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EFFECT OF LABORATORY INSTRUCTIONAL METHODS ON STUDENTS' ATTITUDES IN SOME CHEMISTRY CONCEPTS AT SENIOR SECONDARY SCHOOL LEVEL

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ABSTRACT

This study investigated the effects of guided discovery and demonstration methods against lecture method on students' attitudes, A total of 230 senior secondary one (SS1) chemistry students were involved in the study. This number was made up of 100 males and 130 females from five secondary schools in Ahoada West Local Government Area of Rivers State of Nigeria. A non- randomized pretest- posttest control group was used for the study. Cronbach Alpha was used to establish the reliability of the Chemistry Students' Attitude Scale (CAS). The reliability coefficient of CAS was 0.75 .To analyze the data of the study, the research questions were answered using mean and standard deviation scores. Hypotheses were tested using analysis of covariance (ANCOVA). From the findings, it was observed that guided discovery was the most effective in facilitating students' attitudes. This was followed by demonstration while lecture was found to be the least facilitative method. Attitude is dependent on teaching methods. Students' attitude mean scores in practical chemistry (acids and bases) were significant. The interaction effect of gender and teaching methods on students' attitude mean scores in practical chemistry (acids and bases) were not significantly different. The interaction effect of gender and teaching methods on students' attitude mean scores in practical chemistry (acids and bases) were not significantly different. The study recommended among others that guided discovery and demonstration methods should be used by teachers in teaching practical chemistry contents (acids and bases) to guarantee effective instructional delivery.

Keywords: attitude, acid, base, laboratory, practical chemistry, instructional delivery

Background of the Study

Chemistry is a central science that cuts across all the sciences and its importance cannot be over emphasized. Chemistry is fundamental in the world of industrialization. Today, the world is seen as a global village; meanwhile, this perception of globalization is not unconnected with industrialization in which chemistry is central. Chemistry has multiple benefits for national development. It plays fundamental roles in food production, clothing, housing, medicine, transportation, etc. The work anchored on the identification of methodologies which may adduce the modus oparandi of teaching this central or core science called chemistry. Be that as it may, the subject chemistry must be taught at the secondary school level by experts (chemistry educationists) who are thoroughly grounded in chemistry education (Zudonu, 2011). This is because they are specialists abreast and equip with chemistry pedagogy, which is how to go about teaching their learners (Zudonu, 2011). However, in our secondary school system today, the numbers of students who are offering chemistry are very few and even the very few ones are performing poorly. The decline and poor performance may not be unconnected with the teaching methods employed by teachers, as most of them are not teachers but only accept teaching at the last resort (Ajene, (2003); Terngu, 2010 and Osefugbo, 1998).

Okegbile (2007) described an academic achievement as a general pedagogical terminology used while determining learners' success in formal education which is measured through reports, examinations, researches and rating with numerous extraneous factors or variables exerting influences. Achievement results revealed the level of learners' performance and prove their capacities. However, the underachievement is characterized by the results of schools whose educational attainment falls below appreciable level. The poor achievement in chemistry may have been triggered by the incessant use of lecture or traditional method by teachers in secondary school which indeed is not a hand-on method. It could also be as a result of learners performance that is below their capacities, which is in consonance with the view of Vamadevappa (2002) and Odili (2004) that underachievement comes from a student's scholastic performance that is below his or her ability level. The researchers puts some of the factors that are likely attributed to the wrong perceptions that students have created against chemistry laboratory practical work which include: student carelessness, poor study habits, lack of motivation, inappropriate teaching methods, students' behaviour and peer group influence, poor home background or environment, unqualified teacher, instructional and evaluation process that failed to recognize learners' individual differences.

