

Relationship between Socio-Cultural Factors and Achievement in Chemistry among Senior Secondary School Students of Kaduna State

Moriliat Jumoke Afolabi, Ph.D
National Open University of Nigeria
Lagos
jumafolabi@yahoo.com

Abstract

This study investigated the relationship between socio-cultural factors and academic achievement of secondary school students in chemistry. Three hypotheses were tested at 0.05 level of significance. The study adopted Correlational design. A purposive sampling technique was used to select one hundred and twenty Senior Secondary School Two students from twelve public secondary schools in Kaduna State. Socio-Cultural Factor Scale (SCFS) and Chemistry Achievement Test (CAT) were the instruments used. Pearson Product Moment Correlation Coefficient and t-test statistics were used for data analysis. The findings indicated that there is no significant relationship between students' achievement in chemistry and a set of Socio-Cultural Factors. The findings also show that there is no significant difference between the students in urban and semi-urban areas in their mean achievement in chemistry as measured by CAT and also their mean socio-cultural factor score in chemistry in SCFS. The researcher recommends that there should be possibility of balancing the socio-cultural factors and achievement where necessary especially in the rural settings where traditional rules and respect for elders must not be violated, thereby improving the quality of academic achievement in chemistry in Nigerian schools.

Keywords: Chemistry, Achievement, Socio-Cultural, Factors, Urban, Semi-Urban.

Introduction

Within the context of science education, chemistry has been identified as a very important school subject and its importance in scientific and technological development of any nation has been widely reported. It was as a result of the recognition given to chemistry in the development of the individual and the nation that it is made a core subject among the natural sciences and other science-related courses in the Nigerian educational system. Its inclusion as a core subject in secondary school calls for the need to teach it effectively. This is because effective science teaching can lead to the attainment of scientific and technological greatness.

Chemistry teaching can only be result-oriented when students are willing and the teachers are favourably disposed, using the appropriate methods and resources in teaching the students. With the current increase in scientific knowledge the world over, much demand is placed, and emphasis is laid on the teacher, the learner, the curriculum

and the environment in the whole process of teaching and learning of science. Despite the importance of chemistry to mankind and the efforts of researchers to improve on its teaching and learning, the achievement of students in the subject remains low in Nigeria. The poor performance leads to serious negative outcomes which may result in low self-esteem in students and significant stress to parents. One of the significant components of education is the socio-cultural factor. A Socio-cultural factor is a combination of social and cultural factors. Socio-cultural factors, which are shared values, norms and attitudes among people of the same community, are important factors for education (Apsalone & Sumilo, 2015).

When one considers the effect of the general background of the Nigerian child in the development of scientific concepts, one must be forced to talk mainly in terms of the limitations these background factors impose on the acquisition of such a concept rather than advantages. There are many settlements where the bicycle is still rare and the most usual means of transporting goods is still the human heads or the backs of animals (donkeys or camels). In such an environment, therefore, the developing child grows up without coming in contact with a number of useful gadgets on which the society depends. According to a study by Maric and Sakac (2014), students' socio-cultural factors affected their academic performance. They studied social factors related to students' academic achievement in Serbia and found that social factors were related to students' academic achievement.

Karande and Kulkami (2005) and Reche, Bundi, Riungu and Mbugun (2012) found that certain socio-cultural factors could promote poor academic performance in a school. However, neither Karande and Kulkami (2005) nor Reche et al. (2012) elucidated what those particular socio-cultural factors were. The present study filled this gap by pointing out the relationship between specific socio-cultural factors and students' academic achievement using Jegede and Okebukola (1993) socio-cultural factors. These are:

1. Authoritarianism: This characterizes the traditional society where the belief is strongly held that the older person, having been exposed to more life experiences should be in a better position to appraise a situation and pass 'correct' judgement. Authoritarianism is part of our culture.
2. Goal Structure: This refers to the interaction pattern that is predominantly cooperative in nature. In this cooperative setting, the goal structure of everybody is directed at the same objective. The classroom learning environment views students' grouping as cooperative, individualistic or competitive.
3. Traditional African worldviews: These are some traditional beliefs that owe their origin to magic and superstitions. African society holds the notion that supernatural forces do have significant roles to play in daily occurrences and the younger members are supposed to learn and believe these notions.

4. **Societal Expectations:** The success of individuals within a community is developed and interpreted through the nature of their interaction within a communal society.

5. **Sacredness of Science:** This refers to conceptual interpretation of science; the belief that science is a subject that can be understood only by certain people that have attained certain level of intellect.

