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Effect of Feedback on Academic Performance of Chemistry Students in Selected Public Schools in Port-Harcourt Metropolis Rivers State

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ABSTRACT
This study examined the Effect of Feedback on Academic Performance of Senior Secondary School Class 1 Chemistry Students in Selected Public Schools in Port Harcourt Metropolis. This topic was chosen because of the obvious problem of poor achievements in Chemistry which has been of great concern to teachers, students and even parents and the researcher imagined that the problem could be attributed to a poor feedback system. Hypothetically, the researcher stated in null form that there was no significant difference between in academic performance of chemistry students given feedback and those not given feedback in Senior Secondary schools, in Port Harcourt Metropolis as that appeared to be the most logical assertion. The study adopted Quasi-experimental design as the research design. From a population of 462 Senior Secondary School Class 1 chemistry students in Port Harcourt Metropolis, the study had a sample of 120 Chemistry students that were randomly selected. A 30-item Chemistry multiple choice test titled "Chemistry Test Question" (CTQ) was employed to collect data from the students for the study. The data generated for the study were analyzed using mean scores and t-test statistics at 0.05 level of significance. The study found that students taught with feedback performed better than students taught without feedback. It was also observed that feedback motivates students while learning. Hence, recommended that students should be given feedback promptly and be encouraged to make use of any correction given to boost their academic performance in chemistry and other subjects.
Key Words: Effect, feedback, chemistry, students, schools, academic performance.

INTRODUCTION

Education is an institution of the society that has been universally recognized as the key for social, economic and national development. It is also regarded as the greatest agency for human development. It is for this reason that many countries in the world spend a lot of their money to provide adequate education for their citizens. Education has been identified as an element that is essential for effective national development in Nigeria and other countries in the world which is seen an instrument "par excellence." There is an immense need for government to identify that all citizens should benefit from the educational visions and objectives which is an important need of the nations and the individuals (Federal Republic of Nigeria, 2004). Among the courses/subjects to be offered by students in the Nigerian Senior Secondary Schools, Chemistry is one of the subjects especially for science students. One major policy provision as posited by researchers is that the teaching of Chemistry at the senior secondary school level emphasizes on changing the position of science in the scheme of national education for maximum academic performance and producing person(s) with rational thinking with scientific concepts and chemical concepts.

Chemistry as a branch of natural science occupies an important place in the secondary school curriculum. As an academic discipline, it is highly admirable as it even creates a sense of excitement among learners. Its inclusion in the curricula of Secondary Schools and Technical Colleges of Education has been justified (for attracting youth to careers with chemistry options) and commended as innovative for creating wealth of experience for the educated citizens (Critchlow, 2012).

Chemistry curriculum is designed in such a way to show inter-relationship between the subject (chemistry) and other science subjects (biology and physics) and to satisfy requirements for senior secondary school programme in the National Policy on Education. Students are required to learn Chemistry by understanding, which demands a mastery of reasoning capabilities at the formal operational stage. Onwu (2011), contends that secondary school chemistry should be developed along basic chemical theory, its importance and relevance to everyday life. Science education which Chemistry is one seeks to develop a child's well-defined abilities and values such as being inquisitive, being creative, being objective, the ability to ask questions, and an exquisite sensibility.

No nation can survive technologically if her future generations are performing poorly in science-related subjects such as Chemistry. Over the years, science students offering Chemistry are made to believe the notion that Chemistry as a pure or physical science is a difficult, hard, abstract, complex subject and is confined only to the laboratories. The causes of eventuality hassled many to attributing failure to students' poor performance. Many persons seem to be confused as to what factors performance in Chemistry are rooted in such as psychological, physiological or environmental factors. These are actually responsible for the performance standard of student in Chemistry. The confusion stated, has conditions of services for teachers, lack of qualified teachers, inadequate supply of facilities and equipment, students' wrong notion about Chemistry, lack of motivation, lack of instructional materials, lack of proper supervision and, wrong method of teaching Chemistry (Emaikwu & Nworgu, 2015; Onah, 2012).

Concerning the fall of students' performance in Chemistry, teachers need to apply assessment in the aspect of learning. Assessment for learning as described by Asuru (2017), is an assessment used by a teacher to collect information that will enable him/her adjust his instructional strategies and at same time enable the students adjust his/her learning method based on the guidance received. It should be part of constructive planning, teaching, learning and assessment. Such planning could be flexible and include strategies to enable learners understand the goals as well as how they will receive the feedback.

