

EFFECT OF GUIDED DISCOVERY METHOD ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN QUANTITATIVE ANALYSIS

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Abstract: *This study was designed to investigate the effect of guided discovery and expository methods on secondary school students' achievement in quantitative analysis. It was quasi-experimental study, non-equivalent control design was used. A total of 180 SSI students were drawn from two secondary schools in Enugu Education Zone. Intact classes were randomly assigned experimental and control groups. The researcher developed instrument called Teacher-made quantitative Analysis Test (TEMQAT) which was used for data collection. The instrument was validated by their research experts. TEMQAT achieved a reliability of 0.76 calculated using Kuder Richardson 20 (KR-20) formula. Two research questions and two research hypotheses guided the study. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). Major findings of the study revealed that students taught Quantitative Analysis using guided discovery teaching method achieved higher than those taught with expository method. Consequently, it was recommended that chemistry teachers in secondary schools should adopt guided-discovery teaching method for teaching quantitative Analysis in chemistry concepts.*

Keywords: *guided discovery method, secondary school students, achievement, quantitative analysis*

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Introduction

The relevance of quantitative analysis in chemistry, as a required science based courses and a vehicle for technological breakthrough has been stressed by some science educators. The present dwindling situation of students' loss of interest and their consequent poor achievement in chemistry in secondary schools deserve the interest of educators and researchers together. The WAEC Chief Examiners' annual reports have continued to show students' poor achievement in secondary school certificate chemistry examination. The Federal Republic of Nigeria

(2013) stated that the broad goal of secondary education is to prepare individuals for "useful living within the society. Mogbo, (2000) maintained that quantitative analysis aspect of practical chemistry has its natural abode in laboratory. Mogbo described laboratory as an indispensable tool for the development of skills for problem solving in quantitative analysis Meester, (2005) maintained that for over 25 years a lot of articles have featured on changes in the role of quantitative analysis in secondary school education. There are many quantitative analysis topics in senior secondary school chemistry curriculum. For

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instance, the volumetric analysis, stoichiometry, chemical calculations, concentration and percentage purity etc.

Odogwu, (2003) emphasized that poor method of teaching chemistry was a vital contributing factor to poor achievement of students in quantitative analysis. Odogwu described it as “differences in intellectual functioning” of all these problems, the controlling factors are poor method of teaching chemistry especially in quantitative analysis aspect. According to Ezugwu, (2002), as a teacher is, so is his student. Ezugwu added that result of a teacher’s poor method of teaching in a chemistry class is poor achievement, low interest and negative attitude.

A lot of innovations have been introduced as teaching methods for secondary school chemistry. These include guided discovery, expository, laboratory, concept mapping, demonstration, etc. yet there seems to be no significant improvement in students’ interest and achievement in chemistry. This suggests the need to look for new methods. This work is based on one of such methods guided discovery method of teaching which has been designed in order to determine the extent to which it can help students achieve highly in quantitative analysis.

According to Ezugwu, (2002), learning is a process of guided discovery in which the existing knowledge of an individual is changed or reconciled by the interaction between experience and new information. At classroom level, discovery method of teaching and learning quantitative analysis is student centered and implies a situation where chemistry students arrive at “new”. Knowledge as a result of using their mental process like observing, measuring, classifying and so forth and then drawing a logical conclusion from the data they have generated.

Statement of the Problems

Available research evidences point to the fact that senior secondary students in Nigeria achieve poorly in sciences especially in quantitative analysis aspect of chemistry. The West African Examination Council (WAEC) chief Examiner’s report observed that students achieve very poorly in quantitative analysis aspect of practical chemistry. Since then, students problems have been on the increase in the quantitative analysis aspect of practical chemistry.

In addition, insufficient number of laboratory assistants, inexperienced chemistry teachers and lack of enthusiasm by students towards quantitative analysis pose a serious

problem in the teaching and learning of chemistry. The situation as it concerns teacher centred current method of teaching quantitative analysis aspect of chemistry is particularly worrisome described such methods like traditional methods as being dull, uninteresting and ineffective.