Attitudes towards chemistry in this context, denotes interests or feelings towards studying practical chemistry. Students' belief and attitudes have the potential to either facilitate or inhibit learning (Yara, 2009). The position of Yara, absolutely corroborates the view and cry of the researcher that the misconceptions of the students about the laboratory housing acids and bases have affected their attitudes which has eventually occasioned inhibition in learning. Many chemistry teachers regard practical chemistry as very important for various reasons which include concept learning, motivation and the development of skills and appropriate scientific attitudes. This is in line with the objectives of chemistry education (Bradley, 1999; National Education Council, 2002). These objectives may not have been achieved because of students' aversion for chemistry laboratory. The aversion for chemistry laboratory activities could have been emanated from the phobia of acids and bases domiciled in the chemistry laboratory, which are fundamental compounds used in quantitative and qualitative analysis.

Chemistry is essentially a practical oriented subject which demands proper exhibition of science process skills (practical skill) for effective interpretation of existing phenomena (Njelita, 2008). Several works (Hofstein and Lunetta, 2004; Mamlok-Naaman, 2007 and Lagarowitz and Tamir, 1994) have shown that students enrollment chemistry is declining gradually over the years in high schools. It is, therefore, the thinking of the researcher that students may be running away from chemistry, because practical chemistry is done in the laboratory which the students already considered as a dangerous place since it contains acids and bases which they are afraid of. Consequently, this fear that resulted from the misconceptions has affected students' attitudes, enrollment, class attendance, motivation and performance. This has practically deadened students drive, enthusiasm, curiosity and occasioned lost of interest in learning practical chemistry. Indeed, the fear has tremendously affected students' academic achievement and attitudes not only in practical chemistry but has spread to all aspect of chemistry at the SSCE level. Research evidence in Nigeria (WAEC chief Examiners' report, 2000-2007) underscores low achievement in chemistry (especially Chemistry practical) among senior secondary school students. This situation is amplified by the few numbers of students pursuing science related courses in higher educational institutions compared with the art and social sciences.

It is argued that laboratory experiences are worthwhile aspect of science education where drilling and practicing is applied to train students to be more scientifically inclined and pass their practical examination (Morgil, Gungor & Secken, 2009). Meanwhile, the laboratory has value for nurturing positive students' attitudes and providing avenue to develop and demonstrate their practical skills in practical chemistry works. Novak (1984) observed that students fare no better with a laboratory experience than without one in developing understanding of chemistry. Ali (1996) noted that there is no best method but the effective science teaching should be laboratory centred, activity-oriented rather than text or lecture centred which characterized the Nigerian schools. Various instructional methods, such as guided discovery and demonstration instructional methods that may share features with laboratory experiences may be successful in attaining numerous vital educational goals. In view of this, Hofstein and Lunetta (2004) observed that these goals are arousing and maintaining the interest of students, developing higher-level thinking skills, promoting the acquisition of science process skills. Therefore, in the context of this study, considering laboratory experiences are apposite and appropriate to search for instructional methods or modification of existing ones which can promote the objectives of education and investigate their effects, on students' learning outcomes in practical chemistry.

Gender is also a crucial variable that will be considered in this study. Gender issue in Nigeria has become an issue of concern in some years back. As schools and educational institutions are more structured, gender difference takes up new and more focus of researchers. Gender relates to the difference in sex (that is, either male or female) and how this quality affects their dispositions and perception toward life and academic activities (Okoh, 2007). (Obioma, & Ohuche, 1986) have shown that gender disparity is still very prevalent in Nigeria and perhaps the whole African countries. This is in line with the finding of Jimoh (2004) that male students performed better than female students in cognitive affect and psychomotor skill achievement. This shows that there is a strong association between gender and response to science education. Okeke, (2007) sees gender as a socially/culturally constructed characteristics and roles, which are associated with males and females in any society.

According to Okeke, it is different from sex which is a biological distinction in appearance (morphology) and function (physiology) as well as contributions of men and women. Some studies have shown that male show superiority in achievement than their female counterparts in chemistry and physics (Njoku, 1997 and Ukwungwu, 2001). Cheung (2009) conducted a comprehensive review of the literature regarding gender issues related to chemistry education. The study revealed that girls had a more favourable attitude towards studying chemistry than did boys. In the other way round some studies (Okwor, Agu and Ukwuaba, 2006 and Mbaba, 2010) have shown that there is no significant difference in the achievement of males and females in chemistry and physics. This study will indeed, verify the veracity of the claims of these authors.

