Effects of Collaborative Instructional Strategy on Learning Outcomes of Students in Basic Science Practical Skills in Ekiti State, Nigeria

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Abstract
This study investigated the effects of collaborative instructional strategy on learning outcomes of students in Basic Science practical skills in Ekiti State, Nigeria. The study also determined the influence of gender on the student's learning outcomes in practical skills in Basic Science. The study adopted pre-test and post-test control group quasi- experimental research design. A sample of 135 Upper Basic Public School ll (UBPSll) students was drawn using purposive sampling technique from a total population of 16,256 Upper Basic Public School ll (UBPSll) students in Ekiti State. Two instruments 'Basic Science Practical Achievement Test (BSPAT)' and 'Basic Science Practical Skills Rating Scale (BSPSRS)' were used to collect data. The instruments were validated by experts and test-retest method was used to establish reliability coefficient of 0.88 for BSPAT and Inter-rater reliabilities of BSPSRS using Scott's Pi based on observations of students on practical activities and the index of reliability obtained was 0.84. Data collected were analysed using t-test and Analysis of Co-variance (ANCOVA) for hypothesis 1 and 2 respectively at 0.05 level of significance. The results of the analysis showed that students' achievement in collaborative instruction class at post-test was found to be significantly better than that of the control group and that both instructional strategies were not gender sensitive. The study therefore recommended that collaborative instructional strategy should be introduced to the teaching of Basic Science practical skills.

Keywords: Basic Science, Practical skills, Collaborative instructional strategy, Learning outcomes, Gender.

Introduction

The role science can play in national development cannot be over emphasized. The significance of science and technology for sustainable national development is obvious and not in doubt. One of the fundamental issues in Nigeria today is the determination of how effective science is, at all the levels of education. Science, being an activity- based subject, needs practical activities regularly for the ultimate achievement and attainment of the goals of science and science education as outlined clearly in the National Policy of Education (FRN, 2014). Technology employs knowledge, skills and tools to improve human potentials, to solve practical problems and to modify our environment. Technology is therefore concerned with the application of science to obtain practical solution to the myriad of human problems (National Teacher Institutes, 2011).

Basic science is a preliminary and core subject at the junior secondary school level of Education. Basic science presents science as a unified whole in order for learners to have a holistic view of the science subjects (Seweje &Jegede, 2012). It is a subject that teachers approach with wider application in terms of its concept and objectives as an academic discipline. The knowledge of Basic science is necessary for individual to be scientifically trained in different areas of endeavor. It also helps in the development of the nation scientifically and technologically.

In Nigeria, at Junior Secondary School level, Integrated Science used to be one of the subjects which students must offer and pass in the Junior Secondary Certificate Examination (JSCE). This science subject which was offered as Integrated Science in Junior Secondary School has changed both in content and name. The content was broadened and the name changed from Integrated Science to Basic Science due to recent educational reforms in Nigeria (FRN, 2011).

The subject was introduced into the Nigerian secondary schools as a panacea for some of the problems be devilling science education especially at the junior secondary school level. The programme as stated in National Policy on Education emphasizes acquisition of skills and development of the spirit of enquiry as opposed to rote learning. It is also to develop acquisition of scientific attitudes rather than accepting scientific facts as a dogma (Adenike & Busayo, 2003).

Basic science involves the study of elementary biology, anatomy, earth/solar system, ecology, genetics, chemistry and physics as a single science subject in the Junior Secondary school. It offers the basic training in scientific skills required for human survival, sustainable development and societal transformation. Basic science studies also involve bringing together traditionally separate science subjects so that students can grasp a more authentic understanding of science. Thus, Basic science is the gateway to the teaching and learning of science

which provide the foundation for the learning of specialized scientific discipline like Physic, Chemistry and Biology (Afuwape, 2003). The specialized scientific disciplines of Physics, Chemistry and Biology form the conceptual science. There is an interface between these three conceptual science subjects. Therefore, basic science is the study of science which comprises of biological, physical and chemical sciences in a holistic approach.

