

IMPACT OF CHEMISTRY TEACHERS' PARTICIPATION IN WAEC AND NECO MARKING ON STUDENTS' LEARNING OUTCOMES IN CHEMISTRY IN ONDO STATE

By

Josephine Kehinde ARIYO

Department of Science Education, AdekunleAjasin University, AkugbaAkoko
ariyojosephine@gmail.com

&

Adesewa Titilayo OGUNWOLE

Department of Chemistry, Federal College of Education, Odugbo, Benue State.
titilayoadesewa@gmail.com

Abstract

The study investigated the effect of higher, average and low years of participation in WAEC and NECO marking on chemistry students' performance, self-concept and attitude in Akure South Local Government (LG) of Ondo State. The study adopted the quasi experimental research design. The population for the study comprised all the senior secondary two (SSII) chemistry students in Ondo State. The sample for the study comprised of 136 students using the multi-stage sampling procedure. The instruments used for the study were Chemistry Achievement Test (CAT), Chemistry Students' Self-Concept Questionnaire (CSSCQ) and Chemistry Students' Attitude Questionnaire (CSAQ) which were trial tested using and the split half method. Reliability coefficients were determined respectively as CAT = 0.76 using Kuder Richardson (K-20), CSSCQ = 0.83 and CSAQ = 0.69 using the Crombach Alpha respectively. The results showed that that students that were taught by teachers with higher ($t = 16.670$ at $P < 0.000$), average years ($t = 13.631$, $p < 0.000$) of participation in WAEC and NECO marking had improved chemistry achievement in the State. It also showed that students that were taught by teachers with higher ($t = 19.118$, $p < 0.000$), average years ($t = 14.055$, $p < 0.000$) of participation in WAEC and NECO marking had enhanced chemistry self-concept. It finally showed that students that were taught by teachers with higher ($t = 15.406$, $p < 0.000$), average years ($t = 15.763$, $p < 0.000$) of participation in WAEC and NECO marking had improved attitude to Chemistry. The study concluded that students that were taught by teachers with higher and average years of marking of WAEC and NECO improved on their academic achievement, self-concept and attitude.

Key Words: Marking experience, participation, students' learning outcomes, self-concept, students' performance, attitude

INTRODUCTION

Science may be regarded as an organized body of knowledge that engages a methodical approach to investigating nature in a testable, verifiable and replicable manner. This affords scientists a greater opportunity to establish presumed relations among phenomena with the basic aim of improving the understanding of the natural world. The major components of science knowledge arising from the methodic approach to science should reflect the information, process, creative, attitudinal and personal relevance domains (Okebukola, 2008). Sciences subjects at the secondary school level are distinct subjects like physics, chemistry and biology.

Chemistry is the science subject that deals with the composition, structures and properties, relationship and interaction between different types of matter and energy. Through the learning of chemistry, it is possible to acquire relevant conceptual and procedural knowledge as well as develop understanding and appreciation of development in engineering, medicine and other related scientific and technological fields. Besides, learning about the contributions, issues and problems relating to innovations in chemistry will aid students in the development of a holistic view of the relationships among science, technology and society.

The Nigeria Bureau of Statistic (NBS, 2022) in December, 2022 revealed that the Nigeria's unemployment rate is about **33%** which represents only those that are actively seeking employment. Many Nigerians have even given up looking for jobs, after years of fruitless searches in the job market. The document further stated that the number of Nigerians living in poverty rose by 35 million in 2022. This national challenge can be resolved to a reasonable level if the teaching and learning of chemistry in Nigerian schools is reenergized. This is because, studying chemistry will also put one in an excellent pedestal to choose from a varied variety of useful, interesting and rewarding careers thereby reducing the unemployment rate and raising the people beyond the poverty line. A person with a high knowledge of chemistry is well prepared to assume professional positions in industry, education, or public service. The list of career possibilities for people with adequate training in chemistry is extensive and varied. Even in such times when unemployment rates are at a geometric progression as in the case of present day Nigeria, the chemist remains one of the most highly sought after and employed scientist.

Despite the universality and obvious indispensability as well as infinite career options associated with chemistry, there exist palpable decline enrolments in Chemistry in Nigeria (Abanikannda, 2016). This, according to Osokoya (2015), has degenerated to the level that there are situations where only four students are enrolled in a school that is having more than ninety students in a class. Glory (2020) had even forewarned that chemistry was conspicuously missing from the list of 21 top sought after courses in Nigerian universities. This scenario no doubt obviously portends severe danger for future of industrialization and science education in Nigeria.

