

ENHANCING STUDENTS' ACADEMIC ACHIEVEMENT IN BASIC SCIENCE THROUGH THE USE OF REFLECTIVE INSTRUCTIONAL STRATEGY

¹OGUEZUE, Nnaemeka K., ²OSUAFOR, Abigail M. & ²EKOYO Destiny, O.

nk.oguezue@unizik.edu.ng, am.osuafor@unizik.edu.ng

2348064034041, 2348037276887

Faculty of Education,

Science Education Department

Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Abstract

The effect of reflective instructional strategy was investigated on upper basic VIII students' achievement in Basic Science in Onitsha Education Zone of Anambra State. Anon-equivalent groups' quasi-experimental research design was used for the study with a sample size of 89 students. Two research questions and three hypotheses guided the study. Students' achievement was measured using Basic Science Achievement Test (BSAT). The reliability coefficient of the instrument was established through a pilot study using Kuder-Richardson 20(KR-20) formula, and the instrument was found to be reliable with a coefficient value of 0.83. To answer the research questions, the data were analyzed using mean, standard deviation, and ANCOVA for testing of hypotheses at 0.05 level of significance. The study also recorded no significant difference between male and female students' achievement. Based on the findings, the study recommended that Basic Science teachers/science educators should adopt reflective instructional strategy as a medium of classroom instruction for teaching science, and basic science in particular.

Key words: Basic Science, Reflective Instructional Strategy, Achievement, Gender.

Introduction

Basic science also known as integrated science is an interdisciplinary subject that attempts to remove the various single subjects' boundaries by presenting science as one entity through a unified approach. Basic science as the name implies, forms the basis of every core science subject offered by students at the senior secondary level or classes (Mbonu-Adigwe, Eya, Umate and Attah, 2021). According to Agbidye (2015), it serves as the bedrock that provides the required training in science skills acquisition to meet the growing needs of the society. To this end, there is need to offer the best experience in teaching and learning of basic science in order to facilitate the students' interest early enough in science. Basic science prepares students at the junior secondary schools for the study of core science subjects (Biology, Chemistry and Physics) at the senior secondary (SS) level (Oludipe (2012); and Joseph and Ikechi, 2018). In Nigerian educational system, every student is expected to undertake the subject, Basic Science.

In Nigeria, poor academic achievement of students has continued to be a major cause of concern for all especially basic science teachers, researchers and other stake holders in the system (Obomanu and Adaramola, (2011), Omiko (2017) and Mbonu and Okoli (2019). Evidence from the achievement reports recorded by the Examination Development Center (EDC) Awka, Anambra State (2014-2019) showed that students' achievement in basic science is still inconsistent and far below average. The body (within the range of academic year above), reported that more credit and failure in students' performance in BECE examination were recorded compared to percentage of distinction made. This report of poor and inconsistent achievement of students in basic science is one that deserves urgent attention. The present study is an attempt to fill this gap.

Interestingly, several reports have revealed that this poor achievement in Basic Science among other factors, is as a result of poor teaching method such as the use of conventional method (Obomanu and Adaramola, 2011; Ochu and Haruna, 2015; Agbidye 2015; Okeke 2015; Akama 2015; Enebechi 2016). Many researchers such as Omiko (2017); Mbonu and Okoli (2019) reported that despite the efforts by the government, Science Teachers Association of Nigeria (STAN) and other stakeholders in an attempt to solve or overcome the problem of students' poor achievement, achievement in basic science is still below average in both internal and external examinations. The persistent poor achievement in basic science

which is as a result of poor method of teaching portrays that the current educational paradigm is weak (Mbonu-Adigwe et al, 2021). Conventional method is the method of teaching that is characterized by the following: it is teacher-centred. It inhibits active participation of students in the classroom; it reduces students to mere note-taking and passive listeners and learners, perception and assimilation of the subject matter is slow. It is examination oriented (Agbidye, Achor and Ogbeba, 2019). To tackle this problem, a new approach to teaching and learning of science subjects in general and basic science in particular has to be considered and adopted. It is on this note, that the present study investigated the effect of reflective instructional strategy (RIS) on students' achievement in basic science.