According to the National Policy on Education (NPE, 2014) which specifies that aims of Basic Science are directed at enabling students who are exposed to acquire the following skills:

1. Observe carefully and thoroughly
2. Report completely and accurately what is observed.
3. Organise information acquired
4. Generalizing on the basis of the acquired information
5. Predicting as a result of the generalization
6. Designing experiments (including control where necessary) to check predictions.
7. Using models to explain phenomena where appropriate; and
8. Continuing the process of inquiry when new data do not conform to predictions.

According to the National Policy on Education (FRN, 2007) Basic science is supposed to be presented in such a way that the child:

i. gains the concept of the fundamental unity of science (Physic, Chemistry and Biology).
ii. gains the commonality of approach of problem of a scientific nature.
iii. gains an understanding of the role and function of science in everyday life and the world in which he or she lives.

The thematic approach to content organization was adopted in developing the BSTC in order to achieve a holistic presentation of scientific and technological concepts and skills to learners. The themes and sub-themes that formed the integrating threads for the Basic Science and Technology Curriculum are holistically coherent (FME, 2012).

It seems that some science teachers make no attempt at all to embellish the curriculum by taking their students out of the classroom and they make minimum effort to run practical classes. Indeed, their sole aim appears to be to cover the curriculum so that their students will achieve the highest grades possible in examinations, even by abandoning many of the practical classes if that should prove necessary(Brian,2008). The importance of practical work in school science is widely accepted but it is important to ensure that such practical work genuinely supports learning and teaching, and that flexibility is given to the teachers to do this in relation to their pupils' needs and the courses they are studying.

An enquiry-based approach may also encourage students to be more independent and self-reliant. In this

way, it supports general educational goals such as the development of individuals' capacity for purposeful, autonomous action in life. In the introduction to a recent book, published in the USA, Omiko, (2015), while noting that 'inquiry' plays a prominent role in discussions about science education reform, suggest that it would be a mistake to assume that the 'science education and research and teaching communities wholeheartedly embrace it.

The researcher observed that practical activities are not properly done in some of the schools by the teachers for students to be able to acquire adequate and necessary scientific skill expected by the students at this level of education. Despite the utilitarian value of Basic Science in science and technological advancement and teachers' position in the realization of these objectives, lack of practical activities in Basic Science has resulted in poor manipulation and observation skills (Adepoju, 2002), and the absence of these skills gave rise to students poor performance in Science subjects both in qualitative and quantitative analysis (Oyedokun and Timothy, 2001).

The researcher also observed large population of students in Basic Science in some of the Upper Basic School classrooms and subsequent difficulty in providing sufficient teachers for sizable students per class in Ekiti State. This necessitated the call for the use of productive and relevant instructional strategies to involve students in active practical skills.

The observed performance of students in Basic Science that is not encouraging might be as a result of conventional method of teaching that mostly adopted by some of the teachers seems to be insufficient in educating an individual who is supposed to have the contemporary skills. One of the most effective ways to better the prevailing condition of students' performance in Basic Science could be to take advantage of instructional technologies perhaps Collaborative Instructional Strategy (Abiona, 2001). It is in light of this that Okebukola (2005) advocated a re-examination of instructional approaches to teaching of science subjects in educational institutions.

Collaborative learning is an instructional method in which students team together on an assignment. Collaborative learning, on the other hand, involves various types of students working together on a given learning task especially in practical subjects, with the teacher adopting an advisory role in each group. Hiltz and Turoff (2000) define collaborative learning as a learning process that emphasizes group or cooperative effort among students. In collaborative classroom, learners are arranged on group basis with minimum of five members per group. Members of each group are made to collaborate to perform certain tasks. Under this situation, the teacher stands as the

facilitator. He gives the objectives of the day's learning activities and procedures necessary for the task after which learners are allowed to carry-on the tasks to an acceptable conclusion, a leader or representative of each group reports the group findings to the entire class while the teacher ratifies the reports. Though it is a group work, every member of the group must give their contribution, every student is an active member of the group. This strategy is learner-centered and activity-based. It enhances hands-on the task and minds-on. It brings students directly into contact with subject material instead of leaving them as passive observers.

