Relative Effect of Two Forms of Pedagogy on Secondary School Students Performance in Ecology Concepts in Rivers State

B, J Obomanu, Nwanekzie A, U, Ekineh Dorathy, R
Department of curriculum Studies
University of Port Harcourt, Nigeria
University of Port Harcourt Demonstration Secondary School (udss), Nigeria
Corresponding author, e-mail:ekdorathy@gmail.com

Abstract

This paper investigates the effectiveness of forms of pedagogy on secondary school students' performance in ecology in Rivers State. The study adopted a quasi-experimental design in four secondary schools and considered a sample size of 240 senior secondary two students. In each sampled schools, one class was randomly assigned the experimental group (Collaborative) while the other the control group (guided inquiry). The result of the pre-test and post-test were analysed using mean, standard deviation and z-test. Hypotheses were tested at $P<0.05$. Result obtained showed that students in collaborative group performed significantly better than those in guided inquiry group. Resulting from these, the study recommended that collaborative teaching strategy be adopted at the secondary school level of education.

Keywords:*Collaborative strategy, Guided inquiry strategy,* Ecology concepts and *performance.*

Introduction

Many issues confront the Nigerian educational system, but the most identified one according to Okonkwo (2004) is the level of performance in the sciences among students in both internal and external examinations. Bojuwaye (2006) reported that poor performance in science and its effects on the economy of the country has been the major concern of various science educators and other stakeholders in the education industry. The West African Examination Council (WAEC), Science Teachers Association of Nigeria (STAN), the Federal Ministry of Education and the different State Governments had to set up committees one time or the other to identify the reasons for the poor performance of students in Science, Bojuwaye, (2006). Some reasons behind the poor performance of students in science according to Salau (2005) have been low quality of science teachers produced by our tertiary institutions, negative attitude of students towards science subjects and others.

Biology specifically is seen as a core subject offered by virtually all science students. It is a subject that deals with all living things, their existence and

their relationships. Infact a foundation for medical, biological and even environmental science. However, students perceive this subject as relatively easy amongst other science. Unfortunately, the contrary has always being the case because in very many instances students record very low performance in this subject as indicated by West African Examination Council (WA+EC) annual report of 2011 on students performance between the years 2000 and 2010 (See Table 1 below)

Table 1: Performance of candidates in SSCE Biology 2000 – 2010 in Rivers State

Year	No. of students	No. pass at credit level and above in Grades 1 – 6	% pass at credit level and above in Grade 1-6
2000	620,291	119,716	19.3
2001	745,105	201,177	27.8
2002	787,209	42,665	54.1
2003	44,087	164,700	37.0
2004	267,132	108,030	40.4
2005	1,051,557	375,850	35.7
2006	1,137,181	559,854	49.2
2007	1,238,163	413,211	33.3
2008	320,962	122,872	38.28
2009	299,364	116,803	39.0
2010	429,626	127,803	29.7

Source: Annual Report for Each Year (2011).

The Table above shows the performance of candidates in SSCE Biology from 2000 – 2010, with slight improvement in the percentage of credit pass which stood at 54 percent in 2002. And so, according to Soyibo (2002), students' perceived impression that biology is an easy subject appears to be one main factor responsible for the abysmal performance noticed.

In another vein, Odubunmi and Balogun (2001) found that some students perceived topics in plant and animal diversity as easily understood when taught while topics in ecology and genetics were perceived as difficult. Ecology is a branch of biology that deals with general ecological principles, including energy flow in an ecosystem, ecological succession, biomes and others. The poor performance in Biology as observed over the years according to Odubumi and Balogun (1991) have been as a result of students lack of understanding of different concepts in ecology, genetics and poor teaching methods employed by the teachers Qutub and Musa (1973) had reported that understanding ecological concepts has enormous advantages on the students in addition to increase Biology performance. The students will have knowledge about the global ecological and environmental problems associated with man's impact on the biosphere (past, present and future) relative to man's role as steward of God's creation.

