

Effects of Cooperative Learning Method on Academic Achievement of Primary School Pupils in Basic Science and Technology in Anambra State

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ABSTRACT

This study investigated the effects of Cooperative Teaching Method (CTM) on pupils' academic achievement in Basic Science and Technology, as well as how its effect varies across gender. Two research questions guided the study and two hypotheses were tested at 0.05 alpha level. A quasi-experimental, non-equivalent control group design was utilized in the investigation. The population consisted of 2,432 primary five (Pri.5) Basic Science and Technology pupils in all 52 public schools in Awka Education Zone of Anambra state for the 2018/2019 academic session. A sample of 98 pupils from three primary schools were purposively selected. Basic science and technology Achievement Test (BSTAT) was the instrument used for data collection. This instrument was validated by three experts and tested for reliability. Kuder Richardson Formula (KR-20) was used to establish the reliability of BSTAT which yielded a reliability of 0.80. Mean was used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings of the study showed a significant effect of CTM on pupils' academic achievement in Basic science and technology. The findings also indicated that both male and female pupils' academic achievement were enhanced with the use of CTM using BST. Since the present result (academic achievement) agrees with the earlier findings in other countries, it implies that the use of CTM does not discriminate among location and subject. Implications of the findings were highlighted. The study recommended among others that classroom teachers should use CTM to make more time available for in-class active learning and implement active approaches to promote pupils ownership of the learning process.

Keywords: Cooperative Learning Method, Academic Achievement, Primary School, Pupils, Basic Science, Technology

1.1.Introduction

Education is the bedrock of any nation's development and is central to all aspect of any nation's science. It is the most powerful instrument devised by man for his own improvement. Education, according to Chukwuma and Aniekwe (2011) can be regarded as instrument for effecting human learning, transformation and capacity development. It is the total process of human learning by which knowledge is impacted, faculties trained and skills

developed. Thus, it is a means through which man acquires learning and is molded to fit into the society. The major aim of education is to provide individuals with the relevant knowledge, skills, attitudes and ideas to enable them live as effective citizens in the society.

Every educational system is developed and structured according to many diverse and distinct needs and demands of the society that established it. However, education is constantly changing and adapting itself to new demands and circumstances. In the National Policy on Education, the Federal Government of Nigeria (FGN, 2013) had continued to update her educational system to meet up with various educational challenges. The FGN properly placed a significant emphasis on the importance of pupils/pupils acquiring and developing of appropriate skills as equipment for them to live in and contribute positively to the society. Moreover, Basic Education in Nigeria, on its part, aims at equipping pupils to live effectively in our modern age of science and technology.

It is in recognition of the importance of education that Nigeria has continue to make serious efforts towards providing the citizens with quality and functional educations for social, economic and political development. In making effort towards qualitative and functional education, the Federal Republic of Nigeria (2013) in the National Policy on Education stated that one of the aims and objectives of education in Nigeria is to help the child acquire appropriate productive skills, abilities and competencies, both mental and physical from the primary school level as equipment for the individual to live and contribute to the development of the society. These skills, abilities and concept could be acquired through the training provided in the schools and colleges from primary school level down to the tertiary education level.

Primary school is a school for children from about five (5) to eleven (11) years old, where they receive primary education. It can be referred to both the physical structure (buildings) and the organization. Typically, primary school comes after preschool, and before secondary school (Ikeanumba, 2017). Bertlett (2016) considers primary education as a single phase where programmes are typically designed to provide fundamental skills in reading, writing and mathematics, and to establish a solid foundation for learning. Primary school level is classified from primary 1-6 as junior Basic levels and primary 4-6 as senior Basic levels.

The National curriculum requires children to be taught the following subjects at their primary education levels: English, Mathematics, Basic Science and Technology, Civic Education, Art and Design, Music, Physical Education (including swimming), Computer Science among others. The inclusion of Basic Science and Technology will no doubt have positive impact on the pupils. Basic Science and Technology is the study that encompasses the systematic study of the structure and behaviour of the physical and natural world through observation and experiment, and the application of scientific knowledge for practical purposes (Oxford, 2020). Basic Science and Technology (part of science and technology education) is a compulsory subject in the Nine Year Basic Education programme to be studied in primary schools.

