

THE IMPACT OF VEE MAPPING STRATEGY ON CHEMISTRY STUDENTS' PERFORMANCE IN QUANTITATIVE ANALYSIS IN KADUNA STATE, NIGERIA

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Abstract

This paper investigated the impact of vee mapping strategy on chemistry students' performance in quantitative analysis in Kaduna state. The pretest-posttest experimental control design was employed. Stratified random sampling was used to select two schools which were randomly assigned as experimental and control groups. The experimental group was taught quantitative analysis using vee mapping strategy while the conventional practical method was used on the control group. A total of 80 students formed the sample size selected from all co-educational schools in kafanchan Inspectorate Division. The instrument for data collection was a 20-item CQAAT in quantitative analysis. The results showed that students in the experimental group outperformed their counterparts in the control group tested at 0.05 level of significance. No gender differences emerged when male and female students used the the vee mapping strategy. It was concluded that the strategy is gender friendly thus science teachers should utilize the strategy.

Keywords: chemistry, vee mapping strategy, quantitative analysis, performance, senior secondary school.

Introduction

Chemistry is a branch of science that deals with composition, structure and properties of matter and with the transformations they undergo. It deals with the properties of atoms, the interaction of the various molecules undergo with one another and the accompanying energy changes (Adeyemo, 2005). Akinsola and Igwe (2002) see it as the science that deals with molecular transformation and manifestation of matter. Chemistry is a core science subject taught in the senior secondary school level. It is the bedrock of scientific and technological breakthroughs. The subject is applied to virtually every human activity and almost all professions involve some element of it. Chemistry is prerequisite to many fields like medicine, pharmacy, Engineering, Bio-chemistry, Microbiology, environmental chemistry, analytical chemistry and agriculture Nkwocha, (2012). Despite its importance in the field of science and

human endeavours, students' performance both in internal and external examinations like NECO and WAEC is not encouraging.

Practical chemistry in WAEC and NECO is called Paper 1 which comprises of qualitative and quantitative analysis. Quantitative analysis is the determination of the amount (Concentration) of Chemical species in samples like molar concentration, concentration in grammes, molecular mass, molecular formula and percentage purity Ayinde & Asubiojo (2016). The concept is based on volume measurement of solutions hence can also be called volumetric analysis. Experience has shown that a large number of chemistry students face difficulty in learning practical concepts meaningfully Gaiya, (2014). This may be as a result of non-availability of the practical facilities (Ibe 2004), teacher centredness (okeke 2010), or (Madu 2004) for practicals. Onyegegbu, (2008) asserted that most practical work in science (Chemistry inclusive) are conducted in a Mundane and Unimaginative manner. Teachers of the 21st Century still engage in "Cookbook" laboratory activities with the textual discrimination of experiments. This approach has been proven not to enhance students' knowledge and performance rather it works antagonistically to the best practical approach in which students pursue their own inquiry under the guidance of the teacher. Thoron and swindle (2008), thus the need for metacognitive strategy in practical classroom that will facilitate better knowledge gain. One possible strategy is the vee map which is both teacher and learner friendly.

A vee map is an instructional strategy in which learning takes place through discoveries that results from investigation made by the students (Hoffman & Riggs 2006). It is an instructional strategy that help students develop their thinking skill. A vee map is a road showing a route from prior knowledge to new and future knowledge. It is one of the constructivist models of teaching and learning which enhance students understanding of science practicals Thorom & Myers (2010). It was first developed by Gowin in 1977 to help instructors and learners understand the process of constructing their own knowledge during practicals. The vee map which is a formative assessment tool provides a framework and guide learners through the steps involved in scientific reasoning methods. The vee map shows how new knowledge interacts with what is already known and make available strategies that will enhance their conceptual understanding of an experiment. In other words vee map is a metacognitive instructional method based on Ausubel's assimilation theory which explains that meaningful learning occurs through the assimilation of new concepts into existing concepts held by the learner.

The vee map follows the shape "V" as its name implies by two axes extending down from the top to form a crux where the join at the bottom. The left and the right sides of the vee emphasize two interdependent aspects of science learning; knowing and doing respectively. The knowing or the conceptual side forms the left axis of the vee while the doing or methodological side forms the right axis. The knowing side comprises of:- associated words, philosophy, principles and relevant concepts which are the constructs that provide the foundation for methodology or context for further learning. On the other hand, the methodological side comprises claims, transformation and records. It is worthy to know that what a student know about a topic at any one moment (previous knowledge), the investigative tools available and their ideas will determine the quality of questions they ask. Also the answers students give to their questions will affect what they know by changing, adding to, refining or reconfiguring their knowledge.

Researches on vee mapping have proved better performance on students.

Thoron&myers (2010) found a statistical significant difference between groups on the posttest in favour of those who used vee maps in Agricultural science.

Osegbemi (2004) examined the effects of vee mapping on secondary school students anxiety and achievement in practical chemistry and found vee mapping to significantly enhance learning in volumetric analysis.

Gender is the biological difference in terms of sex. It has been identified as one of the moderating factors affecting students' performance in science (Chemistry) at senior secondary school level. For instance, Olasehinde and Olatoye (2014), Umar (2011), Gaiya (2014)Thorom and Myer (2008) found no significant difference between the performance of male and female students taught science concepts. Amoo (2011), Kauru (2010) found that girls achieved higher in science concepts while Udousoro (2011), Aniodah &Eze (2014) found that male students out-performed their female counterparts, therefore the need to study gender effects in this research.