Coupled with low enrolment, Mailumo, Agogo and Kpagh (2007) observed a consistent poor performance of secondary school students in chemistry and attributed the cause to defective teaching pedagogy. Other reasons identified for the dwindling interest and low level of performance in Chemistry include: insufficiency of qualified chemistry teachers, poorly equipped laboratories, poor study habits, lack of requisite infrastructure and poor funding (Alam, Oloruntegbe, &Orimogunje, 2010).

There is therefore the need to properly interrogate the teaching and learning of chemistry in Ondo State with a view to discerning possible deficiencies and corrective mechanisms. The study is predicated on the necessity of perpetuating and transferring the knowledge of chemistry to the next generation. It is aimed at re-awakening interest and providing enabling environment for effective mastery of the subject.

Aside students' academic performance, there are other expected learning outcomes from the students at the end of instruction. These include the acquisition of the psychological constructs such as academic self-concept. Academic self-concept is a psychological construct employed to describe a students' belief regarding their ability in a particular academic area such as chemistry. Valentine (2004) suggests that academic self-concept refers to an individual's understanding and perceptions about themselves in academic achievement situations. This is another important learning outcomes which relates to student's self-perception of their ability developed through specific endeavours and academic interactions.

Another learning outcome of secondary school chemistry is students' attitude. In other words, attitude, motivation, and genuine interest are the most important student characteristics associated with successful studies (Norman &Salleh, 2005). Attitude towards chemistry is essential.

This is because it denotes interests and feelings towards studying chemistry. Attitude and academic achievement are important outcomes of science education in secondary schools. Students' attitude and interest could play substantial role in students' decision to study science (Abulude, 2009).

The extent to which the chemistry teachers are able to foster these skills and improve on the performance of the students in chemistry based on their marking experience is uncertain. It has also been observed by Fehintola (2009) that one of the major issues that bother students in Nigeria today is their academic performance. Poor academic performance of students in internal and external examinations is a reflection of the problems and challenges facing the educational system in Nigeria. In Nigeria, education is seen as the only means of getting to the top hierarchy in any endeavour. Therefore, poor academic performances usually bring about sadness and frustration to the individual concerned and to his or/her parents as well as other members of the family. It gives parents and students the feelings of satisfaction and joy when children excel academically (Fehintola, 2009). There is therefore the need to investigate the effect of chemistry teachers' marking experience in WAEC and NECO on the students' academic performance, chemistry self-concept and scientific creativity.

Statement of the Problem

The essential function of the teaching of chemistry is to facilitate learning towards improving the students' learning outcomes. Several studies have been conducted on the best ways of improving the students' learning outcomes in sciences and chemistry in particular with myriads of inconsistent evidences. In-service and pre-service training, year of teaching experience and teachers' pedagogical content knowledge are some of the teachers' characteristics that have been proven to improve on the students' learning outcomes. Much has not been documented as to the effect of teachers' marking of WAEC and NECO scripts on the academic performance of the students in chemistry. Few studies with conflicting reports focused majorly on academic performance with little efforts at investigating other psychological constructs relating to students learning outcomes such as chemistry students' self-concept, attitude and creativity. It is assumed that a chemistry teacher examiner of WAEC and NECO is expected to have adequate knowledge of the dynamics of the questions and the exact approaches students need to do well in examinations and improve on other skills associated with teaching and learning of chemistry. The extent to which these skills are deployed in the teaching of the students cannot be ascertained. Therefore, the problem of the study can be seen in the following broad question: What is the impact of chemistry teachers' participation in WAEC and NECO marking on students' learning outcomes in chemistry in Ondo State?

Hypothesis

The following research hypotheses are stated and shall be tested at 0.05 level of significance:

1. There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' achievement in Akure South Local Government (LGA) of Ondo State.
2. There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' self-concept in Akure South Local Government (LGA) of Ondo State.
3. There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' attitude in Akure South Local Government (LGA) of Ondo State.