School location: The term school location connotes the position of the school within the chosen area of study. This may be rural or urban. Rural areas refer to villages that are areas away from the local government headquarters, and lacking major amenities like healthcare centres, tarred road, electricity and pipe borne water. On the other hand, urban areas depict areas within the local government headquarters with the key amenities such as healthcare centres, tarred road, electricity and pipe borne water. Zudonu (2013) accentuated that our highly qualified teachers prefer to serve in urban areas than rural areas because of the presence of social amenities.

Statement of the Problem

Reviewed literatures in science education have revealed that the various instructional methods that have been used in teaching practical chemistry have not improved students' academic achievements in the subject to any significant extent. This connotes that the most desired scientific and technological knowledge that should be derived from practical chemistry for solving societal problems may not be sustained. The implication of this is that the teaching of practical chemistry does not result in the learners' understanding of concepts. Attitudes to practical chemistry contents (acids and bases) are very poor and are impeding the desired growth of science and technology that involve and revolve around chemistry. Based on this reason, the researchers are interested in finding the relative effects of two laboratory methods (guided discovery and demonstration against lecture method) that would enhance students' attitudes in senior secondary schools.

Purpose of the study

The main objective of this study is to determine laboratory methods that would enhance students' attitudes in senior secondary school I chemistry.

More specifically the study aims to:

1. determine the relative effect of treatment and control on students' attitude to practical chemistry content (acids and bases).

2. identify the interaction effect of gender and treatment against control on students' attitude to practical chemistry content (acids and bases).

3. determine the interaction effect of location and treatment against control on students' attitude to acids and bases in practical chemistry.

Significance of the Study

The findings of this study will be of huge benefit to the government, curriculum developers and educational policy makers, prospective and practicing chemistry teachers as it will provide vital information on the effectiveness of using laboratory instructional methods (guided discovery and demonstration) against lecture method on students' attitudes in practical chemistry in senior secondary schools.

The application of the findings of this study will be of immense help to the government. It will aid in designing in-service training programmes that will provide benchmarks for comparison and gauging programmes progress. It will also be of help as they are taking decisions on national strategies for science education integration at the senior secondary school level. Thus, the data provided by this study will aid in taking concrete action that will facilitate the recommendation of appropriate instructional methods that will be apt for the teaching of certain concepts in practical chemistry. Both the prospective and the practicing chemistry teachers are bound to stimulate more research interest in this area.

Scope of the Study

This study was carried out in Ahoada West Local Government Area of Rivers State. The study was delimited to practical chemistry contents (acids and bases). The content scope of the study includes the concepts of acids and bases. This content is found in SS1 chemistry curriculum. The dependent variable includes students' attitudes in chemistry practical activities.

Research Questions

In order to guide this study, the following research questions were posed:

1. What are the relative effects of teaching methods on students' attitude to practical chemistry contents (acids and bases)?
2. What are the interaction effects of gender and teaching methods on students' attitude to practical chemistry (acids and bases)?
3. What are the interaction effects of location and teaching methods on students' attitude to practical chemistry (acids and bases)?

Hypotheses

The following null hypotheses were tested at 5% level of significance to further answer the research questions.

$H0_1$: Students' attitude mean scores in practical chemistry (acids and bases) would not depend on the teaching methods used in instruction ($P<0.05$).

$H0_2$: The interaction effect of gender and teaching methods on students' attitude mean scores would not be significantly different ($P<0.05$).

$H0_3$: The interaction effect of location and teaching methods on students' attitude mean scores would not be significantly different ($P<0.05$).

Design of the Study

The study employed the quasi-experimental research design, it is non-randomized pre-test, post-test control groups design, involving intact chemistry classes at SS1 level.

Area of the Study

The study was conducted in Rivers State of Nigeria located in the south-south region of the country. Rivers State has 3 educational zones: Rivers West with 8 LGAs, Rivers East with 6 LGAs and Rivers Central that has 9 LGAs. But this study was delimited only to Rivers East Education Zone that made up of 8 LGAs out of which only Ahoada West Local Government Area was selected for the study. There are fifteen (15) senior secondary schools in this Local Government Area.

