APPRAISAL OF INFLUENCE OF CHEMISTRY EDUCATION IN INCULCATING VALUES INTO CHEMISTRY STUDENTS IN DEVELOPING NATIONAL SECURITY

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Abstract
The high rate of poverty, diseases, unemployment, violence, exploitation, political corruption, terrorism and the corruption in public life in Nigeria could be related to erosion of moral value. It has been reported that the mastery of the scientific methods and the acquisition of scientific values and attitudes could tremendously help towards the development of moral value. Therefore, this study examined influence of chemistry education in values inculcation. The study was carried out in Federal College in education (special) Oyo. A total number of eighty (80) students were selected. Data were obtained from the participants through the researchers designed questionnaire containing ten (10) chemistry questions which were based on the interaction of atoms in forming chemical bonds and ten (10) questions on moral value. The data collected were analyzed by Pearson moment correlation and simple linear regression using R software version 3.6.2. No significant correlation between the chemistry education and moral value was observed during the analysis. It was concluded that development of moral values in the students is not affected by their level of understanding of the elements interaction and the applications of the interaction in human lives, and that development of the moral value cannot be predicted by the level of knowledge acquired in chemistry. Therefore it was recommended that, in order to remove the present problems associated with insecurity, introduction of moral value education into chemistry curriculum is essential for inculcation of moral value into science students to promote social welfare, love, peace, good will and understanding in their community and Nigeria at large.

Keywords: *Chemistry, Education, National security, Science, Value*

Introduction

The concept of national security has often been taken to merely connote the preservation of sovereignty, territorial integrity and internal stability with the focus on the coercive power of the state. In today's complex and interdependent world faced with many nontraditional threats like epidemics, terrorism, climate change, etc. it must however, been seen in a more holistic manner. Such an all encompassing view of national security demands that the determinant of security is not just the coercive elements of state power but its comprehensive national power with the latter being a composite of many factors across all facets of national life. These factors, inclusive of leadership can help develop a national security index which in comparative terms could serve as an indication of the relative security of a country vis-à-vis peers (Ngozi *et al*., 2019).

Romm (2010) described national security as the capability of a nation to overcome the multi-dimensional threats to the apparent well-being of its people and its survival as a nation state at any given time. It was stated that this can be done through balancing all instruments of state policy through governance and is extendable to global security by variables external to it. Potential causes of national insecurity may include actions by other states (e.g. cyber attack), violent non-state actors (e.g. terrorist attack-Boko Haram), organized criminal groups such as armed robbers, kidnappers etc, and also the effects of natural disasters (e.g. flooding, earthquakes) (US, 2018). In view of the wide range risks, Kristi & Maia

(2015) observed that the security of a nation has several dimensions which include economic security, energy security, physical security, environmental security, food security, boarder security and cyber/internet security.

Nigeria and many countries are experiencing massive erosion of values. Political and economic corruption, scandals and scams, antisocial and anti-national activities, etc., are on the rise all over the countries. In our modern society, degrading violence, exploitation, political corruption and terrorism, and the corruption in public life etc., are increasing day by day and this indicates that humanity seems to have lost its values. Today young people have to face innumerable value problems. Young people are manipulated into believing that violence is not only morally justifiable but also tactically superior and the right thing to do. The educational narrative that challenges violence as the only solution needs to analyse the ethical issues involved in the indiscriminate use of violence, and explore how oppressed people, on whose behalf the violence is carried out, have been affected by such actions. There is breakdown in the lives of individuals, families and societies. All these are the result of the neglect of the moral development and the sense of human dignity (Ratna *et al*., 2016).

Education is a powerful instrument of change and progressive improvement of human behaviour. It has played an important role in shaping the destinies of societies. Nkokelonye (2005) perceived education as the process of bringing the individual in agreement with past, present and future civilization; with civilization as the art of living in harmony, and transmitting to the individual the moral content of that civilization and methods of self-control. He further noted that education can be used to reform the society; and the best education is that which trains the character of its citizens. Education is the greatest force for positive change. In line with this, Alawa & Osinem (2009) observed that education brings about permanent change in behaviour gained through activity, training or observation.

The word value reflects the importance, worth, desirability and the respect something gets in return (Soykan, 2007). Values refer to similarities and shared demands. Social values are moral beliefs and principles that are accepted by the majority so as to ensure the continuity of a society (Ergil, 1984 in Mimar, 2014). Schwartz (2000) included honesty, patience and compassion among core values. He also mentions three discrete values which include: tolerance, freedom, and friendship. Arweck and Nesbitt (2004) stated that values-based education can be seen as a kind of tool-kit for children and young people as well as adults in thinking about the values in their lives, applying them in dealing with relationships and social situations, and shaping attitudes towards others, property, and social structures.

