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Summer 8-23-2022

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Nweze, Bernadine Ngozi PhD; Udu, David Agwu PhD; and Okpala, MaryAnn Ngozi Mrs., "EFFECT OF LIBRARY RESOURCES ON SECONDARY STUDENTS' ACADEMIC ABILITY LEVELS IN CHEMISTRY IN ENUGU STATE, NIGERIA" (2022). *Library Philosophy and Practice (e-journal)*. 7381. <https://digitalcommons.unl.edu/libphilprac/7381>

EFFECT OF LIBRARY RESOURCES ON SECONDARY STUDENTS' ACADEMIC ABILITY LEVELS IN CHEMISTRY IN ENUGU STATE, NIGERIA

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Abstract

The study explored the effect of library resources on secondary school students' academic ability levels as determined by their academic achievement in Chemistry. The study employed a quasi-experimental design. Precisely, the pre-test, post-test, and non-equivalent control group design. Two research questions with corresponding null hypotheses guided the study. The population of the study was all the senior secondary school class two (SS2) chemistry students of the 295 public secondary schools in Enugu State in the 2019/2020 academic session. A sample of 166 chemistry students (Male 89, and Female 77) was drawn through the purposive sampling technique from two secondary schools. Four intact classes were used. Two were assigned to experimental and the other two to control groups. The regular chemistry teachers of the sampled schools were trained and used as research assistants for the study. The instruments for the study were a 30-item multiple-choice chemistry achievement test (CAT) and the library resource teaching manual (LRTM). The instrument was face and content validated by three experts. The CAT was pilot-tested on 30 students and a reliability coefficient of 0.70 was obtained using Kuder-Richardson's formula 20 (KR-20). The research questions were answered using mean and standard deviation while the null hypotheses were tested using Analysis of Covariance (ANCOVA) statistics at a 0.05 level of significance. The study found that the chemistry students exposed to lessons with the use of library resources improved their academic ability levels more than their counterparts taught with the conventional method. It was recommended among others that chemistry classroom teachers should keep up pace with the developmental trends in teaching and learning by using library resources and new technologies for effective instructional delivery. The implication of the study is the overall improvement of students' academic performance in chemistry and science subjects in general for the economic, scientific and technological development of the nation.

Keywords: Ability level, Academic achievement, Chemistry education, Library resources, Science education.

Introduction

Education is the key factor in the development and advancement of society. Education greatly contributes to a nation's socio-economic development and is a powerful tool for change. Schiller (2008), sees education as an investment in human capital that produces returns to individuals in the form of higher earnings and social returns. It should be noted that the training of the cream of the human capital of a country takes place in schools. This is because schools have been known to play a

central role in developing a knowledge base of individuals, societies and organizations. Information provision and management are crucial to development at all levels. It is accepted that information is knowledge and knowledge is power and those who have it will always be ahead of those who do not have it. Information can only be provided when it exists but when information has not been properly packaged and stored, it cannot be made available. The creation of libraries is therefore a means to ensure quality access to information (Bannerman, 2007). Informed library users know that libraries have resources that are more comprehensive and scholarly, relative to cyber cafés. Libraries often provide access to scholarly literature for users at various schools.

The school library is an integral part of the educational system that can not be ignored without jeopardizing the quality of education in schools. It is an important part of school programs without which, students would not thrive academically and invariably find it most difficult to conduct academic research before they reach the college level (Francis Lance & Lietzau, 2010). According to Kolade (2001), the school library can be described as the nerve centre of the school and is expected to play an important role in the school curriculum since it has unlimited jurisdiction in the field of knowledge. The school library is a facility in the school, where books and periodicals are stored in sequential order for research, study, evaluation and recreation by students as well as teachers who are ready to make use of the library (Odusanya, 2004; Ogunbote and Odunemu, 2008; Oluwadare, 2007 and Tiwari 2013). Nowadays, libraries have become the intellectual storehouse, where all forms of publications, manuscripts, books, newspapers, diaries and other printed works are documented and kept. Every school needs a standard library as the backbone of academic achievement and that is why the importance of the school library and its resources cannot be overemphasized.