Reflective instructional strategy (RIS) is a broad-based approach that engages the learners to discuss, collaborate and think back on their learning experiences together on a particular subject matter (Timitimi, 2010). Reflective instructional strategy can also be seen as a tool for self-assessment in the classroom (Fines, 2014; Gupta, et al, 2019). Specifically, RIS presents students with problems and allows them to utilize collaborative learning, self-assessment, and peer evaluation tools to solve the problems (Agbasi and Okeke, 2020). According to Gupta et al (2019), reflective instructional strategy also includes peer observation, self-evaluation, peer critique and feedback mechanism. Several studies have emphasized the effectiveness of RIS (Ogbuanya and Owodunni (2013); Odewale (2018); Agbasi and Okeke 2019; Gupta, et al (2019). Since poor teaching method has been identified as reported the major contributing factor in students' poor achievement especially in basic science, this study therefore sets to determine the effect of RIS on students' academic achievement in basic science.

Academic achievement in basic science is the quality of knowledge acquired by students as a result of exposure to classroom experiences. It is the outcome to which a student, teacher or institution has achieved their educational goals (Tomas, 2011). Odagboyi (2015) highlighted the indicators of achievement as knowledge gained, skills acquired and retained, through their studies within and outside the classroom experience. The students' academic achievement on the other hand can also be used by the teacher as an indicator in assessing his teaching and methodological approach (Samba and Ogah, 2020; Adonu, et al, 2021). Perhaps, reflective instructional strategy may affect students' academic achievement positively irrespective of their gender.

Gender refers to the roles and relationships between men and women in a given context (Akper, Gire and Orshi, 2014). It is a socio-cultural construct that assigns roles, attitudes and values considered appropriate for each sex (Godpower-Echie and Owo, 2019). Several contrasting findings have been reported as regards to students' achievement with respect to gender. For instance, Khairulanuar, Nazre, Sairabanu and Norasikin (2010) found gender differences in favour of male students. Oludipe (2012) and Anaehobi and Okigbo (2019) in their different studies found out that there is no significant difference on the academic achievement of male and female students. Amidst these contrasting reports, the study also sought to determine gender influence on the academic achievement of students in basic science.

Statement of the Problem

Basic science as a necessary subject for national development must be taught effectively and purposefully for meaningful learning to take place. The necessity of the subject has prompted many stakeholders such as Government, STAN and others to proffer solutions to the abysmal performance of students in basic science reported by EDC (2014-2019), in order to improve their academic achievement. Several studies reviewed, have pointed out reasons for the poor achievement of student in basic science. One major factor as highlighted by these researchers is the use of conventional approach. On this note, there is need to consider a different approach that could prepare and equip the students with problem solving skills, decision making, and most importantly improved academic achievement. Thus, the choice for a student-centered approach like reflective instructional strategy. The approach was employed to find out if it will enhance the academic achievement of students in basic science which is main the rationale of the study.

Purpose of the Study

The purpose of the study was to determine effect of reflective instructional strategy on students' achievement in basic science. Specifically, the study intended to determine;

1. Difference between the mean achievement scores of students taught using RIS and that of those taught using conventional method
2. Difference between the mean achievement scores of male and female students taught Basic science using RIS

3. Interaction effect of teaching method and gender on students' achievement in Basic science

Research Questions

The following research questions guided the study

1. What is the difference between the mean achievement scores of students taught Basic Science using RIS and that of those taught using conventional method?
2. What is the difference between the mean achievement scores of male and female students taught Basic Science using RIS?

Hypotheses

1. There is no significant difference between the mean achievement scores of students taught Basic Science using RIS and those taught basic science using conventional method.
2. There is no significant difference between the mean achievement scores of male and female students taught basic science using RIS
3. There is no interaction effect of teaching methods and gender on students' achievement in Basic Science.

