Formative Assessment, Feedback, Remediation and Students' Academic Achievement in Basic Science: A Quasi-Experiment

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Abstract

Literature is replete with evidences attributing or relating poor learning outcomes or achievement to varied inhibiting factors. Often cited are teachers' teaching strategy and inappropriate pattern of assessment. This study as result sought what the outcome will be when the strategy is applied in the teaching of Basic Science in Junior Secondary Schools. The objective of study is to examine the effect of formative testing; formative testing with feedback and formative testing, feedback and remediation on students' academic achievement in Basic Science This work adopted a partly randomized pretest, posttest control group quasi-experimental design. Three null hypotheses were tested at a .05 level of significance. 268 Junior Secondary II students participated in the study. Simple random sampling technique was used for the selection of the sample. Instruments used for data collection include Basic Science Achievement Test (r = .795) and four packs of Basic Science formative test items with reliability indices of Pack I r = 0.77, Pack II r = 0.64, Pack III r = 0.82 and Pack IV r = 0.73. ANCOVA and Estimated Marginal Means were analysis techniques used. Result showed that main effect of treatment on academic achievement was significant ($F_{(3, 268)} = 118.71$, $p < 0.05$), main effect of gender was not significant($F_{(1, 268)} = 1.687$, $p > .05$) and no significant interaction effect of treatment and gender on achievement. ($F_{(3,267)} = .018$, $p > .05$). The conclusion was that the strategy employed in the study affected achievement in Basic Science positively. Part of the recommendations was that Basic Science teachers should incorporate the strategy into Basic Science instruction.

Keywords: Formative Assessment, Feedback, Remediation, Academic Achievement

INTRODUCTION

In contemporary Nigeria, as in other developing nations, great emphases and importance are being placed on industrial and technological development which calls for students being encouraged to take up Science and Science-related subjects in the Secondary Schools. Science Education and methods pervade every field of human endeavour and as such exerts an influence on the economic development efforts in most countries. In pursuit of scientific and technological advancement, a meaningful school Science programme demands nothing short of a high level of achievement in Secondary Science. Since the quality of Science Education at the tertiary level is dependent on the Science at the lower prongs, the target of this paper is to "catch them young" at the Basic school level.

The concern about improving outcomes in Basic Science and its instruction, demands that concerted efforts be made to not only improve the strategies of instruction but also to evolve more positive classroom dynamics. Given the numerous benefits of Science and Technology to society, it is expected that this would have been a motivating factor for pupils in JSS to do well in Basic Science. But what is noticed in the field is a relatively low achievement of pupils in Science (Ezike, 2007). A look at the Basic Science result (2009-2016) in Ogun State Basic Education Certificate Examination (BECE) Table 1 reveals a dismal and dwindling performance trend in students' BECE result.

Table I: Basic Science BECE 2009 – 2016 Results for Ogun State

Year	Number of candidates Examined	Number passed at credit level (A-C)	Percentage passed at Credit level	Number Failed	Percentage Failed
2009	59712	15150	25.37	44562	74.63
2010	34229	4074	11.91	30155	88.09
2011	58572	4361	7.45	54211	92.55
2012	40265	8890	22.08	31375	77.92
2013	45309	10768	23.77	34541	76.23
2014	42710	13691	32.60	29019	67.94
2015	72624	30530	42.04	42094	57.96
2016	79835	34921	43.74	44914	56.26

Source: *Ogun State Ministry of Education, Department of Planning, Research and Statistics (2017)*