Feedback mechanism has been conceptualized by many as a means through which vital and cogent information about individuals are provided by others in relations to their standards, performance and attitude (Weibell, 2011). Feedback thus is a consequence of performance. Biggs and Tang (2017) claimed that feedback tops the list of factors leading to good learning. Feedback is the process of informing students, parents and administrators regarding students' progress under shortest period.

Studies have revealed that feedback reinforces a correctional effect, thus feedback has positive and negative effect on academic performance. For example, test scores feedback may affect the motivational, self-confidence and anxiety level of students. Conversely, a negative feedback on performance may produce one of the two effects. It has the ability to correct the students or for a trial process of subsequently improving oneself. It creates a defeating and inadequate feeling among the students in the subject which influences him/her negatively, hence, it leads to poor performance as well as loss of interest in the subject (Bardwell, 2010).

It is against this background that this study was undertaken to examine the effect of feedback on academic performance of Chemistry students in selected public schools in Port Harcourt metropolis.

Statement of the Problem

The problem of poor achievements in Chemistry has been of great concern to teachers, students and even parents. The purpose of setting up the educational system is to evaluate the performance and progress of students and attain their level of achievement. This evaluation system uses test and other instruments as instructional during the process to guide, direct and monitor students learning and forecast their progress towards attaining the objectives of the course. (Alonge, 2004; Kolawole,2010).The happiness of a teacher

is based on performance of the learner at any given point based on the availability of information on instructional materials in relation to achievement of the set goals of the lesson.

Therefore, periodic continuous test and assessments given by teachers is used to evaluate the level of understanding and enhancement of their performance level concerning a specific area. Some of the aspects of continuous assessment that are very relevant to the teaching and learning outcomes include the frequency of the period of reporting on teacher-learner achievement, effecting immediate feedback which results to the teaching-learning situation. Despite the numerous benefits of feedback which include affecting motivational, self-confidence, interest, anxiety level of students, informing the students about their performance, teachers have neglected this important aspect of teaching and learning (feedback) in schools to the extent that it is now suspected to be one of the reasons why students are not performing well in Chemistry. It is a common knowledge that in some cases, the teachers just mark or tick the students' tests continuous assessment without making their wrong responses known to them. Also, the teachers are much more interested in completing their scheme of work than making the students understand what have been taught using feedback. This aroused the interest in this research. Hence, the study examined the effect of feedback on students' academic performance of Chemistry students in selected public schools in Port Harcourt Metropolis.

Purpose of the Study

The main purpose of this study was to access the effect of feedback on chemistry students in selected public schools in Port Harcourt metropolis. Specifically, the study sought to examine:

1. The difference in academic performance of chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis.
2. The difference in academic performance of male chemistry students given feedback and those not given feedback in senior secondary schools in Port Harcourt Metropolis.
3. The difference in academic performance of female chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis.

Research Questions

The following research questions guided the study.

1. What is the difference in academic performance of chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis?
2. What is the difference in academic performance of male chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis?
3. What is the difference in academic performance of female chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis?

Hypotheses

The hypotheses were stated in their null form.

1. There is no significant difference in academic performance of chemistry students given feedback and chemistry students not given feedback in Senior Secondary schools in Port Harcourt Metropolis.
2. There is no significant difference in the academic performance of male chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis.
3. There is no significant difference in the academic performance of female chemistry students given feedback and those not given feedback in Senior Secondary schools in Port Harcourt Metropolis.

LITERATURE REVIEW

Concept of Feedback

Feedback is a result gotten from evaluation, which could be in form of test, assignment, homework and examination (Mkpa & Izuagba, 2016). She further argued that feedback is a cyclic process, the teacher and the learner benefits and modifies their actions and reactions based on the continuous feedback derived

from teaching and learning processes. Feedback is conceived as information about a student performance on the task.

The purpose or the brain behind test and evaluation mechanism for teaching and learning process is to guide, direct and monitor students' learning and progression in attaining the objectives the course. Instructors and observers cannot enhance optimal performance without the availability of adequate information on students standing at any given time and the extent his progress towards of instructional objectives. Feedback is essential in the process of teaching and also learning, as it determines the effectiveness of the materials used in teaching, and also, if remedial teaching is required (Mkpa & Izuagba, 2016). Pickup and Anthony (2015) opined that feedback is important features/instruments which the teacher can use in evaluating successful students and failure of his teaching. They stressed more that the value of applying feedback by the instructor is to achieve maximal objectives of instructions among students. Beard (2018) suggested that the provision of feedbacks to students on their performance margin will enhance their performance base. Frequent and prompt interaction is always enhanced and facilitate among teachers and students which increases their information margin.