Majority of studies carried out by researchers indicates that collaborative learning is often efficient than learning alone. It affords students enormous advantages not available from traditional instruction because a group whether

it is the whole class or a learning group within the class can accomplish meaningful learning and solve problems better than an individual, Crook (1994). Collaboration means individuals working together for a purpose or to accomplish shared goals.

Specifically, collaborative teaching learning strategy refers to any instructional method in which students work together in groups for the purpose of achieving a common academic goal. Although, its learning activities may vary widely, it has focus on students' joint exploration or application of the course materials and therefore learning becomes a shift away from the typical teacher centre or lecture centered milieu in many secondary school classrooms. One reason for this shift was to move away from the mentalist conceptions of learning to perspective that emphasizes activity and practice. Many collaborative teachers have expressed surprise when seemingly less able students had insights that went beyond what teachers' expected. Further, if each student contributes something, the pool of collaborative knowledge will indeed be rich. Data from Johnson and Johnson, (1989) suggested that high-achieving students gain much from the exposure to diverse experiences and also from peer tutoring. Also students who may be high achieving in one area may need help in the other area. Teachers facilitate collaborative learning by creating learning tasks that encourage diversity, but which aim at high standards of performance for all students. These tasks involve students in high level thought such as decision making and problem solving that is best accomplished in collaboration, Tinzman *et al,* (1990).

Science educators have in modern times emphasized the use of guided inquiry method in science teaching and learning. The method has been well identified above others to provide meaningful learning for the students in heuristic teaching, activity and problem solving which are the major ingredients of modern science. Maxwell (2005) observed that inquiry method builds the student's self-concept, develop talents, avoid learning only at the verbal level, permits time for students to assimilate and accommodate information. Children involved in inquiry experiences learn to think autonomously, having had many successful experiences in using their investigative talents; they learn Forley (2005).

The term guided inquiry is used when there is considerable structure and indicates that there is little guidance provided by the instructor, much of the planning outlined by the teacher to students do not originate the problem, considerable guidance on how to set up and record the data is provided.

Aim of Study

The aim of this study is to determine the effectiveness of collaborative and guided inquiry teaching strategies on the performance of students in Biology. Specifically, the objective of the study is to: examine the extent to which the collaborative strategy enhances students' performance in Biology in ecology concepts compared to guided inquiry method.

Rationale

There are number of important reasons why collaborative teaching and learning strategy should be implemented:

1. The collaborative strategy promotes the principles of inclusion. Cook (2004) eloquently stated that: "as a result, collaborative strategy shares many benefits with other strategies, including a reduction in stigma for students with special needs, an increased understanding and respect for students with special needs on the part of other students, and the development of a sense of heterogeneously-based classroom community.
2. Collaborative strategy provides a number of benefits for students, including greater access to the general education curriculum for those with special needs and the support of two highly – qualified teachers for all students.

   Having student-teacher interaction allows for greater opportunity for differentiating and enhancing the curriculum, as well as attending to students' need. Educators must pull together by sharing their work through collaborative processes, Friend and Pope (2005).

Conceptual Framework

Collaborative concept states that learners should constantly be challenged with tasks that refer to skills and knowledge just beyond their current level of mastery. This will capture their motivation and build on previous successes in order to enhance the confidence of the learner.

In order to fully engage and challenge the learner, the task and the learning environment should reflect the complexity of the environment that the learner should be able to function in or at the end of the learning process. The collaborative concept points out that emotions and life contexts of those involved in the learning process must therefore be considered as an integral part of learning. Savery, (1994) contends that the more structured the learning environment, the harder it is for the learners to construct meaning based on their conceptual understanding. A facilitator should structure the learning experience just enough to make sure that the students get clear guidance and parameters within which to achieve the learning objectives, yet learning environment should be open and free enough to allow the learners to discover, enjoy, interact and arrive at their own. It is therefore important that teachers constantly assess the knowledge their students have gained to make sure that the students perception of the new knowledge are what the teacher had intended. Teachers will find that since the students build upon already existing knowledge, when they are called upon to retrieve the new information, they may make errors. It is known as reconstruction error when we fill in the gaps of our understanding with logical, through incorrect thoughts. Teachers need to catch and try to correct these errors, though it is inevitable that some reconstruction error will continue to occur because of our innate retrieval limitations. Currently, the practice of collaborative is only advocated by science

educators. Renner and Stafford, (1972) have said that scientific literacy deals with understanding (knowledge) ones environment, the process of inquiry by which understanding of the environment is gained and the spirit of science. The teacher could engage the students in active dialogue. The students continually build upon what they have already learned. Good methods for structuring knowledge should results in simplifying, generating new propositions, and increasing the manipulation of information.

