Research on Humanities and Social Sciences
ISSN 2224-5766 (Paper) ISSN 2225-0484 (Online)
Vol.7, No.19, 2017

Effect of Immediate Feedback on the Mathematics Achievement of Low Achieving Senior Secondary School Students

NDUKWU, Eric Chima NDUKWU, Edith N.

Abstract
This study investigated the effect of immediate feedback on the mathematics achievement of low achieving senior secondary school students in Owerri educational zone II of Imo State, Nigeria. The influence of gender on mathematics achievement was also explored. The interaction effect of immediate feedback and gender on mathematics achievement was examined. Three research questions and three null hypotheses guided the study. The design of the study was a quasi- experimental non equivalent pretest–posttest control group design involving one experimental group and one control group. The population of the study was made up of 2,314 low achieving SSII students. The sample size consisted of 145 identified low mathematics achieving students drawn from two schools. The two schools were randomly assigned to experimental and control groups. One research instrument: Mathematics Achievement Test (MAT). The instrument was validated by experts and used for data collection after the instruments was trial tested and found reliable using Kuder Richardson (KR20). Mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses. The study revealed that instructing low achieving students using immediate feedback strategy has a significant effect on their mathematics achievement. There is no significant difference in the mean mathematics achievement scores of male and female low achieving students exposed to immediate feedback strategy. The interaction effect of immediate feedback and gender on mathematics achievement of low achieving students was not statistically significant. The interaction effect of immediate feedback and gender on mathematics achievement of low achieving students was not significant. Based on these findings, conclusions were drawn and the educational implications were also discussed. It was recommended that students should be exposed to immediate feedback during mathematics teaching and learning interactions, so that they will participate actively and achieve highly. Immediate feedback strategy will enable low achieving students to learn, retain and recall concepts, ideas and principles. Immediate feedback should be incorporated into teacher education programmes to educate the prospective teachers on how to use the strategy.

Introduction

Over the years, efforts have been made to enhance students' mathematics achievement; yet students' achievement in mathematics has continued to dwindle, especially in external examinations. Mathematics is one of the subjects that occupy the centre stage in the pursuit of a science course in the university. Mathematics is a core subject in the school curriculum that deserves a serious attention. Onuigbo and Eze (2010) opined that mathematics is so crucial that it is a prerequisite for admission into Nigerian universities. There is no doubt that, secondary students go to school with the aim of acquiring dependable knowledge and passing excellently in subjects that will enable them to study their dream courses in the higher institutions. Mathematics is such a subject that can help students to realize their dreams. Mathematics is a mental activity which facilitates abstractions, inductive and deductive reasoning. Mathematics is the backbone of all science subjects. It is the bedrock of intellectual development and the foundation of all the innovations and inventions individuals see in science and technology today. Hornby (2000) believes that mathematics is a science of number and shapes while Tobies, Renate, Helmut and Neunzert (2012) noted that mathematics is certainly not just a fixed body of knowledge, its growth is not only confined in inventing new numbers, but it also pervades every aspect of modern life.

Mathematics cuts across the following disciplines; physical sciences, engineering, medicine, management, education and social sciences because of its importance. That is to say that mathematics is all embracing. Mathematics is so recognized and appreciated globally, such that, it is studied from primary to tertiary levels of education. Many scholars believe that a strong foundation in mathematics enables students to acquire new and advanced skills that will equip them to participate actively in solving both educational and societal problems. In this study, mathematics defined as an essential school subject, which helps students to develop the ability to think critically, creatively and ingeniously; and use the acquired knowledge to solve novel problems. It is disheartening that in spite of the importance of mathematics as elucidated above, students in Imo State and Nigeria still achieve poorly in it. There are evidences that students' mathematics achievement has been poor in Nigeria in the recent times. Babalola (2006) found that students achieve poorly in numeracy and mathematics. Onuigbo and Eze (2011) observed that many students have persistent low mathematics achievement. Ajogbeje and Alonge (2012) reported a general poor mathematics achievement of Nigerian students in 2009 West African Examination Council (WAEC), National Examination Council (NECO) and National Business and Technical Examination Board (NABTEB).

In Imo State precisely, there was a public outcry in 2012, 2013, 2014 and 2015 respectively, that the students who sat for the West African Senior Secondary Certificate Exam (WASSCE) recorded a low mathematics achievement. The above assertion is empirically evidenced by the following WASSCE results of students in Imo State. In 2012, out of the 24,533 students who registered mathematics in the WASSCE, only 10,230 representing 41.7% had credit pass and above in mathematics. In 2013, out of the 16,312 students who registered mathematics in the WASSCE only 6,231 representing 38.2 % had credit pass and above in mathematics. In 2014, out of the 19,576 students who registered mathematics in the WASSCE, only 6,276 representing 32.06 % had credit pass and above in mathematics. And, in 2015, out of the 20,042 students who registered mathematics in the WASSCE, only 7,480 representing 37.32 % had credit pass and above in mathematics (Ministry of Education Owerri, 2016). Imo state was in the front line of the Nigerian educational system, but of late, academic achievement is dwindling in the state especially in mathematics. The statistical evidence above shows that between 2012 and 2015, more than 58 % of Imo state students who sat for the WASSCE had low mathematics achievement.

Achievement means accomplishment or realizing success in a task. Achievement is the competence of a person in relation to a domain of knowledge. It is the pattern of action and feelings connected to striving to achieve some internalized standard of (Uzoma, 2015). Achievement is the word preferred in the educational or psychometrics fields as the degree of competence required on the part of students to give correct responses to measurement tool (Salvador & Dasí, 2001). In summary, achievement is the realization of oneself dreams by successfully completing a given task. Achievement is the ability to overcome obstacles and actualize success, while mathematics achievement is the ability of a learner to attain success in a mathematics test.

