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EFFECT OF COLLEGIAL TEACHING STRATEGY ON ACADEMIC PERFORMANCE AND RETENTION OF SCIENCE CONCEPTS AMONG SCIENCE EDUCATION STUDENTS IN USMANU DANFODIYO UNIVERSITY, SOKOTO NIGERIA

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ABSTRACT
This study evaluated the effect of collegial teaching strategy on academic performance and retention of science concepts among science education students in Usmanu Danfodiyo University, Sokoto Nigeria. The study adopted quasi experimental and control groups design involving pre-test, posttest and post post-test to determine retention level. The two groups involved in the study were pre-tested, treated, post tested and post post-tested for retention purpose. One hundred level students of Science and Vocational Education Department are the population of this study totaling eight hundred and sixty-seven (867). Samples of eighty students were selected for the study using convenient sampling technique. The instrument used for data collection was multiple choices Performance Test on Science, Technology and Mathematics (PTSTM). Items in the instrument were obtained from the content of the course SED 101- Introduction to Science, Technology and Mathematics. Senior Lecturers with PhD in Science Education validated the instrument and reliability index of 0.74 was obtained using split-half method. Pearson Product Moment Correlation was used first to determine the correlations of the two halves before Brown Prophesy was used to determine the reliability of the full instrument. Data collected were analyzed using descriptive statistics and t-test analysis at 0.05 level of significance. Result from findings showed that there is significant difference between the academic performance of students in experimental and control groups in favor of experimental group. No significant difference between the academic performance of male and female students in experimental group was observed while in the post post-test for retention, significant difference between the academic performance of students in experimental and control groups in favor of experimental group was found. On the ground of the findings the research recommends among others that Collegial teaching strategy should be use at universities as an instrument for meaningful and effective learning of science and its related fields as well as improvement of student's performance and retention in those fields.

Keywords: *Collegial Teaching Strategy, Lecture Method, Retention, Academic Performance, Science Education*

INTRODUCTION
The relevance of science as indicated by the Federal Government of Nigeria could not be overemphasized; this could be as a result of the general belief that science is inevitable for improving and changing skills, attitudes and cognition by increasing students' store of knowledge about themselves, their environment and the world at large. It is on this ground that hands most be on desk in order to realize a better way

for effective and efficient teaching and learning of science for the actualization of this assertion. Teaching methods can be defined as the method in which a teacher delivers his subject matter to students, based on pre-determined instructional objectives, in order to promote learning in the students. There have been vigorous searches for strategies to improve the quality of instruction in schools and subsequent student learning for an enhanced performance most especially in the field of science and its related disciplines, thus the need to look at collegiality teaching strategy and lecture as its affects performance among science education students and retention.

Collegiality refers to the quality of the relationship among members of staff in a school setting. Seldom has the term carried with it a positive value, referring to good (supportive, stimulating, rewarding, equal/democratic) relationship among equals (Kelchtermans, 2006). Staff collegiality could also imply cooperative efforts among teachers in pursuit of a common goal of effective teaching and learning in a typical school setting. This means collegiality entails collaboration and shared purpose among teachers in furtherance and realization of a common school goal. Shah & Abualrob, (2012) argued that although school staff collegiality seems to be limited to relationship between teachers as peers, it typically does enhance the relationship between teachers and students there by proving a positive working relationship among teachers build by the reason of collaboration among themselves for the realization of effective teaching and learning process which is the ultimate goal of school system. Collegiality and collaboration are terms often used by educators interchangeably as they convey similar meaning and implications. According to Ketchtermans, 2006, collaboration is a descriptive term referring to cooperative actions, while collegiality refers to the quality of the relationships among staff members in a school setting. Hence, collegiality implies a normative dimension that goes beyond mere description and refers to an aspect of the school's organizational culture. The actual achievements of working together are determined by the quality of relationships among members of staff in a giving organization. Equally important, the actual achievements contribute greatly to the meaning and relevance of the professional relationships. It is important noting that both collaboration and collegiality always appear in the particular context of a school at a particular moment in time. Both terms constitute important working conditions for teachers and as such they influence the professional development of teachers and school. Collaborative teaching according to Shah (2012) is diadem-teaching through collaboration to carefully planned and infused learning activities. Collaborative teaching which is also called team teaching as its best very rich and satisfying experience for both teachers and students where more learning takes place. Unlike in