Theoretical Framework

The theory of collaborative strategy is generally attributed to Vygotsky (1978), a developmental theorist and a researcher who has influenced some of the current research on collaboration among students and teachers and on the role of cultural learning and schooling. His principal premise is that human beings are products not only of Biology but also of their human cultures. According to him, intellectual functioning is the product of our social history and language is the key mode by which we learn our verbal thinking and regulates our actions.

A number of research in recent years have demonstrated high degree of learning possible when students can collaborate in learning tasks and when they use their own knowledge as foundation for school learning. Palinesar, (1989) noted that in contrast to effective adult-child interactions outside school, classroom talk does not always encourage student to develop personal control on a system. Thus a goal of this research was to find way to make dialogue a major mode of interaction between teachers and students to encourage self regulated learning. His classroom research revealed increase self-regulation in classrooms where, subsequent to training, dialogue became a natural activity. Within a joint dialogue, teachers modeled thinking strategies effectively, apparently in part because students felt free to express uncertainty, ask questions, and share their knowledge without fear of criticism. In a number of classrooms, students freely discuss what they knew about topics, thus revealing persistent misconceptions such revelations do not always happen in lecture method classrooms Palinesar, (1988/ 1989). Furthermore, teachers helped students change their misconceptions through continued dialogue.

Collaborative theory maintains that teaching will be successful only when teachers believe the underlying assumption that collaboration among teachers and students construct meaning, solve problems and leads to higher quality learning. Learners bring to classroom ideas that affect new information received. What a learner learns therefore, results from interaction between what is brought to the learning situation and what is experienced in it. The collaborative theory hold that learning is an interpretative process as new information is given meaning in terms of student's prior knowledge Roth, (1994). Emerging in true dialogue requires practice for both teachers and students. However, the principles of collaborative dialogue and scaffolding for purposes of self-regulated learning ought to be effective across many content

areas. What may differ of course, are the critical specific strategies for different subject areas. For example, defining problems seems critical in mathematics, judging the reliability of resources appears important in social studies, and seeking empirical evidence is essential in science Palinesar, (1989).

From a collaborative point of view, each learner actively constitutes and reconstructs his or her understanding rather than receiving it from a more authoritative source such as a teacher or textbook. Use of small, heterogeneous, collaborative groups in content area reading as observed by Herber (1978) increases students' involvement in learning. They are more willing to take risks and to learn new strategies and ideas from their peers. Teachers who use Heber's strategy reported that all students seemed to benefit from collaborative work. They found in their work that it is critical, however, to teach students to work in groups. When students select their own topics they will learn more, than if teachers always assign topics Graves, (1983). Both teachers and students engage in writing as a graft. Teachers' main functions are to facilitate, model and coach. Students dialogue or interact with other students and teachers in conference as part of the audience. This mode of interaction is collaboration among students and teachers Graves, (1983). Collaboration promotes learning in that students collaborate in small groups or as an entire classroom; they share prior knowledge, set learning goals, monitor their progress, and share responsibility for results Cohen, (1986).

Collaborative theory holds that, heterogeneous grouping may team student from various socio-economic groups and students with varying experiential background. Learning is an interpretive process as new information is given meaning in terms of student's prior knowledge Roth, (1994). As a consequence, collaborative theory implies that learners must be given opportunities to experience what they are to learn in a direct way and time to think and make sense of what they are learning. Students apply higher order thinking strategies which help them construct meaning from what they read and help them monitor progress towards their goals Collins, (1989). Curriculum and instruction have also changed as pointed out by Herber, (1978). Instruction is much more collaborative and curriculum focuses more on higher order thinking skills needed for success in school and in life. Teachers tap students' prior knowledge and help students "learn how to learn" through collaborative problem solving and decision making Brandt and Mech (1990). When students need information, they ask an "expert" classmate or contact a community expert. Students develop their own tools to "test" how well they have learned. The curriculum has also become more interdisciplinary and builds on the multicultural resources in the teaching and learning environment Meck, (2000).