Mathematics achievement is directly related to the score a student obtains in a mathematics test. The score may be low, average or high. If a student consistently obtains a score that is above average, the student can be referred to as a high mathematics achiever. But if a student's mathematics score is continuously below average (50%), the student is labeled a low mathematics achiever. The contrast between high and low mathematics achieving students is clear in each school. Result of the study by the Third International Mathematics and Science Study (TIMSS, 1995), shows that mathematics high achievers constantly obtain an average percentage score of 70% and above in a mathematics test, while low mathematics achieving students score less than 50% in mathematics tests. Ramírez (2004) postulated that low mathematics achieving students achieve below their class average.

Low mathematics achieving students are not only anxious about mathematics, but also try to avoid it. Low mathematics achieving students are learners who seem to experience learning disabilities and low persistence on mathematics (Geary, 2012). Low mathematics achieving students always score lower than their peers in mathematics tests (Woodward & Broun, 2006). In this study, low mathematics achieving students are learners who always score below their class average in mathematics tests. Some researchers attribute low mathematics achievement to low task engagement due to low self-efficacy and poor instructional strategy. Johnson and Schmidt (2006) opined that it is imperative to develop strategies that will meet the educational needs of low achieving students.

Empirical literature shows that in the past, many scholars have tried to remedy the problem of low mathematics achievement through research studies. Some of the measures adopted by those researchers include; electronic learning, problem based learning strategy, project method, the use of games for teaching mathematical concepts, role playing, information communication technology and sequential presentation of facts and instruction (Onuigbo & Eze, 2010). It is unfortunate that the use of the above mentioned strategies did not yield the desired result. There is need to develop a strategy that can help students to achieve highly in mathematics. Immediate feedback is such a strategy that can aid students to decipher why they fail and understand how to do things right.

Feedback in the context of teacher education has been identified as an important tool in the classroom. Akkuzu (2014) defined feedback as information that is presented to learners following their performance which reflects upon the adequacy and quality of a teaching strategy. Many teachers give feedback to their students only at the end of week or term. A learning process in which feedback is well utilized tends to have the potential of facilitating high academic success (Hattie, 2009). Feedback is a basic tool that is used in stimulating learning and achievement at all levels of education (Hattie, 2013). Feedback can be given or sought by teachers or students. Evidences from previous studies reveal that feedback has a positive impact on linguistics, mathematics and sciences (Higgins & Nicholl, 2003). Feedback is an important component of effective instruction (Onuigbo & Eze, 2010).

In this study, feedback is seen as a process through which teachers let their students know their abilities and what they have achieved in a test, with the aim of urging them to perform better in the future. Feedback aids both the teacher and the learner to reappraise the approach they previously adopted. Feedback is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding (Hattie & Timperley, 2007).

Feedback could be effective or ineffective depending on how and when it is given to the learner. Feedback is effective when students are given accurate and detailed information about their achievement, specifying what needs to be improved (Eliot, Kratochwill & Cook, 2000). Effective feedback offers information about students' achievement (Hattie & Timperley, 2007). Feedback seems to be effective and more beneficial to learners if the following points are taken into consideration; providing a feedback that clearly and explicitly identifies what needs to be improved in order to move learners forward and promote their understanding of concepts (Centre for Education Policy, 2009). Feedback seems most effective when it is given at the time of the learning, so that students can make improvements as they go. Feedback has been suggested to be an important tool capable of enhancing learning. Adewale (2004) regard feedback as a crucial device in improving achievement and skill acquisition.

Feedback can be grouped according to modes (written or oral), the type of information it provides (positive or negative), forms (delayed, elaborative or immediate) feedback (Duane, 2005). The studies of Onuigbo and Eze (2010), Ajogbje and Alonge (2012), Hattie (2013), Akkuzu (2014), indicate that many studies have been conducted on the following kinds of feedback; corrective feedback, progress feedback, forms and modes of feedback. The studies above have examined the strength and weaknesses of many feedback strategies. The studies revealed that feedback can actually help to improve one aspect of human behaviour or the other, though none of the studies explored the use of immediate feedback strategy extensively.

Despite the fact that, little has been done on immediate feedback (IFB). The few studies conducted on immediate feedback show that immediate feedback can help to facilitate learning. According to Kehrer, Kelly, and Heffernan (2013), immediate feedback, while students complete homework leads to better learning than waiting until the next day to receive that same feedback. Woolfolk (2010) noted that feedback is effective when it emphasizes immediate progress. Immediate feedback strategy is the process of letting students know instantly why they fail and where they fail or what they fail to do correctly, as teaching and learning are going on. Duane (2005) was of the view that immediate feedback aids students to know what they did wrongly and what needs to be done. Immediate feedback is such a strategy that can encourage students to work hard and achieve success in school because it makes the teaching and learning of mathematics pragmatic. Immediate feedback (IFB) is different from conventional feedback (CFB), because it is being given when teaching and learning are ongoing in the classroom, while the conventional feedback is either given at the end of the week, term and programme. Kulik and Kulik (1988) reported that immediate feedback is more effective than delayed and other kinds of feedback. They are of the view that immediate feedback enables students to recall learnt materials easily. Giving immediate feedback, while students complete their work leads to better learning than waiting until the next day to receive that same feedback (Kehrer, Kim & Heffernan, 2013). Immediate feedback is a response format that promotes learning and retention (Metcalfe, Kornell, & Finn, 2009). Epstein et al. (2002) declared that immediate feedback promotes recall, increases confidence and reduces incorrect answers.

In this study, immediate feedback strategy is seen as the process of giving an on the spot correction to students along side with teaching and learning. Immediate feedback is an instant way of correcting students and letting them know their errors and how to get things right.

