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Culture of peace and care for the Planet Earth as predictors of students' understanding of chemistry concepts

Ngozi Okafor

[a] *Department of Science and Technology Education*
University of Lagos, Akoka, +2348037121842, Nigeria

Abstract

This study focused on how culture of peace and care for the planet earth variables predicted public coeducational secondary school students understanding of chemistry concepts in Anambra State of Nigeria. Three research questions guided the study. It was a survey and correlational research designs that involved sample of 180 drawn from six schools through a three-stage sampling procedures. Culture of Peace and Care for the Planet Earth Questionnaire (CPCPEQ) and Chemistry Understanding Test (CUT) were used for data collection. Their validity and reliability were determined using Cronbach alpha and Kuder-Richardson formula 20 which gave indices of r=.71 and r= 0.78 respectively. Linear regression and bivariate correlation analyses as well as One-way analysis of variance (ANOVA) were used in data analysis. The results showed that for culture of peace, tolerance significantly predicted higher chemistry concepts scores while social movement significantly predicted lower concepts scores on chemistry understanding test. On care for the planet earth, adjusting thermostat significantly predicted higher scores while saving water significantly predicted lower scores on chemistry understanding test. The study recommended setting- up of Visionary Chemists for Environment and Peace Culture (VCEPC) in all schools that would sensitize students on how to shun hostility, indoctrination and embracing effective methods of waste disposal. It concludes that everybody should go green, plant more trees, and promote mutual understanding, tolerance, peaceful co-existence and friendly environments as fundamental tips of peace culture and care for the planet earth that foster meaningful understanding of chemistry concepts among secondary school students.

Keywords: Waste control, Tolerance, Understanding Test, Scores

1. Introduction

1.1. The problem

Early exposure of students to chemistry education is very important because it could foster: positive attitude; environmental knowledge; respect for unity and culture in diversity and social cohesion in coping with the challenges of the global world. Students' of today deserve all round chemistry education that does not glorify war but peace and careful management of the environment. The curriculum developers in Nigeria have observed the problem associated with the waste management, violence

and ethnic conflicts and thus have made provisions for its inclusion in the school curriculum. Every day, the atmosphere is polluted by the emissions of carbon (IV) oxide, methane, oxides of nitrogen and other pollutants. These emissions change the balance of gases in the atmosphere and cause climate change, global warming and degrade the ozone layer. Chukwuka (2014) insists that every individual should acquire knowledge of environmental issues and other factors harming the planet earth. Flaring of gases by some oil companies have also led to the environmental degradation (black rain drops). In Nigeria, oil spillages damage the community farmland, pollute the air and destroy the ecosystem. Most times the oil prospecting companies fail to care for the host community environments thus resulting to disputes and conflicts. Existing conflicts among communities, ethnic groups, schools and homes worldwide cannot be adequately tackled if culture of peace characteristics are not practiced and sustained in the school system (Akaamaa, 2013). He further emphasized that culture of peace should be upheld at all educational levels in Nigeria because of the existing conflicts among communities, ethnic groups, schools/classrooms and homes worldwide. Research studies on peace education explained that culture of peace is a major component in reconciling group identities within a frame work of social cohesion as to promote peaceful co-existence, confidence, cooperation and tolerance (King 2010 & Niroula, 2010). Uhemba (2013) described culture of peace as the fundamental human rights, self- awareness, trust, freedom from fear, non-confrontation, non-indoctrination and conflict resolution. The United Nations (UN) programme of actions in promoting culture of peace and goals of education stipulates *"actively promoting a culture of peace, respect for one another regardless of belief, culture, language …"* (Niroula, 2010 & UN,2013). These demand creating a range of cultural thought, tolerance, experiences, positive self-esteem, confidence, trust, cooperation and love among students that may foster conceptual understanding during the classroom activities for better academic achievement. Similarly, the environmental educators pointed that the planet earth is in grave danger and at the risk of destruction if human activities are not adequately checked (Chukwuka, 2014, Spitzer, 2009 & Wilson 2008). They stated that it is no longer an option to live without care for the planet earth since pollution has grown to its critical proportion and must be properly understood and addressed through proper education.