Empirical Studies on Collaborative and guided Inquiry.

Atwood and Stevens (1978) examined the performance of students using the collaborative learning and guided inquiry approaches and discovered a high academic performance on the students taught with the collaborative based strategy than the guided inquiry teaching strategy. The collaborative strategy is a generalized programmatic approach derived from Piaget's theory on mental development especially the aspect of the theory of mental functioning. The activity of collaborative strategy allows the students to recall experience where none originally exist. Ezeife (1990) in his work stated that the new experience puts the student in a state of disequilibrium because questions are now raised which the students cannot give complete answer to.

Atwood and Stevens (1978) findings are supported by the studies of Biology students carried out by Barnett (2004) in comparative studying of inquiry teaching strategy of different groups of biology students. He found in his work that there was a high level of performance between the students' level of intellectual development and their cognitive preference patterns of responding which enhanced the students reasoning ability.

Dolmatz and Wong (2001) reported that students taught with the collaborative teaching strategy which stresses the importance of the students using their cognitive processes to work out the meaning of things, which also involves investigation of phenomena, use of evidence to backup conclusion and the designing of experiments, demonstrated high performance than the student's taught with the inquiry strategy.

Related studies on the relationship between the collaborative and the inquiry teaching strategy and how it affects the performance of the students also investigated by Jung Worth (1978), testing the evaluation of curriculum implementation and Gershon (1978) in an attempt to evaluate the new Biology project in which the collaborative indicated a positive response in the collaborative teaching strategy. Barnett (2004) in the study of an investigation of relationships among Biology student, perception of teacher style and cognitive prestige also supported the findings of Gershon and Jurngworth (1978).

In a study about the social outcome for students in a collaborative classroom, Vaughn,*et al* (1998) obtained a positive outcome. In his study, the sample consisted 185 third six-grade students distributed between low achievement, average achievement and high achievement. The participants were distributed between two different settings: co-teaching setting and collaborative teaching setting. According to the results the students on the collaborative teaching setting demonstrated a more positive outcome than their peers on the co-teaching setting.

Further it was demonstrated that there was an increase in the number of reciprocal friendships formed Vaughn,*et al* (2008).

Klingner, J and Vaugh, S. (1999) conducted a study about which program students prefer (inquiry or collaboration). In the study 32 students were interviewed individually by the research using key questions accessing

their perceptions, the result indicated more children prefer inquiry strategy but many children confident that the collaborative strategy was more useful in terms of the outcomes and social skill development Klingner, *et al* (1998).

In another study of students' perception of collaboration, Vaughan *et al* (1996) examined the students' perception by interviews and surveys using a sample of 442 students and found that students liked going to the resources room because they thought work in the resources room was easy and fun and because they received special help. Yet students also stated that they liked the collaborative classroom because they were able to make friends Vaughn and Klinger, (2001).

In a study by Larivee, (1985) a sample size of 118 teachers were used in a collaborative classroom and concentration was paid to the students in their various groups. Larrivee collected her data using four methods; observed the classroom directly, the teacher's records, self report from the teacher and interviewed the teachers and the students. The 74 variables used in her study were divided into seven categories. To collect the data she developed 14 instruments to assess all variable and reported that students in the collaborative classroom demonstrated a greater level of achievement when the teacher used the time efficiently, his or her relationship with the students was good, gave the students positive feedback, made a high rate of success for learning tasks and responded to all students positively.

The study sought to provide answers to the following research questions:

i. What is the relative effect of collaborative teaching strategy and guided inquiry method on students' performance in ecology concepts teaching?
ii. Which of the two strategy (i.e. collaborative and guided inquiry) is the most effective and facilitative?

