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Effect of collaboration learning strategy and photo-visual literacy on the academic performance of student in chemistry

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Abstract
This paper investigated the effect of collaborative learning strategy and photo-visual literacy on the academic performance of students in chemistry. The study adopted a quasi-experimental design approach. The target groups for the study were senior secondary school students in Ikwerre Local Government Area of Rivers State. The study sampled 200 SSII students, randomly selected from two senior secondary schools in in Port Harcourt metropolis. The two schools were randomly placed as experimental/treatment and control groups each with 100 students. The experimental/treatment group was further divided into two groups A and B. The dependent variable was measured through a self-constructed 20-item performance test used as a pre-test and post-test. The collaboration strategy and photo-visual strategy were used on the experimental group while lecture method was used for the control group. Data analysis was done using mean, standard deviation, t-test, ANOVA and scheffe multiple comparism test. The findings showed that collaboration strategy was more effective than photo-visual literacy. Hence there was a significant difference in the effectiveness of collaboration and photo-visual literacy. It is recommended that student should be encouraged to read collaboratively instead of individually in other to enhance academic performance.

Keywords: collaboration, digital literacy, (photo-visual literacy), academic performance and chemistry

Introduction

Academic performance is an important focal point in the process of learning. It captures or portrays the forward or backward progression of an individual educational flow. Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university. Academic achievement should be considered to be a multifaceted construct that comprises different domains of learning depending on the indicator used to measure it. The field of academic achievement is very wide and covers a broad variety of educational outcome, among many criteria that indicates academic achievement is procedural and declarative knowledge acquired in an educational system. All criteria mirror the intellectual capacity of person.

One of the major reasons of the downturn in student's achievement in their various subjects is the non-utilization of necessary techniques in learning. It has therefore become necessary to seek effort that will enhance an approach or approaches that will enhance better academic performance of students in that aspect.

To cope with the technologically advancing world, the 21st century learning skills has to be incorporated in to the educational system. These skills are set of abilities that students need to develop in order to succeed in the information age, such as collaboration, communication, critical thinking, problem-solving and digital literacy. The sills mentioned above will further enable students to know how to use their knowledge and ability by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating collaborating and making decisions.

Chemistry also called the "central science" because of its connectivity with other sciences such as biology, physics, geology and environmental science is the pillar upon which they are studied.

It is in line with this view that Otu and Avaa (2011) [12] pointed out that chemistry education has been identified to be one of the major bedrock for the transformation of our economy and technological development. The in-depth study of chemistry enables the learner to be grounded in the 21st century learning skills such as exploration, manipulative, and problem-solving skills. As a result of this recognition given to chemistry in the development of individual and the nation, chemistry was made a core-subject among the natural sciences which has been a pre-requisite subject for offering most science related courses in the tertiary institution.

Students' interest in chemistry is very paramount in the teaching and learning of science. However, results in various external examinations over the years have shown a steady decline in the performance of students; especially in the science subjects, chemistry inclusive. For examples, West African Examination Council (WAEC) result between 2012 and 2014 analyzed by Myschloolbase.com; shows that the number of students who obtained credit in 5 subjects including mathematics and English fluctuated around 31%, 29% & 31% for 2012, 2013 and 2014 respectively; consecutively very poor performances. The school system would not continue like this; something needs to be done to stem the tide of poor performance in WAEC conducted examinations.

Concept of Collaboration

The very dictionary definition of collaboration will tell us what collaborative learning means. The word

"collaboration" brings together the Latin "col-" meaning "with or together" with the Latin "labor" or toil. For educationists, collaborative learning is a comprehensive term for "a variety of educational approaches involving joint intellectual effort by students, or students and teachers together."[1]

Banerjee, (2015) [19] is of the view that collaborative learning points to cooperation between the teacher and the student and stands against the competitive system followed in a traditional classroom.

Wichadee, (2007) [16] views Collaborative learning as structures in many different models; some of the general ones are Students' Team Achievement Division (STAD), Teams-Games Tournament (TGT) and Jigsaw I and II. He also further explained that Collaborative learning models share the idea that students work together to learn and are responsible for their team mates' learning as well as their own.