a single classroom, teaching is done in quite different ways by more than one teacher, in doing so, teachers consider many factors so as to make it effective and efficient. Few among such factors like students' background, content, process of delivery, ability level of the students, age, academic level and students' comprehension to mention but a few. These factors are meant to be harness by two or more school teachers who are working together for the common good of the students and ultimately realization of the objectives of school system which is meaningful teaching and learning. Teachers sometimes find it difficult to do it alone beginning and going through the process without support. So team teaching is introduced as a possible remedy.

Collegial teaching strategy can be a wonderful experience when effective and efficient planning and communication are in place beginning day one. According to National Education Association NEA (2015), six steps are very essential and helpful when preparing for collegial teaching experience. These steps are; establish rapport, identify your teaching styles and use them a cohesive classroom, discuss strengths and weaknesses, discuss individual educational plans and regular educational goals, formulate a plan of active act as a unified team and finally take risk and grow. Scholars argued that collegiality in school system and any other organization does not happen by chance (Ketchtermans, 2006). Gramston & Wellman 2003 insisted that efficient and effective collegiality in school system needs to be learned. It is therefore believed that the ground work for a collaborative and collegial culture is essential for school teachers who realize that a collection of quality teachers working independently may not produce the same results as interdependent colleagues who share and develop professional practices together. Shah, (2012) and Fullan (2013) opined that collegiality among teachers as measured by consistency of communication; mutual support and help are vital indices of implementation success. They concluded that the benefits of teacher collegiality and collaboration include greater students' performance, more positive interpersonal relationship and cohesion as a staff, increase social support within the staff and enhance self-esteem for teachers. This is a very clear indication that when it comes to helping people find fulfillment in their work in any given organization, there is nothing more important than team work like in collegial circles.

From the above assertion, it is important to note that when collegial teaching strategy is involved in teaching and learning of science concepts, there is a strong tendency for effective and efficient teaching and learning. This is because science is a broad field and experts with different skills, knowledge and technical know-how, when collectively share ideas and work together, it will not only result to healthy

working atmosphere amongst teachers but will definitely bring about meaningful teaching and learning of scientific concepts. Lecture method on the other hand permits a great deal of information to be passed to the learner and favours handling of large classes. Lecture teaching method is concerned with the teacher being the controller of the learning environment, the power and responsibility are held by the teachers and they play the role of instructor and decision maker. They regard students as having 'knowledge holes' that need to be filled with information.

In spite of this advantage, the lecture method does not stimulate students' innovation, inquiry and scientific attitudes. It rather encourages students' regurgitations of facts which can easily be forgotten (Okwilagwe, 2002). However, there is still a need to search and incorporate modern instructional strategies which the advanced world has long accepted into their classrooms. Thus the need to look at collegial teaching strategy and lecture method to see if there will be any effect on the students' academic performance and subsequently retention. In lecture method of teaching, teacher transmits information (subject matter content) verbally to his students, sometimes writing on the chalkboard. The students listen and take notes of facts and ideas that are considered important and also sometimes asking the teacher questions for clarification (Uwameiye and Ojikutu, 2008). Here, one teacher handles a course or subject irrespective of whether students follow or not. Lecture method of teaching focuses on rote learning and memorization instead of meaningful learning (Okwilagwe, 2002). It does not support student-centered and task-based approaches to learning, neither does it encourages interactions between previous learned concepts and present concepts of learning. This approach may likely hinder one of the aim of traditional education which is to transmit to a next generation those skills, facts, and standards of moral and social conduct that adults deem to be necessary for the next generation's material and social success. Teachers are the instrument by which this knowledge is communicated and by these standards of behavior are enforced. Lecture teaching methods include lecturing, dictation and note taking where the learner is given contents to memorized and to read reproduce when ask in an examination. These methods are inadequate as they are not interactive; they do not facilitate learning adequately, thus direct result of lectures is that student only memorizes facts (Ibrahim, 2003).