The general objectives of Basic Science and Technology in primary school as stipulated in the NPE by FRN (2013) are to provide the broader objectives of science and technology that is process skill knowledge curiosity, to encourage and enable pupils to develop inquiring minds and curiosity about science and nature, to acquire knowledge, conceptual understanding, and skills to solve problems and make informed decisions in

scientific contexts, to develop skills of scientific inquiry to design and carry out scientific investigations and evaluate scientific evidence to draw conclusions, to communicate scientific ideas, arguments, and practical experiences accurately in a variety of ways, to think analytically, critically and creatively to solve problems, judge arguments and make decisions in scientific and other contexts, to appreciate the benefits and limitations of science and its application in technological developments, to understand the nature of science and the interdependence of science, technology, and society including the benefits, limitations, and implications imposed by social, economic, political, environmental, cultural and ethical factors, to demonstrate attitudes and develop values of honesty and respect for themselves, others, and their shared environment, etc. (Dewey, 2020).

The Basic Science and Technology curriculum for primary school consists of various topics such as You and Technology, Safety, Materials and Processing, Drawing Practice, Tools and Machines, Applied Electricity and Electronics, Energy and Power, Maintenance, Building, etc. For the purpose of this study the following topics were taught are captured: Pollution, waste and waste disposal and technology (materials) and safety. It is obvious that the quality of Basic Science and Technology (BST) teaching and learning in early primary school has a great influence and motivation on the achievement of pupils in Basic Science at the junior primary education. This is because, the effective teaching and learning of BST will expose pupils to the world of work and eventually qualify them to proceed to higher educational level through primary level. With this, the pupils could become middle level manpower who are knowledgeable in the field of science and technology and possess the skills and ability to solve societal problems in future.

In BST, pupils are expected to have competencies in science and technology including the ability to develop functional knowledge of BST concepts and principles, observe and explore the scientific and technological environment, improvise simple equipment or machine from available resources in the immediate environment to solve societal problems and promote pupils' academic achievement (FRN, 2013).

Academic achievement according to the Cambridge University Reporter (2013) is defined in terms of examination achievement. Santrock (2006) defined academic achievement as what the pupils has learned or what skills the pupils has learned and is usually measured through assessments like standardized tests, achievement assessments and portfolio assessments. The descriptive assessment information will usually be translated through grading system such as Grade Point Average (GPA) and subject grade (Santrock, 2006).

Academic achievement, which is measured by the examination results, is one of the major goals of a school. Hoyle in Ikeanumba (2017), argued that schools are established with the aim of imparting knowledge and skills to those who go through them and behind all this is the idea of enhancing good academic achievement. The academic deans and the quality assurance committee are concerned about those who do not perform well because if this poor achievement goes unchecked, the school may lose its reputation, which may result in loss of confidence in graduates. Kyoshiba (2009) saw academic achievement as achievement outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Epunam (2009) also opined that academic achievement connotes performance in a school subject as symbolized by scores or marks in an achievement test.

Academic achievement is attitudinal exhibition of an individual's performance in class, workshop and laboratory at school, college or university (Alaba, 2010). It is a permanent change in the conceptual attainment of knowledge skills and attitude of the learner on the completion of a specified course or study or module. Spinath (2012) opined that academic achievement represents outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in schools. It is described as the outcome of pupils' effort in examinations. It could be high, average or low or poor.

In the opinion of Loo & Choy (2013), academic achievement means a multidimensional construct consisting of three dimensions: pupil's characteristics, teacher competencies and academic dimension. This means that academic achievement concerns how pupils cope with or accomplish different task given to them by their teachers. Thus, the determinants of this dimensions are pupils' intelligence, personality and the socio-economic status within the academic context.

The researchers define academic achievement as pupils' success in meeting short or long-term goals in education. Slavin (2011) posited that when engaged children in cooperative learning; it could produce positive effect on pupil's academic achievement.

The duty of a teacher is to promote learning methods which bring about interaction among pupils and improve on their relationship with individuals in the classroom. Igboko & Ibeneme (2006) pointed out that traditional education practices such as use of demonstration and lecture methods alone have proved incapable of producing skills required for coping with the challenges posed by rapid technological development. They also noted that teachers are strongly encouraged to use the pupils' activity-based and inquiry mode activities in teaching to ensure achievement and retention of concepts in BST. One of such methods is cooperative learning.

Cooperative Learning refers to instructional method in which pair or small group of learners with different level of ability work together to accomplish a shared goal (Igbal, 2004). In the view of Amita (2006), cooperative learning refers to a situation where a small dedicated group of pupils learn together and take advantages of each other's expertise to achieve a common goal. Mekeachie (2009) explained that in a Cooperative learning class, pupils often elaborate on the concept being taught to achieve what is expected. Elaborations do not only enhance the learning of pupils who receive the explanation but could also deepen the understanding of the pupils providing the explanation. Cooperative learning comprises instructional method in which teachers organize the pupils into small groups which then work together to help one another learn some academic content (Slavin, 2011).