In the context of science, three particular domains of values are present in society: the values associated with education, values of science and values of science education. These three values remain in close proximity and interact or overlap with one another (Hildebrand, 2007). Thus science cannot be isolated from society. Values in science education include values associated with teaching science in schools, epistemic values of science, societal values and the personal values of scientist. The existence of value is not context specific. For example, western science has different values from other indigenous science value sets (Corrigan *et al*., 2010). Morality, values and ethics are always connected and interrelated to society, and attached to societal culture, which are constantly influenced by politics (Unesco, 1991; Witz, 1996).

The purpose of education is much more than just the cultivation of knowledge, understanding and skills. Education ought to instill values of engaged citizenship at the societal level and strive to reduce inequality at the individual level to achieve a just and

politically stable society. The making of resilient communities is intrinsic to maintaining public safety and security. For example, unequal access to education leads to an uneven attainment of resources and opportunities, which increases the likelihood of conflict (Burde, 2015).

Also individual scientists may choose to engage in certain kinds of research, but different societies and institutions may encourage or discourage them (Forge, 2008). Furthermore, these non-epistemic types of values including ethical, social, and political responsibilities affect science practice because of inductive risk (Douglas, 2000). Therefore teaching and learning about the role of values in science and controversial issues can play a role in humanizing sciences and illustrating their ethical, cultural and political facets. A study conducted by Nielson (2012) showed that students co-opted science to make it appear that their evaluative claims were solidly supported. Furthermore, students used scientific evidence not only for justifying their claim but also for emphasizing the importance of their claim (Nielsen, 2012).

Chemistry is the scientific study of the structure of substances, how they react when combined or in contact with one another and how they behave under different conditions (Hornby, 2005). Chemistry is used in most fields of human endeavour: sciences, engineering and medicine (Helmenstine, 2010). Qualitative functional chemical knowledge is practical and useful i.e. Chemistry taught in such a way that it reflects on our immediate environment and developmental needs. One of the objectives of chemistry education is to show chemistry and its links with industry, everyday life, hazards and benefits. Thus, chemistry as a science school subject is a subject that entails creativity and fulfils the aims that are linked to values education and the shaping of values.

The results of science surround us and structure our everyday world and science impacts us almost every moment in our lives. Numerous decisions are made on issues related to science especially Chemistry during our lifetime, and every time such a decision is made, values are involved, because chemistry is value-laden (Douglas, 2009; Kourany, 2010; Brown, 2012; Biddle, 2013). In fact, values play a role not only in decision-making of science-related issues such as socio-scientific issues, but also in science practice. Coulo (2014) pointed out that science not only bears on our values in many ways, but science is also affected by values because ethical and political responsibilities of scientific work and knowledge impact scientists and science. Values play an implicit role in the choice of research subjects and research methods (Coulo, 2014).

There is high rate of insecurity witnessed among young people in Nigeria as a result of massive erosion of values. It has been established that science is all around us, structures our everyday world and controls us almost every moment in our lives. There have been many calls to make teaching of science subjects more relevant to student lives and link the content to the world beyond the classroom. It is against this backdrop that this study is carried out to ascertain relationship between chemistry content and value. This will provide information which could serve as a tool for redressing how chemistry as a course is being organized so that a better balance is achieved between academic excellence and human values.

Statement of the problem

Threat to national security has become the order of the day in developing nations especially in Nigeria. This threat includes economic, political, social, energy, food among others. If this is not well handled it could lead to disaster and catastrophic situation. This study therefore, seeks the influence of chemistry education in promoting values for developing national security among chemistry students in Federal College of Education (Special), Oyo.

Aim and Objectives

The objective of the study is to appraise the influence of Chemistry education in inculcating values into chemistry students in developing national values among chemistry students of Federal College of Education (Special), Oyo.

Significance of the study

The study will be of great importance to the students in inculcating the essence of chemistry education in promoting values that could enhance national security. It also serves as a reference point for other researchers

Research Methodology

The study aimed to ascertain the relationship between chemistry education and development of moral value in chemistry students. The study tried to answer the following questions:

1. Is there relationship between chemistry education and development moral values in students?
2. What is the effect of chemistry education on moral values?
3. Could chemistry education predict the degree of values inculcated in students?

This study was conducted in Federal College of Education (Special), Oyo and a total number of 80 students were randomly selected from the school. A descriptive survey design that utilized designed questionnaire to obtain data from the respondents was employed. This design enabled the researchers established the relationship between the independent (chemistry education) and dependent variables (moral values) used. The questionnaire consists of 20 items that were statements about various chemistry and value questions with responses anchored based on the four Likert points-Strongly Agree, Agree, Strongly Disagree and Disagree.

The survey forms containing demographic questions, chemistry and values scales were administered to 200 level students. Enough time was given to the respondents to complete the questionnaire. The respondents were allowed and encouraged to express their honest feelings without any bias. The questionnaires were retrieved from the respondents immediately after the completion.

Data Analysis

Pearson moment correlation and linear regression analyses were used for the research questions with the aid of R software verson 3.6.2 where chemistry acted as independent variable and value acted as the dependent variable. After analyzing the data collected, a reliability coefficient of 0.56 using Pearson Correlation Moment Coefficient was obtained.