Retention here is seen as the ability to store what has been learned by an individual student and able to recall what has been stored thereafter. Retention of scientific concepts today has become one of the most important factors in a classroom setting. Aggarwal (2008) defines retention as a process of recollecting of the past experience in the sub-conscious mind of the individual in form of mental experience. Retention

plays a vital role to what the teacher does; it determines the time teachers spend in reviewing lesson from the days or week. According to Bichi (2002) retention is the ability to retain and later remember information or knowledge gained after learning in to memory. Giginna (2013) observed that, stimulating learning environment, interest and activity oriented teaching strategies are all that the learner need to retain new learned information. Retention could be explained as the process or ability to retain and remember things and experiences learned by an individual at the later time. This could be achieved when experiences are coded in the memory. According to Bichi (2002) appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane. It is important to note that, the type of resources used both human and material resources to the large extent determine the level of retention to occur among students most especially in the field of science and its related areas.

STATEMENT OF PROBLEM

There has been a drastic reduction in the level of performance by students at all levels of education in Nigeria most especially in science related subjects (Matazu, 2014). The seemingly decline in the standard of education in Nigeria could be attributed to many factors which are rooted in psychological, physiological or environmental. Parent, teachers and other stakeholders often become perplexed as to what factors are actually responsible for the decline in students' performance in schools. This argument has led some scholars to attribute the fall in performance to: poor condition of service for teachers; lack of qualified science teachers; inadequate supply of facilities and equipment for teaching and learning of science as well as lack of motivation, lack of instructional materials; and wrong method of teaching science (Emaikwu & Nworgu, 2005). The decline in the academic performance of students at post primary and secondary level is arguably connected to pedagogical approaches used by teachers in schools. It has been reported that learning and understanding of school subjects have been frustrated by the clumsy methods and instructional materials used (Etukudo, 2006). In a related development, Salau (2009) opined that poor teaching method was the factor responsible for the poor students' performance in public examination. It is obvious that efficient and effective teaching method has the possibility of improving students' interest, performance and retention at all level of education in Nigeria. The strategy employed in any teaching and learning situation is of great importance, because the way teachers present subject matter to learners may make them to like or dislike the subject. Mtsem (2011) argued that teaching method affects the responses of students and determines whether they are interested, motivated and involved in a lesson in such way that it brings about

meaningful learning. This simply implies that the use of appropriate methods of teaching brings about good teaching and learning of school subjects particularly science related discipline. Science and science related course at the university are bulky in nature. Equally important the students' population in these fields at the university is scaring thus when a single lecturer is assign to any of these courses, it will lead to unavoidable rush over the content to cover. Similar rush over the marking of continuous assessment and examination is possible and that could be responsible for the poor performance of students in these disciplines. It is against this background that, this study examined the acquisition of science knowledge using collegial instructional strategy and lecture method with the view of determining the effect of each method on the academic performance of science education students and retention in Usmanu Danfodiyo University, Sokoto, Nigeria.

RESEARCH OBJECTIVES

The objectives of this research are as follows:

a. To find out whether there is any difference in the performance of students taught STEM using collegial teaching strategy and lecture method
b. To ascertain if there is any difference in the performance of male and female students taught STEM using collegial teaching strategy
c. To find out the effect of collegial teaching strategy on the retention of STEM concepts among science education students of Usmanu Danfodiyo University, Sokoto

RESEARCH HYPOTHESES

The hypotheses of this research work are as follows;

a. There is no significant difference in the performance of students taught STEM using collegial teaching strategy and lecture method
b. There is no significant difference in the performance of male and female students taught STEM using collegial teaching strategy
c. There is no significant difference in the retention of STEM concepts among science education students of Usmanu Danfodiyo University, Sokoto when taught using collegial teaching strategy and lecture method

METHODOLOGY

Quasi experimental research design was used for the study. According to Wasagu (1998), the characteristics of experimental design permits partial control of the variables in the study. Matazu (2014) argued that quasi experimental design will likely allow for convenient assignment of treatment to groups with minimal disruption in educational situation. Quasi experimental research design has the

power of non-randomization capable of checking a threat to internal validity that may arise from some intervening variables of the study. Pre-test, post-test groups assignment was adopted with subjects of the study assigned into experimental and control groups. Pre-test was conducted to all groups and subjects in order to ensure the equivalence of the subjects, after that, the experimental group received treatment with the collegial teaching strategy while the control group received treatment with the conventional lecture method. Both experimental and control groups were taught concepts in SED 101: Introduction to Science, Technology and Mathematics.
The structure of the design is represented below:

EG,	Y_{00}	X	Y_{01}	R_0
CG,	Y_{11}		Y_{02}	R_1

Where:

EG	=	Experimental group (collegial teaching strategy)
CG	=	Control group (lecture teaching method)
Y_{00} and Y_{11}	=	Pre-test for experimental and control groups respectively for equivalence
Y_{01} and Y_{02}	=	Post-test for experimental and control group respectively for performance
R_0 and R_1	=	Post posttest for experimental and control groups respectively for retention
X	=	Treatment given (Collegial teaching strategy).

The experimental and control groups were taught SED 101- Introduction to Science, Technology and Mathematics Education under similar conditions i.e. the same number of lesson, time and at similar hour of the day. The researchers did the teaching by themselves in both the experimental and control groups expect in the experimental group where additional experts were used. While experimental group was taught using collegial strategy with group of experts in the same field, control group was taught using single lecturer- lecture method.

The populations of the study are all one hundred level students of Science and Vocational Education Department of Usmanu Danfodiyo University, Sokoto. Samples of eighty students were selected for the study using convenient sampling technique. The instrument used for data collection was Performance Test on Science, Technology and Mathematics (PTSTM). Items in the instrument were obtained from the content of the course. Senior Lecturers with PhD in Science Education validated the instrument and reliability index of 0.74 was obtained using split-half method. Pearson Product Moment Correlation was used first to determine the correlations of the two halves before Brown Prophesy was used to determine the

reliability of the full instrument. The researchers did the collection of data and t-test statistics was used in analyzing the data collected.

Hypotheses Testing and Results

Table 1: Pre-Test Performance of Experimental and Control Groups for Equivalence

Groups	N	Mean	Std. Deviation	t-cal.	t-critical	Remark
Control Pre-test.	40	8.91	3.631	0.353	1.97	Not Significant
Experimental Pre- Test.	40	9.09	3.428			

α = 0.05 (two-tailed)

Table 1 above indicates that, there is no significant difference between the performance of the control and experimental groups during pre-testing. This shows that the two groups (control and experimental) are homogenous before the commencement of the treatment. Thus the result revealed equivalence level of the subjects of the study. This further implies elimination of biasness in-terms superiority or otherwise of the subjects before the treatment.

Table 2 for Ho1: Post Test Means of Control and Experimental Groups

Groups	N	Mean	Std. Deviation	t-cal.	t-Critical	Remark
Control Post Test.	40	9.23	4.314	2.734	1.98	Significant
Experimental Post Test.	40	14.45	3.431			

α = 0.05 (two-tailed)

Result from Table 2 above indicated the calculated t-value of 2.734 which is greater than the critical value of 1.98 at 0.05 level of confidence. This implies that the first null hypothesis is rejected which means that, there is a significant difference in performance students between those that were taught using collegial teaching strategy and those that were taught using lecture method in favor of the experimental group that were exposed to collegial teaching strategy.

Table 3 for Ho2: Means of male and female students in Science, Tech, and Maths

Groups		N	Mean	Std. Deviation	t-cal	t-critical	Remark
Male Post Test		28	9.89	3.542	1.186	3.280	Not Significant
Female Post Test		18	11.43	4.732			

α = 0.05 (two-tailed)

Results on table 3 showed the t-critical value of 3.280 which is greater than the t-calculated value of 1.186 at 0.05 level of significance. Thus this implies hypothesis two is retained, there is no significant difference in the performance of male and female students taught science, technology and mathematic using collegial teaching strategy. This further implies that both male and female students can perform better if science and other science related fields could be taught using collegial teaching strategy.

Table 4 for Ho3: Means score comparing Retention of Experimental and Control groups

Groups		N	Mean	Std. Deviation	t-cal	t-critical	Remark
Exp. post-test.	Post	40	12.89	4.237	2.341	1.98	Significant
Control post Post-test		40	8.43	6.213			

α = 0.05 (two-tailed)

Result from Table 4 above indicated the calculated t-value of 2.341 which is greater than the critical value of 1.98 at 0.05 level of confidence. This implies that the third null hypothesis is rejected which means that, there is a significant difference in the retention level of students between those that were taught using collegial teaching strategy and those that were taught using lecture method in favor of the experimental group that were exposed to collegial teaching strategy.