For feedback to be effective, instructions need to be effective. Teachers need to ensure professional decisions concerning when, how, and at what level feedback should be offered. Feedback should be regulated to suit the students' needs. It is only effective if students understand the comments and are able to use them to improve their level of understanding (Brookhart, 2011). Feedback should be descriptive. It should be part of a frequent contemplative practice throughout instruction. It should be considered a study of what should students know, need and more importantly, what actions need to be taken to address those needs. For feedback to impact learning, it should explain why answers are incorrect as well as how to correct them, not just give the correct answer.

There are many forms of academic feedback; teachers' feedback (moral and written) peer feedback, self-assessment or self-referential, anticipated feedback, normative feedback (Vanessa, 2012)**.** Therefore, students that perform at different levels need different forms of academic feedback. For instance, students who are given feedback by their teachers perform better on assessment and have a greater degree of involvement in classroom activities. A good feedback principle as propounded by Spiller (2019):

i. Promotes peace and conservation surrounding the objectives of the assessing job.
ii. Emphasizes should be placed on the instructional part of the feedback, not correctional only.
iii. Provision of feedback should be focal, because it enhances forwarding indicators among students
iv. Enlarges the length of involvement in the feedback mechanism, thereby bringing more individuals and group to get involved.

Concept of Academic Performance

Performance can be seen as a visible or tangible attitudes or behaviour expressed by an individual or non-living things like animals in a specific or unique way, usually experimental situation, it measures the behavior or an aspect of a feat that can be observed over a period of time (Simpson & Weiner, 2019; Adedeji, 2018).

In relations to research in educational research, academic performance of students exhibited visible attributes shown by students in a particular manner (Yusuf, 2012). Academic performance of a student in Chemistry includes the behaviors (observable and measurable) of that Chemistry student at any point in time during a course. In Chemistry, students' performance in their academic consists of their scores at any particular time obtained from a teacher made test, first term examination and mid semester/term test.

Therefore, academic performance should be viewed in a different area which covers their focus of learning in the school. This is so, because the field has a wide range of interest in educational features. Trying to give meaning to educational achievement is a determinant factor that is measurable by performance indicators. The procedural and declarative knowledge acquired from the school makes up the indicators of academic achievement. All criteria have in common that they represent intellectual endeavors and thus, more or less, mirror the intellectual capacity of a person. In developed societies, academic achievement plays an important role in every person's life. Therefore, performing well in a

subject like Chemistry in secondary schools, gives one a 100% guarantee of studying any science related courses.

Relationship between Feedback and Academic Performance

Many studies have been investigated and conducted concerning feedback on academic by some educationists and researchers. A recent study (Chen, Thompson, Kromrey & Chang, 2011) indicates that teachers' expectations and the oral feedback provided to students have a high impact on students' self-concept. Teachers need to set high expectations for all students, especially for those that have a low achievement level, or have behavior issues. With higher expectations, students' perception of oral feedback is taken more positively, and has a greater impact, not only on achievement but also on self-concept. In another study conducted by Santrock and Ross (2011) where they child is needed to working each especially some children feel inferior and downcast towards having negative attitude and have feedback which influence their performance.

A study conducted by Ajogbeje, Ojo and Ojo (2013) looked at the effect that feedback on formative testing had on achievement in mathematics. The researchers stated that teachers and students could not perform adequately to meet learning goals without knowing their levels of understanding at any given time throughout instruction. During the research, a group of students were given formative testing with feedback while another group received only the formative assessment. A third group, the control group received neither the formative assessment nor feedback. This study showed that students who were provided with feedback as well as remediation had a positive effect on academic performance.

The manner in which an individual perceives a test, affects his test taking behaviours. That is to say, if the individual identify that the test score will accurate, he will be willing to accepted resulting and acting on themselves, but if he is seeing the testing scores as a poor reflection of his capabilities, he dismisses or rationalize themselves. Hence, test results which are not indicative of what the students" expects or conceived of themselves produces negative effects on their academic performance.

Scannel and Tracy (2013) association of the lacking of knowledge in performing an earlier tasking job will affect the incompletion of subsequence in learned and poor retentions of what has been learnt. This is because he/she will not be able to assess his/her ability and the extent that the student perceives the score as representing his academic performance or goals competence on the task. The result of these findings is that feedback from test is effective.

