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Effect of laboratory-based pedagogies on secondary school chemistry students' acquisition of observing and reporting skills in Okrika local government area in rivers state, Nigeria

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Abstract
The study investigated the effect of laboratory-based pedagogies on Secondary School Chemistry students' acquisition of observing and reporting Science Process Skills. Quasi-experimental pre-test post-test non-equivalence control group design was adopted for the study. Two research questions and two null hypotheses were postulated and tested at 0.05 alpha level. A self-structured test and rating scale tagged Science Process Skills Assessment Test (SPSAT) and Science Process Skills Rating Scale (SPSRS) respectively with reliability coefficient of 0.68 and 0.64 was used in collecting data from a sample size of 63 students in three selected Schools in Okrika local government area in Rivers State, Nigeria. Mean, standard deviation and ANCOVA statistic were employed to analyze the data as fitting the research questions and hypotheses The finding of the study revealed that independent work laboratory-based and small group laboratory-based pedagogies effect students' acquisition of observing and reporting skills better than teacher-demonstration laboratory-based pedagogy. However, small group is better in observing skills while independent work is better in reporting skills while teacher-demonstration method was below total mean in both skills hence, not effective for acquisition of these Science Process Skills. Based on the findings, the study recommended that among others Chemistry teachers should adopt students' activity-centered methods of teaching-learning of Chemistry in particular.

Keywords: reporting, skills, observing, laboratory-based, pedagogies

Introduction

In this era of scientific explosion and speedy growth in technology, Science Education recommends that teaching and learning in Science tour the path of equipping the leaner with scientific skills capable of bringing about knowledge that is transferrable to everyday life and solving of problems that are posed by this development. Pedagogical approaches in Science that is targeted towards development of concept and does not consider acquisition of scientific process skills is no longer sufficient for the learner and also not beneficiary to any government and society. Obialor (2016) [8] opined that teaching-centered approach in which there is steady flow of information giving from the teacher and students being passive listeners do not enhance achievement of Science Process Skills acquisition needed for proper understanding of Biology concepts. Miller (2017) [6] added that in order to enhance students' acquisition of science process skills, teacher must improve in the use of teaching styles and also create enabling environment and that this will lead to motivation in the learner not only to attend classes but as well excited to learn and by this way scientific literacy and sustainable development will be reached. In the same vein (Rauf *et al* (2013) [9] advocated teaching approach that will give learner opportunity to acquire science process skills for problem solving.

To development a teaching-learning process that will be able to bring about effective gain in knowledge and scientific skills require that science teachers utilize laboratory-based pedagogies that have a lot of activities to engage the learner in the learning. When teaching-learning process brings the learner in contact with learning materials, effective appropriate and retentive learning is gained. Yumusak (2016) [11] suggested development of science process skills that will bring about paradigm shift from knowledge-based teaching and learning to activity-based teaching and learning. Yumusak (2013) defined science process skills as transferrable skills that are applicable to many sciences and reflect the behavior of scientists. While Obialor (2016) [8] defined science process skills as the activities which scientists employ in carrying out scientific investigation in order to arrive at new knowledge. Hence, science process skills helps the learner to find out about his world, identify problem and proffer solution to them through engagement via human senses with the world. In essence science process skills are the basis for advancement in scientific knowledge and birth to technological creation.

Independent-work and small group learning that apply inquiry/practical are liable to make learner gain skills across all subjects. There is also advantage of effective communication of what is learnt through reporting whereby reporting science process is allowed to grow. Small group learning creates opportunity for independent learning to come to the forefront of the class and supports learner to build communication science process skills.

Observing science process skills is the first of the basic science process skills. When experiment is set up, the first thing is to observe what goes on and even before that, the events and occurrences in nature calls attention to observation. Observation is done via the sense organs – mouth, eyes, nose, hands ear, skin. To start with, what we see, experience, hear are all liable to testing and observation. Good observation is necessary to arrive at

correct answers or solution to problems. According to Idiege, Nja and Ugwu (2017) [4] results of quality observation constitute primary source and a major ingredient in science learning.

Similar to observation, the second of the basic science process skills being communication or reporting of the information arrived at scientific investigation, is done by words through talking, listening, reading, drawing, painting, charts, tables, sketches, symbols, formula, facial or bodily gestures. The quality of the information depends upon the way it is disseminated, received, gathered and the expression medium. The community of scientists as well as the general public is informed by this mean to avoid when there is danger treat, new opportunities or advantages to be derived from object discovered. The information could be for immediate remedial purposes or for future references (Idiego *et al*., (2013); Green-Osahogulu (2017) [3].

