CHEMISTRY EDUCATION AS A MEANS TO ACHIEVING SEVEN POINT AGENDA IN NIGERIA

Dr. S. G.. Adewusi

Abstract

Chemistry as a pure science like other science disciplines is well poised to enhanced the realization of seven-point agenda. The focus of this paper is on how four variables. Chemistry, Ability, Qualification, Gender and Age affect secondary school chemistry teachers' performance in the classroom. A total of 200 teachers (166 female and 34 males) all chosen from secondary schools around Kaduna, Zaria, and Markarfi educational zones of Kaduna state. Some structured and multiple-choice test questions on Kinetic theory of gases, Nuclear Chemistry, and Stoichriometry calculations, were used for data collections. The outcome of these studies was slightly satisfactory on all the four concepts for data collection. The use of point-biserial correlation coefficients relating chemistry teachers' Gender, Qualification, Age and Chemistry Ability to there scores in the above mentioned concepts shows that: The relationship between their qualification and performance in Nuclear chemistry is statistically significant but moderate ($r_{pb} = 0.30$, $p<0.01$). The positive, statistically significant but moderate relationship, between chemistry teachers' chemistry abilities and their performances in each of those four variables apart from the chemistry teachers' abilities and there performances in each of these concepts (topics) suggests that there were other variables apart from the Chemistry teachers' abilities which could have accounted for significant differences in their performance, but which were not explored in this study.

Introduction

Today, Nigeria is at the cross roads of scientific and technological knowledge, breakthrough and development, (1), with well over eighty universities and large number of other teacher institutions running courses in science and technological studies (1).Chemistry education, like other science disciplines will enhance the realization of the seven-point agenda of the Federal Government of Nigeria if desirable reforms are employed. The objectives of chemistry education include the following: To develop functional knowledge of chemistry concepts and principles; To observe and explore the chemical environment; To apply the skills and knowledge gained through the study of chemistry to solve day to day problems; To explain simple natural phenomena; To develop scientific attitude such as curiosity, honesty, humility, perseverance, open –mindedness etc; To manipulate simple apparatus for the purpose of demonstration and use. (NCCE, 2002). Chemistry education therefore shall emphasize the teaching and learning of all these processes and principles. On the long run, the functional and applied scientific researches and technological breakthrough which the nation is presently in dare need of will be accomplished. With this background, the teaching/training of secondary school students in chemistry has been studied with dismay. (Miriogwu, 2007). Proper pedagogical methods are not used by teacher so as to make learning and achievement rewarding. Equipments needed are either in short supply or not available. Teachers are often not interested on the job while students are more interested in cheating among themselves in the examinations (Mercy, 2000). The present high level failure in senior secondary certificate chemistry has been ascribed to teachers' inadequate level of the conceptual understanding necessary for teaching chemistry. (Nwosu, 2007). The teaching qualification of the teachers of the subject is another factor indicated (Nwosu, 20007) to be haring direct influence on chemistry teaching and learning achievement. Finally, studies on demographic factors have widely held opinion that they have little or no influence on chemistry teaching and learning outcome (Ahmed, 2008). Other variables which could have direct influence on chemistry teaching achievement include the self esteem of the teacher, teaching style, socioeconomic background, teaching experience, language ability etc (Bell-Hutchinson, 2004).

Purpose of the Study

The primary purpose of the study was to investigate the effects of Chemistry ability, Qualification, Age and Gender of selected chemistry teachers on some selected topic/concepts in SSCE O/L chemistry syllabus. Specifically, the study focused on:

(a) The level of knowledge of the concepts of Kinetic theory of gases, Stoichiometry calculations and Nuclear chemistry of selected chemistry teaches in secondary schools.

(b) The overall performance of these chemistry teachers in all the three concepts under investigation linked to their ages, gender, qualifications and chemistry abilities.

(c) The significant relationships among the teachers' gender, qualification, age and chemistry abilities

Research Question.

One research question was posed for the study:

Will there be any significant relationship between chemistry teachers' chemistry ability, qualifications, age, gender and their performance in the following topics: Kinetic Theory of Gases, Stoichiometric Calculations and Nuclear chemistry.

Hypothesis.

The following null hypotheses were tested at 5%level of significance.

Ho 1: There is no significant difference in the level of performance of chemistry teachers in all the chemistry concepts/topic.

Ho 1: There is no significant relationship between chemistry teachers', age, gender, qualification, chemical ability and performance in chemistry concepts/topics under investigation.

Method

Research Design

An ex post facto research design was utilized in this study. This was aimed at establishing significant correlations among chemistry teachers' gender, qualification, age and chemistry abilities, if any. These variables are referred to as independent variables, and cannot be manipulated, and their performance on Kinetic theory of gases, stoichiometry, calculations and Nuclear chemistry, otherwise referred to as dependent variables. (Weidnam, 1995).

