EFFECT OF CONCEPT MAPPING TEACHING STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN AGRICULTURAL SCIENCE IN UMUAHIA EDUCATION ZONE, ABIA STATE

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Introduction

Agricultural Science is an experimental science which deals with food production in other to ensure national food security. This importance gave rise to a comprehensive definition of Agricultural science as the science of rearing of animals and raising of crops for human consumption (Erebor, 2003). It is a very important subject in our society and educational system, because it is one of the courses that empowers her people with entrepreneurial and vocational skills for sustainable agricultural development and empowerment of the people especially the youth to ensure national food security. Agriculture is the mainstay in any Nation's economic and social development (Joshua, 2007), as it contributes to about 68% of the labour force in Nigeria and also as it is also the principal sources of livelihood in Nigeria (Philip, Nkonya, Render & Oni, 2008). The importance has made Agricultural Science to remain one of the few subjects that is offered at Primary, Junior Secondary, Senior Secondary Schools and Tertiary institution.

Agricultural Science plays a very important role in the revival of the Nation's crumbling economy through effective stimulation of the students interest in the study of Agricultural Sciences. When the students develop strong interest in the study of agricultural science, it will increase agricultural activities through active participation of the youth, thereby making the youths

to be gainfully employed in agricultural and its allied industry or to be self-employed.

The benefits of agriculture to make the youths to be self-employed and entrepreneur have made Agricultural science to be classified as a vocational subject in the National Policy on Education (FRN, 2004), hence it is meant to provide entrepreneurial skills for the students for national food security. A good knowledge of Agricultural science is a pre requisite for the study of Agriculture and its allied Courses such as Agricultural Economics, Animal Science, Crop Science and Production. This importance gave rise to the objectives of Agricultural Science as stipulated in the Agricultural Science Curriculum to include, stimulating and sustaining student's interest in Agriculture, enabling students to acquire basic knowledge and practical skills, preparing students for future occupations (Madu & Ebere,2016).

When these objectives are achieved it will stimulate student's interest in the study of Agricultural Science thereby making them to take career opportunities in Agriculture. These objectives can be achieved through the teachers employing the most effective methods in teaching the subject to the students which will in turn reflect in enhanced academic achievement of the students in Agricultural Science. This enhanced academic achievement will stimulate the students interest and increase the students participation in Agriculture. The methods of teaching adopted in the teaching of Agricultural Science will determine the students' academic achievement.

It is been indicated that students' academic achievement in Agricultural Sciences have been declining over the years as reported by WAEC chief examiner's report (2014).This decline in academic achievement of students may be attributed to the different teaching methods adopted by the Agricultural Science teachers. The teaching method mostly applied for teaching of Agricultural Science presently in secondary schools still involves the conventional method which may not have been yielding the desired result in the academic achievement of the students in Agricultural Science. Thus, this may not stimulate the student's interest in agriculture and may pose a threat to effective participation of the youths in Agriculture activities for national food security and sustainable development. Aside the conventional method of teaching agricultural science which are lecture method, discussion and demonstration methods, other teaching methods such as the meta cognitive teaching methods such as concept mapping, mild mapping, ethno science, computer assisted instruction, problem solving, field trip amongst others can be employed in the teaching Agricultural Science (Fasasi, 2014). It is on this bases that the present study seeks to investigate the effect of concept

mapping teaching strategy on the academic achievement of the students in agricultural science.

The conventional method of teaching has been the most predominant method used in teaching students Agricultural Science. These conventional methods include; lecture method, project method, discussion method, field trips and excursions. The most commonly used conventional method for teaching of Agricultural Science at the secondary level is the lecture method (Fasasi, 2004). Nworgu (2006) described conventional lecture method as the verbal presentation of concepts and ideas to the students. Lecturing is perhaps the most widely used formal educational method in the world for along time. It is more or less a continuous elucidation by a speaker who wants the audience to learn something from his delivery. Apart from formal educational setting, it is also used in political speeches and religious sermons. The word "Lecture" has its etymological roots in the Latin word *lectus* (to read). Lecture method is essentially a one way flow of communication from the teacher to the students. It is a teacher-centred or teacher-dominated approach. The teacher does most of the talking while the students remain as passive listeners taking down notes. This is why it is sometimes referred to as didactic (*to teach*) approach or talk-and-chalk. It assumes that the teacher knows it all and she/he pour the knowledge on the students. On the contrary, Ezeudu (2013) commenting on the merits of lecture method said that large course content are covered within a limited time, and distractions on the part of the students are removed as the method keeps them thinking all the time. As the students write faster, their co-ordination, listening and writing abilities improve and these help them when they embark on independent studies and research at higher educational levels.

The use of this conventional method of teaching for teaching Agricultural Science to the students have continuously been used by teachers despite the call for the use of modern teaching methods which exist in meta cognitive mode of teaching. According to Awofala and Awolola (2011) one of the meta cognitive strategy of teaching that may be adopted in the teaching of Agricultural Science to the students involves student-centred, activity-based and minds-on approach that caters for individual needs and differences, learning styles, interests and abilities. An example of the meta cognitive teaching strategy which is student centred and inquiry-based method to organize learning is the concept mapping.