The following null hypotheses were tested in this study:

(i) There is no significant difference in the performance of students taught ecology using the collaborative teaching strategy (CTS) and those taught using Guided Inquiry Teaching Strategy (GIS)
(ii) The mean scores of students taught ecology concepts using collaborative and guided inquiry do not differ significantly.

Methodology

The design of the study was quasi-experimental involving one experimental group (collaborative teaching strategy) (CTS) and one control group (Guided Inquiry Strategy) (GIS). The population of this study was made up of all Government Senior Secondary II students studying Biology in the Port Harcourt, Obio/Akpor and Ikwerre Local Government Areas of Rivers State. The estimated population of two thousand, four hundred (2,400) students were selected from schools spread across the Local Governments of Obio/Akpor, Port Harcourt and Ikwerre Local Government Areas of Rivers State. Simple

random sampling technique was adopted to get the sample size of 240 students which constituted 10% of the entire population. The study utilized one major instrument named Biology Performance Test (BPT). The instrument consist of Fifty Questionnaire (50) divided into three sections all in objective forms.

The researcher validated the instrument using face and content validity to ensure that the items reflected very well, the specific concepts needed to be measured in this study. An estimate of reliability coefficient was found to be 0.98 using Pearson's product moment correlation statistics. Mean scores, standard deviation, z-test analysis was used to test and analyze the research questions and hypotheses at 0.05 level of significance.

RESULTS

Research Question 1: What is the relative effect of collaborative and guided inquiry strategies on students' performance in ecology concepts?

Table 2: Pre-test and Post-test mean scores and standard deviations of the performance of experimental and control group on ecology concept

Group	N	Pre-test $(\bar{x})$	Post-test $(\bar{x})$	SD	Gain	% Gain
Collaborative (Experimental Group)	80	23.82	28.85	8.46	5.03	21.11
Guided inquiry (Control group)	80	26.48	26.23	6.39	0.25	0.94

Table 2 shows the mean and standard deviation scores of students taught using guided inquiry strategy (control group) and those taught using collaborative strategy (experimental group). The mean and standard deviation for the collaborative group is 28.85 and 8.46 while that of the guided inquiry (control group) is 26.23 and 6.39, respectively. As shown in Table 1, students taught using collaborative strategy obtained a higher mean score than those taught using guided inquiry method. This shows a marginal increase in the mean score of collaborative strategy over the guided inquiry strategy.

Research Question 2: The summary of the result shown in Table 2 indicates that students taught using the collaborative strategy (experimental group) obtained a higher mean score than those taught using guided inquiry showing that collaborative teaching strategy (CTS) is the most facilitative and most effective.

Testing of Hypotheses

Hypothesis One ($H0_1$): there is no significant difference in the performance of students taught ecology using the collaborative teaching strategy and those taught using guided inquiry strategy.

Table 3: Summary of z-test analysis of the performance of students in experimental (collaborative) and Control Group (Guided inquiry)

Teaching Strategies	N	$(\bar{x})$	SD	z-cal	df	Table Value	Decision at p<0.05
Collaborative (Experimental Group)	80	28.85	8.46	2.81	158	1.96	*
Guided inquiry (control group)	80	26.23	6.39				

N/B: * = Significant at p < 0.05

Table 3 shows the calculated z-value of 2.81 while the table -value is 1.96. Since the z-calculated is greater than the table-value, the null hypothesis stating no significant difference in the performance of students taught ecology concepts using the collaborative strategy and those taught ecology concept using guided inquiry strategy is rejected. This shows that students taught ecology concepts using the collaborative teaching strategy performed significantly better than those taught using guided inquiry strategy. The high performance was concluded to be due to the teaching-learning method and interaction that took place between the collaborative groups.

Hypothesis Two ($H0_2$): There is no significant difference in the most facilitative and effective teaching method with respect to collaborative and guided inquiry teaching method.