1.2. World's conceptual views about education on peace and care for the Earth

The right to education was recognized when the World Declaration on Education for All (EFA) was adopted at a World Conference on Education in Jomtien, Thailand, in 1999 (UNESCO, 2000).The conference declaration reference was on deficiencies of qualitative education that must be improved upon. The report suggested a framework of improvement on conceptual understanding that covers the interrelated components of the education system. Conceptual understanding must be constructed in the learners' cognitive structure and utilized in daily experiences if meaningful learning would take place (Okafor & Olayemi, 2014; Warren & Rosebery, 2011). Ban Ki-moon (2012) further, posited that, through education; children are taught not to hate, core

values are strengthened, leaders with wisdom, compassion are raised and lasting culture of peace are established. He further asserted that the absence of peace has caused sufferings, citing not only open conflicts, but also the deadly effect of discrimination, terrorism and human rights abuses around the world. Uhemba (2013) suggested that action on the culture of peace should be taken by all educators to ensure that school children learn in the environment that is devoid of unhealthy confrontation and human rights abuses. King (2010) explained that culture of peace is a major component in reconciling group identities within a frame work of social cohesion that promotes peaceful co-existence and tolerance. These demand creating a range of cultural thought, tolerance, experiences, positive self-esteem, confidence, cooperation and love among chemistry students that would foster conceptual understanding during the classroom activities. Chukwuka, (2014) stated that through proper education people would be aware that carpooling allows sharing the cost of gas by cutting expenses to 50% or more and thus reducing air pollution. He outlined some effective ways of caring for the planet earth such as planting of more trees, recycling of reusable materials, avoiding plastics that do not bio-degrade, turning off electrical appliances not in-use and keeping environment clean from pollutants and other solid wastes. Emphasis was laid on switching off car engine while waiting for the traffic signal to go green because, it reduces emission of carbon (II) oxide and other harmful gases (Wilson, 2008). These are part of knowledge which secondary school chemistry students are directly and indirectly exposed to in their environments.

1.3. Purpose and research questions

Some secondary school chemistry students have difficulties in understanding some concepts in chemistry in spite of their consciously and unconsciously exposure to some culture of peace and care for the planet earth variables both at home and in the school settings. Inadequate knowledge of environmental problem and issues in conflict resolution which are built up in their curriculum could be attributable to poor understanding of chemistry concepts. Some studies have identified challenges of secondary school students understanding of chemistry concepts and learning outcomes such as representation of concepts at the microscopic and macroscopic levels (Okafor, Yewande & Okedele, 2014); poor awareness that over 2,300 chemicals detected in drinking water could cause cancer (Spitzer, 2009 & Wilson, 2008); inadequate laboratory utilization (Okafor & Uzoechi (2012); ineffective teaching methods (Okafor 2014; Okafor, 2013a & 2013b; Okafor & Umoinyang, 2008) and attitudes to proper disposal of solid wastes (Chukwuka, 2014). The objectives of this study therefore was to explore and identify the culture of peace and care for the planet earth variables that significantly predicted higher and lower scores of secondary school chemistry students in understanding of concepts and also to ascertain the extent to which gender was a contributing factor.

The specific research questions for the study were:

RQI: What are the culture of peace variables that significantly predict students higher and lower scores in Chemistry Understanding Test (CUT)?

RQ2: What are the care for the planet earth variables that significantly predict students higher & lower scores in CUT?

RQ3: To what extent could the effect of gender on culture of peace and care for the planet earth variables significantly predict students' higher & lower scores in CUT?

However, literature is sparse on the predictive effects of culture of peace and care for the planet earth on secondary school students understanding of chemistry concepts. A contribution in that direction could promote cultural solidarity, foster harmony, promote proper wastes management and improve conceptual understanding among secondary school chemistry students in Anambra State of Nigeria.

2. Method

2.1. Sampling procedures

The population consisted of all the public coeducational SSS1 chemistry students from six educational zones of Anambra State in Nigeria. A three-stage sampling procedure was conducted. Firstly, two educational zones that have 70% of coeducational schools were purposively selected. Secondly, simple random sampling technique was used in selecting three schools in each zone that have two or more chemical based industries. Lastly, in each of the schools, the class that has more than 30 students was randomly selected.

2.1.1. Sample size

A total sample of 180 students from six public coeducational schools participated in the study. The sample size however did not differ in any way from the target population.

