ISSN: 2708-4841(Print), 2708-7042 (Online)

Volume: 2, Issue: 12
Page: 16-27
YEAR: 2021

Commonwealth Journal of Academic Research (CJAR.EU)

Effects of Labless Kits On Gender and School Location On the Academic Performance of Senior Secondary School Students in Physics in Osun State

AUTHOR(S): TAYE Mufutaudeen,
AND
PROF. JEGEDE, S. A.

CJAR
Accepted 18 December 2021
Published 31 December 2021
DOI: 10.5281/zenodo.5826758

Abstract:

This study examined the effects of labless kits on gender and school location on the academic performance of senior secondary school students in physics in Osun state. The study adopted the quasi- experimental pre-test, post-test control group design. The sample consisted of 206 students drawn from six public secondary schools in Osun State. The selection of the sample was done using multistage sampling technique. Two Senatorial districts were randomly selected from the three senatorial districts in Osun. Three Local Governments were randomly selected from each of the two senatorial districts earlier selected, making a total of six Local governments selected. One public secondary school was randomly selected from each of the six local governments chosen for the study. An intact class from each of the six selected schools was used for the study. Purposive sampling technique was used to assign the schools into Labless kits and laboratory groups respectively. Physics Achievement Test (PAT) was developed, validated and used to generate the data for the study. The research question raised was answered descriptively while the four hypotheses generated were tested using t- test and Analysis of Covariance (ANCOVA). The result of the study showed that there was no significant difference in the performance of male and female students used and school location does not influence students' performance when Labless kits and conventional laboratory were used. Based on the findings of the study, recommendations were made to eliminate gender dichotomy

in Physics through the use of Labless kits and conventional laboratory. Also, school location will not be a barrier when Labless kits and conventional laboratory are employed.

Keywords: Labless kits, practical skill, academic performance, rural,

urban, gender,

About Author

Author(s):

TAYE Mufutaudeen
Department of Science Education
Faculty of Education
Ekiti State University, Ado-Ekiti, Nigeria.
mufutaudeentaye@gmail.com

And

PROF. JEGEDE, S. A.
Department of Science Education
Faculty of Education
Ekiti State University, Ado-Ekiti, Nigeria.

Introduction

Science has developed to be one of the greatest and most influential fields of human endeavour. Different branches of science investigate almost everything that can be observed or detected and science as a whole, shape the way we understand the universe, planet, ourselves and other living things (Ogunleye & Adepeju, 2011). Science has become an integral part of human culture. Countries that ignore this significant truism are risking the potential aspiration of their future generation. It is therefore worthy to note that development of any nation depends, to a large extent, on the level of scientific education of her citizens.

The national education policies are geared towards creating generally scientific literate citizens. Specifically, the National Policy on Education of Nigeria clearly stated in its aims and objectives that the learner would be given opportunity to acquire basic practical skills for self – reliance and employment, (Federal Government of Nigeria,2004). In realization of this laudable objective, practical activities should be an integral part of the teaching and learning of science in secondary schools because it proffers first-hand knowledge of science concepts.

Physics as a science subject is the study of physical properties of matter and its interaction with energy. It is typically an experimental subject; principles and concepts generated from Physics are very useful in interpretation of natural phenomena in sciences. This means that effective practical activities in Physics are important because they enable learners to build a bridge between what they see, hear, handle (hands-on) and scientific ideas that account for their observations (brains-on). Physics is one of the science subjects studied at the senior secondary education level. It lays foundation for further study in physics and other Physics related course at higher levels. Physics is needed in medicine, nursing, pharmacy, food technology and others. Physics is a practical oriented subject that requires a lot of practical work using physics laboratory equipment.

It appears that no Physics principle or concept can be taught without adequate practical activity accompanying such presentation using appropriate practical apparatus. Gbamanja (2002) stated that practical experience in science ensures student–centered learning, allowing effective interaction between the students and the learning materials. Also, Obomanu and Nbina (2009) added that practical experience in science will improve students' cognitive ability and knowledge. Huan, Haur and Biaowen (2001) stated that the laws of Physics are founded on experiments and that experiments are integral part of a Physics education. Therefore, in explaining a concept to a child in Physics, one must not only be concerned with filling him with abstract information, but one must be careful that the child understands what he learns. This reflects a strong view of relevance of practical activities and how science teaching should be directed.