Table 4: Summary of z-test analysis of the performance of students in experimental (collaborative) and Control Group (Guided inquiry)

Teaching Strategies	N	$(\bar{x})$	SD	z-cal	df	Table Value	Decision at p<0.05
Collaborative (Experimental Group)	80	28.85	8.46	2.81	158	1.96	*
Guided inquiry (control group)	80	26.23	6.39				

N/B: * = Significant at p < 0.05

Table 4 shows a confirmatory analysis of table 3 indicating the calculated z-value of 2.81 and the table -value is 1.96. Since the z-calculated is greater than the table-value, the null hypothesis stating that the mean scores of students taught ecology concept using collaborative and guided inquiry do not differ significantly is rejected. This shows that students taught ecology concepts using the collaborative teaching strategy performed significantly better than those taught the same concept using guided inquiry strategy. Collaborative teaching strategy is therefore seen as being most facilitative and effective.

Discussion of Results

In this study, collaborative and guided inquiry strategies were used in teaching ecology concepts. A comparison made between the academic performances of students in the two groups as shown in Table 2 indicates that the collaborative

strategy is superior to the guided inquiry teaching strategy as it gives room for interaction, sharing views and ideas freely etc. This is in agreement with Johnson and Johnson, (1989) data which suggested that high-achieving students gain much from their exposure to diverse experiences and also from peer tutoring. It helps students to take responsibility for their own learning as they gain confidence in their ability to communicate and reason freely. The guided inquiry teaching strategy cannot achieve this easily. The most facilitative and effective strategy between these two strategies with respect to the performance of students in ecology concepts is the collaborative strategy. This agrees well with Tinzman *et al,*(1990) that collaborative teaching strategy facilitates learning greatly if the teacher creates learning tasks that encourages diversity aimed at high standards of performance to all students.

CONCLUSION

Based on the findings, the following conclusions were made:

i. The collaborative teaching strategy enhances the students' performance in ecology concepts.
ii. Collaborative teaching strategy was the most facilitative and effective teaching strategy.

EDUCATIONAL IMPLICATION

- Teachers should employ the use of collaborative teaching strategy in the classroom or school environment especially when teaching ecology concepts. If this is done, learners will benefit immensely from this strategy.
- Teachers should ensure that learners are actively involved during the learning process. The teacher in this strategy is a behaviour modifier.

References

Atwood, R. K. and Stevens, J. J. (1978). Do cognitive preferences of ninth grade students influence science process achievement? *Journal of research in science teaching* Vol. 15 No 4.

Barnett, H. C. (2004). An investigation of relationship among Biology achievement. Perception of teacher style and cognitive preferences. *Journal of research in science teaching*: Vol 111, 114-147.

Bojuwoye, O. (2006). Crisis in Science Classroom- poor enrolment of Secondary school students in Science Subjects and its implications for Science Teacher. STAN, Vol. 23, Nos 112.

Brandt, R. S. and Meck, A. (1990).Coorperative Learning (Entire issue) *Educational leadership. 47(4).*

Bruner, J.S. (1973, 1975 and 1990). Use of student centred problem based, discussions to enhance learning. *Harvard Educational Review,* Vol. 45. No. 1 P.21 – 23.

Cohen, E.G. (1986). Designing group work: Strategies for the heterogeneous class room.Newyork; *Teachers college press.*

Collins, A. (1989). Knowing, learning and instruction: Essays in honor of Robert Glasser (PP. 453- 494). Hillsdate, *NJ:Lawrence Erlbaum Associates*

Cook, B. (2004), A comparison of researchers' attitudes towards their included students with mild and severe disabilities. *The Journal of Special Education* Ed (4), 203 – 213.

Crook, C. (1994). Computers and the Collaborative Experience of Learning, London, Routledge.

Dolmatz, M and Wong, H. (2001). Physical science: ideas and investigations in science. Teachers manual. Eaglewood Cliffs, N. J., prentice –Hall.

Ezeife, A. N. (1990). Sex and environment as factors in physics achievement international *journal of educational research*. 4, 17-23.

Friend, M. and Pope, K. (2005). Creating schools in which students can succeed. Kappa Delta Pi Record, 41 (2), 56-61.

Forley, U. (2006). Developing Inquiry Skills with an experimental social studies curriculum. *The Journal of Educational Research* 63, No. 1 (September, 2006):35.