It is unfortunate that many Nigerian teachers do not know how to use immediate feedback in the classroom. Such teachers do not give immediate feedback to their students at all. It is necessary to give immediate feedback to students because, if students did not do well in a mathematics test and do not know the cause of their failure; it is most likely that such students will fail again. It is as a result of this communication gap that exists between teachers and their students, and the failure of the previous studies to find a lasting solution to low mathematics achievement that the researcher seeks to solve the problem of low mathematics achievement using immediate feedback as an instructional strategy. The researcher believes that students' self efficacy, task persistence and mathematics achievement could be improved by utilizing immediate feedback.

The findings of studies conducted in Europe, India and America by (Hattie and Timperley (2007), Vibha and Rayat (2011), Rozek (2014), revealed that immediate feedback can facilitate learning. There is need to know if immediate feedback can actually make students to be more confident in themselves and achieve success in mathematics. The researcher seeks to know if immediate feedback can transform low mathematics achieving students to high achievers irrespective of their gender.

In the recent past, mathematics achievement and gender have attracted the attention of many researchers due to the discrepancies in the results of most research studies. These studies either revealed that males outperform females in mathematics or the contrary. Gender is a concept used to distinguish between male and female, especially, in the case of men and women, masculine and feminine (Woolfolk, 2010). The characteristics demonstrated by boys and girls vary from sex, social role, to gender identity. Gender is a set of relationships that show what being a man or woman within the society is like (Akin, 2008). Denzin (2008) was of the view that gender is one of the factors that affect students' achievement. Onuigbo & Eze (2010) noted that research evidences tend to indicate that in Nigeria there is gender imbalance and bias in mathematics in favour of males. Similarly, the study of Hannover and Kessels (2011) revealed that boys exceeded girls in mathematics

achievement. Conversely, the study of Jeff (2015) revealed that females outperform boys in mathematics. Jeff maintained that boys fall behind girls in overall achievement; reading, mathematics, and science in 70 percent of the countries studied. In Jeff's study boys outperform girls in only three countries: Colombia, Costa Rica and the Indian state, Himachal Pradesh while boys and girls had similar mathematics achievements in the United States and United Kingdom. While researchers like Abdul-Raheem (2012), Mirjam, Heikamp and Trommsdoff (2013) observed no gender gap in the mathematics achievement of students.

The picture of gender differences in mathematics achievement of students is not clear. The inconsistency of results on gender studies has remained inconclusive. It is as a result of the controversies from the result of gender studies that the researcher seeks to ascertain the manner of results that will emerge when immediate feedback strategy is used in teaching mathematics to males and females.

Statement of the Problem

There is general belief that mathematics is hard, and whenever mathematics is mentioned, there is always an apprehension; what comes to the mind of students is, that difficult subject. It is true that the sign, symbols and the multifarious formulas used in the subject makes it seem hard to many students. Most students complain that mathematics is a complex subject. This is due to the fact that they lack the basic mathematical skills required to do well in mathematics as a result of poor strategies used in teaching mathematics. Many students think that they cannot do well in mathematics no matter how they try.

Purpose of the Study

This study aims at investigating the effect of immediate feedback on mathematics achievement of low achieving senior secondary school students. Specifically, the study sought to determine:

1. The effect of immediate feedback on the mathematics achievement of low achieving students.
2. The influence of gender on the mathematics achievement of low achieving students.
3. The interaction effect of feedback strategies and gender on mean mathematics achievement of low

Significance of the Study

When the findings of this research study are properly disseminated through publications, seminars and workshops, they will have the potential of being useful to students. The result of this study will enable students to understand and appreciate mathematics more than ever, as mathematics will be made easy with the help of immediate feedback. This study will enlighten students on the need to achieve highly in mathematics. The findings of this study will enlighten teachers on the importance of immediate feedback and how it can be used to boost students' mathematics achievement. Teachers will also know the appropriate time, manner, method and how to give feedback. The result of this study will help parents to know the kind of feedback they will give to their children at home. It will also help parents to know the appropriate time, manner, method and how to provide feedback. The findings of this study will make education planners to know the enigmatic power of immediate feedback in the classroom. The result of this research work will make school administrators, education planners and curriculum developers to see the need to incorporate immediate feedback in the process of teaching and learning for better school out comes. The findings of this study will provide literature and empirical data for future researchers who will consult this work.

Scope of the Study

This study covers all the low achieving senior secondary two (SSII) students in the six Education Zones of Imo state. This study focuses on the effect of immediate feedback on mathematics achievement of low achieving senior secondary school students. It also covers mathematics achievement, low achieving students, gender and immediate feedback.

Research Questions

The following research questions are posed to guide the study;

1. What is the difference in the mean mathematics achievement scores of low achieving students exposed to immediate feedback and those exposed to conventional feedback?
2. What is the difference in the mean scores of low mathematics achieving male and female students?
3. What is the interaction effect of feedback strategies and gender on mean mathematics achievement of low achieving students?

Hypotheses

In order to address the stated problems, nine null hypotheses were formulated and tested at 0.05 probability level.

Ho_1: There is no significant difference in the mean mathematics achievement scores of low mathematics achieving students who received immediate feedback and those exposed to conventional feedback as measured

by Mathematics Achievement Test (MAT).

Ho_2: There is no significant difference in the mean mathematics achievement scores of low mathematics achieving males and females students as measured by Mathematics Achievement Test (MAT).

Ho_3: There is no interaction effect of feedback strategies and gender on mean mathematics achievement of low achieving students.

Design of the Study

This study adopted a quasi experimental research design. Specifically, the study made use of pretest-posttest non-equivalent experimental and control group design, with the experimental group receiving immediate feedback in their mathematics class, while the control group received conventional feedback. A quasi-experiment is a research study in which there is no random assignment of the subjects (Bradley, 2009). The design is considered suitable in this study because, intact or existing groups were used for experimental and control groups in order not to disrupt the normal class timetable and to avoid labeling. Quasi-experimental designs tend to be used in real life conditions and investigations, where existing groups are not divided like we have in this study.