The most important source of input of information into the system is the environment. The environment could be geographic, domestic and socio-cultural. It represents a link between what is already known and what is to be learned. Wasagu (1999) argues that an understanding of science concepts neither begins nor ends in the classroom. This is in view of the argument that successful science students are those who link semantic relationships across time and contexts and apply scientific terminology in flexible and useful ways. It is however refreshing to note that the constructivist movement has made major contribution to science education by reminding us that, 'we must take account of what students already know and be concerned about how they understand concepts' (Harding & Hare, 2000). Constructivism works perfectly when African children have to learn about things within their environments using prior-knowledge situated within their non-Western worldview. Problems arise when they have to now learn western culture along with chemistry.

A learner from an indigenous background within an environment that uses the Modern education mode comes into the classroom with all the characteristics of his indigenous background. More often than not, he learns effectively from Western perspective and within a Western culture. He will be expected to erase from his mind, the prior-knowledge brought into the classroom from the indigenous background as pre-requisite to learning Western-based knowledge. However, in real situation, what obtains is that, the student needs to cross borders from the everyday subcultures of peers, family, ethnic orientations into the subcultures of the school, classroom and chemistry.

Johnson and Johnson (2009) outlined three types of classroom goal structure as individualistic, competitive and cooperative. In an individualistic setting, the students typically work individually with limited interaction in achieving individual goals. In a competitive structured classroom, students essentially work against each other (Johnson, Johnson & Holubee, 2013). Cooperative learning is a way of structuring classroom so that students work together to achieve common goals while being held individually accountable for knowledge and skills being taught. Cooperative learning has documented many desirable results, among these are academic achievements, social and effective development and improved ethnic relations.

Kintsch (1994), in a study on text comprehension, memory and learning, has also established the importance of background or prior knowledge for memory, and stresses that this has consequences for retrievability. What this means is that the understanding of any new learning is strongly influenced and perhaps determined by the prior-knowledge that the learner already has about a thing. It also means that this will make a lot of differences regarding the way a learner gives meaning to a thing as well as the way the different cultures of science and technology are viewed especially by an African learner.

Jegede (1994) discovered that Authoritarianism, African worldview, societal expectations and Sacredness of science had negative effects while Goal structure exerted positive effects on the learning of science in Nigerian classrooms. The obvious implication of what was discovered is that regardless of how adequate the conditions of teaching science are in our classrooms, the socio-cultural characteristics, which students bring into the class from their environments, might create a wedge between what they are taught and what they learn. They also reported that learners in an African environment often find out that what is learned in school do not always relate to their day-to-day life experiences because students bring to science classes knowledge derived from their worldview as the basis for understanding the science taught in the classroom. They then suggested that there is a need to harness all the beneficial aspects of culture to make learning more accessible to African children; and that Science should be taught with cultural activities (such as games, toys, role play, storytelling and indigenous technology) and the thinking of the people.

The relationship between school location and students' academic achievement in science has been widely reported. Adepoju (2001) found that students in urban schools manifest more brilliant performance than their rural counterparts. Also, Odinko (2002) and Ogunleye (2002) reported a significant difference in the achievement of students in urban, semi-urban areas. However, Orji (1998) did not find any significant difference in the urban and semi-urban schools.

The main aim of this study is to investigate the extent to which the socio-cultural environment that the students come from can influence the way they achieve or understand concepts in chemistry class. The overall goal is to quicken the pace of delivery of good quality chemistry education in Nigerian schools. The reason is that if the socio-cultural environment of the students actually inhibits the study of chemistry, efforts could then be made to reduce or eliminate its influence.

This study is hinged on socio-cultural theory of Lev Vygotsky (Vygotsky, 1997) which explains how individual mental functioning is related to cultural and historic context. Socio-cultural theory looks at the important contributions that society makes to

individual development. The theory stresses the interaction between developing students and the culture in which they live. It also explains how the school success is a factor of culture inherited from the community rather than the measure of achievement. Many research studies have shown that students achieve poorly in chemistry (Abdullahi, 2005). Available evidence from West African Examination Council (WAEC) indicates that students' performance in chemistry worsens as the years go by and many students seem to have negative attitude towards the subject (Betiku, 2002). WAEC statistics 2008-2017 indicate high rate of failure in chemistry. Information is also scanty on relationship between socio-cultural factors and achievement, as such there is need to fill the gap. The objective of this study is to determine whether socio-cultural factors have relationship with the achievement of students in urban and semi-urban areas.

Research Questions

The following research questions guided the study:

1. What is the relationship between students' chemistry achievement and a set of the socio-cultural factors?
2. What is the difference between chemistry achievement of students from semi-urban and urban areas?
3. What is the difference between students' socio-cultural factors from semi-urban and urban areas?

Hypotheses

The following null hypotheses were formulated and tested at .05 level of significance:

Ho1: There is no significant relationship between the mean achievement scores of students in chemistry and students' mean scores in a set of five subscales as measured by SCFS.