Result and Discussion

The descriptive and inferential statistics for the study are presented in the Tables below. The study determined the relationship between Chemistry education and value for national development. The independent variable is chemistry while the dependent variable is value. The results of the process analysis are shown in Tables 1, 2 and 3.

Table 1: Descriptive Statistics and correlation between the Independent and Dependent Variables

Variable	N	Mean	SD	Chemistry	Value
Chemistry	80	33.76	3.69	1.000	
Value	80	31.09	3.59	0.065	1.000

Correlation is significant at the 0.05 level (2-tailed).

Table 2: Model Summary of Linear Regression Analysis for the Relationship between Chemistry and Value

Variable	Std. error of estimate	R^2	Adjusted R^2	F-statistic:	P
Che &Val	0.06729	0.004284	-0.008481	0.3356	0.5641

Table 3: Analysis of variance

Model	Sum of Square	DF	Mean Square	F value	Pr(>F)
Regression	4.62	1	4.6203	0.3356	0.5641
Residuals	1073.87	78	13.7675		

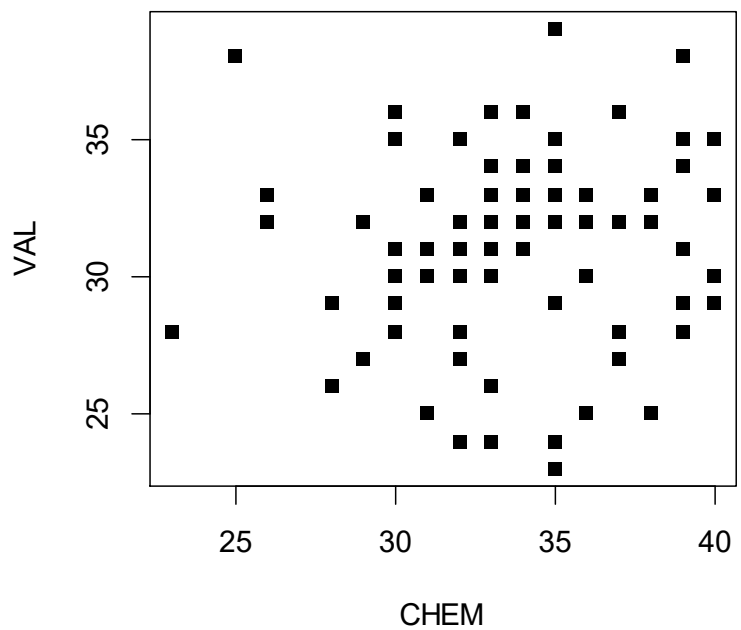

Figure 1: Plot of Values against Chemistry education

The descriptive statistics on chemistry education, value and their correlation are shown in Table 1. The finding of this result shows the mean scores and standard deviations for chemistry education (M= 33.76 SD= 3.69) and for value (M=31.09, SD= 3.59). it is shown in the Table that is correlation between chemistry education and development of moral value in students education with 0.065. And this shows that there is insignificant correlation between the variables. In other words, even if the

students understand chemistry concepts and their application very well, the effect on the students' moral value will not be pronounced. A scatter plot summarizes in Figure 1 shows that there was no significant correlation between chemistry education and value.

The influence of the chemistry education on the development of moral value in the students is 0.0042 or 0.042 % as shown in the R Square number of Table 2. That is, Chemistry education only explained 0.042% of the variation of the students' moral values. Furthermore, the F value in the table is statistically insignificant (F = 61.156, p=0.5641) and this revealed that the influence of chemistry education on students' positive attitude is insignificant in the model (Rheterford, 1993; Greene *et al*., 2004). Also, the value of standard error in Table 2 is 0.06729 while the value of standard deviation for value is 3.59. Since the value of standard error of the estimate is smaller than the value of standard deviation, the chemistry education cannot be used to predict the moral value (Auwalu *et al*., 2015).

The reliability of regression model was determined by the Anova calculation as shown in Table 3. From the table, the F value is 0.34 and the significance level is 0.56. The reliability of the regression model should meet the criteria saying that the model is reliable when the value of the significance level is less than 0.05. The significance level from the Anova is 0.56 or greater than 0.05. This concludes that the regression model above is not reliable (Oyekola *et al*., 2020).

Conclusion and Recommendation

It is concluded from the study that there is no significant correlation between the chemistry education and moral value. Development of moral value in the students is not affected by their understanding of chemistry concepts and their applications. Students moral value development cannot be predicted by the level of knowledge acquired in chemistry because the regression model of the research based on the observed data is not reliable. The development of curriculum containing moral education should be initiated so as to contribute to the acquisition of moral value education by learners which could contribute to security development of the nation.

Further research is encouraged to verify the relationship between chemistry education and moral value possibly with a wider range of students (i.e. postgraduate, mature).

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