Population of the Study

The population of the study constitutes all senior secondary school I (SS1) chemistry students in Ahoada West Local Government Area of River State. The total number was 612 students (Source: Ahoada West Zonal School Board, Rivers State), made up of 250 males and 362 female students. The reason for taking senior secondary school I chemistry students was that acids and bases are in their curriculum.

Sample and Sampling Technique

All the 15 senior secondary schools in Ahoada West Local Government Area were taken as the target schools out of which 10 co-educational schools were randomly selected. The choice of co-educational schools was because gender was one of the variables under study. From this selected LGA that made up of 10 co-educational schools, 5 of them were randomly selected and sampled. Three intact classes of 18 (18 x 5 = 90 for G_1), 15 (15 x 5 = 75 for G_2) and 13 (13 x 5 = 65 for G_3) SSS 1 chemistry students were purposively selected from each of the schools sampled, making a total of 230 subjects for experimental groups (G_1 & G_2) and control group (G_3) respectively.

Treatment Procedure

Out of the three intact classes of 230 students drawn from five (5) co-educational secondary schools in Ahoada West L.G.A, two of the intact classes consisting of 90 and 75 chemistry students were assigned to groups (G_1 & G_2). They were treated using guided discovery and demonstration instructional methods respectively (experimental groups). The other intact class consisting of 65 chemistry students was assigned to group 3 (G_3) which was treated using lecture method (control group). Initially the intact classes were identified and labeled G_1, G_2 and G_3 for the pre-test on attitudes to practical chemistry. This was followed by treatment X_1, X_2 and X_3. The treatment lasted for four (4) weeks. At the end of the treatment the last test on attitudes were administered to the students. Chemistry Attitude scale (CAS) used was developed by the researchers. The structured questionnaire contains 30 statements which were administered to three groups. From CAS, attitudinal cluster contains 30. All these terms in the CAS were designed to measure students' attitudes towards the learning of practical chemistry (acids and bases) using guided discovery, demonstration and lecture methods in chemistry laboratory. And this was administered as pre-test and pos-test to treatment (G_1 & G_2) and control (G_3). The CAS contained items in a 4 point likert scale which was: strongly agree (SA), Agree (A), disagree (DA) and strongly disagree (SD). 230 copies of Chemistry Attitude Scale (CAS) questionnaire were administered to SSS I chemistry students during pre-test and post-test exercises respectively, this was undertaken by the researchers

and the trained chemistry teachers of the sampled schools. The completed copies of the administered questionnaire were retrieved back.

Validation of the Instruments

The Chemistry Attitude Scale (CAS) was face and content (item analyzed) validated by two experts for the correctness of content, representation of the practical chemistry concepts used and its appropriateness. Their observations, suggestions and corrections on the adequacy of the instruments were incorporated into the final draft of the questionnaire (CAS).

Reliability of the Instruments

The reliability of CAS was conducted using a trial testing on 20 SSS 1 chemistry students in co-educational schools in Ahoada West education zone of Rivers State. The number of items used was thirty (30). The instrument reliability coefficient gotten through the use of Cronbach's Alpha was 0.75 and it ensures the internal consistency of the instrument used. Therefore, the instrument was considered reliable for use in this present study.

Method of Data Analysis

The data collected were analyzed using the statistical tools of mean scores, standard deviations and ANCOVA. The descriptive statistics of mean scores, standard deviation were used to answer the research questions while the inferential statistics of ANCOVA of independent means was used to test the null hypotheses at 0.05 level of significant.

Research Question 1

What are the relative effects of (guided discovery and demonstration method) and control (lecture method) on students' attitudes to practical chemistry laboratory?