Column 4 of the Table indicates the percentage of pupils passing with (A-C) grades for each year. Ordinarily, one would have accepted a 50% level pass but what we have for all the years is below 45% which is not good enough for a level that is expected to feed the Senior Secondary with its Science students' population. The question that readily comes to mind is, "what is responsible for the dismal outing?' For the years under review, the poor performance of candidates in the Basic Education Certificate Examination (BECE) conducted by the Ogun State Government has been a source of concern and worry to parents, educators and other stakeholders in Science Education. This prompted investigations to be conducted to find out the causes of under-achievement in Basic Science. Various performance indicators have been implicated to account for the observed under achievement in Basic Science. Some of the factors attributed to this poor performance include; insufficiently trained teachers (all comers or teachers without teaching qualification), over-population of classrooms, school location, perceived nonfigurative and difficult nature of Basic Science, lack of students' interest in Basic Science (Ezike, 2018), inadequate number of learning facilities, challenges of not having well equipped and modern laboratory for practical experience, insufficient Basic Science books, insufficiently trained teachers, students' variables such as cognitive style, attitude and gender (Ezike, 2011, Adegoke, 2010). In his contribution, Bernard (2013) emphasized lack of problem-solving skills and faulty instructional strategies. The faulty instructional strategy at the base of this poor achievement is the conventional teaching strategy used by almost all the teachers in the Nigerian educational system (Eilks, 2002, Von, 2002). In the use of this strategy, teachers are interested in the completion of the syllabus without adequately ensuring mastery of content which compromises improved achievement. This agrees with Orji (1998) in Ezike (2013 that teaching Physics with the strategy produced students with moderate numerical ability and responsible for students' underachievement. In proffering a solution to the shortcomings of the lecture method, alternative strategies that can ensure mastery through repeated measures could be adopted. Hence the use of formative assessment/testing, feedback with remediation in this study.

Learning activities in the classroom involve both the teachers and the students. The responsibilities of the teacher in this context go beyond mere teaching but include directing, supporting, guiding and determining the extent to which learning has occurred. To carry out this later function, the teacher is required to measure through the administration of instruments that will assist him in capturing the level of learning that has taken place. The process of doing this is called testing which in this study will be used synonymously as assessment. Assessment is a practice that is integrated with teaching and learning which facilitates and improves instruction. According to the Glossary of Educational Reform (n.d), assessment refers to the wide variety of methods or tools that educators use to evaluate, measure and document the academic readiness, learning, progress, skill acquisition or educational needs of students. It is a fundamental process for making references concerning student learning. Mehmood, Hussain, Khalid and Azam (2012) assert that assessment includes observation made by the teacher in the classroom, discussions, scrutinizing students' works, their assignments, tests and informal questioning. When the assessment is administered by the teacher in the course of several units of the lesson so as to identify the strengths and weaknesses of learners, it is referred to as formative assessment or assessment for learning. William, Lee, Harrison, and Black (2014) agreed that assessment for learning involves using information generated from assessment by teachers and students to identify areas of difficulty and then execute on-target instruction to assist the learners to adequately fix the issue that is of concern. In other words, assessment becomes formative when the outcome is used by the instructor to adapt or modify teaching to meet the students' needs. Amoako (2018) observed that a common method advocated in educational literature to improve student achievement is the use of formative assessments, both to improve the pedagogical practices of teachers and to provide specific instructional support for lower-performing students. This view is supported by Njiru (2015) in a study in Embu County, Kenya where he found that formative assessment enables teachers to adjust their teaching to meet individual student's need and to better help all students to reach higher standards Chemeli (2019) defined formative assessment as a process that engages teachers and students in gathering, interpreting and using evidence about what and how students are learning to facilitate further student learning during a short period. Formative periodic learner assessments continuing Januori (2020) are highly encouraged to gauge the extent to which both teachers and learners are achieving learning objectives. In his contribution, Asare (2015) in Amoako (2018) noted that studies have shown that using formative assessment apart from facilitating improvement in the instructional process also reveals 'gaps' in curriculum and assists in improving students' achievement. It is therefore the view of this study that formative assessment is a technique in teaching and therefore can be adopted or applied in the modification and improvement of pedagogy and give the students' knowledge of where they are, where to go and how to get there. This concurs with Klopter (1971) in Ajogbeje and Alonge (2012) who noted that students take diagnostic tests at several points in the course of the study and based on test results called feedback they obtain guidance (remediation) to where next they should proceed.

The purpose of assessment can be achieved when the assessment results are given back to the learners as feedback. Rudner and Burton (2003) in Januori (2020) are of the view that using assessment frequently enhances achievement more so when teachers use feedback effectively. Knowledge of the results of the assessment called feedback is very important in the teaching-learning process. Hattie and Timperley (2007) citing Winnie and Butler (1994) defined feedback as information with which a learner can confirm, add to, overwrite, tune or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks or cognitive tactics and strategies. Feedback is usually a consequence of