Studies have also revealed that collaborative learning is one strategy for group instruction which is under the learner centered approach. It is a instructional approach that promotes students to students' interaction through working in small groups to maximize their learning and reach their shared goals. It could also be seen as learning in a collective term for a diversity of methodologies in education that encompass combined intellectual effort by students or students and teachers. Collaborative learning refers to procedures and environments in which learners engage in a common task in which each individual depends on and is answerable to each other. It includes use of lesser groups so that all students can maximize their learning and that of their peers. It is a process of shared creation: two of more individuals interacting to create a shared understanding of a concept, discipline or area of practice that none had previously possessed or could have come to on their own. Collaborative learning activities can include collaborative writing, group projects, and other activities.

The idea of collaborative learning is linked to co-operative learning and concepts found in learning institutions, learning communities and communities of professional learning.

Digital Literacy Defined

The ability to locate, organize, understand, evaluate, and analyze information using digital technology. It involves a working knowledge of current high-technology, and an understanding of how it can be used. Digitally literate people can communicate and work more efficiently, especially with those who possess the same knowledge and skills.

Digital literacy is "The capability to use digital technology and knowing when and how to use it.

Digital literacy is when students are able to engage with multi-media to read and interpret text, sounds and images. Digital literacy is when students can manipulate and evaluate data to construct their own meaning. Digital literacy also includes a student having knowledge about how to use technology to construct meaning, but most importantly in ways that are appropriate to their needs. Students who know how to use technology are also instructed by parents and teachers on how to use it effectively and appropriately to communicate a message.

Concept of Digtal Literacy

Eshet-Alkala (2004) [7] published a 5-skill holistic conceptual model for digital literacy arguing that it covers most of the cognitive skills that users and scholars employ in digital environments, and therefore provides scholars, researchers and designers with a powerful framework and design guidelines. Today, this model is considered one of the most complete and coherent models for digital literacy (Akers, 2005), and it was also included among the pivotal models for digital learning in the Encyclopedia of Distance Learning (Eshet-Alkalai, 2005) [8].

The five cognitive digital literacy skills that comprise the model are:

1. Photo-visual literacy is the ability to read and deduce information from visuals.
2. Reproduction literacy is the ability to use digital technology to create a new piece of work or combine existing pieces of work together to make it your own.
3. Branching literacy is the ability to successfully navigate in the non-linear medium of digital space.
4. Information literacy is the ability to search, locate, assess and critically evaluate information found on the web and on-shelf in libraries.
5. Socio-emotional literacy refers to the social and emotional aspects of being present online, whether it may be through socializing, and collaborating, or simply consuming content.

Based on the above conceptual model for digital literacy revealed by Eshet-Alkala (2004) [7], the researcher carried the study with one of the models for digital literacy.

Statement of the Problem

The challenges of academic achievement has become a thing of concern in the educational system, scholars have sought various means to combat this issue in other to enhance effective teaching and learning. Poor academic achievement have led to the students not being able to move to another academic level as at when due, this has led spending more than the required time in a particular level of education and also poor academic achievements has contributed to students graduating with unqualified result that will not fit in the technologically challenging world

The teaching and learning of the sciences has also been a thing of major concern. Chemistry is not left out being a prerequisite subject for tertiary institution and a must know in the sciences. Scholars and educationalist have sought for ways to properly unfold the understanding of chemistry to science students.

It is against the background that the researchers conceived the idea to assess the relative effectiveness of collaborative learning and digital literacy (photo-visual literacy) on the academic permanence of students in chemistry. The identification of a more effective technique will enhance its use in school by practicing teaching during their lessons presentation. Students will also benefit from potency of the teaching strategy and this may result in effective teaching and learning.