Method

A non-equivalent groups quasi-experimental research design was used in the study. The design was adopted because the study adopted intact classes of which the subjects in the sampled schools were not randomized. The research was conducted in Onitsha Education Zone of Anambra State. All two thousand, eight hundred and forty-five (2,845) Secondary School Two (JSS 2) basic science students in nineteen (19) public Secondary Schools in Onitsha Education zone made up the study's population. The sample size comprised of eighty-nine (89) students. For sampling, multistage sampling procedure was used: purposive and simple random sampling (Balloting without replacement). The instrument for data collection was Basic Science Achievement Test (BSAT). The instrument drawn from Basic education Certificate Examination (BECE) past questions, consisted 25 multiple choice questions of two sections -A and B. Section A contained the demographic information of the

students while section B was actual question items. Using Kuder-Richardson 20 (K-R 20) formula, the internal consistency reliability coefficient of BSAT was calculated to be 0.83.

Data collected were analyses using mean, standard deviation and Analysis of Covariance (ANCOVA). The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results

The results of this study were presented in line with the research questions and hypotheses that guided the study

Research Question One: What is the difference between the mean achievement scores of UPPER BASIC VIII students taught Basic Science using RIS and that of those taught using conventional method?

Table 1: Pre-test and Post-test Mean Achievement scores of students taught basic science using RIS and (CLM)

Groups	N	Pre-test		Post-test		Gained Mean
		Mean	SD	Mean	SD	
Experimental	45	44.09	10.50	81.33	7.77	37.24
Control	44	43.91	8.90	73.09	8.81	29.18
Mean Difference		0.18		8.24		8.06

Results in table 1 reveals that the students taught Basic Science using RIS had pre-test mean achievement score of ($M=44.09$, $SD=10.50$) and post-test mean achievement score of ($M=81.33$, $SD=7.77$) with gained mean achievement score of 37.24, while those in the control group taught with conventional method has pre-test mean achievement score of ($M=43.91$, $SD=8.90$) and post-test mean score of ($M=73.09$, $SD=8.81$) with gained mean 29.18. Students taught conventional method Basic Science using RIS had a less spread of scores in the post-test (7.77) than those in the conventional group (8.81) indicating that students taught using RIS had a more homogeneous score in their post-test. The difference between the mean gained achievement scores of the students in both groups is 8.06 in favour of RIS.

Research Question Two: What is the difference between the mean achievement scores of male and female students taught Basic Science using RIS?

Table 2: Pre-test and Post-test Mean Achievement Scores of Male and Female Students taught Basic Science using RIS

Gender	N	Pre-test		Post-test		Gained Mean
		Mean	SD	Mean	SD	
Male	26	43.85	10.09	79.54	7.27	35.69
Female	19	44.42	11.31	83.79	7.94	39.37
Mean Difference		0.57		4.25		3.68

Table 2 reveals that the male students taught Basic Science using RIS had pre-test mean achievement score of (43.85, $SD=10.09$) and post-test mean achievement score of ($M=79.54$, $SD=7.27$) with a gain in mean scores of 35.69, while the female students have pre-test mean achievement score of ($M=44.42$, $SD=11.31$) and post-test mean achievement score of ($M=83.79$, $SD=7.94$) with a gain in mean scores of 39.37. There was a higher spread of scores among the female students in the post-test (7.94) than among the males (7.27) indicating that the male students had a more homogeneous score in the post-test. The difference between the mean gain achievement score of the male and female students is 3.68 in favour of the females.

Test of Hypotheses

H₀₁: There is no significant difference between the mean achievement scores of students taught Basic Science using RIS and those taught basic science using conventional method.

Table 3: ANCOVA Test of Significance of Difference between the Mean Achievement Scores of Students taught Basic Science using RIS and (CM)

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	1722.240 ^a	4	430.560	6.252	.000	
Intercept	23134.409	1	23134.409	335.930	.000	
Pre-test	6.541	1	6.541	.095	.759	
Gender	137.716	1	137.716	2.000	.161	Not Sig.
Method	1473.510	1	1473.510	21.397	.000	Sig.
Gender * Method	54.837	1	54.837	.796	.375	Not Sig.
Error	5784.816	84	68.867			
Total	538736.000	89				
Corrected Total	7507.056	88				

Results in table 3 shows that there is a significant mean effect of the treatment on students' achievement in Basic Science $F(4, 84) = 21.397$, $P = 0.000 < 0.05$. Therefore, the

null hypothesis is rejected meaning that there is a significant difference between the mean achievement scores of students taught Basic Science using RIS and those taught using conventional method in favour of RIS.