Statement of the problem

Chemistry is referred to as the queen of the science subject because of the central position it plays in the scientific and technological development of individual and nation. Notwithstanding, evidences abound in research works that students' achievement in this subject falls below expectation. This scenario in majorly attributed to lack of effective and appropriate manner in which the teaching and learning process is done. Chemistry teacher in Nigerian Secondary Schools are observed to pay little or no attention to practical Chemistry but only do this when it is very close to external examination such as WAEC, SSCE, NECO.

Science Education has recommended that science teaching-learning process should be learner-centered, activity-oriented, and practical-based and that engages the learner with the learning materials. Some of the methods that can ensure this, are- - independent work and small group laboratory-based methods of teaching that lay cognizance of developing science process skills of the learner. Therefore, what this study sought for is to investigate the effect of laboratory-based pedagogies in Secondary School students' acquisition of observing and reporting skills.

Aim and Objectives of the Study

The aim of the study is to investigate the acquisition of observing and reporting skills of Secondary students using laboratory-based pedagogies in Okrika local government area in Rivers State of Nigeria. Specifically, the study is to

1. Determine the mean achievement scores in observing skills using teacher-demonstration skills and when using independent and small group methods.
2. Examine the mean achievement scores in reporting skills using teacher-demonstration and using independent work and small group methods.

Research Questions

The following research questions were raised to guide the study:

1. What is the mean achievement scores in observing skills acquired by students taught using teacher-demonstration method and those taught using independent work and small group methods.
2. What is the mean achievement scores in reporting skills of students taught using teacher-demonstration method and those taught using independent work and small group methods.

Hypotheses

The following null hypotheses were formulated at 0.05 level of significance.

Ho1: There is no significant difference in observing skills between students taught using teacher-demonstration method and those taught using independent work and small group methods.

Ho2: There is no significant difference reporting skills between students taught using teacher-demonstration method and those taught using independent work and small group methods.

Methodology

The quasi-experimental pre-test non-randomized control deign was adopted for this study. The population comprised of all the Senior Secondary Chemistry students in the seven Schools of 2017/2018 academic session in Okrika local government area, Rivers State, Nigeria numbering 1782. The sample size of 63 Chemistry students were drawn and assigned into two experimental and one control groups by randomized sampling technique. Instrument used for data collection was Science Process Skills Assessment Test (SPSAT) and Science Process Skills Rating Scale (SPSRS) consisting of 8 activities based on acid/base titration in Chemistry. The research instrument was validated by two experts who are Senior lecturers from Ignatius Ajuru University of Education. The reliability of the instrument was given as 0.68 and 0.64 for manipulating and measuring skills respectively by Cronbach alpha level.

Results

Research Question 1: What is the mean score of observation skills of students taught using teacher-demonstration method and those taught using small group laboratory-based method and independent work laboratory-based method?

Table 1: Mean and standard deviation of students' scores on observing skills using SGLM, IWLM and TDLM

Group	n	Pre-test mean	Post-test mean	SD pre-test	SD post-test	Mean gain
SGLM	24	7.71	16.00	16.28	2.126	8.29
IWLM	19	7.84	14.58	2.192	1.774	6.74
TDLM	20	6.90	11.45	1.518	3.000	4.55
Total	63	7.49	14.13	1.804	3.013	6.64

Remark: TDLM (4.55) < IWLM (6.74) < SGLM (8.29)

Research Question 2: How difference is the mean score in reporting skills of students taught using teacher-demonstration method and those taught using small group laboratory-based method and independent work laboratory-based method?

Table 2: Mean and standard deviation of students' scores on reporting skills using SGLM, IWLM and TDLM

Group	n	Pre-test Mean	Post-test mean	SD pre-test	SD post-test	Mean gain
SGLM	24	9.38	14.46	2.300	1.167	5.08

IWLM	19	7.47	14.79	1.775	1.782	7.32
TDLM	20	6.80	11.65	2.375	3.453	4.85
Total	63	7.98	13.67	2.426	2.595	5.69

Remark: TDLM (4.85) <SGLM (5.08) < IWLM (7.32) IWLM has highest mean gain score = 7.32

Hypotheses 1: There is no significant difference between the mean achievement score in observation skills of students taught using teacher-demonstration method and those taught using small group laboratory-based method and independent work laboratory-based method.

Table 3: ANCOVA on the effect of treatment on observation skills of students.

Source of Variation	Sum of squares	df squares	Mean	F	Sig.
Observation skills	32.327	1	32.327	6.374	0.14
Treatment on group	188.662	2	94.331	18.598	0.000
Error	299.254	59	5.072		
Corrected total	562.984	62			
Total	1316.000	63			

F(2,59) = 18.598) p(0.000 < 0.05) F = Significant (S)

Hypotheses 2: There is no significant difference between the mean achievement score in reporting skills of students taught using teacher-demonstration method and those taught using small group laboratory-based method and independent work laboratory-based method.