The design and symbols are represented thus:

Groups	**Pretest**	**Treatment**	**Posttest**
Experimental Group	0_1	X_1	0_2
Control Group	0_1	X_0	0_2

Key;

X_1 = Treatment (Immediate Feedback)

X_0 = Control Group (No Treatment, but Conventional Method)

O_1 = Pretest

O_2 = Posttest

Area of the Study

This Study was carried out in Owerri Educational Zone II of Imo State. Imo state is made up of 27 local government areas and six sub-education zones, namely; Okigwe zone I, Okigwe zone II, Orlu zone I, Orlu zone II, Owerri zone I and Owerri zone II. Imo state is bordered by River State, Abia State and Anambra State. The area was chosen for this study because evidence has shown that students in Owerri educational zone II of Imo state have consistently recorded low mathematics achievement in external examinations like NECO, NABTEB and WAEC in the recent past.

Population of the Study

The population of this study is made up of all the 2016/2017 low achieving SSII students in the 46 public secondary schools in Owerri education zone II of Imo state numbering 2,314 (1,122 males and 1,192 females)(Ministry of Education Owerri, 2016). SS II students were used for the study because they were not preparing for any external examination. It was also to prepare and help them to achieve success in future external examinations, especially in mathematics. SSII students are intellectually matured for this type of study and have stayed in school long enough for their teachers to identify those of them who are low mathematics achievers.

Sample and Sampling Technique

The sample for this study was 145 (66 males and 79 females) identified as low mathematics achieving SSII students. Four intact classes were used for the study. The four classes were drawn from two public coeducational secondary schools identified by the ministry of education Owerri as the lowest in mathematics achievement in Owerri education zone II of Imo state. The two schools are Enyiogugu Secondary School and Nguru Secondary Technical School. The two schools were selected and assigned to experimental and control groups respectively.

Instruments for Data Collection

The researcher used one research instrument (Mathematics Achievement Test) (MAT) for data collection in this study.

The Mathematics Achievement Test (MAT) was developed by the researcher with the help of two SSII mathematics teachers to assess students' mathematical achievement. The items are 20 objective questions generated from SSII mathematics scheme of work. Two mathematics teachers guided the researcher in developing and structuring the items for data collection in this study. The items covered sub-topics like; series, sequence, terms of arithmetic progression and sum of arithmetic progression. The students were expected to solve the questions to demonstrate their mathematical abilities. The instrument has sections "A" and "B". Section "A" showed gender of the students while section "B" showed the items.

Validation of the Instruments

The Mathematics Achievement Test (MAT) developed by the researcher with the help of two mathematics teachers, was face validated by two experts in Education Mathematics unit, of the faculty of education, University of Nigeria Nsukka (UNN). The experts were told to correct and validate the content, coverage, appropriateness and instructional procedure of the instrument in line with the topic, purpose, research question and hypotheses. Their suggestions were used to modify the instrument for this study.

Reliability of the Instruments

To ascertain the reliability of the Mathematics Achievement Test (MAT), it was trial tested in two public secondary schools (Community Secondary School Alor-Uno and Community Secondary School Isienu) in Nsukka Education Zone of Enugu state. Twenty copies of the MAT were administered to 20 low mathematics achieving SSII students in the two schools. The data collected by trial testing the Mathematics Achievement Test (MAT) were used to determine the reliability of the instrument using Kuder Richason (KR20) which yielded 0.85 coefficient, Pearson product moment correlation which yielded 0.77 coefficient was used to determine the stability of the MAT, A difficulty index analyses was also calculated to determine the appropriateness and non discrimination of the Mathematics Achievement Test (MAT) items.

Trial Testing of the Lesson Plan

The lesson plans were subjected to field trial after they had been face validated to ascertain its usability. The SSII mathematics teachers in the two secondary schools selected for the field trial used the lesson plans developed by the researcher in teaching SSII students in the two schools (Community Secondary School Alor-Uno and Community Secondary School Isienu) for two weeks. The field trial was done to guarantee the suitability, usability and appropriateness of the lesson plans. Useful suggestions from the teachers were incorporated into the lesson plans. The field trial also helped to ensure that the lesson plans were designed towards achieving the objectives of this study.

Experimental Procedure

Before the commencement of the research study, the researcher sought the consent and cooperation of the principals of the schools selected for the study. The intention was to enable the school integrate the research programme into the school schedule without disrupting the later. The researcher achieved that by meeting the principals of the schools on the first day of school resumption and explained to them the purpose of the study and the benefits that could be derived from the study, if it is properly conducted. On request, the principals introduced the researcher to their mathematics teachers who served as his research assistants. The researcher also explained to them the purpose of the research study and then solicited their cooperation. The researcher and the research assistants scheduled time for training. Thereafter, the researcher trained his research assistants. The two teachers received their training separately from each other. The training was concluded before the teachers were involved the in the research study, that was done to ensure that the teachers knew what to do and how to do it well. The researcher was not directly involved in the data collection, but gave the validated lesson plans, test questions, and the marking schemes to the research assistants for the treatment and control groups.

The researcher met the SSII form teachers in the two schools selected for the study to help him identify the low mathematics achieving students in the classes. The teachers reported that more than 98 % of their students are low mathematics achievers. However, they listed the names of few (3) students in the schools (SS II classes) who are high mathematics achievers, and showed them to the researcher. That enabled the researcher to sort out the scripts of the low mathematics achieving students in the classes after the tests.