2.1.2. Measures and covariates

Culture of Peace and Care for the Planet Earth Questionnaire (CPCPEQ) and Chemistry Understanding Test (CUT) were used for data collection. The independent variables were measured on CPCPEQ statements that had four point likert scales of Strongly Agree; Agree; Strongly Disagree and Disagree respectively. CPCPEQ was in three sections. Section A included items on students gender and age (see appendix 1). Sections B and C, contained twenty statements in each that measured Culture of Peace and Care for the Planet Earth respectively (see appendix 1). CPCPEQ was developed by the researcher and every item was reviewed by the chemistry education evaluator. Its reliability was determined using Cronbach alpha which gave an index of r=.71 indicating its internal consistency. It was trial-tested on 50 secondary school chemistry students of two private schools that did not form part of the study.

CUT included nineteen (19) items that involved multiple choice and short answer / completion with a total score of twenty-seven (27) points (see appendix 11). The total

scores of students earned points were used to measure the dependent variable of understanding of chemistry concepts. Content validity of CUT was established by chemistry education expert in test development who reviewed the content and found the items indicative of understanding of chemistry concepts. Construct validity was also established by conducting factor analysis on a pilot sample. Based on the data of the final sample, Kuder-Richardson formula 20 was used for the conceptual understanding of chemistry concepts scale and was found to be 0.78. According to DeVellis (2012), scales with reliability indices between 0.65 and 0.70 are minimally acceptable, between 0.70 and 0.80 respectable, and above 0.80 very good. Thus the scale of understanding of chemistry concepts with a reliability of 0.78 was accepted. The respondents were then given the survey questionnaires or CPCPEQ to complete and the Chemistry Understanding Test (CUT) to attempt (see appendices 1 and II).Research design

2.1.3. Research design

The study adopted descriptive survey and correlation research designs. There was no treatment and manipulation of variables but efforts were made in ascertaining the directions of correlation between the independent variables. Concepts were drawn from two themes (chemistry & industries and chemistry & environment) as contain in the Senior Secondary School 1 (SSS1) chemistry curriculum.

2.1.4. Data analysis

A bivariate correlation analysis was used to identify significant predictors related to culture of peace and care for the planet earth on the dependent variable. One-way analysis of variance (ANOVA) was performed to indicate linear relationship among the predictor variables as well as criterion variable. Then, the identified significant independent variables from the correlation matrix were subjected to a step-wise linear regression analysis to identify a smaller set of significant predictors of the dependent variable. Statistical Package for Social Scientist (SPSS) version 18.0 was used to conduct the above correlation and regression analysis.

3. Result

The analysis of the findings is delineated from the results of the research questions as stated below.

3.1. Research Question1:

What are the culture of peace variables that significantly predict students higher and lower scores in Chemistry Understanding Test (CUT)?

Table 1. Model Summary-Analysis of Variance Table of Culture of Peace Variables Predicting Higher Chemistry Concepts Scores

Mode	**R**	**R^2**	**$R^2_{Adjusted}$**	**$F_{7, 172}$**	**Sig. of P.**
1-8	.696	.484	.482	12.457	.000

Table 1 shows that eight culture of peace variables such as: tolerance, collaboration, self-esteem, confidence, openness, conflict prevention, creativity and equitable resource distribution significantly predicted higher chemistry concepts scores in chemistry understanding test ($F (7, 172) =12.457$, $P<0.05$, $R^2_{Adjusted}=.482$). The squared correlation when adjusted indicates that the eight variables accounted for 48.2% of the variance.

Table 2. Table of Coefficient of Higher Chemistry Concepts Scores

Variables	**B**	**Standard Error**	**Beta**	**t-value**	**Sig. of P.**
Constant	18.867	1.463		12.762	.000
Working together	.864	.302	.150	2.861	.005
Self-esteem	.958	.333	.151	2.880	.004
Openness	.697	.282	.129	2.472	.009
Confidence	.786	.287	.143	2.739	.007
Conflict prevention	1.043	.453	.121	2.302	.016
Tolerance	1.334	.397	.176	3.361	.001
Creativity	1.136	.425	.140	2.673	.008
Equitable resource Distribution	0.754	.346	.114	2.179	.036