This study will make use of Jigsaw strategy of cooperative teaching method. According to Aronson (2000), Jigsaw is a cooperative learning strategy that enables each pupil of a "home" group to specialize in one aspect of a learning unit. Pupils meet with members from other groups who are assigned the same task and after mastering the materials, return to the "home" group to teach this material to the group members. Jigsaw can be used whenever materials are segmented into separate components. Each group member becomes an expert on a different concept or procedure and teaches it to the group (Reys, 2010). Just like jigsaw puzzle, each piece (pupil part) is essential for the completion and full understanding of the final product.

Despite the plan and efforts of the government to improve science and technology education at all levels of education, the achievements of pupils in BST have not been encouraging. The outcomes of internal and external examinations of pupil in primary schools have revealed a declining in the achievement level in the subject. For instance, in the 2014/2015, 2015/2016, 2016/2017 and 2017/2018 primary school pupils' results in BST Common Entrance Examination published by the ministry of education, only 40.23%, 37.18%, 32.19% and 47.14% respectively of pupils were able to make credit passes and above (Primary Education Management Board, Anambra State, 2018)

This fall in the academic achievement level in Basic science and technology in primary schools in Anambra state is traceable to many psychological and physiological or environmental factors, which could be governmental, institutional, parental, societal factors and teaching methods. These factors could be as a result of government's poor attitude towards revitalization of basic institutions in Nigeria, parent perception on education, lack of qualified technology teacher, pupils' poor reading habit, and poor societal attitude in embracing Basic science and technology, teaching method, gender and location has been reported among the factors that affect pupils' academic achievement. To this regard, the classroom teacher is therefore faced with the challenge of teaching to attain effective conceptual change, high academic and skill achievement.

The findings of Okpala & Onocha as cited in Offiah and Okonkwo (2011), and Muhammad (2014) and indicated that achievement in BST towards the subject could be influenced by some learner characteristics such as gender. Gender is an important variable in BST and it has continued to be an issue of concern to educators and researchers. Ezirim (2006); Longe and Adedeji (2003); Yoloye (2004), noted in their studies that gender has impact on BST. Gender can be considered to be sexual classification into male and female. Gender issues in the context of education is referred to as the differences, both real and perceived between boys and girls and their relative achievements and opportunities (West Minister Institute of Education, 2006).

Gender-related issues have attracted the attention of many researchers in BST for male and female in primary schools. Agommush and Nzewi (2003); Babajide (2010); Danladi (2003), found that gender has no influence on pupils' achievement in BST and their retention. Also, Sema, Seda and Nilda (2014) in their study found no significant difference between male and female pupils' achievement. The influence of gender on achievement and in retention is therefore still a controversial issue among BST researchers.

The reports on gender as a group factor in pupils' achievement in sciences are mixed. While some findings indicated no significant effect of gender in BST achievement (Adekoya, 2010; Olatoye, 2009), some researchers reported significant influence of gender on academic achievement with boys having better scores than girls in the study. This study therefore sought to examine the influence of gender on the achievement of pupils. These contradictory evidences in academic achievement and lack of clear trend on gender influenced in the study of BST resulted in the need to carry out a study with a view to determine the effect of cooperative learning method on primary school male and female BST pupils' academic achievement and retention in Anambra State.

1.2 Purpose of the Study

The purpose of the study was to determine the effect of cooperative learning method on the academic achievement of primary school pupils in Basic science and technology (BST). Specifically, the study sought to determine the:

1. Mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method.
2. Mean pretest and post-test achievement scores of male and female pupils' taught BST using cooperative learning method.

1.3 Research Questions

The following research questions guided the study

1. What is the mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method?
2. What is the mean pretest and post-test achievement scores of male and female pupils' taught BST using cooperative learning method?

1.4 Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant difference in the mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method.
2. There is no significant difference in the mean pretest and post-test achievement scores of male and female pupils' taught BST using cooperative learning method.