Gender issue in science generally in chemistry is particular in indeed very vital. This becomes more obvious in societies such as ours where sciences are erroneously viewed as masculine and arts such reviewed as feminine. It is worrisome that despite the huge number of female professionals doing so well in science- based professionals, medicine, engineering, architecture are still looked at for males while nursing, food and nutrition and their likes are regarded as female profession. This work therefore, investigated the interaction between teaching strategy and students’ gender as its affects their achievement in chemistry with an aim to correct some gender = based misconceptions in teaching and learning of chemistry.

Perhaps, it is in realization of the need to inject dynamism into the science teaching in Nigeria that has given rise to the current researches on the use of innovation approaches to science teaching.

Therefore, the problem of the study is how effective would the two innovative methods of teaching chemistry be in order to enhance achievement in the subject with particular reference to qualitative analyses.

Purpose of the Study

The purpose of the study was to determine the effect of Guided Discovery method of teaching on Senior Secondary School students’ achievements in quantitative analysis aspect of chemistry, specifically the study was aimed at finding out;

- (1) The mean achievement scores of students taught quantitative analysis using Guided Discovery method and those taught using expository method.
- (2) The mean achievement scores of male and female chemistry students taught quantitative analysis with guided discovery teaching method and those taught using and those taught quantitative analysis using expository teaching method.

Research Questions

The following research questions guided the study:

- (1) What are the mean achievement scores of senior secondary school chemistry students taught quantitative analysis with guided discovery method and those taught using expository method?
- (2) What are the mean achievement scores of male and female senior secondary school students' taught quantitative analysis with guided discovery method and those taught quantitative analysis using expository teaching method?

Research Hypotheses

The following null hypotheses (H_0) were formulated for the study and tested at 0.05 level of significance.

H_{01} : There is no significant difference between the mean achievement scores of students taught quantitative analysis using Guided Discovery and those taught using Expository method.

H_{02} : There is no significant difference between the mean achievement scores of male and female chemistry students taught quantitative analysis with guided discovery using method of teaching.

Design of the study

The research design adopted was quasi-experimental research design, nonequivalent pre-test, post-test control group research design was used for the study.

Methodology

The quasi-experimental design was adopted for the study. The population of the study was all the senior secondary two chemistry students in Enugu East Local Government Area of Enugu Education Zone of Enugu state of Nigeria. Purposive random sampling technique was used to select two schools out of seven schools in Enugu East Local Government Area of Enugu Education zone. Simple random technique was also used to select salt analysis for

titration in quantitative analysis in chemistry used for the study. A Teacher made Quantitative Analysis Test (TEMQAT) Questions were generated for instrument used in data collection. The instruments were face and content validity, which was validated by the experts from the department of Science Education Enugu State University of Science and technology and from measurement and Evaluation Department and the other was from Science Education department in Institute of Ecumenical Education, Thinker's Corner, Enugu State Nigeria. The comments and suggestions of the experts were incorporated in building the final draft of the instruments content validity of the TEMQAT was ensured by the use of the test blue print. Items analysis was used to select only item that satisfied.

Psychometric Qualities for Teacher Made Quantitative Analysis Test (TEMQAT). The TEMQAT was pilot test on thirty S.SII students from community high school Emene – Enugu and community secondary school Orgo-Ikem, Enugu.

The result was used to determine the reliability of the instrument using Kuder Richardson formula 20. The internal consistency of the instrument was 0.98. the (TEMQAT) Instruments were administered as both the protest and post-test by the researcher. The data obtained was analyzed using mean standard deviation and Analysis of Covariance (ANCOVA). The hypotheses were test at 0.05 level of significance.

Result and Discussions

The results were presented in line with the research questions and hypotheses in the table below.

Research Questions 1:What are the mean achievement scores of senior secondary school chemistry students taught quantitative analysis with guided discovery method and those taught using expository method?

Table 1: Mean scores and standard deviation of guided discovery and expository group in the pretest and post-test.