DISCUSSION OF RESULTS

Results from this study have indicated a relative effectiveness of collegial teaching strategy in the teaching and learning of science, technology and mathematics at Usmanu Danfodiyo University, Sokoto. Findings also showed clearly that collegial teaching strategy enhances retention of scientific concepts. Equally important, the study also revealed that university students taught using the collegial teaching strategy performed better in science, technology and mathematics performance test

than those taught using lecture method. This is not unconnected to that fact that students were exposed to scientific concepts by group of experts in the field with diverse experiences, techniques and uniqueness in teaching of science including allowing active students' participation in science learning activities. This clearly revealed a singular fact that collegial teaching strategy is an antidote to dwindling performance experienced by science students and could further effectively enhance students' performance in science. The finding of this study is in agreement with the findings of Ingersol, (2001) and Kelchtermans, (2006) who also found out that students taught using collegial teaching strategy tend to perform better in a classroom learning tasks. This could be hinged to the fact that students were able to experience variety from diverse teachers with different enormous experiences and mastery of subject matter which resulted to an improved performance in science. The study strongly fill the lacuna of poor performance experienced by science students through revealing the effect of collegial teaching strategy which provides the impetus for students to understand better certain scientific, technological and mathematics concepts from group of experts with ease.

Findings of this study is also in consonance with the findings of the Gramston & Wellman (2003), Shah, (2012) and Fullan (2013)who studied the effects of a collegial teaching strategy on pre-service teachers' outcomes in Science. It was discovered that collegial teaching strategy seems to be more effective in yielding positive results than using inquiry strategy. In a related development, findings in this study revealed a better retention level from students when they are taught science, technology and mathematics concepts using collegial teaching strategy. This showed that the method is superior over traditional lecture method in terms of enhancing retention of learned scientific concepts. Students in the collegial teaching strategy classroom were found to show a better retention level of concepts presented to them. This implies that with the services of variety of experts in science, meaningful and effective learning is bound to occur. This finding is in agreement with the findings of Shah, (2012), who discovered that collegial teaching strategy is significant in aiding learners acquire a lot from a given curriculum. This is not unconnected to the fact that in collegial teaching strategy, experts with different experience, techniques and expertise handle students with the view of impacting knowledge. The high retention level observed from collegial class group may not be unconnected to the fact that interactions between teachers and students in collegial learning groups is intense and prolonged in classes with meaningful and effective feedback, reinforcement, and support from students. Gender of students was found not to be a hindrance to effective and meaningful learning of scientific concepts most especially when collegial teaching strategy is employed. It is on that ground that the finding of this

study indicated no significant difference in the performance of male and female students when collegial teaching strategy is employed. This finding is in agreement with that of Viann (2002) who studied gender differences and their effects on collegial learning in chemistry classroom setting and found out that gender is not a barrier to learning. The finding also disagrees with the findings of Bichi (2002) who found out that gender played a significant role in determining the academic performance of students.

CONCLUSION

From the findings of this study, it can be concluded that collegial teaching strategy is more effective and efficient than traditional lecture method in teaching and learning of science, technology and mathematics in Usmanu Danfodiyo University, Sokoto. It is also safe to say collegial teaching strategy was found to be an antidote to poor academic performance of students most especially in science related disciplines and could also enhance effective and efficient retention of learned scientific concepts.

RECOMMENDATIONS

The following recommendations are put forward for improvement

1) Collegial teaching strategy should be use at universities as an instrument for meaningful effective learning of science and its related fields as well as improvement of student's performance in those fields.
2) Science Education lecturers should bear the stress of collegial teaching and used it meaningfully. They should carry lower level (young) lecturers along so as to imbibe the culture of collegiality as they grow in the profession.
3) Collegial teaching strategy should be adopted as a means of teaching science and other related fields to both male and female university students as it has the capability of improving better students' performance and retention of scientific concepts.

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