Physics is a practical oriented subject that requires a lot of practical work using physics laboratory equipment. Physics laboratory equipment must not only be adequately provided in schools but must be optimally utilized for its effective teaching (by teachers) and meaningful learning (by students) (Lawal, 2006). The failure to organize practical work for students by their Physics teachers can be attributed to unavailability of Physics laboratory equipment, absence of Physics laboratory, poor motivation on the part of Physics teachers and Physics teachers' deficiency in practical skills required to put the available Physics laboratory equipment into productive use (Nwosu, 2000). In order to improve students' performances and arouse their interest, students have to be taught Physics with hands-on and different learning materials so as to enable them acquire the cognitive competence and skills that they needed in passing physics examinations (Okafor, 2007).

Thus, researchers through the advancement in technology were able to make use of an innovative labless kits or ready-to-use kits as alternative to the conventional laboratory. The labless kits (microscience kits) practical apparatuses were produced and comprised pre-selected collection of scientific apparatus designed to illustrate particular scientific principles, usually linked to curriculum material. They are also affordable and far cheaper than conventional laboratory apparatuses and materials (UNESCO, 2013).

The first large scale labless kits were produced in 1992 by the Research and Development in Mathematics, Science and Technology Education (RADMASTE) Centre at the University of the Witwatersrand in Johannesburg (South Africa). They are small, virtually unbreakable and inexpensive, and have been designed to enhance the quality, relevance and accessibility of science and technology education, and also to involve the learner in applying scientific knowledge to real life situation (Rachmanwati, 2013). These labless kits have been produced and introduced on a large scale to more than 80 countries including Nigeria, South Africa, Cameroon, Kenya, Ethiopia, Sudan, Tanzania, Gambia among others.

Awotua, Williams and Aderonmu (2015) asserted that learners will be active participants in the teaching and learning process during practical classes reducing or eliminating the idea that physics is a difficult subject. Using labless kits for practical activities in the teaching and learning of physics provides the learner with new skills, increase understanding of concepts and stimulate their interest to do experiments and learn science. Observations using these kits can be clear and quickly done ensuring accurate results if appropriately utilized.

In Nigeria the students at the pre-primary, primary and higher institutions are mixed with boys and girls. But at secondary school level, many schools grouped the girls in one school, boys in one school, and some have both boys and girls in one school. According to Bakare (2006) gender has great influence on the students' performance; boys perform better than girls in physics. Comparing the superiority of one gender group to the other, Oyedun (2008) said that students in single- sex schools performed better than students in mixed schools. Also Akusoba and Okafor (2004) discovered that mixed gender group achieved higher than each of the male and female groups respectively. The higher mean difference recorded by the mixed gender group may be explained by the fact that high and low ability students obtain higher performance scores after learning in mixed gender group. They maintained that as much as possible, mixed gender classes should be adopted in all science practical classes. Furthermore, Afolabi and Olajuyigbe (2018) reported that gender has a significant main effect on students' achievement in Physics with female students performing significantly better than male students.

Further studies by Fennema and Sherman (2000) documented differences for females and males in both achievement and participation in Physics courses in Senior Secondary School. As example of the attitudes studied, males were found to be more confident in their ability to learn Physics than females and males perceived Physics to be more useful to them than females. While exploring the gender differences in Physics performance, Campbell and Storo (2011) found out that, certain myths have become widely accepted as truth. One such myth is that "women are qualitative; men are quantitative". Another myth is the linkage of a science-gene in male. Parents and teachers alike hold lower expectations for girls in science than they do for boys. In addition to these myths, most models of orientation to Physics emphasize on social factors such as gender stereotypes. It is these gender stereotypical attitudes over the years, held by teachers and absorbed by students that play a major role in the future biological performance of females (Banaji, Greenwald & Nosek, 2002).