Aim and Objective of the Study

The study will explore the effect of collaborative learning strategy and digital literacy (photo-visual literacy) on student's academic achievements in chemistry in rivers state. In specific terms the study objectives are to:

1. The effectiveness of collaborative learning strategy and photo-visual literacy on the academic achievements of students in chemistry.
2. Determine the effectiveness of photo-visual literacy of the academic achievement of students in chemistry.
3. Investigate the combine effects of collaborative learning strategy and photo-visual learning strategy in the academic achievements of students in chemistry.
4. Determine the mean score of students taught with collaborative learning strategy, photo-visual literacy and control / lecture method.

Research Questions

1. What is the effect of collaborative learning strategy on students' academic achievements in chemistry?
2. What is the effect of photo-visual literacy learning strategy on the academic achievements of students in chemistry?
3. How does the academic performance of students taught with collaborative learning strategy differ from those thoughts with photo-visual literacy?
4. To what extent is the difference between the post-test mean score of students taught with collaborative learning strategy and those taught with control/lecture method?

Research Hypotheses

The following null hypotheses tested at 0.05 level of significance guided the study.

1. There is no significant difference between the pre-test and post-test scores of students taught with collaborative teaching strategy.
2. There is no significant difference between the pre-test and the post-test of students taught with photo-visual literacy.
3. There is no significant difference between the academic achievements of students taught with collaborative teaching strategy and those taught with photo-visual literacy.
4. There is no significant difference between the post-test mean score of students taught with collaborative learning strategy, photo-visual learning strategy and lecture method

Significance of the Study

The study is of great importance to me as a chemistry teacher because it will unveil an effective teaching strategy to convey the concept of chemistry to students whose academic performance has been a great discouragement to them.

The outcome of this study will go a long way to harmonies the pedagogical content and learning ability, which will enhance learning outcome and academic achievement.

It will help curriculum planners to inculcate the 21st century learning skills in the curriculum; this will expose the students and enable them to face the technologically advancing world.

Another important aspect of this research is that it will help the government to realize the need to organize workshop and seminars on digital literacy this will enable the teachers get acquainted to the use of digital tools in the class room.

Scope of Study

The study will focus on the effectiveness of collaborative teaching strategy and photo-visual literacy on the academic performance of students in Ikwerre local government area of rivers state. The scope will cover students in senior secondary two students only. Specifically, the study will investigate on the dependent variable which is academic performance, the indepent variable will constitute collaborative learning strategy and photo-visual literacy.

Study Area

The study will be carried out in Ikwerre local government area of Rivers state.

Methodology

The research employed a quasi-experimental technique which involves intact group, pretest and post-test and control group,

Quasi-experimental design was adopted for this research because it is suitable to approximate conditions of true experimental situation that do not permit the control and manipulation of all relevant variables.

Population of Study

The target population for the study comprises of all the SS2 student in Ikwerre local government area in the metropolis of port Harcourt Rivers State.

Sample and Sampling Technique

A sampling size of 200 senior secondary (II) students was drawn from two secondary schools in Ikwerre Local Government Area.

In each school a total of 100 students was randomly selected and divided into two groups of 50 students each. One impact group will be for experimental group while the other group will be for control group.

Experimental Procedure

Permission will be taken from the principals of the sampled schools with the assistance of the chemistry teacher. Pretest was given to both the experimental and control group. This is to establish equivalence in terms of academic ability.

The experimental group was further divided in two group A and B respectively. After our week, treatment was given to the two groups of the experimental groups A and B.

Experimental group A was taught with instructional guide Collaborative Teaching Strategy (CTS), while experimental group B was also taught with Photo-Visual Literacy (PVL).

The control group was taught with lecture method (LM).

After two weeks, a post-test was given to the two groups (experimental and control) after the treatment.

Method of Data Collection

The study instrument that was developed for data 20 item chemistry achievement test (CAT) which was used to measure students achievement in Chemistry.

The 20item chemistry achievement test was focus on separation technique or process.

Validity of Instrument

The validity of the instrument was determined by the research's supervisor, experts in the field, lectures in curriculum studies and educational technology department.