Significant at p < .05 level

Table 2 shows the culture of peace variables that significantly contributed to higher scores in chemistry understanding test. Tolerance for peace to reign was the most significant predictor of higher chemistry scores (ß=.176, t= 3.361, p<.05). The beta value indicates that for every unit positive change in tolerance, there is a corresponding increase of 0.176, higher score on chemistry understanding test. This was followed by self-esteem and working together (self-esteem: ß=.151, t= 2.880, p<.05; working together: ß=.150, t= 2.861, p<.05). The beta values for self-esteem and working together are indications that for every unit change in self-esteem and working together, there was a corresponding positive change of .151 and .150 respectively on higher scores of chemistry understanding test respectively among others.

Table 3. Model Summary-Analysis of Variance Table of Culture of Peace Variables Predicting Lower Chemistry Concepts Scores

Mode	R	R^2	$R^2_{Adjusted}$	$F_{6, 173}$	Sig. of P.
1-7	.623	.388	.327	8.639	.000

Table 3 indicates seven culture of peace variables that significantly predicted lower concepts scores in chemistry understanding test which include: social movement, satisfaction, freedom from fear, peaceful marriage, status placement, non-violent communication and resolution training that show the following (F (6, 173) =12.457, P<0.05, $R^2_{Adjusted}$=.327). The squared correlation when adjusted indicates that the seven significant variables accounted for 32.7% of the variance.

Table 4. Table of Coefficient of Lower Chemistry Concepts Score

Variables of P.	B	Standard Error	Beta	t-value	Sig.
Constant	14.653	1.234		11.874	.000
Satisfaction	.754	.302	.149	2.497	.008
Social movement	1.345	.396	.203	3.396	.000
Freedom from fear	.564	.271	.124	2.081	.056
Peaceful marriage	.956	.347	.165	2.755	.004
Status placement	.686	.293	.140	2.341	.014
Non-violent comm.	.789	.325	.145	2.428	.011
Resolution training	.691	.290	.142	2.383	.013

Significant at p < .05 level

It can be observed from Table 4 that seven culture of peace variables significantly contributed to lower concepts scores in chemistry understanding test. Social movement was the most significant predictor of lower chemistry concept score (ß=.203, t= 3.396, p<.05). The beta value indicates that for every unit positive change in social movement, there is a corresponding increase of 0.203 in lower scores on chemistry understanding test. Next significant predictors of lower concept scores were: peaceful marriage and satisfaction (peaceful marriage: ß=.165, t= 2.755, p<.05; satisfaction: ß=.149, t= 2.497, p<.05). The beta values for peaceful marriage and satisfaction are indications that for every unit change in each, there was a corresponding positive change of .165 and .149 respectively in lower scores of chemistry understanding test and among others.

3.2. Research Question 2:

What are the care for the planet Earth variables that significantly predict students higher and lower scores in Chemistry Understanding Test (CUT)?

Table 5. Model Summary-Analysis of Variance Table of Care for the Planet Earth Variables Predicting Higher Chemistry Concepts Scores

Mode	R	R^2	$R^2_{Adjusted}$	$F_{6, 173}$	Sig. of P.
1-7	.893	.798	.794	231.998	.000

Table 5 shows that seven care for the planet earth variables such as: adjusting thermostat, energy saving bulbs, switch off/unplug, proper vehicle maintenance, recycling metals, glass and newspaper, use of less pesticides, herbicides or chemical fertilizers significantly predicted higher scores in chemistry understanding test (F (6, 173) =231.998, P<0.05, $R^2_{Adjusted}$=.794). The squared correlation when adjusted indicates that the seven variables accounted for 79.4% of the variance.