The pre-test, treatment and post-test were held during the normal lesson periods in the school timetable. The experimental group lesson plan was used to teach SS II students in Enyiogugu Secondary School (which is the treatment group) on each mathematics lesson period, for four weeks, while the control group lesson plan was used in teaching in Nguru Secondary Technical School (which is the control group) each mathematics lesson period, for four weeks. While immediate feedback is entrenched in the experimental lesson plan, the conventional feedback which is given at the end of a topic was embedded in the control group lesson plan. The teachers administered the three research instruments to the students for pre-test; that is, before commencing the treatment. The pre-test scores were used as covariates to the students' post-test scores. After the pre-test, the researcher reshuffled the items in the MAT for the post test. The post-test was administered in the fifth week after the treatment had been concluded. The research assistants administered the tests under the guidance of the researcher. Each group held their instruction classes for 40 minutes each day, three times a week, according to the school timetable. The researcher supervised the teachers' use of lesson plans. Effort was made by the researcher to minimize cheating by the subjects (students) during the mathematics tests.

The three research instruments were administered to the respondents by the researcher with the help of two research assistants (Mathematics Teachers) to facilitate the study and remove suspicions. After the tests, the administered instruments were collected back from the respondents immediately after they had answered the

questions. That was to avoid loss of the instruments.

Method of Data Analyses

Mean and standard deviation were used in answering the nine research questions posed by the researcher, while analysis of covariance (ANCOVA) was used to test all the nine null hypotheses at 0.05 level of significance. ANCOVA was a suitable statistical tool capable of taking care of any difference that existed between the experimental and control groups, vis-à-vis pretest-posttest scores. In testing the hypotheses and taking a stand, when the associated probability value is greater than the 0.05, the null hypotheses was not rejected; but if the associated probability value is less than the 0.05, the null hypotheses was rejected.

RESULTS

The results are presented in tables according to the research questions and hypotheses that guided the study.

Research Question 1:

What is the difference in the mean mathematics achievement scores of low achieving students exposed to immediate feedback and those exposed to conventional feedback?

Table 1: Pretest post-test of mean score mathematics achievement of low achieving students exposed to both immediate and conventional feedbacks

Variable		Pretest		Posttest		Mean gain
Feedback Strategies	N	$\bar{x}$	SD	$\bar{x}$	SD	
IFB	74	22.57	11.11	65.88	22.27	43.31
CFB	71	19.15	10.69	34.23	12.86	15.08

The result presented in Table 1 shows the difference in the mean mathematics achievement scores of low achieving students exposed to immediate feedback (IFB) and those exposed to conventional feedback (CFB). The result shows that the pretest mean mathematics achievement scores of low achieving students exposed to IFB (experimental group) was 22.57 with a standard deviation of 11.11 and a posttest mean of 65.88 with a standard deviation of 22.27. The difference between the pretest and posttest mean mathematics achievement scores of low achieving students exposed to IFB (experimental group) was 43.31. Those exposed to conventional feedback-CFB (control group) had a pretest mean of 19.15 with a standard deviation of 10.69 and a posttest mean score of 34.23 with a standard deviation of 12.86. The difference between the pretest and posttest mean score for those exposed to the conventional feedback-CFB (control group) was 15.08. For both IFB (experimental group) and CFB (control group), the posttest mean score were greater than the pretest mean score mathematics low achieving students. However, those exposed to IFB had higher mean gain score of (43.31) than their counterparts who were exposed to the CFB who had mean gain score of 15.08. This is an indication that the immediate feedback (IFB) strategy helped to improve mathematics achievement scores of low achieving students than the conventional feedback (CFB).

Hypothesis 1

H_{01}: There is no significant difference in the mean mathematics achievement scores of low mathematics achieving students who received immediate feedback and those exposed to conventional feedback as measured by Mathematics Achievement Test (MAT).

Table 2: Analysis of Covariance (ANCOVA) of mean mathematics achievement scores of low achieving students exposed to (IFB) and (CFB) as measured by Mathematics Achievement Test (MAT)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	38320.486[a]	4	9580.122	29.295	.000
Intercept	62257.996	1	62257.996	190.376	.000
PreAchi	985.449	1	985.449	3.013	.085
Strategy	34277.491	1	34277.491	104.816	.000
Gender	703.248	1	703.248	2.150	.145
Strategy * Gender	197.752	1	197.752	.605	.438
Error	45783.652	140	327.026		
Total	452125.000	145			
Corrected Total	84104.138	144			

The result in Table 2 shows an F-ratio of 104.816 with associated probability value of 0.000 was obtained with regard to treatment as main effect on the mean mathematics achievement scores of low mathematics achieving students who received immediate feedback (IFB) and those exposed to conventional feedback (CFB).

Since the associated probability (0.000) was less than 0.05 set as the benchmark for taking a decision, the null hypothesis (H_{01}) was rejected. The inference drawn is that there was a significant difference in the mean mathematics achievement scores of low mathematics achieving students who received immediate feedback (IFB) and those exposed to conventional feedback (CFB) as measured by Mathematics Achievement Test (MAT).

Research Question 2:
What is the difference in the mean achievement scores of low mathematics achieving male and female students?

Table 3: Mean and Standard deviation of pretest and posttest difference in the mean scores of low achieving male and female students

Variable		Pretest		Posttest		Mean gain
Gender	N	$\bar{x}$	SD	$\bar{x}$	SD	
Male	27	21.82	10.55	49.85	23.53	28.03
Female	47	20.13	11.37	50.82	24.83	30.69

Result in Table 3 shows the difference in the mean achievement scores of low mathematics achieving male and female students. The result shows that the male students had a pretest mean score of 21.82 with a standard deviation of 10.55 and a posttest mean score of 49.85 with a standard deviation of 23.53. The difference between the pretest and posttest mean achievement scores was 28.03. On the other hand, the female students had a pretest mean achievement of 20.13 with a standard deviation of 11.37 and a posttest mean scores of 50.82 with a standard deviation of 24.83. The difference between the pretest and posttest mean scores for the female group was 30.69. For both male and female groups, the posttest mean scores were greater than the pretest mean score with female students having a slightly higher mean gain than their male counterparts. In essence, the mean achievement scores of low mathematics achieving female students seem to be slightly higher than their male counterpart.