Methodology

The design adopted for the study was the quasi-experimental pre-test, post-test, control research design. The population for the study comprised of all Senior Secondary Three (SS III) chemistry students in Akure South Local Government (LG) of Ondo State. The sample consisted of 136 students from three intact chemistry classes in the Local Government Area which were purposively selected based on availability of chemistry teachers with the required years of marking

experience in WAEC and NECO examinations. One arm of SS III students was selected in each of the three schools using the random sampling technique. Three instruments: Chemistry Achievement Test (CAT), Chemistry Students' Self-concept Questionnaire (CSSCQ) and Chemistry Students' Attitude Questionnaire (CSAQ) were used for data collection. Validation of the three instruments was carried out to determine its strength and weakness before administration on the respondents. The instruments were trial tested on 25 students similar to the target population from a secondary school in Ekiti State using the split half method. The reliability coefficient for the three instruments as follows: CAT = 0.76 using Kuder Richardson (K-20), CSSCQ = 0.83 and CSAQ = 0.69 using Crombach Alpha respectively. Each arm of the students in their intact classes were assigned to experimental groups A (A teacher of above 10 years marking experience), and B (A teacher with 5 years marking experience), and the control group C (A teacher without marking experience). The students in their intact classes were taught the concept of organic chemistry by the chemistry teachers with the required (Higher, Average and Low) number of years of marking experience in WAEC and NECO examinations. The first week was for the administration of pre-test. The treatment in all the groups covered two periods per week for a period of four weeks. In the sixth week, post-test which was the same CAT, CSAQ and CSSCQ were administered to the groups to determine the effect of the intervention on their performance, self-concept and attitude. The data generated were analyzed using descriptive and t-test statistics.

Results

The results of the analysis of data collected for the study are presentation based on the hypotheses generated for the study.

Hypothesis 1: There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' achievement in Akure South Local Government (LGA) of Ondo State.

To test hypothesis one, the pre-test and post-test achievement mean scores of chemistry students taught by the categories of teachers (A, B, and C) were subjected to descriptive and t-test analysis as presented in Tables 1 and 2.

Table 1: Descriptive Statistics of Student's Pre-test and Post-test Scores on academic achievement of Students

	N	Minimum	Maximum	Mean	Std.	Std.
	Statistic	Statistic	m Statistic	Statistic	Error	Deviation Statistic
Group A Academic Performance Pre-test	45	6.00	24.00	14.4000	.61002	4.09212
Group A Academic Performance Post-test	45	14.00	29.00	23.2222	.57987	3.88990
Group B Academic Performance Pre-test	48	6.00	25.00	14.2500	.74407	5.15504
Group B Academic Performance Post-test	48	16.00	30.00	21.3958	.49082	3.40050
Group C Academic Performance Pre-test	43	2.00	23.00	13.0930	.77389	5.07475
Group C Academic Performance Post-test	43	5.00	25.00	14.9070	.69152	4.53460
Valid N (listwise)	43					

Table 1 shows that achievement mean scores of students in Group A, B and C as ($\bar{x} = 14.4000$), ($\bar{x} = 14.2500$) and ($\bar{x} = 13.0930$) for pre-test while the achievement means scores for post-test are ($\bar{x} = 23.2222$), ($\bar{x} = 21.3958$) and ($\bar{x} = 14.9070$) respectively. Since the post-test mean score for group A is greater than the post-test mean score for group B followed by group C, it is evident that the experimental group A has higher achievement mean score than the experimental group B and the least achievement mean score is control group C. This result revealed that students taught by teachers with higher years of experience in marking WAEC and NECO gained higher achievement scores in chemistry.

Table 2: Paired Sample t-Test Analysis of Pre-test and Post-test of Student's Scores from Experimental Group A (Students Taught by Teachers with Higher Years of Marking WAEC and NECO).

		Paired Samples Test					t	df	Sig. (2-tailed)
		Mean	Paired Differences						
			Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Group A A P P Pre-test - Group A A P Post-test	8.8222	3.5502	.52924	-9.88883	7.75562	16.670	44	.000

The results from Table 2 showed that $t = 16.670$ at $p < 0.000$ level of significance clearly indicates a significant effect of the intervention/treatment on the student's performance in chemistry. Based on the results, the hypothesis stating that there is no significant impact of teachers teaching with higher years (Experimental group A) of participation in WAEC and NECO marking on chemistry student's achievement in Akure South Local Government (LGA) of Ondo State is hereby rejected.

Hypothesis 2: There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry student's self-concept in Akure South Local Government (LGA) of Ondo State.

To test this research hypothesis two, the pre-test and post-test self-concept scores of experimental group A, B and control group C were subjected to descriptive statistical analysis and t-test analysis with the result presented in Tables 3 and 4.