Azmat and Iriberri (2010), showed that when relative feedback is provided, it improves the performance of students in the university and high school respectively while Ashra, Bandiera and Lee (2014) proved that when relative feedback is not administered, it lowers the exam performance of trainee nurses by discouraging those at the bottom score distribution. From the above, it shows that feedback on one's past performance can affect future performance, also affecting the behavior by providing information on one's own performance and the same performance as they are relative to others.

The effectiveness of various public services is dependent on the effort of those who deliver them and the effort of the people that receive them. For education in particular, the production function is increasing in both teachers and student's effort. That is why researchers and policy makers have concerned with ways to motivate teachers and students in teaching and learning process to increase their performance. Achievement goals are viewed as mediators of the link between the feedbacks that students expect. If a student has no predetermined goals, information on his score alone may not be effective in producing increased performance. Therefore, Chemistry students should have a predetermined goal during every Chemistry instruction as it will produce increase performance on every given task.

Formal feedback is provided through structuring conference with unique objectives and goals. Teachers can meet with a few students a day or a week depending on specific projects, deadlines and individual student needs. This means that effective feedback is one that is based on observable behaviour, not on assumed intentions or interpretations and that effective feedback is a helpful feedback (Sichinga, 2014).

Benefits of feedback

Feedback is an important part of effective learning, as it enables students to understand the subject being studied and illuminates clear guidance on how to improve their learning. Therefore, the following are the benefits of feedbacks:

a. Feedback is productive to students learning;
b. It enables student to know how well they are doing as they learn.
c. It gives a sense of accomplishment that motivates them to learn more.
d. It helps teachers to monitor students' learning.
e. It helps strengthen students' motivation and self-esteem.
f. It increases learning and improve student outcomes.
g. Students directions and target focus is achieved in needed areas of the lesson.
h. Feedback is a medium for information to students that cares about the learning.
i. It gives the student the privilege to be more engaged and involved in the classroom.

Factors that Influence Feedback

According to Hewson and Little (2018), some of the factors include being too general, being judgmental, giving gratuitous information, not soliciting persons, and giving feedback in inappropriate places.

Timing of Feedback

Many scholars have confirmed "timing" as a feedback mechanism that has so much influence on education of the younger child. Wood (2010) argued that the more profitable the feedback the closer in time to the event will be for the learner. Similarly, Archer (2010) identified that feedback will give immediately after the behavior is more effective than delayed feedback. Timing of feedback has the most considerable influence on the effectiveness of feedback which means that immediate feedback is preferable. This is confirmed by Latham (2019) which says that learners wanted early feedback because it gave them greater opportunity to improve.

Continuous or Differential Feedback

Another factor influencing feedback is whether it is provided continuously or differentially or the continuing other types of feedback that enhance each student's learning process and spur the student to participate in the class.

Other factors that influence feedback include:

i. The format of the test
ii. The type of mistakes corrected and
iii. Certain learner characteristics.

The most successful type of correction, both for the learners receiving the feedback and for their peers is that which successfully elicits self-correction in practice situations.

METHODOLOGY

The quasi-experimental research design was adopted for this study. Quasi-experimental design is concerned with testing hypotheses on cause and effect relationship between dependent and independent variables (Maduabum, 2017). The study population comprised 462 senior secondary school chemistry students, out of which 400 are girls and 62 are boys because of the research design, the population was narrowed to two schools, Government Girls Secondary School, Rumuokwuta and Enitonia High School, Borokiri. The sample size for this study was 120 Chemistry students. Sixty (60) students were chosen from each sex and 30 were sampled per section of pre-test and post-test while the simple random sampling technique was adopted in selecting the respondents. The major instrument for data collection was a 30-item Chemistry multiple choice test titled "Chemistry Test Question" (CTQ) constructed by the researcher and drawn from Chemistry scheme of work with the topics; Chemical Combination, Acid, Base and Salt. In other to ensure face and content validity of the instrument, an initial draft of the instrument (Test Question) was given to two Chemistry experts for scrutiny, after which it was given to the research supervisor for confirmation and approval before it was administered to students. The topics

chemical combination, Acid, Base and Salt selected for discussion using test blue print and prescribed procedure for test construction in order to ensure content validity of the test. The items of CTQ were drawn in line with the following six major classes of cognitive domain of Blooms' taxonomy of educational objectives which are Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation. The reliability of the instruments was confirmed using test-retest method. 20 copies of the instrument Chemistry Test Questions, (CTQ) were administered to 20 students outside the sample area. The instrument was re-administered to the same respondents after two weeks, and the relationship between the two results was tested using Pearson Product Moment correlation, and it yielded which gave a reliability index of 0.65. The research questions were answered using mean scores and differences, while the hypotheses were analyzed using t-test statistics at 0.05 level of significance.