Hypothesis 2
H_{02}: There is no significant difference in the mean mathematics achievement scores of low mathematics achieving male and female students as measured by Mathematics Achievement Test (MAT).

The result in Table 2 also shows an F-ratio of 2.150 with associated probability value of 0.145 was obtained with regard to treatment as main effect on the mean mathematics achievement scores of low mathematics achieving male and female students. Since the associated probability (0.145) was greater than 0.05 set as the benchmark for taking a decision, the null hypothesis (H_{02}) was not rejected. Thus, inference drawn was that there is no significant difference in the mean mathematics achievement scores of low mathematics achieving male and female students as measured by Mathematics Achievement Test (MAT). This implies that the mean mathematics achievement scores of low mathematics achieving male and female students do not differ significantly.

Research Question 3:
What is the interaction effect of feedback strategies and gender on mean mathematics achievement of low achieving students?

Table 4: Mean and Standard deviation interaction effect of (IFB) strategy and gender on mean mathematics achievement of low achieving students

Variable			Pretest		Posttest		
Feedback Strategies	Gender	N	$\bar{x}$	SD	$\bar{x}$	SD	Mean gain
IFB	Male	27	22.96	9.83	70.37	21.26	47.41
	Female	47	22.34	11.88	63.30	22.66	40.96
	Male	39	21.03	11.07	35.64	11.48	14.61
CFB	Female	32	16.88	9.90	32.50	14.37	15.62

The results in table 4 show the interaction effect of feedback strategy and gender on mean mathematics achievement of low achieving students. Result showed that the male students exposed to immediate feedback (IFB) had a pretest mean of 22.96 with a standard deviation of 9.83 and a posttest mean of 70.37 with a standard deviation of 21.26. The difference between the pretest and posttest mean was 47.41. The female students exposed to the same strategy had a pretest mean of 22.34 with a standard deviation of 11.88 and a posttest mean of 63.30 with a standard deviation of 22.66. The difference between the pretest and posttest mean for the female group was 40.96. For male and female groups exposed to IFB, the posttest means were greater than the pretest mean with male having a higher mean gain than their female counterparts. This shows that IFB appears to improve the mathematics achievement of low achieving male students than their female counterparts. Table 4 also shows that the male students exposed to conventional feedback (CFB) had a pretest mean of 21.03 with a

standard deviation of 11.07 and a posttest mean of 35.64 with a standard deviation of 11.48. The difference between the pretest and posttest mean was 14.61. The female students exposed to this same strategy had a pretest mean of 16.88 with a standard deviation of 9.90 and a posttest mean of 32.50 with a standard deviation of 14.37. The difference between the pretest and posttest mean for the female group was 15.62. For male and female groups exposed to CFB, the posttest means were greater than the pretest means with female having a slightly higher mean gain than their male counterparts. This is indicative that CFB seems to improve the mathematics achievement of low achieving female students than their male counterparts. In essence, while IFB appears to improve the mathematics achievement of low achieving male students than their female counterparts, CFB seems to improve the mathematics achievement of low achieving female students than their male counterparts.

Hypothesis 3

H_{03}: There is no interaction effect of immediate feedback strategy and gender on mean mathematics achievement of low achieving students.

The result in Table 2 also shows an F-ratio of 0.605 with associated probability value of 0.438 was obtained with respect to the interaction effect of feedback strategy and gender on mean mathematics achievement of low achieving students. Since the associated probability (0.438) was greater than 0.05 set as the benchmark for taking a decision, the null hypothesis (H_{03}) was not rejected, and so it was concluded that there is no interaction effect of immediate feedback strategy and gender on mean mathematics achievement of low achieving students.

Discussion of Results

The findings of this study were discussed in line with the research questions and hypothesis raised in the study. These were discussed under the following subheadings:

Effect of Immediate Feedback on the Mathematics Achievement of Low Achieving Students

Analysis of post-test data collected from the experimental school classroom revealed that the use of immediate feedback strategy had a significant effect on the mathematics achievement of low achieving students. It was revealed that the group taught mathematics with immediate feedback strategy performed significantly better than the group that learnt mathematics with the conventional feedback strategy.

This result is in agreement with the earlier research findings of Onuigbo and Eze (2010) who examined the effect of different forms of feedback on the mathematics achievement of primary five pupils identified as experiencing difficulties in learning mathematics in Enugu Education Zone. The result of the study showed that using feedback in teaching pupils with mathematics difficulties significantly enhances mathematics achievement. The study also supports the earlier reviewed study conducted by Metcalfe, Kornell and Finn (2009) on delayed versus immediate feedback in children and adults' vocabulary learning in New York City. According to Metcalfe, Kornell and Finn, immediate feedback yielded a superior performance than delayed feedback. This result is also in line with the study of Gandhi (2009) which revealed that students' self-efficacy, persistence and achievement are improved by immediate and continuous feedback. The result of this study is similar to the findings of Voerman, Meijer, Korthagen and Jan-Simons (2012) who carried out a study on the types and frequencies of feedback interventions in classroom interaction in Netherlands secondary education, which reveals that feedback interventions are effective in enhancing learning in the classroom interactions. Similarly, the result of the study conducted by Ajogbeje and Alonge (2012) on the effect of feedback and remediation on students' achievement in junior secondary school mathematics is in accord with the present study. Results from this study revealed feedback has a significant effect on students' achievement in mathematics.