Library resources are those materials, both print and non-print, found in school libraries which support curricular and personal information needs. Print items include books, magazines, newspapers, pamphlets, microfiche or microfilms. Non-print items include films, disc records, film strips, slides, prints, audio tapes, videotapes, compact discs and computer software. These resources enable libraries to play a crucial role in the lifelong success of the education of communities and society in general. They can

also, meet the broad and viewing needs of people living in the society for information, knowledge, recreation and intellectual enjoyment. A good library is indispensable if academic excellence is to be achieved in any academic setting, Obajemu (2002). The truth of this statement depends on the types of services that are available in such school libraries. Clark (1999), contented that school libraries serve students by providing materials to meet their various needs and by encouraging reading and the use of the library. The quality of school library services will be largely influenced by the availability of human, material and financial resources. The school library today not only serves the curriculum needs of students and teachers but also provides materials for the professional growth of teachers and students. The school library helps teachers and students to keep pace with the best ideas and practices in education and use materials to broaden their knowledge to derive personal enjoyment. Students may not have been exposed to library resources or may not be aware of which resources a library might have so that they can make use of them, which may be partly blamed on library staff (Waldman, 2003). It is therefore paramount for librarians or information officers to provide up-to-date comprehensive library and information services needed to satisfy the information required by users. Librarians are responsible for gathering, selecting, organizing, disseminating and preserving recorded knowledge and information in all forms and for providing assistance and instruction in their use. Books have been described as channels of civilization, without which history may be silent, literature dumb, science crippled, thought and speculation at a standstill (Bannerman 2009).

Basic knowledge of science is essential for all forms of modern development. To be able to appreciate, control and effectively tap from and utilize the library resources it is imperative to acquire scientific knowledge which is a basic tool for all forms of industrial and technological advancement in any nation. Being aware of this obvious fact, many nations, Nigeria inclusive, have recognized the significance of science and technology and its developmental endeavours. Onu (2017), asserts that no nation can become great, without science and technology. The expression of the need for scientific and technological literacy for all Nigerians was a discussion opined by Ibe et al. (2016). Any nation that ignores scientific and technological education may find it difficult to fit into the global advancement in science and technology. The role of science and technology in the development of a nation is never in dispute. The current

upsurge of effort in the development of science and technology has greatly affected human beings and, to be ignorant of this development is to live an empty, meaningless and probably unreal life. The technological development of any nation lies in its emphasis on sciences, especially chemistry.

Chemistry is a branch of science that deals with the composition of substances, atoms of elements that combine or break up and the reactions of atoms and compounds under different conditions (Udu, 2018a). Students have often gone through secondary school either blindly or without proper guidance as to the importance of Chemistry. It is only when students wish to enter the university that they realize they should have taken Chemistry more seriously. The importance of Chemistry in society today cannot be overemphasized because of its relationship to other fields. The knowledge of the subject and its applications contribute immensely to the industrial development of any nation. As numerous as the importance of chemistry, students encounter difficulties learning the subject, especially at the secondary school level because of its presumed abstract nature. Many factors such as poor primary school background, mathematical aspects/nature of the subject, poor instructional models, lack of instructional materials and libraries in many schools result in most of the schools lacking even a place to access extra materials, lack of interest in school, large classes, and fear of the subject psychologically were associated with students' poor performance in chemistry (Njoku, 2007; Saage, 2009; Udu, 2018b). It was further reported that candidates concentrated mainly on familiar questions that demanded a recall of facts and were unable to apply their knowledge of scientific principles to answer other questions as well as poor mathematical skills, inability to write chemical formula-correctly, poor spelling and poor understanding of the structures and properties of compounds (West African Examination Council (WAEC, 2018). Furthermore, students answered chemistry questions poorly and also failed to draw correct structures and give correct structures. Hence, it is considered that the students could perform better if library resources are effectively used by both the chemistry students and teachers in the teaching and learning processes. Students have great difficulty understanding chemistry concepts at all levels of education. The role of chemistry in the development of the scientific base of a country cannot be overemphasized and Nigeria is not an exception. Yet with the increasing importance of chemistry to the unfolding world, the performance of Nigerian students in the subject at secondary school remains a dismal failure.

However, it is disappointing to note that the students' performance in chemistry at internal and external examinations has remained considerably poor despite the relative importance of Chemistry (Saage 2009).