RESULTS

Data Presentation and Analysis

Decision Rule

The determination of whether there is a statically significant difference between the 2 means is reported as a p-value. Typically, if the p-value is below (0.05) and at 95% confidence interval, the conclusion is that there is a difference between the two group means. The lower the p-value, the greater the evidence that the groups are different.

Research Question 1: *What is the difference in academic performance of Chemistry students given feedback and those not given feedback in Public Senior Secondary Schools in Port Harcourt metropolis?*

Table 1: Pre-test and Post-test Mean Scores of Chemistry Students of Experimental and Control Group

Student Group	N	Pre-Test x_1	Post-Test x_2	Mean Diff.	Standard Deviation	Standard Error Mean
Control Group	60	88.37	89.15	0.78	0.721	0.065
Experimental Group	60	79.01	79.40	0.39	0.792	0.087
Total		**173.41**	**175.02**	**1.61**		

Source: *Field Survey, 2020*

Where;
p-value = $\mu 1 - \mu 1 \neq 0$.
$(88.37 - 89.15)/(0.78^2/60) \neq 0.883/60 = 0.015$.
Also, $(79.01 - 79.40)/(0.39^2/60) \neq 0.624/60 = 0.010$.

Table 1 above shows the mean scores for the academic performances of Chemistry students in pre-test and post-test. The table indicated that the students in the control group had mean scores of 88.37 and 89.15 in the pre-test and post-test respectively. It had a mean difference of 0.78 with a p-value of 0.015. On the other hand, the experimental group had mean scores of 79.01 and 79.40 in the pre-test and post-test respectively. It had a mean difference of 0.39 with a p-value of 0.010. Both p-values are less than 0.05 at 95% confidence interval. The results show that the mean differences are statistically significant.

Research Question 2: *What is the difference in academic performance of male Chemistry students given feedback and those not given feedback in Senior Secondary schools, in Port Harcourt Metropolis?*

Table 2: Pre-Test and Post-Test Mean Scores of Male Chemistry Students of Experimental and Control Group.

Student Group	N	Pre-Test x_1	Post-Test x_2	Mean Diff.	Standard Deviation	Standard Error Mean
Control Group	30	94.40	95.13	0.72	0.699	0.087
Experimental Group	30	86.22	87.19	0.97	0.743	0.092
Total		**180.62**	**182.32**	**1.69**		

Source: *Field Survey, 2020*

Where;

p-value = $\mu_1 - \mu_1 \neq 0$.

$(94.40 - 95.13)/(0.72^2/30) \neq 0.849/30 = 0.028$.

Also, $(86.22 – 87.19)/(0.097^2/30) \neq 0.985/30 = 0.033$.

Table 2 above shows the mean scores for the academic performances of male Chemistry students in pre-test and post-test. The table indicated that the students in the control group had mean scores of 94.40 and 95.13 in the pre-test and post-test respectively. It had a mean difference of 0.72 with a p-value of 0.0028. On the other hand, the experimental group had mean scores of 86.22 and 87.19 in the pre-test and post-test respectively. It had a mean difference of 0.97 with a p-value of 0.033. Both p-values are less than 0.05 at 95% confidence interval. The results show that the mean differences are statistically significant.

Research Question 3: *What is the difference in academic performance of female Chemistry students given feedback and those not given feedback in Public Senior Secondary Schools in Port Harcourt Metropolis?*

Table 3 Pre-test and Post-test Mean Scores of Female Chemistry Students of Experimental and Control Group.

Student Group	N	Pre-Test x_1	Post-Test x_2	Mean Diff.	Standard Deviation	Standard Error Mean
Control Group	30	94.10	95.02	0.92	0.602	0.057
Experimental Group	30	79.31	80.01	0.69	0.671	0.068
Total		**173.41**	**175.02**	**1.61**		

Source: *Field Survey, 2020*

Where;

p-value = $\mu_1 - \mu_1 \neq 0$.

$(94.10 - 95.02)/(0.92^2/30) \neq 0.960/30 = 0.032$.

Also, $(79.31 – 80.01)/(0.69^2/30) \neq 0.831/30 = 0.028$.