Collaborative teaching shares knowledge among teachers and students. Knowledge flows from both the teacher and the materials to the students; the teacher has vital knowledge about content, skills, and instruction, and still provides that information to students. However, collaborative teachers also value and build upon the knowledge, personal experiences, language, strategies, and culture that students bring to the learning situation. In collaborative classrooms, teachers share authority with students in very specific ways. Collaborative teachers invite students to set specific goals within the framework of what is being taught, provide options for activities and assignments that capture different student interests and goals, and encourage students to assess what they learn.

Collaborative teachers serve as mediators. As knowledge and authority are shared among teachers and students, the role of the teacher increasingly emphasizes mediated learning. Successful mediation helps students connect new information to their experiences and to learning in other areas. It also helps students figure out what to do when they are stumped and helps them learn how to learn Abiona, (2001). Thus, a critical characteristic of collaborative classrooms is that students are not grouped according to supposed ability, level of achievement, interests, or any other students' characteristic. Grouping with these, will seriously weaken collaboration and impoverishes the classroom by depriving all students of opportunities to learn from and with each other.

Successful student teams are built around three components: promotion of on-going accountability, linked and mutually reinforcing assignments, and practices that stimulate idea exchange. Students must be accountable for both in-class and laboratory work; the learning that takes place in class must be reinforced and well integrated into the practical activities; and, finally, students must be actively engaged during the learning process, Larry M. (2009). Built-in reinforcement occurs when students verbally reinforce one another for good work during practical work in the laboratory, when the teacher acknowledges exceptional practical skills with dispensing bonus points during the practical activities, with verbal praise when recording

points, and with laboratory intrinsic reinforcement for the winning team or group each day Barbara (2005). Reinforcement is also displayed when the entire classroom cheers as they get closer and achieve pre-established specific practical objectives. This feature provides an opportunity for students in a group to feel good about themselves and to develop and be engaged in more appropriate practical skills (Maheady and Gard, 2000).

Purpose of the Study

The study was to determine the effects of Collaborative Instructional Strategy on teaching Basic Science practical skills within the present 9-3-4 educational structure in Nigeria and also to determine the effect gender will have on the student's achievement of practical skills in Basic Science.

Significance of the Study

It is hoped that the result of the findings would be significant as the findings will equip both trained and untrained teachers on the need to integrate the teaching and learning with Analogy-Enhanced Instructional Strategy in Basic Science practical lesson for better achievement. The result of the findings is expected to equip the teachers with adequate knowledge to boost their logistics of enhancing analytical mind of students towards acquisition of Basic Science practical skills which will improve their achievement. The study would also make available to teachers, curriculum developers and planners and textbook authors information that will assist in making based decision regarding the interactive effect of Analogy-Enhanced Instruction Strategy and gender to improve achievement in Basic Science practical skills.

Research Hypotheses

Two research hypotheses were postulated in this study:

1. There is no significant difference in the performance of students exposed to Collaborative Instructional Strategy and Conventional Method in Basic Science Practical Skills.

2. There is no significant difference in the performance of male and female students in the group exposed to Collaborative Instructional Strategy.

Research Design

The research design was pre-test and post-test control group quasi-experimental research. The population of the study comprised all 10,256 Upper Basic Public School ll (UBPSll) students in Ekiti State, Nigeria. Upper Basic Public School ll (UBPSll) students were considered relevant because they were not involved in Junior Secondary School Certificate Examination (JSSCE) and therefore they were readily available for the study.

Sample and Sampling Technique

The sample of this study was 135 Upper Basic Public School ll (UBPSll) students in Ekiti State. Two secondary schools were purposively selected from two local government areas taking into consideration students' sex

and schools with basic science laboratory. Students in an intact class of an arm randomly selected from each school were considered.