The chemistry students' weaknesses identified by researchers were the learning difficulties to the presumed abstract nature of many chemistry concepts, didactic methods of instruction, students' levels of conceptual understanding, mathematical abilities, problem-solving skills, poor level of communication skills, inadequate practical exposure, poor quantitative skills, inability to relate concepts in Chemistry to everyday life and lack of access to library resources in schools among other factors that may be responsible for this poor performance (Ajeyalemi, 2011; Berg, 2012; Samba & Eriba, 2012). These problems have continued to generate several research concerns among stakeholders on the underlying factors responsible for, as well as possible ways to combat this poor trend of poor achievement. Several reasons have been adduced for the poor achievement. Idoko and Njoku (2017) reported poor laboratory facilities and poor pedagogical characteristics of teachers. Neji (2011) reported the learner's characteristics. Meanwhile, Victor (2018) and Onyeabor (2020) lamented that the teaching of Chemistry in secondary schools is defective since students do not utilize the library and its services effectively. This has posed a lot of threats to students that have the passion to undertake science courses that have Chemistry as a prerequisite requirement for entrance to tertiary institutions.

Academic achievement of students in science subjects generally and in Chemistry, in particular, had witnessed a deplorable trend in the past decades. The observed students' poor performances and weaknesses in Chemistry in Nigeria are strong indications of poor conceptual knowledge and inadequate skills acquisition by the students which might have been caused by the lack of libraries in some schools or poor library resources that do not match the needs of the 21st-century learners, as they encourage rote memorization that leads to poor learning. Effective use of library resources by both the chemistry teachers and students was recommended for science teaching because it involves active student participation. The effectiveness of libraries has often been measured by the volume of library materials available to clients, the amount of use of services and resources and the apparent or quantified satisfaction of users. Very little research has taken into account the objectives of the users. This is

probably because the library plays an indirect role in the process of a user achieving objectives and it is difficult to assess the exact contribution the library has made. Moreover, the users' objectives are not always known. However, we need to keep in mind that the use of libraries is not an end in itself, but a means to an end. This study, therefore, investigated whether the effective use of library resources in the teaching and learning of Chemistry would enhance students' academic ability levels as determined by their academic achievement in the subject.

Research Questions

The following research questions guided the study.

1. What is the difference in the students' academic ability levels in chemistry when taught with library resources and the conventional method as determined by their mean achievement scores?
2. Is there any difference in the male and female students' academic ability levels in chemistry when taught with library resources and the conventional method as measured by their mean post-test scores in CAT?

Hypotheses

The following null hypotheses were tested at a 0.05 level of significance in the study

Ho1: There is no significantly significant difference in the students' academic ability levels in chemistry when taught with library resources and the conventional method as determined by their mean achievement scores.

Ho2: There is no statistically significant difference between the male and female students' academic ability levels in chemistry when taught with library resources and the conventional method as measured by their mean post-test scores in CAT.

Methodology

The study was carried out in public secondary schools in Enugu State, Nigeria. The design was quasi-experimental. Precisely, the pre-test, post-test, and non-equivalent control group design. The population of the study was all the senior secondary school class two (SS2) chemistry students from the 295 public secondary schools in Enugu State in the 2019/2020 academic session. A sample of 166 chemistry students (89 males, and 77 females) from two public secondary schools, was purposively drawn

from the population. The two schools were randomly assigned to experimental and control groups. Two intact classes from each school were randomly assigned to the experimental (72 students) and control (94 students) groups. A five-day pre-experimental conference was organized for the regular chemistry teachers of the sampled schools to train them on the use of library resources in chemistry instructions. During the training, the teachers were exposed to the instructional manual and were drilled using students from another but equivalent location outside the study area. However, the teachers in the control group were told to teach their students using the conventional lecture method. The two groups (experimental and control) were pre-tested before the commencement of the study after permission had been obtained from the school authorities.

Two instruments were utilized in the study. A 30-item multiple-choice chemistry achievement test (CAT) and the library resource teaching manual. Two experts in the field of chemistry education and one from educational measurement and evaluation face and content validated the instruments. Furthermore, the CAT was pilot-tested on a group of 30 students to determine its reliability. The internal consistency coefficient of 0.70 was obtained using Kuder-Richardson's formula 20 (KR-20) which showed that the CAT was reliable. The study lasted for six (6) weeks. Week 1 was used for the training of the regular chemistry teachers of the experimental and control schools on the conduct of the study using library resources during teaching and learning, and conventional lesson notes. The regular teachers in both the experimental and control group administered the chemistry achievement tests to the students as a pretest. Weeks 2, 3, 4 and 5 were used for the instructions while the 6th week was used for administering the post-test to both the experimental and control groups. The pre-CAT and post-CAT were the same sets of questions. However, the pre-CAT questions were renumbered/reshuffled in the post-CAT to make them look different at face value. Each question was scored 2 marks. The minimum score was 0 marks, while the maximum score was 60 marks. Mean and standard deviation was used to answer the research questions while the corresponding two null hypotheses were tested using Analysis of Covariance (ANCOVA) statistics at a 0.05 level of significance.