Ho2: There is no significant difference between the mean achievement scores of students in semi-urban and urban areas as measured by CAT.

Ho3: There is no significant difference between the mean achievement scores of students in semi-urban and urban areas in a set of five subscales as measured by SCFS.

Methodology

This study adopted a correlational design. This type of design seeks to establish the relationship that exists between two variables. In this study an attempt was made to establish the extent to which achievement by secondary school students in chemistry is dependent on:

- The location of school attended, whether rural or urban
- The scores in SCFS

The population of this study consisted of all Senior Secondary Two (SSII) chemistry students in all public secondary schools located in Kaduna Metropolis. The metropolis consists of Kaduna Education Zone with two Local Government Areas (Kaduna North and Kaduna South LGAs). The total students' population was 1,719. The schools were classified into urban and semi-urban. Through random sampling and stratified sampling technique, a total of one hundred and twenty (120) chemistry students were chosen to have a manageable sample that is large enough for meaningful generalization. A minimum of 10% of the respondents were selected from each school. The study sample consists of 35 students from semi-urban and 85 students from urban settings. The sample was representative of Nigerian chemistry students. The average age of the students was determined to be seventeen (17) years.

The Chemistry Achievement Test (CAT), developed by the researcher to measure students' achievements in Chemistry, was made up of a 30-item multiple choice objective test, and validated by two science educators and two secondary school chemistry teachers. The achievement test (CAT) was based on the units covered by the students from SSI to SSII chemistry scheme of work for Senior Secondary School Chemistry. To each item, there were 4-options from which the students were expected to choose one correct option by ticking the letter bearing it. The reliability index of 0.70 was obtained for CAT using Pearson Product Moment Correlation Coefficient (PPMC) statistical technique after a trial testing. The SCFS, consisting of 30-items, developed by Jegede and Okebukola (1993) was adopted for this study. The instrument which has been shown to be valid and reliable has reliability of 0.88. The purpose of SCFS was to get information about students' personal details and socio-cultural factors.

The SCFS and CAT were administered to all members of the sample at the same time of data collection in a normal classroom situation. The schools cooperated and this enabled the successful administration of the test to all study samples. The research assistants went round and ensured that the sampled students were responding to the test questions in accordance with the instructions. The average time taken to complete the instruments was 50 minutes. The papers were collected at the end of the test. The test scores for the instrument were recorded and computed, these were used for data analysis.

The responses of the students in SCFS were scored on a three-point scale because the respondents could hardly distinguish between hardly and rarely, so the rating was collapsed to 3-Likert Scale of Never, Sometimes and Often in order to have less ambiguity and more definite answers. The items were scored 1, 2, and 3 for the responses Never, Sometimes and Often respectively. The researcher used the mean scores of the students' responses in SCFS to determine the students' attitudes towards

socio-cultural factors. Each factor of SCFS was treated as an independent variable. Students' responses in CAT were also scored based on the marking scheme. Each correct response attracted a score of one. The maximum possible score was 30 and minimum 0. The total scores obtained by students were direct measure of the level of cognitive achievements. The results of each of the tests were collated and computed using PPMC to find the relationship between CAT and each of the factors of SCFS scores, while t-test was used in testing the hypotheses on significant differences.

Presentation of results

Ho1: There is no significant relationship between the mean achievement scores of students in chemistry and students' mean scores in a set of five subscales as measured by SCFS.

Table 1: r-values and p-values of all the Sub-Scales

Hypotheses	Scale	r-Value	p-Value	Decision
1 A	Authoritarianism	0.27	0.00	*S
B	Goal Structure	0.04	0.63	**NS
C	African Worldview	-0.00	0.97	**NS
D	Societal Expectation	-0.02	0.80	**NS
E	Sacredness of Science	-0.03	0.74	**NS

*S (Significant at $p \leq 0.05$) **NS (Not Significant at $p \geq 0.05$)

In Table 1, the $p = 0.00$ of Authoritarianism is less than 0.05 level of significance. It is clear that there is a significant relationship between SCF (Authoritarianism) score and CAT score. The p-values of 0.63, 0.97, 0.80, and 0.74 of Goal structure, African worldview, Societal expectations and Sacredness of science respectively, are greater than 0.05 level of significance, indicating that there is no significant relationship between their mean scores and CAT score.

Ho2: There is no significant difference between the mean achievement scores of students in semi-urban and urban areas as measured by CAT.

Since the difference was between two variables, urban and semi-urban schools, a t-test was used to test this hypothesis. The summary of the computation is contained in Table 2 and the α -level of 0.05 with degree of freedom 118.