Gershon, A. (1978). An attempt to evaluate the MABAT project (Biology for the educationally disadvantaged) by means of thesis. The Hebrew University of Jerusalem.

Graves, D.H. (1983). Writing: Teachers and children at work. Portsmouth, Nll: Heinen Educational Brooks.

Herber, H. L. (2008). Teaching reading in content areas (2nd ed). Eaglewood Cliffs, NJ: Prentice-Hall.

Jungworth E. (1978). Cognitive preference testing in the evaluation of curriculum implementation. A critical view I. Proceedings of the Batsheva international seminar on curriculum implementation in science education, Rehorot, Jerusalem.

Klinckman, E. (1970). *Biology Teacher's Handbook.* New York: John Wiley.

Klingner, J. and Vaughn, S. (1999). Students' perceptions of instruction in inclusion classroom: implications for students with learning Disabilities. *The council of Exceptional children*. 66 (1). 23-37.

Klingner, J. Vaughn, S. Schumm, J. Cohen, P and Forgan J. (1998). Inclusion or pull-out: which do students prefer? *Journal of learning Disabilities*, 31 (2). 148-158.

Larivee, B. (1985). *Effective teaching for successful main streaming*. *New York Longman.*

Maxwell, N. L. (2005). Problem-based learning and high school macroeconomics: a Comparative study of instructional methods. *J. Econ Educ, 36(4), 315 – 331.*

Meck C. M. (2000). Student passivity during cooperative small group in Biology. *Journal of Educational Research*, 85 (5), Pp 261-273.

Odubumi, O and Balogun, T. A. (2001). The effects of laboratory and lecture teaching methods in cognitive achievement in integrated science. *Journal of research in Science teaching.* 22(5) 150-162.

Odubumi, O. and Balogun, T.A. (1991). The effects of laboratory and lecture teaching methods in cognitive achievement in integrated science and Biology. *Journal of Research in Science teaching 28(3), 213 – 224.*

Okonkwo, S.C. (2004). Enriching Mathematics Education. Implications of the teaching proceedings of the 41st Annual Conference of Science Teachers Association of Nigeria. 275 – 278.

Palinesar, A.S and Broom, A.L (1989). Classroom dialogues to promote self-regulated comprehension. In J. Brophy (ED). Teaching for understanding and self-regulated learning (vol.1, PP 35- 71). Volume I. Greenwich, CT: JAI Press.

Palinesar, A.S, Ransom, K,and Derber, S.(1988/1989) .Collaborative research and development of reciprocal teaching. *Educational leadership, 46 (4) 37-40.*

Qutub, T. and Musa, Y. (1973). Secondary Environmental Science Methods. Columbus, Ohio: Charles E. Merrill. Pp. 141 – 154.

Renner J. and Stafford, D. (1972). Teaching Science in the secondary schools, New York. Haroer and Row. Pp. 235-253.

Roth W.M. (1994). Experimenting in a constructivist High school physics laboratory. *Journal of Research in science Teaching, 31 (2), 197-223.*

Salau, M.O (2005). An analysis of students enrollment and performance in mathematic at the senior school certificate level. *Journal of studies in curriculum.*

Savery, J.(1994): Science Curriculum and liberal education. Chicago University of Chicago Press.

Tinzmann, B.F, Jones, B.F Fennimore, J B akker, C, Fine, C and Piierce (1990): What is the Collaborative Classroom? NCREL, Oak

Brook.Online:http//www.ncrel.org/sdrs/areas/rpl esys/collab.htm. 02/05/06

Vaughn,S. Elbaaumn, B., Schumm, J. and Hughes M. T. (1998). Social outcomes for students with and without learning disabilities in inclusive classroom. *Journal of learning Disabilities*, 31 (5). 428-436.

Vaughn, S. Elbaum,B and Schumn J.S,(1996): The effectiveness of inclusive on the social functioning of students with learning disabilities. *Journal of Learning disabilities.* 29(6) 598 – 608.

Vygotsky, L.S. (1978). Mind in Society. The Development in Higher Psychological processes. Edited by M. Cole, V. John-Steiner, and Harvard University Press.

WAEC (2011) Chief Examiners Annual Report.