Research Instruments

This study made use of Basic Science Practical Achievement Test (BSPAT) and Basic Science Practical Skills Rating Scale (BSPSRS) which consisted of four theory items to assess the performance of students in Basic Science practical skill. Basic Science Practical Skills Rating Scale (BSPSRS). This also was made up of 24 items rating scale. The rating was done by research assistants on this guide, Poor- 1 point, Average-2 points and Good-3 points. These were distributed among eight science process skill categories which were sub-divided into seven categories.

Validity and Reliability of the Instruments

Face and content validity of the instrument were ensured. The instruments were validated by experts in Basic Science and Test, Measurement and Evaluation. All their corrections were properly incorporated into the instrument before use. The method of test-retest was used to establish the reliability of the Basic Science Practical Achievement Test (BSPAT) as administered to 60 students outside the normal sample for the period of two weeks. The test showed no ambiguity in the instrument with the co-efficient correlation value of 0.88. The inter-rater reliabilities of Basic Science Practical Skills Rating Scale (BSPSRS) as well as of its skills categories were estimated using Scott's Pi based on observations of students on practical activities. The scores awarded by two independent raters were used and the index of reliability obtained was 0.84.

Experimental Procedures

At the pre-treatment stage, the researcher visited the selected schools with letter of introduction to obtain permission from the principals and the Basic Science teachers to use their school laboratories and students with training of the teachers as research assistance. On the first day of the treatment, the pre-test was administered on the participating students. This also was followed by series of lessons designed for the study. The teachers used the teaching manual developed by the researcher as a guide to teach the selected topics using collaborative instructional strategy and the other group conventional strategy group. At the post-treatment stage, the BSPAT was re-arranged and administered to the students as post-test so as to determine their level of skill acquisition through the use of BSPSRS by the research assistants.

Data Analysis

The data obtained were analyzed using t-test for hypothesis 1 and Analysis of Covariance (ANCOVA) statistics for hypotheses 2. Each hypothesis was tested at 0.05 level of significance.

Results

Hypothesis 1: There is no significant difference in the performance of students exposed to collaborative Instructional Strategy and Conventional Method in Basic Science Practical Skills.

Performance of students exposed to collaborative Instructional Strategy and Conventional Method in Basic Science Practical Skills were computed and compared for statistical significance using t-test statistics at 0.05 level. The result is presented in Table 1.

Table 1: t-test of students' performance in Collaborative and conventional groups

Group	N	Mean	SD	Df	t	P
Collaborative	73	62.90	3.41			
Control	62	49.29	2.27	133	26.771	0.000

p>0.05

Table 1 shows that there is significant difference in the performance of students exposed to collaborative instructional strategy and conventional method in Basic Science Practical Skills at 0.05 level of significance ($t=26.771, p<0.05$). The hypothesis is not accepted.

Hypothesis 2: There is no significant difference in the performance of male and female students in the group exposed to collaborative instructional strategy.

Performance mean scores of male and female students exposed to collaborative Instructional Strategy were computed and subsequently compared for statistical significance using Analysis of Covariance (ANCOVA) at 0.05 level of significance. The result is presented in Table 2.

Table 2: ANCOVA of students' performance in collaborative group by gender

Source	SS	df	MS	F	P
Corrected Model	59.702	2	29.851	2.684	.075
Covariate (Pretest)	18.627	1	18.627	1.675	.200
Sex	16.947	1	16.947	1.524	.221
Error	778.627	70	11.123		
Total	289694.000	73			
Corrected Total	838.329	72			

p>0.05

Table 2 shows that there is no significant difference in the performance of male and female students in the group exposed to collaborative instructional strategy at 0.05 level of significance ($F_{1,70}$=1.524,p>0.05). The hypothesis is not rejected.

Discussion

The finding of this study shows that the achievements mean scores of students in collaborative and conventional strategies were significantly different after treatment. By implication, collaborative instructional strategy was more effective in improving students' performance in Basic Science practical skills than conventional mode of teaching. The finding also corroborates that of Abiona, (2001) who found that students taught through collaborative instructional strategy had a better achievement than those taught through the conventional method.