Table 6. Table of Coefficient of Higher Chemistry Concepts Score

Variables	B	Standard Error	Beta	t-value	Sig. of P.
Constant	20.086	1.353		14.7848	.000
Energy saving bulbs	3.901	.322	.391	12.099	.000
Switching off/unplug	.799	.186	.117	4.293	.000
Adjusting thermostat	7.691	.514	.620	14.957	.000
Vehicle maintenance	.903	.171	.137	5.287	.000
Rechargeable batteries	2.101	.269	.240	7.801	.000
Less pesticides & fert.	2.056	.214	.293	9.624	.000
Recycling materials	2.767	.274	.420	10.104	.000

Significant at p < .05 level

Table 6 shows care for the planet earth variables that significantly contributed to higher scores in chemistry understanding test. Adjusting thermostat was the most significant higher predictor of chemistry concepts scores (ß=.620, t= 14.957, p<.05). The beta value indicate that for every unit positive change in adjusting thermostat, there is a corresponding increase of 0.620 in higher score on chemistry understanding test. These were followed by recycling materials and energy saving bulbs (recycling materials: ß=.420 t= 10.104, p<.05; energy saving bulbs: ß=.391, t= 12.099, p<.05) and among others. The beta values for recycling materials and energy saving bulbs are indications that for every unit change in recycling materials and energy saving bulbs, there was a corresponding positive change of .420 and .391 respectively in higher scores on chemistry understanding test.

Table 7. Model Summary-Analysis of Variance Table of Care for the Planet Earth Variables Predicting Lower Chemistry Concepts Scores

Mode	R	R^2	$R^2_{Adjusted}$	$F_{6, 173}$	Sig. of P.
1-7	.848	.721	.715	129.811	.000

Table 7 shows that seven care for the planet earth variables such as: saving water, cut one tree and plant two, limit family size, save animals, go vegetarian, buy recycle products and buy organic foods significantly predicted lower scores on chemistry understanding test (F (6, 173) =229.811, $P<0.05$, $R^2_{Adjusted}=.715$). The squared correlation when adjusted indicates that the seven variables accounted for 71.5% of the variance.

Table 8. Table of Coefficient of Lower Chemistry Concepts Score

Variables	B	Standard Error	Beta	t-value	Sig. of P.
Constant	25.033	1.766		14.179	.000
Limit family size	2.436	.222	.354	10.975	.000
Saving water	2.728	.201	.400	13.562	.000
Buy organic food	1.920	.225	.300	8.529	.000
Buy recycle products	1.643	.214	.232	7.679	.000
Save animals	2.595	.384	.215	6.756	.000
Plant more tree.	1.338	.266	.162	5.030	.000
Go vegetarian	2.400	.500	.154	4.800	.000

Significant at p < .05 level

It can be observed from Table 8 the care for the planet earth variables that significantly contributed to lower scores in chemistry understanding test. Saving water was the most significant lower predictor of chemistry concepts scores (ß=.400, t= 13.562, p<.05). The beta value indicates that for every unit positive change in saving water, there is a corresponding increase of 0.400 in higher score for chemistry understanding test. This was followed by limit family size and buy organic foods (Limit family size: ß=.354 t= 10.975, p<.05; buy organic foods: ß=.300, t= 8.529, p<.05). The beta values for limit family size and buy organic foods indicate that for every unit change in each, there was a corresponding positive change of .354 and .300 respectively in lower score on chemistry understanding test.

3.3. Research Question 3:

To what extent could the effect of gender on culture of peace and care for the planet earth variables significantly predict students' higher and lower scores in chemistry understanding test?

Table 9. Test of Model Coefficients and Classification Values

	Chi-square	**Df**	**Sig.**
Omnibus Test	11.031	3	.012
Hosmer-Lemeshow Test	4.821	8	.705

Cox & Snell R Square =.287 **Nagelkerke R Square = .496**

The overall percentage of correctness of classification is tabled to be 86.7%. Table 9 shows the chi-square value for the omnibus test indicating the model that significantly predicts group membership (χ^2=11.031, df=3, p<.05). Hosmer-Lemeshow test shows that the model is good with respect to the agreement between the observed outcomes and the predicted outcomes ((χ^2=4.821, df =8, p> .05). If p is less than 0.05 then the model does not adequately fit the data and it means that logistic regression being contemplated is better not done. Cox & Snell R Square indicated that the variance accounted for the predictors in relation to the criterion. This index indicated a 28.7% variance while Nagelkerke R Square indicated 49.6% variance that was accounted for. The overall classification shows that the model was correct for about 86.7% in classifying students into higher and lower chemistry concepts.