instruction aimed at the revalidating instructional process and evaluating learning. Kim and Lee (2019) citing Van de Ridder, Stokking, McGaghie and Ten Cate (2008) described "feedback as being specific information about the comparison between trainees' observed performance and a standard, given with the intent to improve performance". Feedback has a powerful influence on students' learning process because students through it can pass data-based judgement on their ability and regulate their study skills and in the process enhancing achievement (Singteach, 2013). Whether norm-referenced, criterion-referenced or self-referenced, feedback can be positive or negative. When students are allowed to make responses following feedback in a teaching process, the instructor would be able to confirm that such learning emanates or stems from the earlier feedback provided (Sadler, 1989 in Ahea, Ahea & Rahman 2016). In this direction the students should be given the opportunity to use the feedback to generate improved performance by repeating the process that gave rise to poor performance, so that the feedback will be deemed effective. The implication of this is that feedback should be prompt and timely, it should be given when the learner can use it to correct his errors, using it as a scaffold for future attempts. Feedbacks that are delayed are likely to stifle remediation and consequently negatively impinge understanding hence achievement. This observation corroborates the statement made by Ajogbeje and Alonge (2012) that in some cases students are provided feedback after they have written their final examination. They noted that such a feedback does not serve any useful purpose and to these present researchers it is a case of crying when the head is off or crying over spilled milk.

The use of assessment in the teaching-learning situation is to generate information that will be needed to assist learners. If this information is ploughed back into the process in the form of feedback to students without the accompanying revision/guidance especially for the weak students, its purpose might be defeated. For according to Mehmood et al (2012), assessment becomes formative when the information is used to meet students' need. They went ahead to note that when teachers know how students are progressing and where they are having trouble, they can use this information to make necessary instructional adjustments such as re-teaching, trying alternative strategies or creating more practice opportunities. Ojugo (2013) stated that formative assessment is essential to both students and teachers as it helps to diagnose students' learning difficulties and the adoption of remedial strategies geared towards improvement in the subject concerned". The remedial measure that is expected from the teacher is to identify learning difficulties and the adoption of some other remedial strategies may involve locating the specific difficulties which students encounter in the subject and adopt appropriate teaching strategies as remediation to assist the learners to overcome the difficulties thereby enhancing their academic achievements in the subject. This, in a nut shell is exactly what remediation is all about. It is therefore the desire of instructional experts such as Ajogbeje and Alonge (2012), Zarei and Yasami (n.d) that remedial teaching should follow every assessment. Remediation which includes remedial teaching can be defined as the act or process of correcting a deficiency (Cleland, Mackenzie, Ross, Sinclair & Lee, 2010). Also, Ajogbeje and Alonge (2012) defined remediation simply as the process of leading learners to be aware of their errors engaging them in possible corrections. Cleland et al (2010) observed that remediation consists of three steps namely diagnosis, remedial activities and re-testing. Formative assessment reveals areas of weaknesses and strongholds for learners (diagnosis). Remediation which normally should accompany feedback serves to correct or assist learners to make amends in the identified areas of difficulty. This could be achieved by the students engaging in extra work independently or in conjunction/collaboration with other high-stake learners. Remediation can therefore be seen as a levelling apparatus and a veritable tool that brings learners to par.

Empirical and theoretical studies have been done by researchers to ascertain the effectiveness of formative assessment, feedback and remediation in teaching and learning situation. black and William (1998) in Hanover Research (2014) concluded after a met analysis of over 250 quantitative and qualitative publications that formative assessment is perhaps the most effective educational practice when it comes to improving academic achievement. Smith (2008) in her research on using formative assessment to predict student achievement on High Stakes tests, found that unit gains on post-assessment demonstrated a statistically significant indicator for academic achievement. Carrillo-de-la-Peňa, Baille, Caseras, Martinez, Ortet & Perez (2009) working with 548 Post graduate Health Science students from four Spanish Universities on the extent to which taking part in formative assessment is related to enhanced achievement, found that learners who took part in the formative assessments got better marks and higher success rates in the final summative assessment than those students who did not partake. They also noted that students who participated received feedback about their achievement which incidentally probably determined their greater involvement in the learning process. In Pakistan, Mehmood et al (2012) using 60 10^{th} class students of a school in Fateh Jang in an experimental study on the impact of formative assessment found that students in the experimental group had a higher mean score (26.86) than the control group with post-test mean score of 14.83. Akyina and Oduro-Okyireh (2019) in Ghana investigated Senior High School teachers' formative assessment practices in the Mampong Municipality, found that even though the teachers did not know that what they practised was formative assessment, agreed that the practice contributed to improvement in teaching and learning. In Nigeria, Ajogbeje and Alonge (2012) Ekiti State, Olagunju (2015) Oyo State found that formative assessment positively predicted achievement. James and Folorunso (2012) in a study on "the effects of formative assessment strategies and feedback and remediation as instructional strategies on Junior Secondary School students' achievement in Mathematics" in Akure South Local Government Area of Ondo State using 240 JS II students revealed a significant effect of treatment on students' achievement in Mathematics. Ikpi, Ojating & Mpantor (2019) working in Calabar Cross River State with 541students in mathematics examined the effect of formative assessment and attitude on learning outcome, found that there is a significant effect of formative assessment on achievement in mathematics. Orheruata and Oyakhirome (2019) in Benin Edo State got similar results in Basic Science using JS II students but also revealed that formative assessment did not affect achievement based on gender.