Table 1: Mean on Students' attitudes rating scores to practical chemistry contents (acids and bases)

	Treatment								
	Guided discovery			**Demonstration**			**Lecture**		
	N	X	SD	N	X	SD	N	X	SD
Pre-test	90	1.84	0.254	75	1.91	0.152	65	2.87	0.39
Post-test	90	3.53	0.09	75	3.38	0.08	65	3.34	0.18
Gain Mean scores	90	1.69		75	1.47		65	0.47	

Result presented in Table 1 shows the effects of three treatments of teaching methods on the students' attitude to practical chemistry contents (acids and bases). The guided discovery

method had the highest gain mean of 1.69 on attitude rating. This was followed by the group taught using demonstration method with a gain mean of 1.47 rating of the attitude of students. The control group had the least mean rating gain of 0.47. The result also indicates that the two methods (guided discovery and demonstration methods), used to teach the contents of chemistry practical (acids and bases) had greater effects on the students' attitude to practical chemistry content (acids and bases) than the lecture method of teaching (control).

Research Question 2

What are the interaction effects of gender and teaching methods on students' attitude on practical chemistry contents (Acids and bases)?

Table 2: Students' mean scores on the interaction effects of gender and teaching methods on attitude to practical chemistry contents (Acids and bases)

	Treatment (Male)								
	Guided discovery			**Demonstration**			**Lecture**		
	N	X	SD	N	X	SD	N	X	SD
Pretest	40	1.95	.15	40	1.93	.18	30	2.61	.44
Post-test	40	3.55	.10	40	3.38	.06	30	3.38	.20
Gain Mean scores		1.60			1.46			0.77	
	Treatment (Female)								
	Guided discovery			**Demonstration**			**Lecture**		
	N	X	SD	N	X	SD	N	X	SD
Pretest	50	1.75	.28	35	1.90	.12	35	3.10	.14
Post-test	50	3.50	.07	35	3.39	.09	35	3.31	.15
Gain Mean scores		1.75			1.49			0.21	

Table 2 gives interaction effects of gender and teaching methods on the students attitude to practical chemistry content (acids and bases), the results show both guided discovery and demonstration methods had higher gain mean ratings for the female (1.75 and 1.49 respectively) than the male gain mean ratings of (1.60 and 1.46 respectively). The control group reflects that the male had higher gain mean rating (0.77) than their female counterparts with 0.21. This result indicates that female students

had more effects of both guided discovery and demonstration methods than the male while the male had better effects only on the lecture method on their attitude to practical chemistry contents (acids and bases).

Research Question 3

What are the interaction effects of location and teaching methods on students' attitude to practical chemistry contents (Acids and bases)

Table 3: Students' mean scores on the interaction effects of Location and teaching methods on students' attitude to practical chemistry contents (Acids and bases)

	Treatment (Rural)								
				Demonstration			**Lecture**		
	N	X	SD	N	X	SD	N	X	SD
Pretest	30	1.95	.12	30	2.00	.08	25	3.14	.15
Post-test	30	3.51	.08	30	3.35	.08	25	3.30	.17
Gain Mean scores		1.56			1.35			0.16	
	Treatment (Urban)								
	Guided discovery			**Demonstration**			**Lecture**		
	N	X	SD	N	X	SD	N	X	SD
Pretest	60	1.78	.28	45	1.86	.17	40	2.71	.42
Post-test	60	3.53	.09	45	3.41	.07	40	3.37	.18
Gain Mean scores		1.75			1.55			0.66	

Results presented on table 3 gives interaction effects of location and teaching methods on the students' attitude to practical chemistry content (acids and bases). The result shows also that for all the treatment types (guided discovery, demonstration and control) the urban students had higher gain mean rating (1.75, 1.55 and 0.66 respectively) than their rural counterparts (1.56, 1.35 and 0.16 respectively). The result indicates that urban students had more effects of teaching methods on their attitude to practical chemistry contents (acids and bases) than the effects had on the rural students.