Table 10. Summary of Model Variables

Variables	**B**	**SE**	**Wald**	**df**	**Sig.**	**Exp. (B)**
Care for Planet Earth	-.314	.107	8.640	1	.003	1.002
Gender	002	.024	.004	1	.948	.731
Culture of Peace	.694	.236	8.643	1	.003	2.002
Constant	1.344	1.661	.654	1	.419	3.834

Significant at p<.05

Table 10 shows that the Wald statistic (W) analogous to test-statistic is in logistic regression. Care for the planet earth and culture of peace variables significantly predicted higher and lower concepts scores in chemistry understanding test (Care for planet Earth: W=8.640, p<0.05, Exp (B) =1.002; Culture of Peace: W= 8.643, p<0.05, Exp (B) =2.002). The exponential B provides an alternative method of interpreting the regression coefficient. The care for the planet earth can be interpreted to be that as one unit increases in the predictor, the students who have higher chemistry concepts scores increase by 1.002 while that of the culture of peace one unit increase implies the odds of the students being classified into higher chemistry concept score increases by 2.002.

In summary, care for the planet earth and culture of peace variables significantly predicted higher and lower chemistry concepts scores. Tolerance among students was the most significant contributor to higher chemistry concept score under culture of peace variable while social movement was the most significant lower predictor. Similarly, adjusting thermostat was the most significant higher predictor of chemistry concepts scores while saving water was the most significant lower predictor of chemistry concept scores on the care for the planet earth. Gender was not a factor to be considered in the prediction of higher or lower scores on chemistry understanding test for the culture of peace and care for the planet earth variables respectively.

4. Discussion

4.1. Effects of culture of peace variables on students understanding of chemistry concepts

In this study, a significant higher scores in chemistry understanding test were obtained among tolerance, self-esteem, working together, confidence, creativity, openness, conflict prevention and equitable resource distributions as shown in Table 2 of the culture of peace variables (tolerance>selfesteem>workingtogether>confidence> creativity>openness>conflictprevention> equitable resource distribution). It supports this author's assertion that creating cultural thought, tolerance, experiences, positive self esteem, confidence, cooperation and love among chemistry students could foster conceptual understanding during the classroom activities. It is also in line with the United Nations (UN 2013) resolutions that peace and non-violence should be promoted through education by revising curriculum to integrate tolerance, cooperation, dialogue, respect for human rights among others (Uhemba, 2013). In addition, the study has proved Ban Ki-moon (2012) statement that, through education; children are taught not to hate, core values are strengthened and leaders with wisdom and compassion are raised thereby establishing lasting culture of peace. Since the above predicted higher scores in chemistry understanding, therefore families, schools and every Nigerian should promote those variables for healthy living and learning outcomes improvement of school children. When adequately imparted on the students, they could also be the subtle weapons for reducing drop-out rates, fighting cultism and other social vices being upheld by some of the students due to poor educational background. Therefore chemistry teachers should strengthened the above virtues among the students since the school environment that is free from conflict would enhance students' performance and meaning understanding of concepts. In addition, social movement, peaceful marriage, satisfaction, non-violent communication, resolution training, status placement and freedom from fear as shown in Table 4 of the culture of peace variables were most significant lower predictors of concept scores in chemistry understanding test. The lower prediction of the above variables could be due to students ignorant of the variables as they interact with their environment. This contradicts Uhemba (2013) statements be describing the culture of peace as fundamental human rights, awareness of self, trust and openness, freedom from fear and socialization, non-confrontation, non-indoctrination, conflict resolution, cultural norms and values since some

of these variables were lower predictors of chemistry concepts scores. In addition, some students are hardly aware of what happens around them, thus efforts should be made to expose them further on how to embrace those variables for adequate conceptual understanding.

4.2. Effects of care for the planet earth on students understanding of chemistry concepts.

The results presented in Table 6 suggest that adjusting thermostat, recycling materials, energy saving bulbs, less pesticides & fertilizer, rechargeable batteries, vehicle maintenance and switching off/unplug significantly predicted higher scores in chemistry understanding test. On the other hand, saving water, limiting family size, buying organic foods, buying recycle products, saving animals, planting more trees and going vegetation significantly contributed to lower scores in chemistry understanding test as shown in Table 8. The results corroborate with Chukwuka (2014) statements that many people do not realise the harm done to the planet earth by idling car that wastes gas and pours pollutants into the environment. Also, chemistry students should be taught environmental challenges using every day experiences for performance improvement (Warren & Rosebery, 2011). This also supports some researchers position that awareness on the need to adjust thermostat, carpooling, recycling materials, energy saving bulbs, less pesticides and fertilizer, rechargeable batteries, vehicle maintenance among others can be socially economical as well as reducing pollutants in the environment (Spitzer, 2009; Wilson, 2008).