Several studies have accentuated the helpful effect of formative assessment with remediation indicating that this approach develops students' interest and enhances academic achievement in various school subjects. Chun (2009) found a significant improvement in students' performance after ascertaining their weakness and conducting remedial teaching. Ajogbeje and Alonge (2012) in their experimental study using formative assessment, feedback with remediation showed that treatment had a significant effect on achievement in mathematics. A related study conducted by Zarei and Yasami (n.d) on the impact of formative assessment and remedial teaching on English as First Language (EFL) learners' listening comprehension, found that treatment had a significant effect on the dependent variable. This finding is similar to that of Olagunju (2015) who worked with 120 SS II mathematics students using the same strategy.

Statement of the Problem

For every instructional process in school, it is expected that learners will exhibit a positive observable change in behaviour resulting from this instruction. However, this

has always not been the case. External terminal examinations have shown this as is the case in the Basic Science BECE under consideration. This lack luster outcome has been attributed to several factors prominent among which is faulty instructional strategy and inadequate, inappropriate application of assessment procedures. It is as a result of this that the researchers investigated the effect of formative assessment, feedback, remediation and students' academic achievement in Junior Secondary Basic Science.

Purpose of the Study

The main purpose of this study is to examine the effect of formative testing, formative testing with feedback and formative testing, feedback and remediation on students' academic achievement in Basic Science in Junior Secondary Schools in Ijebu-Ode Local Government Area of Ogun State, Nigeria. Other objectives of this study are to;

i. Examine the main effect of treatment (formative testing only, formative testing with feedback and formative testing, feedback with remediation) on students' academic achievement in Basic Science.
ii. Examine if gender exerts an influence on achievement in Basic Science.
iii. Determine the interaction effect of treatment and gender on students' academic achievement in Basic Science.

Hypotheses

Three null hypotheses were stated and tested at a 0.05 alpha level of significance.

H_{O1}: There is no significant main effect of treatments (formative testing only, formative testing with feedback and formative testing, feedback with remediation) on learners' academic achievement in Basic Science

H_{O2}: Gender does not have a significant main effect on the achievement of studentsin Junior Secondary Basic Science.

H_{O3}: Treatment and gender do not have any significant interaction effect on the achievement of students in Basic Science.

METHODOLOGY

Design of the study

This study employed a partially randominizedpre-test, post-test control group quasi-experimental design.

Population

The population of interest is made up of all the Basic Science students in JS II of all public schools in Ijebu-Ode Local Government Area, Ogun State.

Sample and Sampling Technique

Four Junior Secondary Schools in Ijebu Ode Local Government Area were randomly selected for this study. In each of the selected schools an intact class was also randomly selected as they were several arms of JS II in each school. Thereafter the four schools were randomly assigned to treatment conditions, formative test group only, formative test with feedback group, formative test and feedback with remediation group and the control group. The sample size of the study was 268.

Instruments

In this study, the instruments used were the Basic Science Achievement Test (BSAT) and four packs of Basic Science Formative Test (BSFT) prepared for each lesson.

Basic Science Achievement Test (BSAT)
BSAT was developed by the researchers and was used for all the group sat both stages (pretest and post-test stages). The BSAT consists of 30 items drawn from four topics in JS II Basic Science that have not been treated in any of the sampled schools. All the questions were in the multiple-choice format with four options lettered A – D. The instrument was validated appropriately and administered to a school that did not take part in the study (parallel sample). The outcome was used for calculating the index of reliability using the Kuder-Richardson-20 technique. An estimate of 0.795 was obtained. Also, the four packs of BSFT prepared for each lesson were equally validated and administered. The estimates of reliability obtained are Pack I r = 0.77, Pack II r = 0.64, Pack III r = 0.82 and for Pack IV r = 0.73.