Sample

The study was conducted using 200 secondary school chemistry teachers (aged 20-45 years), and comprising of 166 male and 34 females, carefully selected at random from secondary schools around Kaduna, Zaria and Makarfi educational areas/zones in Kaduna state. To group the participants into chemistry ability categories, their highest certificate and qualification's grade/class were used. Participants with second class upper and above/upper credits' grades were classified as having a high chemistry ability; those with second, third class lower credit were classified as having an average chemistry ability; while those with pass class/merit were classified as having a low chemistry ability.

Instrumentation and Procedure

For data collection, the Kinetic theory–stoichiometry calculation and nuclear chemistry Test (KS N) that was developed was administered to the participants. The test had three sections. Section A had six items used to obtain detergraphic information about the participants section B consisted of 20 multiple-choice items – 7 each on Kinetic theory, stoichiometry, calculations and 6 on Nuclear chemistry. Each multiple choice item had four options. Section C had 5 structured items, 3 of which were chemical concepts/topics under investigation and the remaining 2 were on general teaching methodology. The maximum scores were: 10 marks for each of the chemical concepts. The test items were carefully drawn from past questions of SSCE/GCE O/L examinations, and school of education, Federal College of Education, Zaria, Before administrating the test, the questions were subjected to content and face validity by other experts in chemistry so as to ascertain there appropriateness. The reliability coefficient was computed using Pearson-product moment correlation method and the value obtained was r= 0.90, which opined very strong reliability. The multiple choice items' difficulty indices range from 0.38 and 0.94, this is equally regarded as good and acceptable in

educational research (Ebel, 1991). The inter-rater reliability coefficient calculated on the scores that the author and an independent marker gave on 10 randomly selected scripts of the participants answers on section C of (KSNT) was 0.89. This coefficient indicated that the two markers were very consistent in their use of the prepared marking schemes in grading the participants' answer scripts.

Table 1: Means, Standard Divisions, Percentages of Kinetic Theory of Gases, stoichiometry calculations and Nuclear chemistry

Variables	Means	%	SD
Kinetic theory of gases	8.36.	52.25	3.15
Stoichiometry calculations	7.19	44.94	3.52
Nuclear chemistry	6.17	61.70	2.21
Total	21.72	51.71	8.88

Kinectic theory of gases = 15, stoichiometry calculations =15, Nuclear chemistry =10, n = 200 in each case.

Tables 2: Chemistry teachers' Means and standard deviations in kinetic theory of gases based on the variable.

Variables	n	Mean	S.D.
Gender			
Male	166	8.82	2.42
Female	34	8.26	3.28
Qualification			
NCE/HND	114	8.49	3.30
B.SC (Ed) & Above	86	8.18	2.96
Age			
21 – 26	145	7.98	3.06
27 – 32	39	9.56	3.25
33 – 45	16	8.81	3.19
Chemistry Ability			
High	29	11.48	2.47
Average	64	8.68	3.04
Low	107	7.31	2.78

Table 3: Chemistry teachers' Means and standard deviations in Stoichiometry calculations based on the variables.

Variables	n	Mean	SD
Gender			
Male	166	7.88	2.59
Female	34	7.05	3.68
Qualifications			
NCE	114	7.45	3.72
B.Sc.Ed & Above	86	6.86	3.24
Age			
21-26	145	6.96	3.51
27-32	39	8.19	3.63
33-45	16	6.91	3.10
Chemistry Ability			
High	29	9.24	3.90
Average	64	7.70	3.73
Low	107	6.34	3.00

Table 4: Chemistry teachers' mean and standard Deviation in Nuclear chemistry based on the variable.

Variables	n	Mean	SD
Gender			
Male	166	6.38	1.88
Female	34	6.12	2.18
Qualification			
NCE/HND	114	6.39	2.19
B. Sc. Ed & Above	86	5.87	2.22
Age			
21 – 26	145	6.10	2.15
27 – 32	39	6.72	2,48
22 – 45	16	5.44	1.90
Chemistry			
High	29	7.45	1.82
Average	64	6.51	2.13
Low	107	5.62	2.19

Table 5

Point-bi serial correlation coefficients relating chemistry teachers'. Gender, Qualification, Age and chemistry Abilities to there scores on kinetic theory of gas, Stoichiometry calculations, and Nuclear chemistry.

Variables	Means	%	SD	Chemistry Abilities
Kinetic theory of Gases	0.06	0.05	0.16*	0.44**
Stoichiometry Calculations	0.09	0.08	0.07	0.30**
Nuclear Chemistry	0.04	0.12	0.00	0.30**

*P< . 05

**P< .001

Results and Discussion

The first purpose of this study was to determine if the knowledge of the chemistry concepts of Kinetic theory of gases, stoichiometry calculation and nuclear chemistry of the selected chemistry teachers secondary schools was satisfactory, Table 1 below shows that, participants exhibited barely satisfactory performance on the entire test because their grant mean score (21.72 or 51.71% is just above the conventional 50% pass mark. The table indicates that there performance in increasing order of magnitude is as follows: Kinetic theory > stoichiometry calculations Nuclear chemistry. This finding was not expected because one would have expected the order of their performance on the concepts from the highest to the lowest mark would have been: stoichiometry calculation Kinetic theory > Nuclear chemistry. These results which is barely satisfactory on these essential/key chemistry concepts was supported indirectly by the low performance of SSCE/GCE O/L students in chemistry annually. This position is backed –up by examiners' reports of WAEC May/June O/L Chemistry reports from 2000-2008, which highlighted the fact that candidates demonstrated significant weakness in the chemistry concepts under consideration.