5. *Conclusions*

Peace culture and care for the planet earth are the means to remain afloat in conceptual understanding through chemistry education. It is fun to practice and sustain tolerance, positive self- esteem, cooperation and conflict prevention which foster sense of accomplishment. It is also imperative that chemistry students should acquire adequate knowledge of their environments especially in saving bulbs/electricity, water and vehicle maintenance which are relevant to some chemistry concepts taught in the classroom setting. Everyone is encouraged to go green, plant more trees to add more life to the planet earth. Also, promoting mutual understanding, tolerance, peaceful co-existence and friendly environments are fundamental tips of peace culture and care for the planet earth that foster meaningful understanding of chemistry concepts among secondary school students.

6. *Recommendation*

Based on the findings of this study, the following recommendations are hereby proffered:

- All education stakeholders in Nigeria and Anambra State in particular should uphold the teaching of tolerance, self-esteem, cooperation, confidence, creativity, openness, conflict prevention, non-violent communication,

resolution training among others to the students as to enhance concepts understanding, waste control and violence prevention.

- Schools and families should continuously create awareness on factors that negate care for the planet earth, culture of peace and possible ways of saving the earth from damage and violence.
- Chemistry teachers should educate students on recycling, reducing consumption and re-using waste materials, how to avoid plastics consumption because when they breakdown, they do not bio-degrade but photo-degrade. Noting that break-down of such plastics into fragments readily soak up toxins, contaminate soil and water ways, thereby pollute the environment by entering the food chain.
- Chemistry students should be committed to keeping their homes, the neighbourhood and schools neat as to give the generation yet unborn a better life in the future.
- Visionary Chemists for Environment and Peace Culture (VCEPC) should be set up in all educational institutions that would promote such virtues as: tolerance, creativity, conflict prevention and harmony in Nigeria. It would also be an establishment whereby students acquire knowledge on effective methods of waste disposal through volunteer commitments.
- Pollution control should be enforced by Anambra State government and school authorities as to give better life to children that would live on the planet earth in the generation yet to come.
- Peace Culture and Planet Earth (PCPE) one month certification programme should be set-up so that on completion, participants would develop their own projects in their community, passing on the skills learnt to other people that are not privileged.

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Appendix A.

Inventory on Culture of Peace (CP) and Care for the Planet Earth (CPE)
Instruction
Thanks in advance for your responses, Kindly express your thought freely on the following items on Culture of Peace and Care for the Planet Earth.
Section A
Biodata:
Please make a tick( ) of your choice from the provided options.
1.Gender A. Male ( ) B. Female ( )
2. Age (a) 11-13yrs ( ) (b) 14-16 yrs ( ) (c)17-19 yrs( )

Instruction
Please tick your response in the column that corresponds to your true feelings about the statements in Sections B and C respectively on the Four Point Likert Scale;
A = Agree; SA = Strongly Agree; D =Disagree; SD= Strongly Disagree.

S/N	**Section B: Culture of Peace**	SA	A	D	SD
1.	Individuals that work together build support for peace culture.				
2.	Respect to individual's personality boosts its self esteem				
3.	Peaceful relationship fosters confidence and trust				
4.	Openness is synonymous to peaceful co-existence.				
5.	Individuals should tolerate each other for peace to reign.				
6.	Conflict prevention is better than war.				
7.	Creativity promotes sustainable culture of peace				
8	Equitable resource distribution brings unity and peace to a nation.				
9	Active citizenship is next to peaceful coexistence.				
10	.Awareness of self (mind, body, emotion and spirit) promotes culture of peace				
11	Positive life transformation can foster peace in an individual				
12	Consciousness and social participation are likely to bring peace in a nation				
13	Equitable distribution of cultural resources does not indicate culture of peace				
14	Satisfaction is synonymous to culture of peace				
15	Social movement is an avenue of nurturing culture of peace.				
16	Freedom from fear is an attribute of culture of peace.				
17	Activity that develops peace culture is peaceful marriage				
18	It is not good to equate individual's status as a culture of peace.				
19	Non-violent communication enhances culture of peace.				
20	Sustainable culture of peace ethic is resolution training and consciousness				