Results and Discussions

The results are presented in tables according to the research questions and corresponding null hypotheses that guided the study.

Research Question 1: What is the difference in the students' academic ability levels in chemistry when taught with library resources and the conventional method as determined by their mean achievement scores?

Table 1: Mean Pre-test and Post-test Achievement Scores of Students taught Chemistry with Library Resources and Conventional (Lecture) Method

Groups	Pre-test		Post-test		Mean Gain Scores	Mean Gain Difference
	N	Mean	SD	Mean		
Experimental Group	72	25.31	7.19	44.47	3.39	19.16
Control Group	94	25.47	8.82	25.49	2.56	0.02

Table 1 shows that the students exposed to chemistry lessons with the use of library resources have a gain in mean achievement score of 19.16, while their counterparts taught with the conventional (lecture) method have a gain in the mean of 0.02. This shows that the students who were exposed to chemistry lessons with the use of library resources, therefore, have higher gain in their mean achievement score than their counterparts taught using the conventional method with a mean gain score difference of 19.14. This shows that there is a difference in the academic ability levels of the students exposed to chemistry lessons with the library resources and their counterparts taught with the conventional method. However, the table could not establish whether the observed difference in the mean achievement gain scores of the two groups of students was statistically significant or could be attributed to a sampling error. The result was, therefore, subjected to inferential testing of the null hypothesis 1 with the analysis of covariance as shown in Table 2 below.

Hypothesis One: There is no significantly significant difference in the students' academic ability levels in chemistry when taught with library resources and the conventional method as determined by their mean achievement scores.

Table 2: Analysis of Covariance for Test of Difference in Academic Ability Levels of Students Exposed to Chemistry Lessons with the Library Resources and Conventional Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	15710.160 ^a	4	3927.540	95.590	.000
Intercept	11401.779	1	11401.779	277.500	.000
PretestAch	986.312	1	986.312	23.567	.000
Method	14815.026	1	14815.026	360.572	.000
Gender	28.181	1	28.181	.686	.409
Method* Gender	22.283	1	22.283	.542	.463
Error	6672.093	161	41.088		
Total	211106.000	166			
Corrected Total	22325.253	165			

Table 2 shows the summary of the ANCOVA statistics conducted to test the null hypothesis one. The result shows that there was a significant difference ($F(1,161) = 360.572, p = .000 < .05$) between the mean achievement scores of the experimental group ($M = 44.47, SD = 3.39$) and the control group ($M = 25.49, SD 2.56$) with a mean difference of 19.14. The result shows further that the experimental group that was taught with the library resources had a higher mean achievement score than their control counterparts taught with the lecture method. Therefore, null hypothesis 1 which states that there is no statistically significant difference in the students' academic ability levels in chemistry when taught with library resources and the conventional method as determined by their mean achievement scores was rejected at a 0.05 alpha level. This means that the main effect of the use of library resources in the teaching of chemistry was statistically significant. The implication is that the use of library resources has effectively improved the students' academic ability levels in chemistry more than the conventional (lecture) method. The finding of this study is in line with previous studies conducted by Onyeabor (2020) who found that effective use of library material improves the academic achievement of students in chemistry. The finding of this study is further supported by the submission of Victor (2018) who reported that students perform better through effective use of library resources and other innovative materials and that school libraries play significant roles in the learning activities of senior secondary school students because it enhances their independent learning which improves their performances. However, the finding of the study contrasts with the findings of other researchers such as Obodo, Ani and Neboh

(2021) that reported that a greater percentage of students do not use library resources, but depend on their teachers' handouts or pamphlets to study and pass their examinations. They found further that some of the teachers prepare notes and pamphlets and sell them to the students who depend on them instead of reading, learning and conducting research with the use of library resources. Although these students pass their examinations, those who make use of the library resources perform better. This is because those students could retain the lessons learned as a result of the utilisation of library resources that allow them to be actively involved in the learning process. This was supported by Ogunbote and Odunemu (2008) who confirmed that the performance of students could be improved considerably if students use the school library regularly. In addition, Odusanya (2004) noted that the school library can be used to promote learning by encouraging students to use the library for further studies, to carry out assignments; for leisure reading, examination purposes and recreation. Finally, Tiwari (2013) emphasized that the schools should make libraries available to provide the students with appropriate library materials and services for the overall growth and development of the personality of the students as an individual which will enhance their academic ability levels in chemistry in particular.