Table 4: Analysis of covariance of interaction of Gender, location and teaching methods on students' attitude on practical chemistry content (acids and bases)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1.928[a]	12	.161	13.363	.000
Intercept	10.108	1	10.108	840.583	.000
Pretest	.039	1	.039	3.234	.074
Gender	.080	1	.080	6.655	.011
Location	.172	1	.172	14.337	.000
Treatment	.935	2	.468	38.877	.000
Gender * Location	.004	1	.004	.357	.551
Gender * Treatment	.056	2	.028	2.330	.100
Location * Treatment	.030	2	.015	1.249	.289
Gender * Location * Treatment	.157	2	.079	6.532	.002
Error	2.610	217	.012		
Total	2706.299	230			
Corrected Total	4.538	229			

Hypothesis 1

Students' attitude means scores in practical chemistry (acids and bases) would not depend on teaching methods ($P<0.05$).

From Table 4, the result corresponding to treatment shows that F value is 38.877. This value is significant at 0.00, which is also significant at 0.05. This is because $P=0.00$, which is less than 0.05. Hence the hypothesis is not accepted. Therefore, students' attitude mean scores in practical chemistry were significantly different.

Hypothesis 2

The interaction effect of gender and teaching methods on students' attitude mean scores would not be significantly different ($P<0.05$).

From Table 4 above, the result corresponding to gender and treatment shows that F value is 2.330. This value is significant at 0.100, which is not significant at 0.05. This is because P=0.100, which is greater than 0.05. Hence the hypothesis is not rejected. Therefore, the interaction effect of gender and teaching methods on students' attitude mean scores is not significant.

Hypothesis 3

The interaction effect of location and teaching methods on students' attitude mean scores would not be significantly different (P<0.05).

From Table 4 above, the result corresponding to location and treatment shows that F value is 1.249. This value is significant at 0.289, which is not significant at 0.05. This is because P=0.289, which is greater than 0.05. Hence the hypothesis is not rejected. Therefore, the interaction effect of location and teaching methods on students' attitude mean scores is not significant.

Discussion of the Findings

Effects of teaching methods on students' attitude to practical chemistry contents (acids and bases)

Findings of this study showed that the effects of three treatments of teaching methods on the students' attitude to practical chemistry content (acids and bases), that the guided discovery method had the highest (1.69) gain mean rating on attitude followed by demonstration method with a gain mean rating of 1.47 rating the attitude of students. The control group had the least mean rating gained of 0.47. The result also indicated that guided discovery and demonstration methods used to teach the contents of chemistry practical (acids and bases) had greater effects on students' attitude to practical chemistry content (acids and bases) than the lecture method (control). From Table 4, the result corresponding to treatment shows that F value is 38.877. This value is significant at 0.00, which is also significant at 0.05. This is because P=0.00, which is less than 0.05. Hence the hypothesis is not accepted. Therefore, students' attitude mean scores to practical chemistry were significantly different. The superiority of guided discovery and demonstration methods might be due to teachers' dispositions towards helping (guidance) and motivating the students and also to availability of laboratory activities (Regan and Childs, 2003). The reason for a change in attitudes when exposed to guided discovery and demonstration was because the students were guided and allowed to discover things themselves and achieved cognitive growth, positive attitudes as well as social relationships among peers. The result is also in agreement with that of Njoku, (2007) which says that a successful student does not only have good study techniques, but he/she is highly motivated to study. In this regard, the treatments (guided discovery and demonstration methods) employed could have motivated the students to do better. Since students' attitudes demand the acquisition of sufficient and appropriate study techniques to ease their problems. This finding is also in agreement with that of Cheung (2007) who opined that guided discovery method is an approach to inquiry.

The interaction effects of gender and teaching methods on students' attitude in practical chemistry contents (acids and bases)