H₀₂: There is no significant difference between the mean achievement scores of male and female students.

Table 3 also shows that there is no significant mean influence of gender on students' achievement in Basic science $F(4, 84) = 2.000, P = 0.161 > 0.05$. Therefore, the null hypothesis is not rejected meaning that there is no significant difference between the mean achievement scores of male and female students.

H₀₃: There is no interaction effect of teaching methods and gender on students' achievement in Basic Science.

Table 3 further shows that there is no significant interaction of teaching methods and gender on students' achievement in Basic Science $F(4, 84) = 0.796, P = 0.375 > 0.05$. Therefore, the null hypothesis is not rejected meaning that there is no significant interaction effect of teaching methods and gender on students' achievement in Basic science.

Discussion

The findings of the study revealed that there is a significant difference in the mean achievement scores of students taught basic science using RIS than those taught using the conventional method. The result revealed that the students taught Basic Science using RIS had pre-test mean achievement score of ($M=44.09, SD=10.50$) and post-test mean achievement score of ($M=81.33, SD=7.77$) with gained mean achievement score of 37.24, while those in the control group taught with conventional method has pre-test mean achievement score of ($M=43.91, SD=8.90$) and post-test mean score of ($M=73.09, SD=8.81$) with gained mean 29.18. The result is supported by the hypotheses in table 3 that there is a significant mean effect of the treatment on students' achievement in Basic Science $F(4, 84) = 21.397, P = 0.000 < 0.05$. Therefore, the null hypothesis is rejected. This means that the effect of RIS differs significantly when compared with that of conventional method. The use of RIS enhanced basic science students' achievement as seen from their gained mean score. This is because RIS is innovative and activity-oriented, and acts as stimulant for the learners to be actively engaged in the classroom. The method also sustained students' attention in the classroom throughout the lesson. The outcome of the findings supports that of

Ogbuanya and Owodunni (2013); Odewale 2018; Agbasi and Okeke 2019; Gupta, Shree and Mishra (2019).

The findings also revealed that gender is a significant factor in students' achievement in basic science. The result revealed that the male students taught Basic Science using RIS had pre-test mean achievement score of (43.85, $SD=10.09$) and post-test mean achievement score of ($M=79.54$, $SD=7.27$) with a gain in mean scores of 35.69 while the female students have pre-test mean interest score of ($M=44.42$, $SD=11.31$) and post-test mean achievement score of ($M=83.79$, $SD=7.94$) with a gain in mean scores of 39.37. The null hypotheses also shows that there is no significant mean influence of gender on students' achievement in Basic science $F(4, 84) = 2.000$, $P = 0.161 > 0.05$. Therefore, the null hypothesis is not rejected meaning that there is no significant difference between the mean achievement scores of male and female students. This finding of the study is because the reflective instructional strategy of instruction uniformly affected the whole students. Since every student irrespective of gender partook in the activities, their achievement and retention were equally affected, although the female students with a gained mean score of (39.37) performed better than the male students with a gained mean score of (35.69), but this was not significant. Therefore, the influence of RIS on female secondary school students' achievement in basic science does not differ significantly when compared with that of the male students. Therefore, the strategy is not gender biased. This is in support of Oludipe (2012) and Anaehobi (2019) who in their different studies discovered that there is no significant difference on the academic achievement of male and female students.

The result of the study also showed no significant interaction between teaching methods and gender on students' academic achievement in basic science. This shows that effect of the instructional approaches did not change when gender was put into consideration. Thus, the method is not gender biased with respect to achievement.