Reliability of Instrument

The reliability of the instrument was determined by using a

test-retest reliability method. The result of the test-retest method will be obtained using Pearson moment correlation coefficient (r).

Method of Data Analysis

The data collected for the study was analyzed using mean, standard deviation to answer the research question, t-test and analysis of variance (ANOVA) and scheffe multiple comparison test were used for the null hypotheses where necessary. How

Teachers Use These Methods?

Data Presentation and Analysis

The result of the research questions and the corresponding null hypothesis were presented together in the same table and was subjected to T-test analysis.

H_o1: There is no significance difference between the pre-test and post-test mean scores of students taught with Collaborative Teaching Strategy (CTS).

Table 1: T-test analysis of the effectiveness of collaboration using pre-test and post-test mean score of the experimental group taught with collaborative teaching strategy.

Test	N	X	SD	df	T-cal	T-crit	Result
Pre-test	20	6.4	3.56	19	3.69	2.09	
Post- test	20	9.95	2.40				

Table 1 shows that the pre-test and post-test mean score of students taught with collaborative teaching strategy are 6.4 and 9.95 respectively. When the mean score were statistically compared using t-test, a calculated t-value of 3.69 was obtained against a critical t-value of 2.09 at df 19 and 0.05 level of significance. Hence the null hypothesis of no significant difference was rejected, indicating that collaboration significantly improve students' academic performance.

H_o2: There is no significance difference between the pre-test and post-test mean scores of students taught with Photo-Visual literacy.

Table 2: T-test analysis of the effectiveness of photo-visual literacy using pre-test and post-test mean score of the experimental group taught with photo-visual strategy teaching strategy.

Test	N	X	SD	df	T-cal	T-crit	Result
Pre-test	20	12.05	4.94	19	0.59	2.09	
Post- test	20	13	5.12				

Table 2 shows that the pre-test and post-test mean score of students taught with photo-visual literacy teaching strategy were 12.05 and 13.00 respectively. When t-test analysis was employed to compare their mean scores a calculated value of 0.59 was obtained against a critical t-value of 2.09 at a df 19 and 0.05 level of significance. Hence the null hypothesis of no significant difference between the pre-test and post-test man score were accepted indicating that photo-visual literacy does not significantly improve students' academic performance.

H_o3: There is no significance difference between the academic performance of student taught with collaborative teaching strategy and those taught with photo-visual literacy.

Table 3: T-test analysis comparing post mean score of the group for collaborative teaching strategy and the group for photo-visual literacy on students' academic performance.

Group	N	X	SD	df	T-cal	T-crit	Result
Collaborative Teaching Strategy	20	11.25	2.99	18	3.54	2.09	
Photo-visual Literacy	20	8.15	2.53				

Table 3 shows that the post-test mean scores of the collaborative and photo-visual teaching strategy group were 11.25 and 8.15 respectively. When t-test analysis was used to compare these mean scores, a calculated t-value of 3.54 was obtained against a lower critical t-value of 2.09. This result shows that the null hypothesis of no significant difference was rejected; hence there was a significant difference in the effectiveness of collaborative teaching strategy and photo-visual teaching strategy in the academic performance of students in Chemistry.

H_o4: There is no significance difference between the post-test mean scores of students taught with collaborative teaching strategy, photo-visual literacy and lecture method.

Table 4: ANOVA comparing the post- test mean score for the collaboration, photo-visual literacy and lecture/control method.

Sources of Variation	Sum of Squares	df	Mean Square	Level of Significance	F-cal	F-crit	Result
Between Group	03.7	2	46.85	0.5	0.97	3.59	
Within Group	818.7	17	48.15				
Total	912.4	19					

Table 4 shows that the calculated f-value of 0.97 is less than the critical f-value of 3.59 at degree of freedom 2 and 17 at 0.05 level of significance. So, the null hypothesis was accepted. This means that a significant difference does not exist among the post-test mean scores of collaborations, photo-visual and lecture method teaching strategy.