Table 3: Descriptive Statistics of Student's Pre-test and Post-test Scores on academic achievement of Students

	N	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
Group A Self-concept Pre-test	45	17.00	32.00	23.2000	.54365
Group A Self-C oncept Post-test	45	29.00	57.00	45.2000	.93506
Group B Self-C oncept Pre-test	48	12.00	45.00	26.0000	.92971
Group B Self-C oncept Post-test	48	32.00	48.00	42.1667	.50908
Group C Self-C oncept Pre-test	43	14.00	37.00	22.5116	.68473
Group C Self-C oncept Post-test	43	12.00	45.00	25.3023	1.14726
Valid N (listwise)	43				

Table 3 shows that self-concept mean scores of students in Group A, B and C as 23.2000, 26.0000 and 22.5116 for pre-test while the self-concept means scores for post-test are 45.2000, 42.5116 and 25.3023 respectively. The results showed that the post-test self-concept mean score for group A is greater than the post-test self-concept mean score for group B followed by group C. From this result, it is obvious that the experimental group A has higher self-concept mean score than the experimental group B and the least self-concept mean score is the control group C. This result showed that students taught by teachers with higher years of experience in marking WAEC and NECO gained higher self-concept scores in chemistry.

In testing hypothesis two the self-concept pre-test and post-test scores of groups A (Students taught by teachers with higher years of marking WAEC and NECO) were compared and analyzed using paired sample t-test analysis at 0.05 level of significance. The results is presented in Table 4.

Table 4: Paired sample t-test analysis of pre-test and post-test of student's self-concept scores from experimental group A (Students taught by teachers with higher years of marking WAEC and NECO)

	Paired Differences				t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference			
				Lower	Upper		
Group A SC Pretest	22.0000				19.6808		
Pair 1 – Group A SC Posttest	0	7.71951	1.15076	24.31920	n	19.11844	.000

The results in table showed that $t = 19.118$, $p < 0.000$ indicated a significant effect of the teachers' teaching with higher years of marking WAEC and NECO on the student's self-concept in chemistry. Based on the results from table 14, the hypothesis stating that there is no significant impact of Teachers teaching with higher years (Experimental Group A) of participation in WAEC and NECO marking on chemistry student's achievement in Akure South Local Government (LGA) of Ondo State is hereby rejected.

Hypothesis 3: There is no significant impact of teachers' participation in WAEC and NECO marking on chemistry student's attitude in Akure South Local Government (LGA) of Ondo State.

To test this research hypothesis, the pre-test and post-test attitudinal scores of experimental group A, B and control group C were subjected to descriptive and t-test statistical analysis and the result is presented in table 5 and 6.

Table 5: Descriptive Statistics of Student's Pre-test and Post-test Chemistry Student's Attitudinal Scores

	N	Minimum	Maximum	Mean	Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic
Group A Attitude Pre-test	45	13.00	34.00	24.0000	.75210
Group A Attitude Post-test	45	29.00	56.00	43.2667	.93008
Group B Attitude Pre-test	48	13.00	38.00	25.3542	.92181
Group B Attitude Post-test	48	32.00	58.00	44.3958	.63143
Group C Attitude Pre-test	43	13.00	43.00	25.8837	1.07277
Group C Attitude Post-test	43	12.00	38.00	25.2093	.82564
Valid N (listwise)	43				

Table 5 indicates that the pre-test attitudinal mean scores of the students in groups A (24.0000), B (25.3542) and C (25.8837) respectively. While the post-test attitudinal mean scores of the students accordingly for each of the groups are A (43.2667), B (44.3958) and C (25.2093). This is an indication that students taught by teachers with average years of marking WAEC and NECO (Group B) developed a more positive attitude to chemistry compared to those taught with teachers with higher (Group A) and lower (Group C) years of marking.

The hypothesis is tested by subjecting the attitudinal pre-test and post-test scores of group A (Students taught by teachers with higher years of marking WAEC and NECO) were compared and analyzed using paired sample t-test analysis at 0.05 level of significance. The results is presented in Table 6.

Table 6

Paired Sample t-Test Analysis of Pre-test and Post-test of Students' Attitudinal Scores from Experimental Group A (Students Taught by Teachers with Higher Years Of Marking WAEC and NECO).