The second purpose of this study was to find out if there were significant differences in the chemistry teachers' performance on the chemistry concepts linked to their gender, qualification age and chemistry abilities. Foremont, the mean and standard deviations of the participants on these chemistry concepts were computed, see (Table 2, to 4). The data in each of the tables 2-4 indicate that (a) the mean of the male is slightly higher than the mean of the female; (b) the mean of degree holders/above is slightly higher/than that of NCE/HND certificate holders. (c) the mean of teachers aged 27-32 years is slightly higher that the mean of teachers aged 21 to 26 years, and 33 - 45 years

respectively; (d) the mean of students with high chemistry ability is much higher than that of students with averages and low chemistry abilities respectively. In all case, the standard deviations are relatively low suggesting that there were low variations in the scores of high and low scorers in the three concepts/topics under investigation..

The third purpose of this study was to find out if there were significant relationship among the chemistry teachers' gender, qualification, age, chemistry abilities and there performance in each of the three chemistry concepts. Point-biserial correlation coefficients (Table 5) were computed for this purpose. The table indicates that there is no relationship between the chemistry teachers' (a) gender, and (b) qualifications and there performance on kinetic theory of gases, while there is a positive, statistically significant but weak relationship between there (c) age and there performance in kinetic theory of gases. Statistically significant but moderate relationship (rpb=0.44, $p< 0.01$) is found between (d) chemistry abilities and there performance on kinectic theory of gases. Table 5 also shows that there is no relationship among the chemistry teachers' (a) gender, (b) qualification and Age and there performance on stoichrometry calculations, whilst there is a positive, statistically significant but moderate correlation (rpb = 0.30, $P< 0.01$) between their (d) chemistry ability and their performance on stoichiometry calculations. The table also indicated that though there are no relationships among the students' (a) gender, (b) age and their performance in Nuclear chemistry is statistically significant but moderate (rpb = 0.30, $p< 0.01$). The positive, statistically significant but moderate relationship between chemistry teachers chemistry abilities and their performance on each of the three chemistry concepts (topics) suggests that there were other variables apart from the chemistry teachers' chemistry abilities which could be have accounted for significant difference in there performance but which were not explored in this.

Conclusion

The finding that the chemistry teachers' performance on the concepts was barely satisfactory account for the poor achievement/performance of secondary school students in there SSCE/GCE O/L examinations. Thus, the chemistry teachers in our secondary schools will need to be improved in all these areas, so that they can competently teach there students effectively. Thus preparing necessary background for our science and technological breakthrough for our National Economic growth and development.

The finding that teacher with higher chemistry ability significantly out performed their peers with average and low abilities suggest that unless chemistry teachers obtain relatively high grade in their training programme, three performance may not be satisfactory in our schools.

The findings that there were no significant gender, qualification and age difference in the teachers' performance on these chemical concepts seem to imply that students SSCE O/L chemistry students can be taught fairly satisfactorily regardless of the differences in their gender, qualifications, and age.

Other variables, beside the teachers' chemistry abilities, which could have contributed to significant difference in their performance on stoichiometry. Calculations, Kinetic theory of gases and Nuclear chemistry which would be investigated in future studies on this topic include/teaching style socioeconomic background, language abilities, teaching experience, and teaching styles of the chemistry teachers. Thus far, the outcome of this study will go a long way in the establishment and nurturing of desirable scientific and technological culture in the chemistry students in secondary schools, by the teachers. The promotion of mission-oriented research in the basic sciences will together be accomplished, thus supporting the seven points agenda of the federal government of Nigeria on economic growth and technological breakthrough.

Recommendations

In order to meet the challenges of seven point agenda, Chemistry Education / Teachers must be tailored / trained to achieve excellence. Thus the relevance of the under-mentioned:

a) Nigerian educational system must formulate guidance and policy for making professional and leadership development in chemistry and science education at large. This will as a matter of fact accelerate our technological growth and aspiration . These guidelines must be simple and workable, backed up with desirable support from all stakeholders at the federal, state and local government.

b) Provision of opportunity and support for life long chemistry learning strategies and other science subjects. This wills product a laudable platform for students' learning achievement. The idea can be achieved through collaborations with science education experts and researchers in and outside the country. The product of which will include organization of workshops and seminars for the teachers in focus.
c) Adequate representation of female chemistry teachers must be ensured in chemistry education, and provision of necessary incentives or motivational packages necessary to sustain their interest in studying and teaching chemistry.
d) Establishment of suitable teaching and learning environment and infrastructures to stimulate students understanding of the subject matter. This will encourage students' understanding of nature and the need for scientific and technological literacy in relation to national and economical growth of the nation.

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