental knowledge and is available to gain more knowledge and skills to become and raise an environmental generation. Therefore, we can conclude that the emphasis should be on the younger generation but not sidelining the current generation. However, differentiation in environmental education is encouraged to achieve some targeted objectives at each level of education.

The study contributes to the existing literature by defining clearly why the younger generation should focus on attention as far as environmental education and awareness are concerned. With the younger generation been abreast of environmental issues and their negative impacts on the three pillars of sustainable development, we could reduce human-related activities that put the earth in danger, increase environmental well-being, and brightens the next generations' chances of a sustainable future. Larger sample size is recommended to validate and apply the environmental generation framework.

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