The result of this study also revealed that there is no significant difference in the learning outcomes of male and female students in Basic Science practical skills when taught with both collaborative and conventional instructional strategies. This result agreed with the findings of Adepoju, (2012) and Bilesanmi- Awoderu, (2006) who provided reports that there are no longer distinguishing differences in the cognitive, affective and psychomotor skill achievements of students in respect of gender.

Conclusion

From the findings of this study, it could be concluded that students' exposure to collaborative instructional strategies resulted to a remarkable increase in academic achievement and that both instructional strategies are not a function of gender variable.

Recommendations

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

1. Conventional method presently in the use by Basic Science teachers should be improved, modified or replaced with activity-based teaching strategy.

2. Basic Science teachers should be encouraged to adopt the collaborative instructional strategy in order to demystify and simplify Basic Science in its entirety especially in its practical skills.

3. Government should organize and sponsor teachers to attend training courses on the use of the collaborative instructional strategy in order to facilitate their adoption.

References

Abiona, F.O. (2008). The impact of three life-skill strategies on students' learning outcomes in environmental concepts of sewage disposal and water treatment in Biology. *Unpublished Ph.D Thesis, Faculty of Education, University of Ibadan.*

Adenike, E.E. & Busayo, B. O., (2003).Teacher Factors as Determinants of Achievement in Integrated Science. *Journal of Science Teachers Association of Nigeria, 38 (1&2), 94-97*

Adepoju, A. O. (2012). Effect of Practical Activities on Students' Achievement in Integrated Science. *Journal of Science Teachers Association of Nigeria, 28 (1&2) 102-103*

Afuwape, M. O. (2003). Teacher and School Factors as Predictors of Students Achievement in Integrated Science. *African Journal of Educational Research, University of Ibadan, 9(1&2) 89-96*

Barbara, T. (2005). An Introduction to Classwide Peer Tutoring. Retrieved June 16, 2011, from Special Connections Website: *wikipedianassignment.*

Bilesanmi-Awoderu, J.B. (2006). Effect of Computer-Assisted Instruction and Simulation/Games on the Academic Achievement of Secondary School Students in Biology. *Sokoto Educational Review*, 8(1): 49-60.

Federal Republic of Nigeria (2011). National Policy on Education. Lagos; *NERDC Press, Nigeria.*

Federal Republic of Nigeria. (2014). National Policy on Education Lagos: NERDC Press.

Federal Republic of Nigeria (2012). Nine Year Basic Education Curriculum for Junior Secondary School Book 1-3 Abuja. NERDC Press,

Federal Republic of Nigeria (2014). National Curriculum for Senior Secondary School Science Volume 3 (Agriculture, Physics, Chemistry and Biology) NERDC Press, Lagos.

Hammeken, D. (2000). Epistemology Beliefs in Introduction Physics. *Cognition and Instruction*, 12 (4), 151-183

Hiltz, S.R., Tueroff, M. (2000).Understanding Software Processing Redesign Using Modelling. *Retrieved through https://www.reseaerchgate.net publication, 200(5), 183-195*

Larry M. H. (2009). How (Not) to do phonological typology: The case of pitch-accident. *International Journal of Science Education, 31(4) 213-230*

Maheady, F. & Gard , H. (2000). The role of modules and analogies in science education: Implication from research. *International Journal of Science Education 6(3) 142-168*

Okebukola, P. A. (2006). Students' Performance in Science Practical: A study of some related factors. *Journal of Research in Science Teacher* 24(2) 119-216

Omiko A.(2015). Effect of instructional resources on students' achievement in Physics in secondary school in Ebonyi State, Nigeria, *Journal of Education Research & Development, 1(2), 208-214.*

Oyedokun, A. & Timothy, O. (2001). Correlates of Student variable and achievement in Integrated Science. *Journal of Education Research & Development, 1(2), 208-214.*

Seweje, R.O. & Jegede, S.A. (2005): Science Education and Science Teaching Methods/a Comprehensive Approach. Ado-Ekiti. Atlantic Associated Publishers.