In Nigeria today, society, parents and students seem to associate better performance and achievement in physics to a variety of factors for which school location is inclusive. School location simply describes the settlement or area in which a school is situated. This settlement could either be urban or rural. Student achievement may be influenced by the area in which the students live or where the school is situated. Eule and Chukwu (2005) asserted that the reasons for variation in Physics achievement can be as a result of geographic location of school, availability of resources and quality of teachers.

Brown and Swanson (2001) assert that the reasons for variation in achievement can be as a result of geographic location of school, resources, availability of technology and quality of teachers. They also identified that low performing youths are mostly in public rural schools. Lackney (2006) stated that school buildings, classroom housing the students, the physical and environmental conditions, could cause poor students' achievement in mathematics. Lackney (2006) points out that school building which are located near factories, poorly ventilated, having large class size and school size and failure of embedding schools within their community, can cause poor achievement in Physics.

Suzanne and Lauren (2012) have it that students in rural schools perform poorly in mathematics and physics because they do not always have access to the same level of federal funding as urban and suburban schools and this can limit the opportunity students have for learning mathematics and physics. Despite the challenges of rural schools, many offer unique factors that are associated with physics achievement such as smaller size and community cohesiveness. For the most part, people think of rural schools as being detrimental to student achievement. Though these schools have proven to be advantageous for some reasons first, the small size of rural schools helps assuage and combat poverty. Since there are fewer students in rural schools, their funding does not have to be comparable to schools, with thousands of students. Additionally, rural schools tend to have low student/teacher ratio, which allows more individualized attention and assistance in areas of student difficulty.

Therefore, the focus of this study is to consider the effects of labless kits on gender and school location on the academic performance of senior secondary school students in physics in Osun state. The purpose of the study is to examine the influence of gender on the academic performance of students in Physics using labless kits and conventional laboratory. It also examined the influence of location on the academic performance of students in Physics using labless kits and conventional laboratory.

Research Hypotheses

The following null hypotheses were generated for this study.

1. There is no significant gender difference in the academic performance of students exposed to Labless kits.
2. There is no significant gender difference in the academic performance of students exposed to conventional laboratory.
3. There is no significant location difference in the academic performance of students exposed to Labless kits.
4. There is no significant location difference in the academic performance of students exposed to conventional laboratory.

Methodology

This study adopted the quasi-experimental pre-test and post-test design (one experimental group and control group).

The paradigm for the design is as shown below.

O_1 X O_2: Experimental group

O_3 C O_4: Control group

Where:

O_1, O_3= Pre-test

O_2, O_4= Post-test

X – Treatment via Labless Kits

C – Treatment via Conventional laboratory

The targeted population for the study was the 57,109 Senior Secondary Schools (S.S.S.) two students in public secondary schools in Osun state (Source: Osun State Teaching Service Commission, 2019). The choice of S.S.S. 2 students was considered more appropriate because they had been exposed to some basic Physics concepts and majority of the students will be able to independently work with little supervision.

The sample consisted of 206 students drawn from six public secondary schools in Osun State. The sample was selected using multistage sampling technique. In stage one, two Senatorial districts were randomly selected from the three senatorial districts in Osun. In stage two, six Local Government Areas were randomly selected (three from each of the two selected senatorial districts) while in stage three, one public secondary school was randomly selected from each of the six local governments selected for the study. After the random selection of a school from each of the six local government, four of the schools were urban schools while two schools were rural schools. Physics intact class size of each of the six schools was used for the study.

Physics Achievement Test (PAT) was used to collect relevant data for this study. PAT was self-designed by the researcher. It consisted of two sections; A and B, section A consisted of bio-data of the respondents which include the name of the school, and sex. Section B comprised of 30 objectives items with four options, consisting of nine questions on Knowledge, eight questions on Comprehension, five questions on Application, four questions on Analysis, two questions on Synthesis and two questions on Evaluation. The items covered all the topics taught for six weeks. The instrument was used as both pre-test and post-test. The content of PAT used for pre-test was reshuffled for the post-test in order to prevent practice effect.