Table 5: Determination of direction of significant difference using Scheffe's Test

Group	N	X	Paired Mean	F-Cal	F-Crit
Collaborative Strategy	20	11.25 X_1	X_1 Vs X_2	0.99	3.59
Photo-Visual Strategy	20	8.15 X_2	X_2 Vs X_3	0.31	
Lecture Method	20	6.4 X_3	X_1 Vs X_3	2.44	

Table 5 shows the that the calculated F-value of 0.99,0.31 and 2.44 were obtained when the group mean of collaborative and photo-visual teaching strategy, photo-visual and lecture method, collaboration and lecture method were compared. As can be seen that the calculated values were less than the critical F-value of 3.59 hence there is no significant difference in the academic performance of students in chemistry of student taught with collaboration, photo-visual and lecture method teaching strategy.

Discussion

The study revealed the effectiveness of teaching strategy with when implemented properly will enhance the academic performance of students in Chemistry.

The result shows that the students had higher mean score in their post-test (9.95) and a lower mean score of 6.4 in their pre-test. This reveals that collaborative teaching strategy enhance the academic performance of students in Chemistry. The rejection of the null hypothesis of no significant effect of collaborative strategy on the academic

performance of students in Chemistry indicated that collaboration had a significant effect in the enhancement of students' academic performance in Chemistry.

Collaboration has a lot of impact in the teaching and learning of science especially Chemistry. This toes the same line with the findings of Slavin (1995) as cited in Wichadee (2007) [16] – Collaborative learning is an institutional tool in which students work in small groups to help one another master academic content.

The study also revealed the effectiveness of photo-visual literacy. The result of a higher mean score in the post-test of photo-visual teaching strategy against the lower mean score of pre-test shows that photo-visual also enhance the academic achievement of students in Chemistry,

The calculated T-value of 0.59 which is lower than the critical T-value of 2.09 proves that not all learners are comfortable with only photo-visuals. Some learners need the combination of photo-visual and audio-media,

This further buttress the view of Dunn and Dunn (1978) [6] as cited in Gilakjan and Alimadi (2011) [10]. They pointed out that not only can students identify their preferred learning styles but that students also on tests, have better attitudes and are more efficient if they are taught in ways to which they can easily relate.

The study has also shown that there is a significant difference between the post mean score s of the students taught with collaborative teaching strategy and photo-visual strategy. This is seen in the higher mean score obtained with the student taught with collaboration strategy 11.25, while those taught with photo-visual strategy obtained a mean score of 8.15 respectively. This indicates that the academic performance of students taught with collaborative teaching strategy is higher than those taught with photo-visual strategy. This was statistically proved to be significant when the T-calculated value of 3.54 is greater than the critical T-value of 2.09 obtained.

The findings have greatly unveiled the need for collaborative teaching and learning of Chemistry. The studies of Majoka (2005), Johnson (2002) [5] and Onabanjo (2002) [15] pointed out that students gain more from collaboration.

Implication of the Study

The finding of this study has some implications which are most beneficial to teachers and students. This implies that teachers should be able to discover the most suitable teaching strategy for the particular level of learners in which they are engaged with. It also implies that effective teaching-learning depends not only the teaching methods but also on the teacher's presentation skills.

Conclusion

On the basis of the findings, the following conclusions were drawn:

1. Collaborative teaching strategy and photo-visual are effective in the academic performance of students
2. Collaborative learning has more rewarding effect on the academic performance of students than photo-visual since collaboration has been proven to widen the student's cognitive ability and problem solving skills. Standing on the findings of this research lecture method has little or no effect on the academic performance of students in Chemistry.
3. Collaborative learning promotes the acquisition of skills that enhances critical thinking.

Recommendation

1. Teachers should encourage teamwork among students in order to work together collaboratively.
2. It would also be necessary to investigate how effective collaborative learning can be used to improve the other skills of students.
3. Government and school authorities should provide avenue for students in order to interact freely with each other.
4. This study is limited to senior secondary school students. It is also recommended that the effectiveness of collaborative learning method can be tested on the academic performance by junior secondary school students.

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