2. METHOD

Quasi-experimental design was adopted in this study. Specifically the pretest posttest non-equivalent control group design was used. Intact classes were randomly assigned to experimental groups and control group. The use of intact classes was informed by the fact that the participants were already in their classes and the school authority might not allow disrupting them for the purpose of the study. The area of this study was Awka South Local Government Area (LGA) in Awka Education Zone of Anambra state, Nigeria. The population of the study consisted of 2,432 (971 males and 1,461 females) primary 5 pupils in 52 public primary schools in Awka South L.G.A for 2018/2019 academic year. The total sample size for the study was 98 Primary 5 pupils offering Basic Science and Technology selected from two (2) public primary schools out of the 52 public primary schools in Awka Education Zone.

The study adopted the use of intact class. Simple random sampling technique was used to select the two schools out of the 52 primary schools. The two primary schools was assigned to one experimental group and one control group. The two intact classes comprised one experimental group of 50 pupils (22 males and 28 females) that was taught using cooperative learning method while the control group of 48 (21 males and 27 females) was taught in a normal conventional way. This gives a total of 114 pupils for the study.

The instrument that was used for this study was Basic Science and Technology Achievement Test (BSTAT). BSTAT consisted of 40 objective test items constructed by the researcher. Each item had four alternative answers and each correct answer had two (2) point while each incorrect answer had zero (0) point. The test covered four topics in Basic science and Technology as contained in the primary school five (Pri. 5) Basic science and technology curriculum. A table of specification was used to determine the lower and higher Bloom taxonomy to be measured in the pool of 40 multiple choice objective test items in the instrument. The BSTAT was validated by two experts from the Departments of Early Childhood and Primary Education and Educational Foundations from Nnamdi Azikiwe University, Awka and one primary school Basic Science and Technology teacher. The purpose of the study, scope of the study, research questions and hypotheses together with BSTAT were given to the experts to guide the validation exercise. The scores for BSTAT obtained from the 40 pupils were used to estimate the reliability coefficient of the instrument using Kuder Richardson Formula (KR-20) which yielded a reliability of 0.80. The data obtained from the pre-test, post-test and delayed post-test were collated and analyzed. The descriptive statistics of mean standard deviation and the inferential statistics of analysis of covariance (ANCOVA) were used to test the hypotheses at 0.05 level of significance.

3. RESULTS

Research Question 1: What is the mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method?

Table 1: Mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method.

Source of variation	N	Pretest Mean	Posttest Mean	Gain in Mean	Pretest SD	Posttest SD	Remark
CTM	50	25.00	82.50	57.50	3.78	2.53	Effective
Conventional	48	23.23	48.85	25.62	3.01	4.41	

Table 1 reveals that the pupils taught basic science and technology using cooperative teaching method had pretest mean score of 25.00 with SD of 3.78, posttest mean score of 82.50 with SD of 2.53 and gain in mean 57.50 in basic science and technology, while those in the control group taught with conventional method had pretest mean score of 23.23 with SD 3.01, posttest mean score of 48.85 with SD 4.41 and gained mean 25.62. With posttest mean score of 82.50, CTM was effective in enhancing pupils' achievement in basic science and technology. The use of CTM reduced the variation of scores among pupils in the posttest compared to pupils taught using the conventional method.

Research question 2: What is the mean pretest and post-test achievement scores of male and female pupils' taught BST using cooperative learning method?

Table 2: Pretest and Posttest Mean Achievement Scores of Male and Female Basic Science and Technology Pupils taught using CTM

Gender	N	Pretest Mean	Posttest Mean	Gained Mean	Pretest SD	Posttest SD	Remark
Male	22	23.43	82.73	59.30	2.43	2.55	More effective
Female	28	24.25	82.32	58.07	2.46	2.54	

Table 2 shows that with higher gained mean of 59.30, CTM was more effective in enhancing the achievement of male pupils in BST. The male pupils had slight increment in score variation than the female pupils in the posttest.

Hypothesis 1: There was no significant difference in the mean pre-test and post-test achievement scores of pupils taught BST using cooperative learning method and those taught using the conventional teaching method.

Table 3: ANCOVA on Effect of Corporative Teaching Method on Pupils' Achievement in Basic Science and Technology and that of those taught using Conventional Method

Source of Variation	SS	Df	MS	F	Sig.	Decision
Corrected Model	27732.842 ^a	2	13866.421			
Intercept	7640.670	1	7640.670			
Pretest	9.362	1	9.362			
Method	25702.488	1	25702.488	2009.466	.000	S
Error	1215.117	95	12.791			
Total	456100.000	98				
Corrected Total	28947.959	97				

Table 3 shows that at 0.05 level of significance, 1df numerator and 97df denominator, the calculated F is 2009.466 with Pvalue of .000 which is less than 0.05. Therefore, the null hypothesis was rejected. Thus, effect of corporative teaching method (CTM) on primary school pupils' achievement in BST is significantly when compared with that of conventional method (CM) using their post-test scores.