The Physics Achievement Test (PAT) was given to experienced senior secondary school Physics teachers, the researcher's supervisor and Tests and Measurement experts from Ekiti State University. The face and content validity were ensured by assessing the wordings and ambiguity of the test items as well as their coverage. The final draft of the instrument was done based on the corrections and suggestions made by the experts. The reliability of PAT was carried out by administering the instrument on 25 participants in one of the school outside the sampled area using test-retest method. They were of comparable age with the participants in this study. After a period of two weeks, the instrument was re-administered on the same participants. The data collected were collated and analyzed using the Pearson Product Moment Correlation Analysis, which yielded reliability co-efficient of 0.89. This value was considered high enough to make the instrument reliable for use in this study.

Before carrying out the research in the schools, the researcher obtained permission from the authorities of the six schools to carry out the experiment in the schools. Afterwards, a day workshop was organized for the research assistants on the respective methods used in teaching their students from the selected schools. The treatment was carried out in three stages:

Stage I: Pre Treatment Stage: The researcher carried out the pre-test before introducing the treatment for each group. The answer sheets were collected and graded with the marking guide. The performance of the students was recorded for analysis.

Stage II: Treatment Stage:

a) Experimental Group (Labless Kits): Labless Kits were used for teaching of the five topics in Physics namely: The Bernoulli effect – Pressure in an air stream, visualizing the concept of pressure, floating bodies in liquids of different densities, attractive force between particles in solid, and the effect of heat on a bi – metallic strip. Students were exposed to eighty minutes of experimental work and discussion for six consecutive weeks by the research assistants.

b) Control Group: The control group has no special treatment, they were taught with the Conventional laboratory within the period of six weeks by research assistants.

Stage III: Post Treatment Stage: Post-test was carried out immediately after the treatment to each group with the same time duration as observed during the pre- test. The same Physics Achievement Test questions used during the pre-test was re-arranged to avoid practice effect and administered to the experimental group and control group.

Results

Hypothesis 1: There is no significant gender difference in the academic performance of students exposed to Labless kits.

Table 1: t-test analysis for gender difference in the academic performance of students exposed to Labless kits

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Remark
Male	53	24.25	0.90	95	0.386	0.700	Not Significant
Female	44	24.32	0.96				

P>0.05

Table 2 shows that the t-cal value of 0.169 is not significant because the P value (0.700) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to Labless kits.

Hypothesis 2: There is no significant gender difference in the academic performance of students exposed to conventional laboratory.

Table 2: t-test analysis for gender difference in the academic performance of students exposed to conventional laboratory

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Remark
Male	58	15.52	1.00	107	0.381	0.704	Not Significant
Female	51	15.59	0.94				

P>0.05

Table 3 shows that the t-cal value of 0.381 is not significant because the P value (0.704) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to conventional laboratory.

Hypothesis 3: There is no significant location difference in the academic performance of students exposed to Labless kits.

Table 3: t-test analysis for location difference in the academic performance of students exposed to Labless kits

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Remark
Urban	62	24.29	0.93	95	0.169	0.866	Not Significant
Rural	35	24.26	0.92				

P>0.05

Table 4 shows that the t-cal value of 0.381 is not significant because the P value (0.866) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant location difference in the academic performance of students exposed to Labless kits.

Hypothesis 4: There is no significant location difference in the academic performance of students exposed to conventional laboratory.

Table 4: t-test analysis for location difference in the academic performance of students exposed to conventional laboratory

Variations	N	Mean	SD	df	t_{cal}	P (Sig)	Remark
Urban	71	15.59	0.99	107	0.605	0.547	Not Significant
Rural	38	15.47	0.92				

P>0.05

Table 5 shows that the t-cal value of 0.605 is not significant because the P value (0.547) > 0.05 level of significance, this implies that null hypothesis is not rejected. Hence, there is no significant location difference in the academic performance of students exposed to conventional laboratory.