Influence of Gender on the Mathematics Achievement of Low Achieving Students

The results of this study show that male and female students in the experimental group obtained higher mean mathematics achievement test score than those in the control group. However, males, female students' mean achievement scores in the experimental group did not vary significantly. Analysis of covariance (ANCOVA) result showed that gender as a variable has no significant influence on mathematics achievement. That is to say that, gender is not a significant factor in learning mathematics with the use of immediate feedback.

Abdu-Raheem (2012) examined gender differences and academic achievement and retention of students in social studies among Junior Secondary schools in Ekiti State. The findings indicated that there is no significant difference between the mean achievement scores of male and female students in the experimental and control groups. There is no significant difference between the retention mean score of male and female students in both the experimental and control groups. The present study is at variance with the study of Santos, Ursini, Ramirez and Sanchez (2006) which revealed that students with masculine traits do better at mathematics. Mirjam, Heikamp, and Trommsdorff (2013) conducted a research study on Gender differences and school achievement in Germany. They found no gender differences in the mathematics achievement of students. The present study is also in line with an earlier study conducted by Achor, Imoko and Ajai (2010) on sex differentials in students'

achievement and interest in geometry using games and simulations technique. The study indicated no gender difference in students' achievement in geometry. However, Muthukrishny (2010) who studied gender gap in mathematics achievement and nature, found a gender gap in mathematics achievement in favour of females. Similarly, Amongne (2015) on gender disparity and academic achievement revealed that there is statistically a significant achievement difference between male and female students favoring the former.

Interaction Effect of Immediate Feedback and Gender on Students' Mathematics Achievement

The study reveals that there is no significant interaction effect of gender and immediate feedback strategy on mathematics achievement of students. This implies that the improvement in the mathematics achievement of students was caused by the intervention using immediate feedback strategy and not other factors. This is in agreement with Eze, (2003) whose research revealed no interaction effect of gender and elaborative feedback on students' achievement. No significant interaction of gender and immediate feedback on students' mathematics achievement shows that both male and females benefited equally in the instruction. This suggests that immediate feedback is capable of bridging gender gap in mathematics achievement.

CONCLUSION

The following conclusions were made based on the findings of the study:

- The use of immediate feedback in teaching mathematics enhanced the mathematics achievement of low achieving students. This conclusion is based on the findings of this study which revealed a significant difference in mathematics achievement of low achieving students exposed to immediate feedback instruction and those exposed to conventional feedback.
- Gender was found to have no significant effect on the mathematics achievement of low achieving students who were exposed to immediate feedback. Therefore, the use of immediate feedback in the classroom minimizes gender effect on the mathematics achievement of low achieving students.
- It was also found that there is no significant interaction effect of immediate feedback and gender on mathematics achievement of low achieving students. It was concluded that immediate feedback was effective in bridging the perceived gender difference in mathematics achievement of low achieving senior school students of Owerri Education Zone II of Imo State.

Recommendations

Based on the findings and educational implications of this study, the researcher made the following recommendations:

- Students should be exposed to immediate feedback during mathematics teaching and learning interactions in the classroom, so that they will be able to participate actively in the teaching-learning process; and in such a way that they will take the responsibility of learning mathematics seriously. In order to achieve this, teachers should use the strategy carefully.
- Immediate feedback should be incorporated into teacher education programmes to prepare the prospective teachers on how to use the strategy.
- Stakeholders in education; the federal and state government, education management boards and school administrators should organize in-service training, workshops and seminars for both the teachers on how to use immediate feedback strategy in the in teaching mathematics.
- Curriculum planners should plan mathematics curriculum in such a way that students' activities and teachers' activities should reflect steps involved in immediate feedback. This will enhance the students' mathematics self-efficacy, mathematics task persistence and mathematics achievement at all levels of education.
- Classroom teachers should encourage their students with review questions, self scoring and comments to take the lead during mathematics instruction, so that students will develop the habit of leaning through self-discovery. Such that the teacher will wholly assume the place of a facilitator.
- Departments of mathematics of teacher training instructions like Colleges of Education, faculties of Education in the Universities should entrench immediate feedback as a teaching strategy, so as to the potential teachers with this effective teaching instruction.

REFERENCES

Abdu-Raheem, B. O. (2012). Gender differences and students' academic achievement retention in social studies among junior secondary schools in Ekiti State, Nigeria. *Eur. J. Educ Study, 4, (1), 155-161.*

Achor, E. E., Imoko, B. I. & Ajai, J. T. (2010). Sex difference in students' achievement and interest in geometry using games and simulations technique. Pecatibey Faculty of education electronic. *Journal of science and mathematics education. 4,* (1), 1 – 10.

Adewale, G. J. (2010). Increasing JSS students' achievement in science through formative testing, feedback and

remediation: A study in school effectiveness. Ibadan. *African journal of special education needs. Department of special education, university of education Winneba Ghana, 5, (1), 171-192.*

Ajogbeje, O. J. & Alonge, M. F. (2012). Effect of feedback and remediation on students' achievement in junior secondary school mathematics. *5, (5,) 73-103. http://www.ccsenet.org/journal/index.php/ies/article/view/19998.*

Ajogbeje, O. J. (2009). Effect of formative testing on students achievement in secondary school mathematics. *European Scientific Journal. 8, (8), 117-153.*

Akin, A. (2008). *Self-efficacy, achievement goals and scaling procedures.* Sage publications.

Akkuzu, N. (2014). The role of different types of feedback in the reciprocal interaction of teaching performance and self-efficacy belief. *Australian Journal of Teacher Education, 39, (3), 83-131. Retrieved from http://www.sagepublications.com*

Amongne, A. E. (2013). Gender disparity analysis in academic achievement at higher education preparatory schools: Case of South Wollo, Department of Geography and environmental studies Ethiopia. *Academic journal of educational research and reviews, 10, (1), 50-58.*

Babalola, V.O. (2006). Curriculum and instruction at the primary education level. Nigerian *Journal of curriculum studies, 13, (1), 166-174.*

Denzin, G.M. (2008). *Social learning theory*. In N.J Salkind (Ed.), Encyclopedia development. Philadelphia: Rontedge Press.