Table 3 above shows the mean scores for the academic performances of female Chemistry students in pre-test and post-test. The table indicated that the female students in the control group had mean scores of 94.10 and 95.02 in the pre-test and post-test respectively. It had a mean difference of 0.92 with a p-value of 0.0032. On the other hand, the experimental group had mean scores of 79.31 and 80.01 in the pre-test and post-test respectively. It had a mean difference of 0.69 with a p-value of 0.028. Both p-values are less than 0.05 at 95% confidence interval. The results show that the mean differences are statistically significant.

Test of Hypotheses

Decision Rule

If the Probability Value (PV) is less than (<) 0.05 level of significance, the null hypothesis will be rejected and conclude that the alternate or the research hypothesis is accepted within the level of significance, indicating that a significant difference exist between the variables of the study. Also, if the t-cal is greater than t-tab (1.70), the null hypotheses will be rejected and verse versa.

Hypothesis 1: There is no significant difference in academic performance of Chemistry students given feedback and chemistry students not given feedback in Senior Secondary schools, based in Port Harcourt Metropolis.

Table 4: Test Statistics showing the difference in the Academic Performance of Chemistry Students.

Variables	t-cal	sig. t	t-tab (0.05, 58)	Mean	Standard Dev	F-cal	F-tab (0.05, 2, 58)	sig f
Control Group	69.362	.000	1.67	91.89	4.711	1021.06	3.15	.000
Experimental Group	51.114	.000		94.11	4.228			.000

Source: *Field Survey, 2020*

Table 4 above indicates the empirical result with a (t_{cal}. =69.362 and 51.114 and a t_{crit}. =1.67) at significant level of (P=0.000 < 0.05%).Also, in table 4, control group and experimental group have t-calculated values of 69.362 and 51.114 which and greater than t-tabulated $_{(0.05,\ 58)}$ = 1.67.This indicates that there is a statistically significant difference in the academic performance of Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt. Therefore, we reject the null hypothesis hence, there is a significant difference in the academic performance of Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt.

Hypothesis 2: There is no significant difference in academic performance of male Chemistry students given feedback and those not given feedback in public senior secondary schools in Port Harcourt.

Table 5: Test Statistics showing the difference in the Academic Performance of Male Chemistry Students.

Variables	t-cal	sig. t	t-tab (0.05, 28)	Mean	Standard Dev	F-cal	F-tab (0.05, 2, 28)	sig f
Control Group	88.154	.000	1.70	90.60	5.615	1195.53	3.32	.000
Experimental Group	90.147	.000		93.39	5.674			.000

Source: *Field Survey, 2020*

Table 5 above indicates the empirical result with a (t_{cal}. =88.154 and 90.147 and a t_{crit}. =1.70) at significant level of (P=0.000 < 0.05%).Also, in table 5, control group and experimental group have t-calculated values of 88.154 and 90.147 which and greater than t-tabulated $_{(0.05,\ 28)}$ = 1.70.This indicates that there is a statistically significant difference in the academic performance of male Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt. Therefore, we rejects the null hypothesis hence, there is a significant difference in the academic performance of male Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt.

Hypothesis 3: There is no significant difference in academic performance of female Chemistry students given feedback and those not given feedback in public senior secondary schools in Port Harcourt.

Table 6: Test Statistics showing the difference in the Academic Performance of Female Chemistry Students.

Variables	t-cal	sig. t	t-tab (0.05, 28)	Mean	Standard Dev	F-cal	F-tab (0.05, 2, 28)	sig f
Control Group	71.021	.000	1.70	93.07	4.322	2035.53	3.32	.000
Experimental Group	63.201	.000		96.21	5.134			.000

Source: *Field Survey, 2020*

Table 6 above indicates the empirical result with a ($t_{cal.}$ =71.021 and 63.201 and a $t_{crit.}$ =1.70) at significant level of (P=0.000 < 0.05%). Also, in table 6, control group and experimental group have t-calculated values of 71.021 and 63.201 which and greater than t-tabulated $_{(0.05,\ 28)}$ = 1.70.This indicates that there is a statistically significant difference in the academic performance of female Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt. Therefore, we rejects the null hypothesis hence, there is a significant difference in the academic performance of female Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt.

DISCUSSION OF FINDINGS

This section focused on the discussion of findings which follows the results of data that was analyzed on the difference in the academic performance of Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt in Metropolis.

Difference in Academic Performance of Chemistry Students Given Feedback and Those Not Given Feedback in Public Senior Secondary Schools in Port Harcourt.