Treatment Procedure
At the onset, students in all the groups were exposed to Basic Science Achievement Test as a Pre-test and results were recorded.

For the formative assessment only group, the class was taught with the modified lecture method and the prepared formative assessment items were administered at the end of each lesson. The students however were not given knowledge of the results and remediation. The students' formative test scripts were kept with the teacher.

For the formative assessment with feedback group, the instruction was also given by the teacher. At the end of each of the lessons formative test was given and was followed with feedback in the form of knowledge of results of the tests but no attempt was made by the teacher to reveal the correct responses. To avoid inter-student remediation and interaction, participants' scripts were collected and kept by the teacher.

Participants in the formative test, feedback with remediation group, the instruction was also given by the teacher. At the end of each of the lessons formative tests were given and were followed with feedback. This was also followed with remediation which came in the form of reviews, taking questions from students on difficult items and discussions targeted at providing reasons for the wrong steps.

For the control group, only instruction was delivered by the teacher. There was no testing therefore no feedback nor remediation. At the end of instruction in all the groups, a post-test was administered.

Data Analysis
Data collected from the study were analyzed using Analysis of Covariance (ANCOVA) and Estimated Marginal Means.

RESULTS

Test of Hypotheses
Main effect of treatment on academic achievement of students in Basic Science
H_{O1}. There is no significant main effect of treatment on students' academic achievement in Basic Science. To test this hypothesis, Analysis of Covariance (ANCOVA) was carried out and the result is presented in Table 1.

Table 1: Summary of ANCOVA of Post-test Achievement scored by treatment and gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3383.708[a]	8	422.963	44.687	.000	.580
Intercept	1590.482	1	1590.482	168.037	.000	.393
Pre-test	.632	1	.632	.067	.796	.000
Treatment	3370.764	3	1123.558	118.71	.000	.579
Gender	15.969	1	.15.969	1.687	.195	.006
Treatment * Gender	.525	3	.175	.018	.997	.000
Error	2451.456	2699.465				
Total	91376.000	268				
Corrected Total	5835.164	267				

a. R Squared = .608 (Adjusted R Squared = .595)

The data on Table 1 show that there is a significant main effect of Treatment (Instructional strategies) on students' academic achievement in Basic Science ($F_{(3, 268)} = 118.71$, $p < 0.05$). The effect size given under the Partial Eta Squared is .579 indicating a moderately high effect size. This also shows that the variance in achievement in Basic Science is explained by the independent variable to the extent of 57.9%. Based on this finding, hypothesis 1 was rejected. To show how the groups performed or which group brought about the significance, Estimated Marginal Means (EMM) was carried out and the result is presented in Table 2.

Table 2: Estimated Marginal Means of post-test achievement scores according to treatment

(a) Dependent Variable: Post-test

Grand Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
18.413[a]	.191	18.036	18.790

Covariates appearing in the model are evaluated at the following values: Pre-test = 13.37.

(b) Treatment: Instructional Strategies

Treatment	Mean	Std Error	95% Confidence Interval Lower Bound	Upper Bound
Formative test only	17.815[a]	.363	17.101	18.530
Formative test with feedback	19.942[a]	.385	19.183	20.701
Formative testing, feedback & remediation	22.848[a]	.431	21.999	23.696
Control Group	13.046[a]	.346	12.364	13.72

a. Covariates appearing in the model are evaluated at the following values: Pre-test = 13.37.

From the data in the EMM, Tables 2, the grand mean is 18.413 for academic achievement in Basic Science. The data revealed that the experimental group I (Formative testing only group) had a mean score of 17.815; experimental group II (Formative Testing with Feedback Group) had a mean score of 19.942; experimental group III (Formative testing, Feedback & Remediation) had a mean score of 22.848, while the Control group had an adjusted mean of 13.046. This indicates that experimental group III performed statistically better than the other groups followed by experimental group II (Formative testing with Feedback). Although learners in group I did better than the learners in the control, both group means are less than the Grand

Mean of 18.413. It should however be noted that the post-test mean score of groups 1 is still greater than the pretest score which is 13.37 By implication, the experimental groups caused a significant change in achievement but had differential effects on the academic achievement of the respondents in Basic Science. Based on this result, hypothesis 1 was rejected.