		Paired Samples Test								
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	Df	Sig. (2-tailed)	
					Lower	Upper				
Pair 1	Group A Attitude	19.2666	8.38939	1.25062	21.7871	16.7462	15.40	4	.000	
	Pretest – Group A	7			2	2	6	4		
	Attitude Posttest									

The results from Table 6 showed that $t = 15.406$, $p < 0.000$ showed a significant effect of the teachers teaching with higher years of marking WAEC and NECO on the student's attitude to chemistry. Based on the results from Table 6, the hypothesis stating that there is no significant impact of teachers teaching with average years (Experimental Group A) of participation in WAEC and NECO marking on chemistry student's attitude in Akure South Local Government (LGA) of Ondo State is hereby rejected

DISCUSSION

This study was set out to investigate the impact of teachers' participation in WAEC and NECO marking on students' performance in chemistry in Ondo State. The result from hypothesis one showed that there is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' achievement in Akure South Local Government Area. The results from this hypothesis corroborate the study of Rizqil&Tiandra (2019) where it was posited that performance of students in chemistry might be due to the abstract nature of chemistry concepts and the experience of the teacher teaching it. It is also in tandem with earlier study by Mailumo, Agogo and Kpagh (2007) where it hinged it on student and teacher related factors. Part of the teacher related factors is the teaching methods employed by teachers to teach the concepts. Other factors range between teacher experience, pedagogical content knowledge and year of teaching experience. The results arising from the hypothesis seem not be in agreement with the earlier study of Osokoya (2015) where it was reported that the effect of action-based testing mode (an experiment that aims at exhibiting a particular scientific concept and ability to carry out activities and answer questions on the actions performed within the limit of time given) and test anxiety on secondary school students' performance in electrochemistry. Also the finding of the study is at variance with Rizqil&Tiandra (2019) where the relative effect of strategy on students' achievement in selected difficult chemistry concepts using the pre-test, post-test quasi experimental research design was established. The result showed a disparity from the findings of Fan (2013) where it was reported that prior knowledge have a correlation effect on students' performance in chemistry.

The results from hypothesis two stating that there is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' self-concept in Akure South Local Government (LGA) of Ondo State showed that a significant effect exists in the chemistry students' self-concept when taught by teachers with higher years of marking experience than average and low. The results is in agreement with Emendu&Okoye (2015) where it was stated that academic self-concept of students depends on their own academic ability and the ability level of the teachers and other students within the same class. The finding of this hypothesis is also in support of Glory(2020) where students' self-concept was frequently positively correlated with the teacher's level of experience and content knowledge. However, the finding seems to be at variance with Fan (2013) where it found out in his study that students' self-concept influences their academic performance and the level of effort exerted by students in learning to a large extent which contributes significantly to students' self-concept in boosting their academic performance. In view of this, teachers, parents, and indeed all stakeholders have it as a duty to consider various factors that can influence the development of positive self-concept among children when dealing or interacting with them. Also, they must help, monitor and supervise students to exert some level of effort in learning since such effort boosts students' academic performance.

Hypothesis three which states that there is no significant impact of teachers' participation in WAEC and NECO marking on chemistry students' attitude in Akure South Local Government (LGA) of Ondo State revealed that teachers with higher experience in marking influence students' attitude to chemistry. The finding of the hypothesis is in contrast with the finding of Emendu&Okoye (2015) where it identified the factors that could positively influence students' attitude to learn chemistry to include factors that could be arranged into three main categories which are teaching approaches, educational tools, non-formal educational material and activities. It is also in agreement with Okeke (2008) where it was suggested that three key factors that should be considered in enhancing attitudes to learning chemistry should include the methods used to present the content (e.g. relevance, and historical approach), instructional techniques that are implanted, and experience of the teachers.

CONCLUSION AND RECOMMENDATION

Based on the analysis of data and the interpretation of the results of the study, it can be concluded that teachers with higher and average years of marking of WAEC and NECO are capable of improving on student's performance in chemistry, promote self-concept and enhance the chemistry students' attitude to the subject. In view of the results of the findings and conclusions reached in this study, the following recommendations are hereby offered:

1. All chemistry teachers should attempt to mark the annual WAEC and NECO marking exercise.
2. Teachers that may not be interested in marking should be encouraged by the school management to participate in the coordination exercise
3. Chemistry teachers should continuously reflect on their marking experience when they teach, set questions and mark students' scripts.
4. Chemistry students should endeavour to follow the guidelines set out by their teachers based on their marking experience.
5. The School management should encourage their teachers to participate in the marking exercise.
6. Examination bodies should stem the tides of the training and coordination, and as well increase the coordination fee because of the attendant effect on the students learning outcomes.

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