Table 4 above indicates the empirical result with a (t-cal. =69.362 and 51.114 and a t-crit. =1.67) at significant level of (P=0.000 < 0.05%). Also, in table 4, control group and experimental group have t-calculated values of 69.362 and 51.114 which and greater than t-tabulated (0.05, 58) = 1.67. This indicates that there is a statistically significant difference in the academic performance of Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt. This result is in line with Orluwene and Ekim (2015) study that investigated the differential effects of performance feedback types on the improvement of students' performance in school-based assessment. It used 145 senior secondary two (SS II) students from five secondary schools in Emohua Local Government Area of Rivers State, Nigeria. The sample was drawn via a purposive sampling technique and assigned to four experimental groups and one control group. The groups were specific positive feedback, (SPF) specific negative feedback (SNF), non-specific negative feedback (NSNF), nonspecific positive feedback (NSPF) and no feedback (NF, control). The study took a 5x2 subject factorial experimental research design by pretest post-test technique. Two research questions and two null hypotheses guided the conduct of the study. Two equivalent instruments used for data collection were chemistry problem solving test form one and form two (i.e. CPST1 and CPST2). They are essay itemed and their equivalent form reliability coefficient was 0.79. The inter-rater and Alpha coefficients for CPST1 were 0.68 and 0.73 respectively, while that of CPST2 were 0.71 and 0.76 respectively. Data collected were analyzed using mean, standard deviation, paired t-test two-way analysis of covariance and pair wise comparison where necessary. The results obtained after data analysis showed a significant main effect for feedback types, gender and interaction between feedback types and gender. It was also found that SPF, SNF, NSNF and NSPF had significant effects, while NF had insignificant effects on the improvement of students' performance in solving problems in chemistry. Based on the results, it was

recommended among all that teachers should endeavour to use SPF in the appropriate ratio to SNF while assessing student's performance.

Moreover, Gokce Eturan-liker (2014) investigated into the effects of feedback on achievements goals and perceived motivational climate in physical education setting in the central district of Denizili. The participants in this study were 47 (27 female and 20 male) 9th grade students. Students were randomly into two experimental groups. The positive feedback group consisted of 27 9th graders (15 female and 12 male) and the negative feedback group consist of 20 9th graders (12 female and male). This study used 2x2 experimental design between subject's factorial feedback conditions (positive, negative) with test condition (pre-test, post-test). The data were analyzed using ANCOVA (Analysis of Co-Variance). Pre-test were used as Co-variance. The study found that feedback influences the achievement goals.

Difference in Academic Performance of Female Chemistry Students Given Feedback and Those Not Given Feedback in Public Senior Secondary Schools in Port Harcourt.

Table 5 above indicates the empirical result with a ($t\text{-}_{cal.}$ =88.154 and 90.147 and a $t\text{-}_{crit.}$ =1.70) at significant level of (P=0.000 < 0.05%).Also, in table 5, control group and experimental group have t-calculated values of 88.154 and 90.147 which and greater than t-tabulated $_{(0.05,\ 28)}$ = 1.70.This indicates that there is a statistically significant difference in the academic performance of female Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt metropolis. This result is consistent with Ajogbeje and Alonge (2012) study that investigated the effects of feedback and remediation as instructional strategies on junior secondary school students' achievement in mathematics. The effects of gender and socio-economic status on these learning outcomes were also examined. The sample for the study consisted of 240 junior secondary two (JSS II) students in intact classes of three co–educational schools purposively selected from Akure South Local Government Area of Ondo State. The study employed quasi–experimental design with treatment at three levels namely: Formative Test with Feedback and Remediation, Formative Test with Feedback only and Formative Test without feedback and remediation which served as control. The treatment levels were crossed with students' socio-economic status (high, medium and low) and gender (male and female). Five research instruments including three Formative Tests I. II and III in Mathematics, Socio Economic Status Questionnaire (SESQ) and Mathematics Achievement Test (MAT) were constructed, validated, and used for the collection of all relevant data. The data collected were analyzed using Analysis of Covariance (ANCOVA) and Scheffe's Post–Hoc Analysis. Results from the study revealed a significant effect of treatment on students' achievement in mathematics. However, there were no significant effects of gender and socio-economic status (SES) on achievement in mathematics.

Also, in another study conducted by Emaikwu (2012), he assessed the effect of quick feedback mechanism is a "motivational strategy" on students' "achievement in Secondary school mathematics." The study used quasi-experimental design, with a sample size of 300 students randomly selected from a total population of 2250 candidates from five selected secondary schools in Markurdi and Gwer West Local Government Area of Benue State. Four research questions and four hypotheses were posed, analyzed and tested using descriptive statistic (mean and standard deviation) and t-test statistic respectively. The results of this finding indicated that students taught using quick feedback mechanism performed better than those taught without it. The mean performance of the female and their male counterpart was not significant when tested through feedback approach. When students are exposed to frequent feedback mechanism, they tend to perform better without the influence of location.