The findings of interaction effects of gender and teaching methods on the students attitude to practical chemistry contents (acids and bases), show both guided discovery and the demonstration methods of teaching had higher gain mean ratings for the female (1.75 and 1.49 respectively) than the male mean ratings of (1.60 and 1.46 respectively). The control group reflects that the male had higher gain mean rating (0.77) than their female counterparts with 0.21. This result indicates that female

students had more effects of both guided discovery and the demonstration methods than the males while the male had better effects only on the lecture method on their attitude to practical chemistry contents (acids and bases). The reason for a change in attitudes when exposed to guided discovery and demonstration was because the students were able to discover things themselves and achieved cognitive growth and positive attitudes. This indeed negated their previous unfounded ideas about acids and bases. The result is also in agreement with that of Njoku, (2007) which says that a successful student does not only have good study techniques, but he/she is highly motivated to study. In this regard, the treatments (guided discovery and demonstration methods) employed could have motivated the students to do better. Since students' attitudes demand the acquisition of sufficient and appropriate study techniques to ease their problems. From Table 4 above, the result corresponding to gender and treatment shows that F value is 2.330. This value is significant at 0.100, which is not significant at 0.05. This is because P=0.100, which is greater than 0.05. Hence the hypothesis is not rejected. Therefore, the interaction effect of gender and teaching methods on students' attitude mean scores is not significant.

The interaction effects of location and teaching methods on students' attitude in practical chemistry contents (acids and bases)

Finding of the interaction effects of location and teaching methods on the students' attitude to practical chemistry content (acids and bases). The result showed that for all the treatment types (guided discovery, demonstration and control) the urban students had higher gain mean rating (1.75, 1.55 and 0.66 respectively) than their rural counterparts (1.56, 1.35 and 0.16 respectively). The result indicates that urban students had more effects of teaching methods on their attitude to practical chemistry contents (acids and bases) than the effects had by the rural students. The result is in line with the finding of Njoku, (2007) which says that a successful student does not only have good study techniques, but he/she is highly motivated to study. In this regard, the treatments used could have motivated the students to do better. Since students' attitudes demand the acquisition of sufficient and appropriate study techniques to ease their problems. This finding is in agreement with the finding of Inomiesia who opined that students in urban schools are exposed to the modernizing effects of science and Technology and for this reason performed better than students in rural schools that have no such experiences. The result corresponding to location and treatment shows that F value is 1.249. This value is significant at 0.289, which is not significant at 0.05. This is because P=0.289, which is greater than 0.05. Hence the hypothesis is not rejected. Therefore, the interaction effect of location and teaching methods on students' attitude mean scores is not significant. The finding is in line with that of Inyang (1993) who found no significant difference in the performance of urban and rural students on an independently constructed and validated Integrated Science test.

Conclusion

The following conclusions were made based on the findings of this study.

1. Guided discovery and demonstration methods promote students' attitude to practical chemistry contents (acids and bases).

2. Gender and teaching methods have no significant effect on students' attitude to practical chemistry contents (acids and bases).

3. Location and teaching methods have no significant effect on students' attitude to practical chemistry contents (acids and bases).

Recommendations

The following recommendations were based on the findings of this study.

1. Guided discovery and demonstration methods should be used in teaching practical chemistry contents in secondary schools, since they are activity-oriented. Both methods possess the tendency to improve students' psychomotor skills, problem solving, critical thinking skills, computational skills and cooperative learning.

2. Adequate instructional activities should be provided in order to stir up students' enthusiasms, curiosity and interest, particularly, in the rural areas.

3. Ministry of education should organize in-service training programmes and workshops for teachers to acquire knowledge and mastery on the usage of the aforestated (guided discovery and demonstration methods) activity-based methods in practical chemistry laboratory activities.

4. Lecture method should not be encouraged in teaching practical chemistry contents in secondary schools, since it is not activity-oriented. It does not possess the tendency to improve students' psychomotor skills, problem solving skills, critical thinking skills, computational skills and cooperative learning.

5. Since the efficacy of guided discovery and demonstration methods in facilitating students' attitude to practical chemistry contents (acids and bases) has been established in this study, the Science Teachers Association of Nigeria, teacher training institutions supervisory bodies, curriculum developers and text book authors should adopt these methods in order to bring about meaningful teaching and learning of practical chemistry concepts.

6. Pre-service chemistry teachers should be given adequate training on how to use the methods. This is necessary, as curriculum developers are expected to include the use of the two methods in the curriculum of secondary schools, colleges of education and universities.

7. Also, government should upgrade the infrastructures and equip laboratories adequately for students use. This if done could raise students' interest and curiosity.

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