S/N	**Section C: Care for the Planet Earth**	SA	A	D	SD
1.	Energy saving bulbs are good to be used at homes to conserve energy				
2.	It would not cost anything by switching off/ unplugging unwanted light.				
3.	It is good to adjust thermostat for energy conservation.				
4.	Proper vehicle maintenance and carpooling save the cost of gas/petrol				
5.	Recycling permits re-using materials many times and conserves natural resources.				
6.	Recycling, reducing consumption and re-using waste materials counter the damage done to the earth.				
7.	There is need to say YES to metals, glass and newspapers recycling				
8	Cutting vehicle miles through combined trips, save fuel and reduce air pollution.				
9	Use of less pesticides, herbicides or chemical fertilizers would reduce air pollutants that are harmful to plants and human health				
10	Saving drops of water will conserve water and make the planet Earth a better place				
11	Plastics that break down to smaller fragments readily soak up toxins and contaminate soil and waterways.				
12	Plastics pollute the environment by entering the food chain.				
13	It is good to nurture, nature by growing plants around the surroundings				
14	To add life to the earth, more trees should be planted.				
15	Few family size can reduce harm done to the planet earth				
16	Animals should be cared for, and nurtured diligently with full dedication				
17	It is nice to show love to the planet earth for making the future better				
18	Only recycled products should be on sale for every household				
19	This is the right time to pay gratitude and care to the Earth by planting trees and going vegetation				
20	Fast food wastes not properly disposed pollute the environment.				

Appendix B.

Chemistry Understanding Test (CUT)

Instruction: Attempt all Questions **Time Allowed:** 30minutes

1. Acids have long been associated with the --------taste of some fruits such as lime and lemon.
2. Acids have the ability to change litmus solution (vegetable dye) from -------to--------
3. Acids dissolve in water to produce----------ions as the only positive ions together with the corresponding negative ions and the process is known as-------
4. How many classes of acids exist? State them.
5. Which of the acids occur as natural products in plants or animals materials.
6. Bee's sting is poisonous because it contains----------

7. Balance the equation below.

$H_2SO_{4\,(l)}$ + Mg(s)----------> ? + $H_2(g)$

Acid Metal Salt

8. Classify the following under its respective acid groups.

$(COOH)_2$; H_2SO_4; HNO_3; HCOOH; H_3PO_4; CH_3COOH

.(a)----------

(b)----------

9. State two **good** effects of acids

(a)----------

(b)----------

10. State two **bad** effects of acids.

(a)----------

(b)----------

11. Fine Chemicals have the following characteristics except

(a) They are produced to a very high degree of purity.

(b) They are produced in a relatively small amount.

(c) They consist of drugs and chemicals.

(d) They consist of paints and explosives.

12. The three important elements that have to be provided in form of fertilizers in adequate proportion are:

(a) Nitrogen, Phosphorus and sodium

(b) Nitrogen, phosphorus and oxygen.

(c) Nitrogen, phosphorus and potassium.

(d) Nitrogen, phosphorus and calcium.

13. The following are examples of heavy chemicals except

(a) NaOH (b) H_2SO_4 (c) Perfumes (d) NH_3

14. Bio-remediation is a method developed to destroy wastes that are

(a) Toxic (b) Aromatic (c)Alkaline (d) Basic

15. One of the following is an undesirable substance released into the land, atmosphere, rivers and oceans that upset the natural processes of the Earth

(a) Polymer (b) pollutant (c) Polarizer (d) Polysaccharide

16. One of the following is not the process for building up soil pollution

(a) Toxic compounds. (b) Platinum compounds

(c) Radioactive materials (d) Salts compounds.

17. Any of these are used for disposal of solid wastes.

(a) Open dumping and sanitary land filling.

(b) Compositing and de-compositing.

(c) Incineration and accumulation.

(d) Combusting and oxygenation.

18. Describe two ways by which chemical industries have degraded or caused environmental problems
    (a)----------
    (b)----------
19. Suggest two ways of reducing environmental problems
    (a)----------
    (b)----------

Thank You.

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