Main effect of gender on students' academic achievement in Basic Science

H_{O2}: This hypothesis states that there is no significant main effect of gender on students' academic achievement in Basic Science. The data in Table 1 revealed that there is no significant main effect of gender on students' academic achievement in Basic Science ($F_{(1, 268)} = 1.687$, $p > .05$). With this finding hypothesis 2 was upheld. Estimated Marginal Means was determined to examine the differences in the posttest means of the two categories of gender.

Table 3: Estimated Marginal Means of Post-test Achievement Score based on Gender.

Grand Mean

Dependent Variable: Post-test			
Grand Mean	**Std. Error**	**95% Confidence Interval**	
		Lower Bound	**Upper Bound**
18.413[a]	.191	18.036	18.790

a. Covariates appearing in the model are evaluated at the following values: Pre-test = 13.37.

Gender Estimates

Dependent Variable: Post-test

Sex of Students	**Mean**	**Std. Error**	**95% Confidence Interval**	
			Lower Bound	**Upper Bound**
Male	18.661	.279	18.112	19.210
Female	18.164[a]	.262	17.648	18.681

a. Covariates appearing in the model are evaluated at the following values: Pre-test = 13.37.

From the data in the EMM, Table 3, the grand mean is 18.413 for academic achievement in Basic Science. The data showed that the males received a means score of 18.661 and the females had an adjusted mean of 18.164. Though there is a difference in the test mean scores (post-test) of respondents showing males with higher mean score, but, analysis shows that this difference is statistically not significant.

H_{O3}: There is no significant interaction effect of treatment and gender on students' academic achievement in Basic Science.

The data in Table 1 depicts a no significant interaction effect. ($F_{(3,267)} = .018$, $p > .05$). As a result, hypothesis three was upheld. This means that a reciprocal action between treatment and gender did not produce any remarkable changes in the achievement of students in Basic Science, contributing insignificantly to achievement. The plot (Fig I) shows that there was no interaction between the instructional strategies employed and gender.

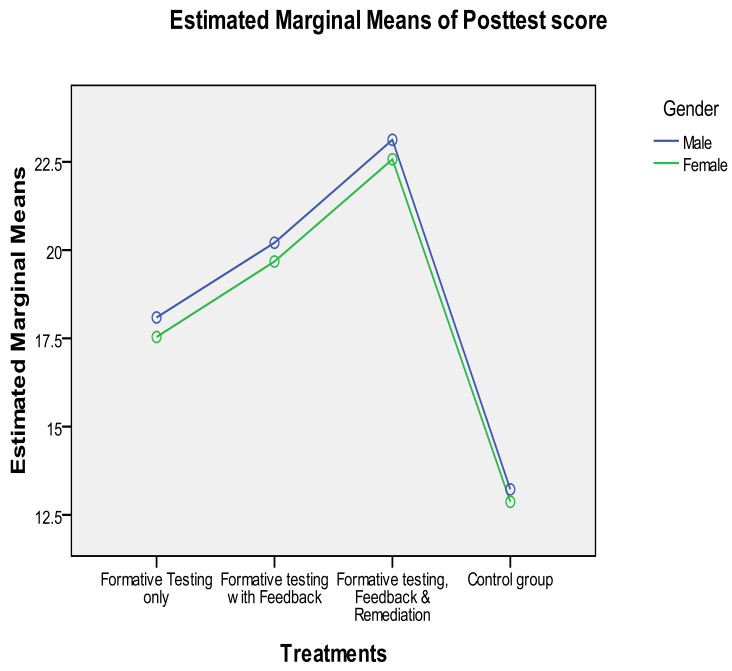

Figure 1: Estimated marginal means for post test scores

The results of this study show significantly greater achievement in Basic Science among the experimental group exposed to the treatment conditions as opposed to those taught using the Conventional Teaching Strategy. The empirical findings of this study did not support hypothesis one which stated no significant main effect of treatment on students' academic achievement in Basic Science. Instead, there is a significant main effect of treatment on students' academic achievement in Basic Science.