Pretest				Posttest		
Group	Mean	SD	N	Mean	SD	N
Guided discovery	48.31	10.14	106	61.35	8.34	106
Expository	48.62	8.81	74	58.76	8.57	74
Average	48.47	9.48	180	60.06	8.46	180

Table 1 showed that the Guided Discovery Group achieved a higher mean score (61.35) than their expository counter parts (58.76) in the posttest which was not the case on the pretest.

Research Question 2: What are the mean achievement scores and standard deviations of male and female senior secondary school chemistry students taught quantitative analysis with guided discovery method of teaching?

Table 2: Mean scores and standard deviations of male and female SS2 students in the Guided Discovery and Expository Groups in the pretest and posttest.

Method	Sex	Pretest			posttest		
		Mean	SD	N	Mean	SD	N
Guided discovery	Male	49.78	9.61	70	61.77	8.74	70
	Female	47.35	8.82	36	60.53	7.54	36
	Average	48.56	9.22	106	61.15	8.14	106
Average	Male	50.93	9.69	43	60.77	8.89	43
	Female	46.43	8.90	67	59.46	7.82	67
	Average	48.68	9.30	180	60.12	8.36	180

Table 2 showed that during posttest, the male guided discovery group student (mean = 61.77) achieved almost equally with the female students (mean = 60.53), while on the pretest, male guided discovery group students (mean=49.78) also achieved almost equal to the female students (mean=47.35). The total mean scores for both sexes combined further show that both sexes achieved equally well in the posttest when compared with their

achievement in the pretest from the above mean scores, one can say that students' achievement in chemistry with regards to sex is just average.

Ho₁: There is no significant difference between the mean achievement score of students taught quantitative analysis using guided discovery and those taught using expository method.

Table 3: Two way ANCOVA Results of Guided Discovery and Expository Groups with respect to sex in the post test.

Sources	Sum of Squares	DF	Mean Square	F	Sig	Dec
Covariate (Pre)	7272.496	1	7272.496	238.18	0.000	S
Main effect	661751.599	5	132350.320	4334.56	0.000	S
Method	299.860	1	299.860	9.82	0.002	S
Sex	2.006	1	2.006	6.07	0.798	NS
Method X sex	4.092	1	4.092	0.13	0.715	NS
Error	5343.401	175	30.534			
Total	667695.000	180				

Where Dec = Decision, DF = Degree of Freedom, S= Significant: NS = Not Significant.

The significance column of table 3, shows the level at which the F-calculated signifies that if this level is less than 0.05 set for this study then there is a significant difference but if it is more than 0.05, then there is no significant difference. Hence table 3 shows that covariates and main effects are both significant. The finding also shows that there is a significant difference between the guided Discovery and Expository method of teaching.

Summary of Findings

1. There is a significant difference between the mean achievement scores of the Guided Discovery and Expository groups in the posttest.
2. There is no significant difference between the mean achievement scores of male and female students.

Discussion of the Findings

The findings from this study has indicated that the use of the guided discovery method of teaching as an instructional strategy has facilitates impacts on students achievement in quantitative analysis and guided discovery method ensures active participation of students in the teaching learning situations. The result is in agreement with the result of the research carried out by Briggs (2004). This result also showed that the male students who were taught guided discover method has a significant higher achievement than female students. Who were taught by the same teaching strategy Ugwu, (2000) and that of Uzoagulu, (2001).

Recommendations

From the findings of this study, the researcher deems it necessary to recommend that

1. More of chemistry teachers at all levels should start now to use Guided Discovery method in teaching students quantitative analysis since it increases achievement.
2. Seminars and workshops should be organized for practicing teachers on the use of Guided Discovery method of teaching.
3. Tertiary institutions preparing chemistry teachers should incorporate Guided Discovery method of teaching in their chemistry education programme to enable chemistry students learn the using Guided Discovery method.
4. Government and professional bodies such as the Science Teachers Association of Nigeria (STAN) should sponsor further research on the efficacy of

the Guided Discovery method of teaching in promoting achievement in other aspects of Senior Secondary School chemistry especially in quantitative analysis, inorganic and organic chemistry.

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