Discussion

The findings from the hypothesis on the influence of gender on the academic performance of students exposed to the use of Labless kits showed no significant difference. This implies that gender has nothing to do with students' response to the use of Labless kits. The findings agreed with that of Ogunleye and Adepeju (2011) who observed that there was no gender difference in the academic performance of students exposed to Labless kits and contradicted that of Okafor (2007) that male perform better than female when exposed to Labless Kits.

Likewise, the findings from the hypothesis on the influence of gender on the academic performance of students exposed to conventional laboratory showed no significant gender difference. This also implies that gender has no effect on students' response to the use of conventional laboratory. This finding contradicted the submission of Afolabi and Olajuyigbe (2018). The findings from hypotheses on the influence of location difference on the academic performance of students exposed to Labless kits and conventional laboratory showed that there was no location difference in students' performance in both groups. This means that location has nothing to do with students' response to the use of either of Labless kits or conventional laboratory. This implies that students in urban schools have the same achievement in Physics as those in rural schools when taught using Labless kits and conventional laboratory. The findings of this research supported the conclusion of Ogunleye and Adepeju (2011) who found no significant location difference in performance of students when exposed to labless kits and conventional laboratory and contradicted that of William (2005) who said that students from urban schools perform better than those in rural schools because of the level of availability of resources.

Conclusion

Based on the findings of this study, it could be concluded that there was no significant difference between the performance of male and female students in Physics when labless kits and conventional laboratory were used. Gender dichotomy in Physics is eliminated through the use of labless kits and conventional laboratory. Also, school location will not be a barrier when Labless kits and conventional laboratory are employed.

Recommendations

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

1. The use of Lableless kits should be encouraged in the teaching of Physics in secondary schools to eliminate the gender dichotomy existing amidst the science students in Nigerian schools.
2. Labless kits should be adequately supplied to both rural and urban schools for the teaching of Physics
3. Physics teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of Labless kits strategy in teaching.
4. Teachers should manage the time allocated well in order to accommodate the use of Labless kits in teaching Physics.

References

Afolabi, F & Olajuyigbe, O. A (2018). Bridging Gender Gap in Physics Classroom : Do Teaching Approaches Matters ? *Kampala International University. Journal of Social Sciences.* 4(2), 69-80.

Akusoba, F.U. & Okafor, C.O. (2004).Chemistry students' performance and knowledge retention. *Orient Journal of Educational Research,* 1 (1), 1-10.

Awotua, E. B, Williams, C. & Aderonmu, T. S. B (2015). Towards an enhanced performance in physics practicals. The Microscience kits experience. Navigation Research Publications. 4(3), 187 – 195. http :// www.ijerm.com/jour nal /2015/ April – 2015/ 04. pdf

Bakare, G.M. (2006). *Poor Academic Performance, Aetiology, Diagnosis and Remediation.* Ibadan: University Press.

Brown, D. & Swanson, L. (2001).Rural Education; Student achievement. retrieved from sctemeller.umich.edu/ but/er/356

Buseri, J.C (2009). A survey of science student's attitudes and perception towards practical work in science. *Journal of Technical and Science Education (JOTASE).*1(1) 22-37.

Campbell, P. B & Storo, J. N (2011). Myths, sterotypes and gender difference. Educational Research Journal, 37(9), 565 - 572

Eule, F.O. & Chukwu, A.C. (2005). Enriching the teaching of chemistry in the secondary school: provision and effective utilization of resources.*41st STAN Annual Conference Proceedings,* 183-185.

Federal Government of Nigeria (2004). National policy on education, Federal Government Press Lagos.

Fennema, E. (2000). Science, gender and research. Towards gender equity in sciences education Amsterdam; Kluwer.

Fennema, E. & Sherman, J. (2000). Sex related differences in sciences achievement related factors: A further study. *Journal for research in Science Education*, 9(3), 189 – 203.

Gbamanja, S.P.T (2002). *Modern methods in science education in Africa*. Total publishers limited, Owerri.

Huan, A, Haur, S.C, & Biaowen, L (2001). A new approach to teaching practical physics Retrieved from http://www.cdti.nus.edu.sg/link/ Nov2001/teach4.html

Lackney, J.A. (2006). The Relationship between environment quality of school facilities and students performance. A Congressional briefing to the US house of representative committee on science. Retrieved from http://www.edi.msstate.edu/performance.html.