Hypothesis 2: There will be no significant difference in the mean pretest and post-test achievement scores of male and female pupils' taught BST using cooperative learning method.

Table 4: ANCOVA on Effect of Cooperative Teaching Method on Male and Female Pupils' Achievement in BST

Source of variation	SS	Df	MS	F	Sig.	Decision
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Corrected Model	3.447 ^a	2	1.723			
Intercept	7427.880	1	7427.880			
Pretest	1.418	1	1.418			
Gender	2.554	1	2.554	.388	.536	S
Error	309.053	47	6.576			
Total	340625.000	50				
Corrected Total	312.500	49				

Table 4 shows that at 0.05 level of significance, 1df numerator and 49df denominator, the calculated F is .388 with Pvalue of .536 which is less than 0.05. Therefore, the null hypothesis was not rejected. Thus, effectiveness of Cooperative teaching method (CTM) on male primary school pupils' achievement in BST do not differ significantly when compared with that of the females using their post-test scores.

4. Discussion of Findings

The finding of this study revealed that effects of CTM is significant when compared to that of those taught using conventional method using their pretest posttest mean achievement scores. The pupils taught BST using cooperative teaching method had pretest mean score of 25.00 with SD of 3.78, posttest mean score of 82.50 with SD of 2.53 and gain in mean 57.50 in BST, while those in the control group taught with conventional method had pretest mean score of 23.23 with SD 3.01, posttest mean score of 48.85 with SD 4.41 and gained mean 25.62. With posttest mean score of 82.50, CTM was effective in enhancing pupils' achievement in BST. The use of CTM reduced the variation of scores among pupils in the posttest compared to pupils taught using the conventional method.

The present study supports the findings of Ibe and Nwosu (2013) who in their separate studies found out that the use of cooperative teaching method as an instructional method improves the academic achievement of students. This finding is in agreement with findings of similar studies carried out earlier by Nbina (2011), Obiekwe (2010) and Ibe and Nwosu (2013). They separately reported that cooperative method is most effective in enhancing learning of science subjects than the conventional method.

The findings of this study showed that effect of cooperative teaching method on the achievement scores of male and female pupils in BST do not differ significantly using their pre-test and post-test mean scores. The findings of this study is in agreement with the findings of Nwagbo and Obiekwe (2010) who reported that no significant difference existed between the achievement of male and female pupils taught with cooperative teaching method. CTM enables pupils to engage in meaningful discussion and observe and learn from one another. The findings of this study however, is in agreement with the findings of Okeke, (2008) who reported that pupils with positive attitude towards the BST subject register better performance in examinations. In this study irrespective of gender.

5. Conclusion

The findings of this study revealed significant positive effect of cooperative teaching method on pupils' achievement in BST. The conclusion is that the use of cooperative teaching method enhances pupils' achievement in BST significantly and is not gender sensitive.

6. Implications of the Study

Based on the findings of the present study, the effectiveness of cooperative method of teaching on basic science and technology pupils' academic achievement was revealed. This suggests the need for science teachers and basic science and technology teachers in particular to adopt the use of activity-oriented teaching method that is cooperatively-based in basic science and technology teaching and learning at primary school level to ensure an improvement in the pupils' academic achievement. This also implies a likelihood of improvement in performance in basic science and technology and other related science subjects in if the pupils are exposed to cooperative teaching method.

Gender did not significantly influence the basic science and technology pupils' academic achievement in this present study. By implication, cooperative instructional method once implemented will discourage gender stereotyping as it provides equal opportunities for both male and female science pupils and basic science and technology in particular to interact with the teachers, amongst themselves and the resources. Consequently, the pupils' academic achievement and retention will be even for both male and female.

7. Recommendations

The following recommendations are made in the light of the findings of the study:

1. Basic science and technology teachers should adopt the use of cooperative teaching method as an instructional technique in teaching BST concepts. Seminars and special training should be organized for basic science and technology teachers by the government in order to familiarize them with the use of cooperative teaching method in teaching and learning.
2. Basic science and technology teachers should arrange classroom setting in such a way as to facilitate collaboration among pupils when teaching Basic science and technology.
3. Basic science and technology teachers should encourage pupils' perception (initial conception) when teaching Basic science and technology concepts. Pupils' attempt to questions should be seen as a process of learning and should be guided into properly conceptualizing the concept in order to improve achievement.

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