Table 4: ANCOVA on the effect of treatment on reporting skills of students.

Source Variation	Sum of squares	df	Mean squares	F	Sig.
Reporting skills	17.837	1	17.837	3.419	0.069
Treatment on group	88.484	2	44.242	8.480	0.001
Error	307.829	59	5.217		
Corrected total	446.000	62			
Total	12213.000	63			

F (2,59) = 8.480) p(0.001 < 0.05) F = Significant (S)

Discussion

The findings of this study revealed a significance difference in the mean gain scores of Chemistry students in the experimental groups taught using independent work and small group laboratory-based pedagogies and those in the control group taught using teacher-demonstration laboratory-based pedagogy. The difference was in favor of the experimental groups. Similar work on laboratory activities was conducted by Akani, (2015) [2]; Nwangi, (2016); Ahmed, Auta, Mohd, David, Buba and Usman (2017). In their separate studies observed that students taught using practical activities performed better than those taught without practical.

Furthermore, the findings of this study also revealed that both independent work and small group laboratory-based pedagogies are better methods of students' acquisition of science process skills than teacher-demonstration laboratory-based. This could be explained in the fact that the formal methods are both hand-on and minds-on while the latter is minds-on only at such does not encourage students' engagement with learning materials so there could have been no way for the students to better acquire observing and reporting science process skills, and so the teacher-demonstration method mean gains were below those of the total mean gain referral. This was shown clearly by the study of Johnson (2016) who revealed that students who had prior exposure to laboratory activities (apparatus) improved in their science process skills than their counterpart. Miller (2017) [6] In his study on inquiry-based hands-on laboratories on students' achievement found out better achievement with the strategy than those of their counterpart. Salami (2014) in his study on hands-on minds-on activity based strategy revealed that teachers' subject matter knowledge was enhanced by the strategy.

Recommendation

The following recommendations were made:

1. Chemistry teachers should adopt the use of laboratory-based pedagogies that are student-centered and activity-oriented in their teaching-learning process.
2. Curriculum planner need to consider embedding science process skills learning strategies in Chemistry Curriculum.
3. Chemistry teachers should avail themselves with more training on the Science Process Skills acquisition by any means available to them.

References

1. Ahmed U, Auta A, Mohd A, David L, Buba DM, Usman UB. Effect of practical activities method on Junior Secondary students' achievement in Basic Science in Gombe Metropolis. Science Teachers Association of Nigeria (STAN). Conference proceedings, 2017, 173-181.
2. Akani O. Investigation of the roles of laboratory in students' achievement in Chemistry Senior Secondary School. Ebonyi, Nigeria. Journal of Education and Practice. 2015; 6(30):306-213.
3. Green Osahogulu RD. Sciencing: A key to attitudinal change. An inaugural lecture series no.7 presented at the Ignatius University of Education, Rumuolumeni, Port Harcourt, Rivers State, Nigeria, 2017.
4. Idiego KJ, Nja CO, Ugwu AN. evelopment of Science Process Skills among Nigerian Secondary School Science Students and Pupils; An opinion. International Journal of Chemistry Education. 2017; 1(2):13-21.
5. Johnson BA. Impact of prior exposure to laboratory apparatus on acquisition of process skills and academic performance in Chemistry at Secondary school in Giwa zone, Nigeria. American Journal of Educational Research. 2016; 4(12):903-906.
6. Miller DK. The effect of inquiry-based, hands-on laboratory achievement in middle school science. Unpublished Ph.D dissertation, Liberty University, Lynchburg, VA, 2017.
7. Mwangi JT. Effect of Chemistry practical on students' performance in Chemistry in public Secondary schools of Machakos and Nairobi counties in Kenya. Unpublished thesis. Department of Educational Communication and Technology, school of Education, University of Nairobi, Kenya, 2016.

8. Obialor DG, Osuafor AM, Nnadi EI. Effect of project work on Secondary school students' science process skills acquisition in Biology. JORIND, 2017, 1(1). www.tarnscampus.org/journal/p371-378.
9. Rauf SAA, Rasul MS, *et al*. Inculcation of Science Process Skills in a Science Classroom. Asian Social Sciences, 2013, 9(8).
10. Salami MO. Impact of modified laboratory learning environment on transformation Biology process skills among Secondary School students in Osun State, Nigeria. Mediterranean Journal of Social Sciences. 2015; 6(5):84-90.
11. Yumusak GK. Science process skills in science curriculum applied in Turkey. Journal Education and practice, 2016, 20. https://files.eric.ed. gov//fulltext//Ej1109214 pdf