Lawal, O.A. (2006). Effect of Mobile laboratory resources on the achievement of students in science. *Proceedings of the 47th Science Teachers Association of Nigeria Annual Conference* .Pp. 24 – 31

Nigerian Educational Research Development Council (NERDC) (2009) Secondary school physics curriculum. NERDC Press, Lagos, Nigeria.

Njoku, Z.C (2002). Primary school teachers' perception of the problems of girls in learning science. In: O. Busari (Ed.): *Women in science, technology and mathematics education in Nigeria.* 43rd Annual Conference Proceedings, STAN. Rivers State, Nigeria, University of Technology, August, 2002: 18-23.

Nwosu, E.C. (2000). Resource utilization in science education class-rooms: implications for the researcher). *41st Annual STAN Conference Proceedings,*166-167.

Obomamu, B.J and Nbina, J.B (2009). The interactive compensational model of learning: Implication for chemistry teaching in Nigeria in trends in education studies. *Journal of the Institute of Education*, University of Port Harcourt.

Ogunleye, B.O & Adepeju O.F (2011).Everyday phenomena in physics education: Impact on male and female students' achievement, attitude and practical skills in urban and peri-urban settings in Nigeria. *Pakistan Journal of Social Sciences.*8(6) 316 – 324.

Okafor, N.P. (2007). Participation of women in science &cultural issues: Which way forward? *42nd STAN Annual Conference Proceedings,* 56-61.

Okafor, P. (2000). Laboratory resources and utilization as correlates of science students' learning outcomes.*41st STAN Annual Conference Proceedings,* 169-173.

Okebukola, P.A.O. (1990). Attaining meaningful learning of concepts in genetics and ecology, an examination of the potency of concept mapping technique. *Journal of Research in Science Teaching 1*, 27(5), 493-504.

Okeke, E. A. (2010). Women in science technology & mathematics education in Nigeria. *42nd STAN Annual Conference Proceedings,3-13*.

Onyemereikeya, C.C. (2008). *Basic principles and methods of teaching and learning.* Awka: Nuel Centi Publishers.

Oyedun, O.S. (2008). Effects of instructional materials on students performance in geography in secondary schools in Ilorin South LGA of Kwara State. Unpublished PGDE Project, UNAD.

Rachmawati, R (2013). Microscience equipment: The Idea of improving in-service science teachers' training quality at Balai Dikilat Keagamaan, Bangung, Indonesia. *International Journal of scientific and Technology Research*.2(5).

Suzanne, G. & Lauren, E. (2012). Mathematics achievement gap between suburban students and their rural and urban peers increase overtime. carsay institute, issuer brief No. 52 Summer 2012. Retrieved from www.carseyinstitute.unh.edu

Udo, M.E. (2010). Effects of integrating practical work with theory on students achievement in secondary school science. *Nigeria Journal of Science Education,* 8(2), 103- 116.

UNESCO (2013). The global microscience experiments project practical teaching aids for secondary schools. UNESCO Natural Sciences Sector Division of Basic and Engineering Sciences. Retrieved on 10/10/13.*http://www.unesco.org/new/fileadmin/MULTIMEDIA*

Williams, J. H. (2005). Cross-national variations in rural science achievement: A descriptive overview. *Journal of Research in Rural Education, 20*, 1-18. Retrieved from www.umaine.edu/jrr.htm

Cite this article:

Author(s), TAYE Mufutaudeen, PROF. JEGEDE, S. A., (2021). "Effects of Labless Kits On Gender and School Location On the Academic Performance of Senior Secondary School Students in Physics in Osun State", ***Name of the Journal:*** Commonwealth Journal of Academic Research, (CJAR.EU), P, 16- 27. DOI: http://doi.org/10.5281/zenodo.5826758 , Issue: 12, Vol.: 2, Article: 3, Month: December, Year: 2021. Retrieved from https://www.cjar.eu/all-issues/

Published by

AND

ThoughtWares Consulting & Multi Services International (TWCMSI)