The Problem

Recently, great efforts by researchers have been directed at strategies that will enhance the learning of science practical. It has been observed that most chemistry teachers still prefer the traditional laboratory method in which learners show their ability to provide title, aims procedures, apparatus used and answer to series of concluding questions Osegbemi(2004), thoron& Myer (2010).The teachers grade student laboratory report by their ability to provide answers to concluding questions only. In this method, students only create documents to turn for marks instead of increase in understanding and ability to apply knowledge

Also, WAEC chief examiners' reports 2010, 2011 and 2016 pointed out among others students' inability to link theoretical knowledge with practical work in quantitative analysis, thus the need for this study "impact of vee mapping strategy on chemistry students' performance in quantitative analysis in Kaduna state.

Research Questions

The study sought answers to the following research questions:

- i. Is there any significant difference in the performance of students taught quantitative analysis using vee mapping strategy and conventional practical method?
- ii. Is there any significant difference in the performance of male and female students taught quantitative analysis using veemapping strategy?

Research Hypotheses

The formulated null hypotheses that guided the study include:

HO₁: there is no significant difference between the mean performance scores of students exposed to vee mapping strategy and the conventional practical method.

HO₂: there is no significant difference in the mean performance scores of male and female students exposed to vee mapping strategy.

Methodology

The study adopted pretest – posttest experimental and control research design. The experimental group was taught using vee mapping strategy while the control used the

conventional practical style. Three stage sampling technique were adopted. First, stratified random sampling was adopted to obtain two secondary schools in the division. The schools were sampled based on similar laboratory facilities, school type (Public Schools), school location (Kafanchan Inspectorate Division) and gender (co-educational schools). The two selected schools were further assigned to experimental and control group using random sampling. GSS Kagoro formed the experimental group while GSS Ngarshang, Kwoi formed the control group. Lastly, stratified sampling technique was used in selecting sample size for the study. By implication, the researchers arranged the students into male and female. A total of (80) eighty SSII students were selected as sample size.

The research instrument was the chemistry quantitative analysis achievement test (CQAAT) developed by the researchers. The (CQAAT) consisted 20 multiple choice objective items. The items in the CQAAT was validated by two principal lecturers in the department of Chemistry, Kaduna state college of Education, GidanWaya. Also, the CQAAT was pilot tested on 20 randomly selected SSII students of Government secondary school Fadan Kagoma, Kaduna state, which was part of the population for the study. The reliability index was 0.74 which was considered adequate for the study.

Results

The data collected for the study was analysed using mean, standard deviation and t-test. The significance of the analysis was ascertained at 0.05 alpha level

Table 1: t-test Comparison of pretest mean scores of experimental and control. groups

Variables	N	X	SD	df	T-Valve	P	Remarks
Experimental	40	23.13	5.51	78	0.785	0.433	Not Significant
Control	40	22.12	5.87				

NS- not significant at 0.05 level of significance

Table 1: Indicates that the pretest mean scores of experimental 23:13 and 22:12 for the control did not differ significantly ($t = 0.785$; $df = 78$; $p > 0.05$). This shows that the two groups were comparable before treatment

Hypothesis 1

HO₁: There is no significant difference between the mean performance scores of students exposed to vee mapping strategy and the convention practical method.

Table 2: t-test Comparison of posttest mean scores of experimental and groups.

Variables	N	X	SD	df	t-value	P	Remark
Experimental	40	58.38	8.68	78	0.409	0.001	Significant
Control	40	47.25	7.41				

Significant $P < 0.05$

Table 2: Presents the T-Test result of experimental and control groups. The mean scores of experimental group was 58.38 and 47.25 for the control. The calculated t-value of 0.409 was

significant at 0.05 level. Hence, the null hypothesis one (H_{O1}) was rejected with a mean difference of 11.13.

Hypothesis 2

H_{O2} : There is no significant difference in the mean performance scores of male and female students exposed to vee mapping strategy.

Table 3: t-test comparison of mean scores of male and female students exposed to vee mapping strategy.

Variables	N	SD	df	t-value	P	Remark
Male	20	60.01	8.92	38	0.345 ^{ns}	0.732
Female	20	58.75	9.65			Not Significant

ns- not significant

The result in table 3 presents the t-test result of the posttest mean scores of male and female students exposed to vee mapping strategy. The t-value of 0.345 was not significant at 0.05 level, ($t=0.345$, $df=38$, $P>0.05$). The null hypothesis two was therefore upheld.

Discussion of Results

The result of hypothesis one (H_{O1}) reveals that there is a significant difference in the performance in favour of students taught quantitative analysis using vee mapping strategy. This result agrees with the findings of Gaiya (2014); Osegbemi (2004) in chemistry practical, Thorom& Myers (2010) in Agricultural science practical. Thus Vee mapping strategy has been confirmed to be an effective strategy for enhancing students' performance in practical science.

The results of hypothesis two (H_{O2}) shows no gender effect on the performance of male and female students taught volumetric analysis with vee mapping strategy. This agrees with the findings of Gaiya (2014); Olatoye (2014) in science concepts. The findings disagree with the results of Amoo(2011) and Kauru 2010 who found that female students performed better in science concepts. The results also disagrees with the findings of Aniodoh&Eze (2014) and Udousoro, (2011) who found that male student performance better in science concepts.

Conclusion

The study showed that the use of vee mapping strategy have the potential of improving the performance of students in quantitative analysis. This may be due to the fact that vee mapping strategy is a formative assessment tool which provides a framework and guide learners through the steps involved in scientific reasoning. The strategy is also gender friendly since it affected both male and female in the same manner.

Recommendations

The following recommendations were made based on the findings

- Vee mapping strategy should be encouraged for teaching and learning chemistry practical in schools since it has been found to improve performance.
- Government should release more funds for training of teachers on strategy that are learners friendly.

- iii. Students should try as much as possible to imitate great achievers in chemistry education as role models in order to be one tomorrow.

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