Conclusion

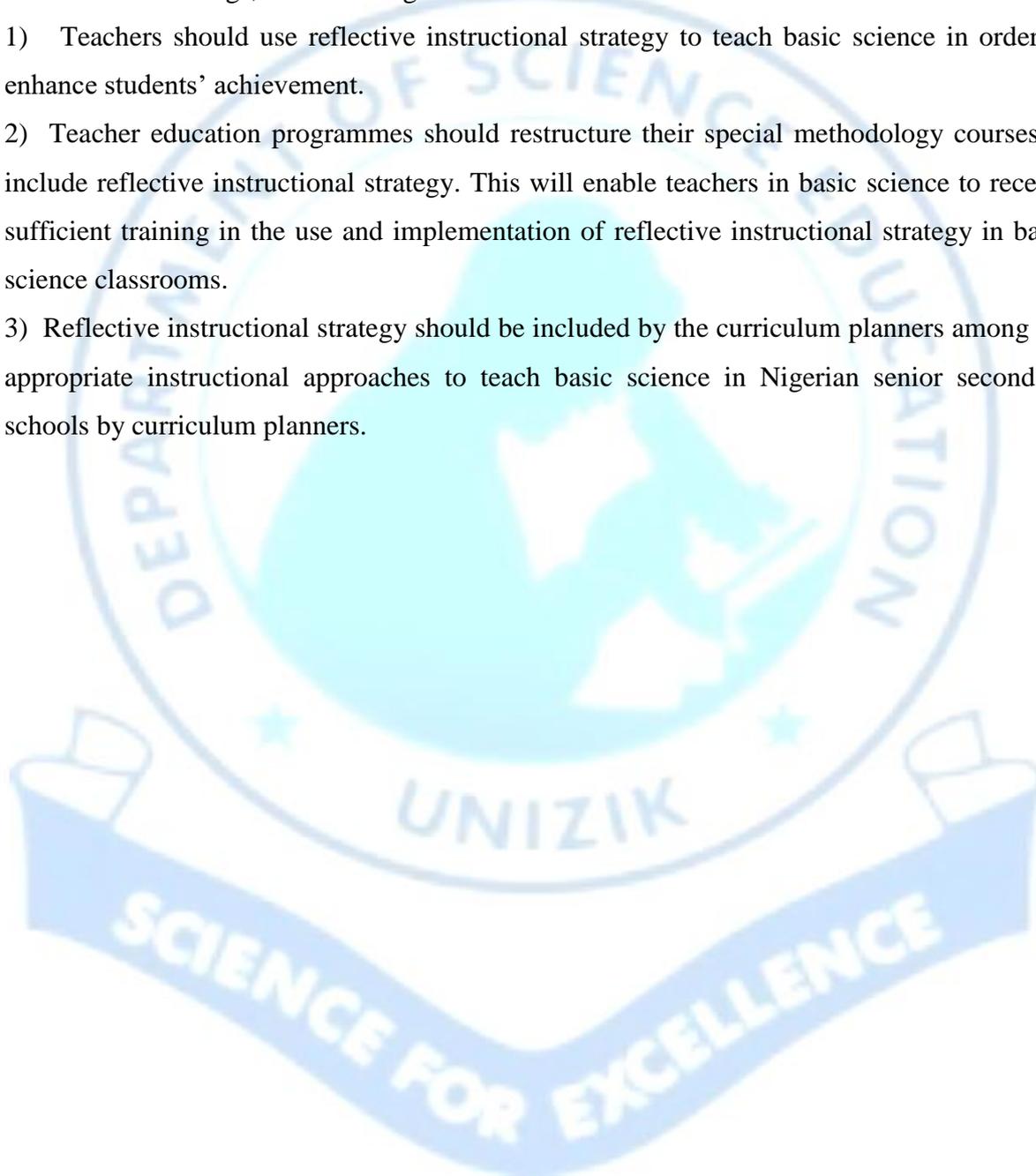
The aim of the study was to see how effective reflective instructional strategy approach is at improving students' achievement in basic science. The study revealed that reflective instructional strategy enhanced student' achievement in basic science more than the

conventional method. Students who were taught basic science using reflective instructional strategy performed better than those who were taught using conventional method.

Recommendations

Based on the findings, the following recommendations were made:

- 1) Teachers should use reflective instructional strategy to teach basic science in order to enhance students' achievement.
- 2) Teacher education programmes should restructure their special methodology courses to include reflective instructional strategy. This will enable teachers in basic science to receive sufficient training in the use and implementation of reflective instructional strategy in basic science classrooms.
- 3) Reflective instructional strategy should be included by the curriculum planners among the appropriate instructional approaches to teach basic science in Nigerian senior secondary schools by curriculum planners.



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