For the experimental group 1 (Formative assessment group), treatment had a significant main effect on academic achievement in Basic Science. This means that the students that were taught with formative assessment strategy had a higher post-test score than their pretest. The reason for this according to Olagunju (2015) citing Ajogbeje (2013) stated that formative assessment encourages learners to prepare sufficiently for such regular tests which make them to really get involved in the teaching-learning process. William, Lee, Harrison and Black (2014) proffered reason to support the effectiveness of formative assessment technique, which was that formative assessment provides a deeper and richer description of learners existing and potential abilities which enables programmes to focus on the personal weaknesses of the students and help accommodate instructions to learners' existing problems. This finding agrees with that of Ikpi et al (2019), Orheruata and Oyakhirome (2019) whose findings revealed that formative classroom assessment had a significant effect on the students' academic achievement in favour of the experimental group.

For experimental group II where the formative assessment was coupled with feedback, it was shown that those in the treatment class had a better achievement when compared with those in the non-experimental class implying that the strategy influenced

achievement. The effectiveness of feedback in improving achievement can be found in the features of feedback as a component of the learning process. Feedback on instructional purpose provides information that is related to the task. This information provides the missing link between what the learner understands and where he/she is expected to be. The effect of feedback on the learner could be increased effort, motivation for better engagement, cognitive restructuring and confirming to the learners whether they are correct or wrong. This finding agrees with Olagunju (2015) Ajogbeje and (2012), Chemeli (2019). According to Mehmood et al (2012) knowledge of test results provided as part of formative assessment leads to the identification of any gaps that exists between learners expected goals and their desired current knowledge, understanding, or skills. The teacher then guides them in remedial activities necessary to reach the goal. In contrast, Bridgeman (2014) in an experimental study involving formative testing with feedback and students' academic performance. He discovered that after the post-test was administered and a comparison of achievement was made between the experimental and control groups, participants in the treatment group performed poorly than students in the placebo group. He however attributed this poor performance after treatments to the possibility that some of the students were given scores, which they felt were not a true representation of their ability thereby eroding their confidence in subsequent tests and as such affected their post-test performance.

The experimental group III was instructed with formative assessment with feedback and remediation. Results show that learners in the treatment group not only outperformed learners in the control group but also outperformed learners in both the experimental groups I and II. This group apart from benefitting from the advantages of formative assessment and feedback also had the advantages of remediation added to it. In this group the learners had opportunities of correcting their mistakes either through putting more effort, brainstorming with classmates or receiving outright teacher assistance with the identified areas of difficulty. For according to Mehmood et al (2012) when teachers know how students are progressing and where they are having trouble, they can use this information to make necessary instructional adjustments such as re-teaching, trying alternative strategies or creating more practice opportunities. In this way the learners become aware of their shortcomings and tend to do better given the next opportunity. This finding agrees with those of Ajogbeje and Alonge (2012), Olagunju (2015) and Zarei and Yasami (n.d). The latter conducted the experiment in Zaijan, Iran, using 34 intermediate students studying English. The result showed that formative assessment, feedback and remedial teaching instructional strategy has a significant positive effect on listening comprehension of the listeners which is the learning outcome in the study.

The study also found that gender did not have any significant effect on achievement both as main effect and as interaction with treatment. This finding is in agreement with Ajogbeje and Alonge (2012) working with mathematics students, Olagunju (2015) and Orheruata and Oyakhirome (2019). However, the finding is dissonant with Ikpi et al (2019) who found that gender affected students' learning outcomes in mathematics. The finding here indicates that the strategies of instruction used in the study could not allow gender as a moderator variable to influence students' achievements in Basic Science. Therefore, the benefits of the strategy were equally shared among both sexes.

CONCLUSION

Based on the findings of this study, it was concluded that adoption of formative testing, feedback with remediation teaching strategy is effective in fostering students' cognitive

achievement in Basic Science. It has also shown that for meaningful learning to take place, teachers' knowledge of students' previous learning success would assist in providing appropriate remediation strategies to sharpen specific areas of deficiencies in the learner. Also, the study concluded that using the strategy neutralizes the effect of gender on achievement making it gender insensitive.

RECOMMENDATIONS

Hinging on the results of this study, the following are proffered as recommendations:
The TeachingService Commission, Head teachers, Principals of schools should provide capacity building through seminars, workshops, conferences, in-service trainings and logistics needed for sustainable practice of the strategy in the schools.
Since the primary goal of formative assessment is to provide feedback within the classroom with no real consequences attached, it is regarded as a form of practice and recommended for use by the teachers to fast-track understanding of content.

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