Research Question 2: Is there any difference in the male and female students' academic ability levels in chemistry when taught with library resources (and conventional method) as measured by their mean posttest scores in CAT?

Table 3: Mean Posttest Achievement Scores of Students Exposed to Chemistry Lessons with the Use of Library Resources and the Conventional method

Groups	Gender	N	Post-test	
			Mean	SD
Experimental	Male	36	44.75	3.32
	Female	36	44.19	3.49
Control	Male	53	26.09	8.92
	Female	41	24.71	8.11

The result presented in Table 3 shows the mean achievement scores of the male and female students exposed to lessons in chemistry using library resources and the conventional (lecture) method. The table shows that male students in the experimental group had a post-test mean achievement score of 44.75 while their female

counterparts had a post-test mean achievement score of 44.19. This shows a slight mean difference of 0.56. Similarly, in the control group, the male students had a mean achievement score of 26.09, while their female counterparts had a mean achievement score of 24.71. This shows a mean difference of 1.38. However, the table did not show whether the observed slight difference is statistically significant or otherwise. The result was, therefore, subjected to inferential statistics to test the null hypothesis two with the ANCOVA as shown in Table 2 above.

Hypothesis Two: There is no statistically significant difference between the male and female students' academic ability levels in chemistry when taught with library resources and the conventional method as measured by their mean post-test scores in CAT. The results in Table 2 above show that there is no statistically significant difference ($F(1,161) = 0.686, p = 0.409 > 0.05$) between the mean achievement scores of the experimental group, male ($M = 44.75, SD = 3.32$), and female ($M = 44.19, SD = 3.49$) and the control group, male ($M = 26.09, SD = 8.92$), and female ($M = 24.71, SD = 8.11$) with mean difference of 0.56, and 1.38 respectively. Since the use of the library resources was more effective in enhancing students' academic ability levels, it can be deduced from the result that the students' academic ability levels in chemistry could be enhanced regardless of gender difference when taught with the library resources. This implies that the effectiveness of the use of library resources teaching strategy in improving the students' academic ability levels in chemistry was not affected by gender. This finding indicates that there was no significant effect of method and gender on students' academic ability levels in Chemistry. It shows further that the method of instruction (Library resources utilization) constantly exerted its effect on students' achievement irrespective of their gender. This finding agrees with Adebayo, (2008) and Udu (2018b) who found separately that though, male students achieved higher scores than female students, there was no statistically significant difference between the male and female students' academic achievement in chemistry. Also, Victor (2018) indicated that male students scored higher on chemistry achievement tests than female students, but there was no statistically significant difference between the male and female students' academic achievement in chemistry. However, the finding of this study disagrees with the findings of Anagbogu and Ezeliora (2007) who found that female students performed better than their male counterparts and there was a significant difference between the male and female

students' academic achievement taught chemistry using digital video instruction and those taught using lecture method.

Conclusion

Despite the relative importance of chemistry, it is very disappointing to note that the performance of students in the subject at both internal and external examinations has remained constantly poor and the trend of their performance has been on the decline. Some of the factors that have been adduced to be responsible for these poor performances may be curriculum-related variables and instructional materials as well as ineffective use of library resources. It was concluded in this study that effective use of library resources increases the academic ability levels of students which in turn improves students' academic achievement in chemistry. It was also concluded that gender has no significant role in the academic achievement of students in chemistry.

Recommendations

Based on the findings of this study, the researchers recommended that:

1. The use of library resources in teaching and learning has been found to enhance the quality of achievement in chemistry, chemistry teachers should therefore be encouraged to increasingly, employ it in the teaching of the subject. in so doing, Chemistry students' ability could be enhanced.
2. Enlightenment campaigns, workshops and seminars should be organized for teachers by Local Education Authorities, State and Federal Ministries of Education, institutes and Colleges of Education, etc. to create awareness of the efficacy of exposing students to lessons with the use of library resources and school authorities sensitized on the adoption of those strategies in their various schools.
3. Electricity Distribution Companies in Enugu state in particular and Nigeria in general, should endeavour to connect all secondary schools in Enugu state and beyond with electricity.
4. State and local governments should endeavour to pay teachers regularly for the effective implementation of the above recommendations.
5. Standby generators with adequate storage facilities should be installed and adequate security provided, in all secondary schools in the state, in case of power failure.

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