Duane, C. L. (2005). Delayed versus immediate feedback in an independent study; high school setting. *Brigham, young university PhD dissertation*.

Elliot, S. N., Kratochwill, T. R. & Cook, J. L. (2000). Educational Psychology: Effective teaching and learning. Boston: McGraw Hill. *Encouragement or discouragement?* Retrieved on September, 26, 2015 from *http://www/huji.ac.il/unew/main.html.*

Eze U.N (2003). Effect of instruction in strategic content learning on university students' achievement in selected psychological theories. *Review of Education, 16,* (2*), 32-43*.

Geary, D.C. & Stoet, G. (2012). Can stereotype threat explain the gender gap in mathematics performance and achievement? American Psychological Association. *Review of General Psychology, 16, (1), 93–102. 1089-2680/12/$12.00 DOI: 10.1037/a0026617*

Hannover, B. & Kessels, U. (2011). Are boys left behind at school? Reviewing and explaining education-related gender disparities. Z. *Pedagogical Psychology, 25, 89–103.*

Hattie, J. A. (1999, June.). *Influences on student learning* (Inaugural professorial address, University of Auckland, New Zealand). Retrieved from http://www.arts .auckland.ac.nz/staff/index.cfm?P=8650

Hattie, J. & Timperley, H. (2007). The power of feedback. University of Auckland. *Review of Educational Research, 77, 81–112.http://dx.doi.org/10.1111/j.1467-8535.2006.00645.x*

Hornby, A. S. (2000). Oxford advanced learner's dictionary; current English. New York: Oxford university press.

Higgins, A. & Nicholl, H. (2003). The experiences of lecturers and students in the use of microteaching as a teaching strategy. *Nurse Education in Practice, 3, 220-227.http://dx.doi.org/10.1016/S1471-5953(02)00106-3.*

Jeff, S. (2015). Girls lead boys in academic achievement globally. *33, 573-882. sossamonj@missouri.edu,*

Johnson, Kristin and Schmidt, Anne, (2006)."The Effects of Teaching Problem Solving Strategies to Low Achieving Students" (2006). *Action Research Projects. http://digitalcommons.unl.edu/mathmidactionresearch/62*

Kehrer, P. Kim, K. & Neil Heffernan, N (2013). Does immediate feedback while doing homework improve learning? Worcester Polytechnic Institute. *Association for the advancement of artificial intelligence (www.aaai.org). nth@wpi.edu*

Metcalfe, J. Kornell, N. & Finn, B. (2009). Delayed versus immediate feedback in children's and adults' vocabulary learning. *Columbia University. Journal of Memory & Cognition,37 (8), 1077-1087 doi:10.3758/MC.37.8.1077*

Mirjam, W. & Heikamp,T. G.(2013).Gender differences in school achievement: The role of self-regulation. *Princeton, NJ: Educational Testing. doi: 10.3389/fpsyg.2013.00442PMCID: PMC3713251*.

Muthukrishny, N. (2010). *Gender differences in mathematics achievement: An Expository study at a primary school in Kwazulu-Natal*. Retrieved from http://www.readperiodicals.com/201012/2187713391

Onuigbo, L.N. & Eze, U. N. (2010). Effect of different forms of feedback on mathematics achievement of pupils with mathematics difficulties. Ghana, African journal of special education needs. Department of special education. *University of education Winneba Ghana, 5, (1), 149-170.*

Onuigbo, L.N. & Eze, U. N. (2011). Effect of instruction in self regulatory learning strategy on interest, task persistence and accomplishment among low achieving students. Review of education institute of university of Nigeria Nsukka, 22, (1), 224-237.

Ramírez, M. J. (2004) Understanding the low mathematics achievement of Chilean students. *Revista electrónica Iberoamericana sobre Calidad, Eficacia Cambio en Education, 2, (1),1-17. http://www.ice.deusto.es/rinace/reice/vol2n1/Ramirez.pdf*

Rozek, C. (2012). *The effects of feedback and attribution style on task persistence*. Gustavus Adolphus College.

Salvador, A. & Dase, C. (2001). The definition of achievement and the construction of tests for its measurement: A review of the main trends. Universitat de València, Spain. *Psicológica 22, 43-66.*

TIMSS (2000). *Third international mathematics and science Study.* Australia and United States of America.

Tobies, R. & Helmut N. (2012). A Life at the crossroads mathematics, science, and industry. *Springer, 9. 22-39*.

Uzoma, O. F. (2015). The effect of cooperative learning strategy on achievement motivation of low achieving students in reading comprehension*. An unpublished thesis submitted to the department of educational foundations, University of Nigeria, Nsukka, in fulfillment of the requirement for the award of Masters degree in Educational Psychology.*

Vibha, C, & Rayat, B. (2011). Effects of student feedback on teaching Competence of student teachers: A microteaching experiment. *India College of Education, India Praveen Thukral Mohan Lal Institute of Education. 2 (1), 77-87 77.*

Voerman, L., Meijer, P. C., Korthagen, F.A.J. & Simons, R.J. (2012). *Types and frequencies of feedback intervention in the classroom interaction in secondary education*. Centre for teaching and learning. Utrecht University, Netherlands. www.elsewer.com/local/tate.

Woodward, J. & Brown, C. (2006). Meeting the curricular needs of academically low achieving students in middle grade mathematics. *University on Puget Sound. Journal of special education. Vol.40, no.3, 151-159.*

Woolfolk, A. (2010). *Educational Psychology*: Ohio, upper saddle River, New Jersey: Pearson Education, Inc.