Difference in Academic Performance of Male and Female Chemistry Students Given Feedback and Those Not Given Feedback in Public Senior Secondary Schools in Port Harcourt.

Table 6 above indicates the empirical result with a ($t\text{-}_{cal.}$ =71.021 and 63.201 and a $t\text{-}_{crit.}$ =1.67) at significant level of (P=0.000 < 0.05%).Also, in table 6, control group and experimental group have t-calculated values of 71.021 and 63.201 which and greater than t-tabulated $_{(0.05,\ 58)}$ = 1.67.This indicates that there is a statistically significant difference in the academic performance of male and female Chemistry students between those that give feedback and those that do not give feedback in public senior secondary schools in Port Harcourt metropolis. This result is further buttressed by Vanessa (2012)

investigated the effects of academic feedback on academic achievement. A sample of 204 6th graders between the ages of 11 and 13 were used in the study (100 females and 104 males where part of the students was assigned to a treatment group of which academic feedback is provided while the remaining students were assigned to the control group. The design used for carrying out this research involved the "concurrent, mixed methods". The "quantitative component" of the study used the "non-equivalent pretest/posttest control group design". ANCOVA was used to test the hypotheses. The findings showed that there is a statistically significant difference between 6th grade mathematics student who received feedback and those who did not.

Similarly, Paul and Mandel (2014) carried out a study on the topic "Raise and feedback in the primary classroom: Teachers' and students' perspectives." A case study approach was used whereby students and teachers from one school participated. Some 56 students and five teachers were interviewed individually or in small groups. The findings suggested that several factors need to be considered when using praise and feedback in the primary classroom. Careful deliberation should be given to the type of praise and feedback used by teachers in their classrooms and when and how it should be used. Younger students prefer 'ability' feedback, and as they grow older their preference for 'effort' feedback increases. Most importantly, general, non-targeted praise was most commonly used in the classroom, but this type of praise is not effective because it is not linked to a specific behaviour or targeted to the successful completion of a task. The results of this study suggest that teachers should use less general, non-targeted praise, more effort and ability feedback, and give more ability than effort feedback to younger students (grades 1-4) and more effort than ability feedback to older students (grades 5-7).

CONCLUSION

The investigation established that feedback is significantly effective in improving students' academic performance in Chemistry. This is an indication that the students performed better in their posttest than in their pretest. This finding is expected due to the fact that the main purpose of feedback is to reduce the discrepancies between current performance and the standard performance by providing information on what to do to close the gap. This finding indicated that students perform better or reached their goal when at least a little feedback on the previous performance is given. That is effective feedback is directional and guidance-oriented for future performance and aimed at improving learning.

The investigation also established that a significant difference was found on the effects of different feedback types on the improvement of students' academic performance in Chemistry. This finding is expected because effective feedback is informative, directives and guidance-oriented towards future performance. Feedback focuses on the key errors and provides corrective measures which help to highly equip the students reduced their levels of uncertainty between their present status quo and the desired/standard performance. Again this finding could be an indication that feedback is specific and more elaborate than since it had informed the students about what needs to be accomplished to attain the desired level of performance more than the other feedback types.

On the other hand, a critical examination of the findings of the study revealed that the students treated with specific feedback types improved significantly better than those treated with non-specific feedback types. This may be attributed to the fact that the non-specific feedback groups lack information, on how and why, the already achieved level and even what more has to be done to meet the standard performance. Based on the result of the findings, it was concluded that feedback has many effect on students, especially academic achievement and motivation to study. Feedback also gave students opportunity to go through their work to get appropriate answers and provided further insight on the lesson which improved their performance.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

1) Students should be encouraged to make use of any correction given to boost their academic performance.

2) Chemistry as a subject should be made more socially relevant in the early secondary years using feedback so as to make it more fun and help students to be grounded in the said subject.
3) Chemistry teachers should also motivate their students to build positive attitude towards learning of chemistry by providing regular feedback on every test/assignment/ homework/assessment at any point in time.
4) Continuous assessment/test/assignment/homework without feedback should be discontinued in our school system. In other to achieve to achieve this, in-school measure should be put in place to ensure chemistry teachers provide feedback to their students.

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