Table 2: Mean, Standard Deviation and t-ratio of CAT on location

Location	N	\bar{X}	SD	SE	df	t-value	p-value
Urban	85	2.17	0.29	0.03	118	0.97	0.38
Semi-Urban	35	2.12	0.33	0.33			

***Not Significant at $p \leq 0.05$

The result gives a t-ratio of 0.97; that is the observed t-value was not significant. The p-value of 0.38 is more than 0.05 level of significance; this indicates that there is no significant difference observed between students achievement as measured by CAT in urban and semi-urban areas, hence the null hypothesis is retained. This means that the locations of the school have no effect on chemistry achievement. This finding can be due to rural-urban movement and vice versa.

Ho3: There is no significant difference between the mean achievement scores of students in semi-urban and urban areas in a set of five subscales as measured by SCFS.

The result of the analysis is given in Table 3.

Table 3: Mean, Standard Deviation and t-ratio of SCFS on Locations of Schools

Location	No	\bar{X}	SD	SE	df	t-value	p-value
Urban	85	2.27	0.19	0.02	118	1.67	0.12
Semi-urban	35	2.21	0.15	0.02			

***Not Significant at $p \leq 0.05$

At the observed t-value of 1.67 with 118 degree of freedom, the p-value of 0.12 is more than 0.05 level of significance. This means t-value was not significant; this means that there was no significant difference between urban students and semi-urban students in SCFS. The null hypothesis is therefore retained.

Discussion of the Findings

The findings of this study revealed that socio-cultural factors as measured by SCFS were not significantly related to students' academic achievement in chemistry. The only exception was authoritarianism which was significantly related to achievement. The significant relationship between students' mean score in authoritarianism and achievement in chemistry could be attributed to the authoritarian nature of the society. The finding of this study agreed with the study which had been carried out on socio-cultural factors. The findings of Jegede and Okebukola (1993) showed that African homes or schools are characteristically authoritarian and are traditional collectivists. Their findings also reported significant culture difference on performance of students

in science. Two explanations can be advanced from the result of this study. First, emphasis is on respect for constituted authority. Secondly, the teacher is the fountain of knowledge and he possesses the knowledge the student is to acquire. The other subscales of SCFS were not significantly related to achievement in chemistry. For instance, in goal structure, the findings showed that a greater number of students believed that group activities encouraged them to learn better. The students interact with their peers without being interrupted by the teachers. The students shared feelings, experiences and thoughts which teach them how to cooperate and work together, sharing workloads and hence permitting large project and promoting peer tutoring.

There is no significant difference between mean score in chemistry by students in urban and semi-urban areas. The result of testing this hypothesis showed that environment has no effect on achievement. The findings showed that the difference between urban and semi-urban students' achievement in CAT is not significant. This means that the urban students did not acquire more meaningful learning than the semi-urban students. The finding is in agreement with that of Ogunleye (2002), but not in agreement with Inyang and Jegede (1991). Inyang and Jegede reported that superior performance is as a result of the cooperative advantages the students enjoy in urban as well as opportunities available for private tuition and extra-mural classes.

There is no significant difference between students mean score in SCFS by students in urban and semi-urban areas. Findings show that location of schools (urban or semi-urban) is not significantly related to students' scores in SCFS. This means that in spite of the fact that environmental issues within African environment have effects on achievements, students in urban and semi-urban locations benefitted equally from being instructed through socio-cultural mode. This result indicates that there may be no basis for achievement differential in chemistry among students in urban and semi-urban areas. This may be due to rural-urban movement. The similar performance of urban and semi-urban students in SCFS could be attributed to the experiences gathered from their environments. Teachers must be aware that students import into the classroom socio-cultural variables that have serious pedagogical and conceptual impact on the new information presented. Teaching the learners, according to Jegede and Okebukola (1993), in a climate that fosters the construction of new knowledge based on previously constructed socio-cultural framework would be advantageous and enhance students' performances.

Conclusion

From the result of this study it was concluded that authoritarianism is capable of instilling perpetual fear in students and may not be conducive to their development of logical thinking. The authoritarianism noticed in over two third of the chemistry students sampled in the study is indicative of teaching/learning environment that was

not inquiry oriented. Also performances of students located either in urban or semi-urban areas are the same, both urban and semi-urban students benefitted equally from the learning experiences. It is desirable that the recent emphasis on socio-cultural factors should have some practical applications in facilitating improvement in the classroom teaching and learning process.

Recommendations

It is thus recommended among others that chemistry teachers and curriculum developers should become more aware of the import of socio-cultural variables such as authoritarianism in the teaching of chemistry and curriculum development and that class achievement of certain outcomes might be enhanced by attempting to change the socio-cultural factor of the school in ways which make it more congruent with the socio-cultural factor of the home. Workshops, seminars and conferences and other refresher courses for teachers of chemistry should be organized periodically.

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