The concept mapping serves as a strategy to help learners organize their cognitive framework into more powerful integrated patterns (Kinchiri, 2006). In this regard, it serves as a Meta-knowledge and Meta-learning strategy. Indeed, many researches on concept mapping have proved that it can improve meaningful learning and help learners independently which can help

improve the academic achievement and retention of students (Novak & Canas, 2008).

The concept maps can be used as knowledge representation tool to reflect relationship that exist between concepts that resides within an individual long term memory(Jacobs-Lawson & Hershey 2002). Thus, when constructing a concept map, the focus is the relationship among concepts. This has made the concept mapping to be reported as one of the effective delivery techniques to help the female students learn more meaningfully in Agricultural Science and for students to have better academic achievement and retention in Agricultural Science. This was evident as Ezeudu (2011) in his finding revealed that Students taught Biology using concept mapping strategy had a higher achievement and retention than those taught using conventional method while Otor (2013) in his findings revealed that Students taught difficult chemistry concepts using concept mapping strategy achieved higher and significantly better than those taught using conventional method. It is on this bases that the present study will seek to determine the effect of concept mapping teaching strategy on the academic achievement of the students in agricultural science.

Furthermore, to adopt a wholistic approach of the effects of concept mapping teaching strategy on students' academic achievement in Agricultural Science, there is the need to investigate how gender influences the effect of concept mapping on the students and academic achievement in Agricultural Science. Gender, according to Okeke (2008) is the social or cultural characteristics, rotes or behavior which male and female is known for by society. Gender as a factor in science academic achievement has for sometimes generated a lot of concern for science educators. For instance, Otor (2013) who found out that the female students had a higher mean achievement score on students achievement in difficult chemistry concepts using both the concept mapping (Experimental group) and lecture method (control group).Therefore, an investigation of gender influences as intended in this research work would shed further light on the issue concerning the influences of gender on students' academic achievement using a meta-cognitive strategy named concept mapping instructional strategy.

Unfortunately in Nigeria, Youths participation in Agriculture is very low which may be as a result of lack of interest in studying Agricultural Science at secondary school level as well as poor academic achievement recorded in the subject over the years (Madu & Ebere, 2016). These persistent decline in the academic performance of students in Senior School Certificate Agricultural Science Examination throughout the country over the years as recorded by both West African Examination Council and National

Examination Council (WAEC &NECO, 2015). This decline in performance of students has denied the students opportunity of taking up a career in Agriculture which has limited their participation in Agriculture for national food security and sustainable development. The poor performances recorded may be as a result of the conventional teaching methods such as the lecture and discussions method adopted by the teacher in the teaching of Agricultural Science in secondary schools. It is against this backdrop that it becomes necessary to examine the effect of concept mapping on students academic achievement in Agricultural Science and the influence of gender on the effect of concept mapping teaching strategy on the students achievement in Agricultural Science in Senior Secondary Schools.

The purpose of this study is to determine the effects of concept mapping teaching strategy on the academic achievement of Senior Secondary Students in Agricultural Science. To achieve this purpose, the study sought the following specific objectives:

i. find out the mean achievement scores of the senior secondary school students in Agricultural Science taught using the concept mapping and lecture method
ii. determine the mean achievement scores of the senior secondary school Male and Female students in Agricultural Science taught using the concept mapping and lecture method

The following research questions were stated to guide the study;

1. What are the mean achievement scores of the senior secondary students in Agricultural Science taught using the concept mapping and lecture method?
2. What are the mean achievement scores of the Senior Secondary School Male and Female students in Agricultural Science taught using the concept mapping and lecture method?

The following hypotheses were tested at 0.05 level of significance

1. There is no significant difference in the mean achievement scores of the senior secondary school students in Agricultural Science taught using concept mapping and lecture method.
2. There is no significant difference in the mean achievement scores of the Male and Female Senior Secondary School Students in Agricultural Science taught using the concept mapping and lecture method.

Method

The Design adopted for this study was the quasi-experimental. It is pretest-posttest non- equivalent control group design. This is because the researcher cannot randomly sample and assign the subjects to experimental groups. They are already in intact classes (Ali, 2006). According to Nworgu (2006) it is an experiment where it is not possible to assign the subjects to experimental and control groups.

This study was conducted in Umuahia Education Zone of Abia State. Umuahia Education Zone comprised 48 Secondary Schools in four Local Government Areas (L.G.As) namely, Umuahia North, Umuahia South, Ikwuano and Umunneochi. The total number of schools is 48. The choice of the Zone is based on the fact that the Zonal Inspector of Education commented that the students had not been doing well in Agricultural Science. The choice of this Zone is also based on the fact that most of the schools have similar number of facilities in terms of equipment, staff strength, staff qualifications among others. This will give enough room for random selection of the samples. All the senior secondary school two (SS2) Agricultural Students in all the government owned secondary schools in Umuahia Education Zone 2015/2016 Academic Session forms the population of the study, thus the population of the study was 1,687 which comprised 780 Males and 907 Females (Abia State Secondary Education Management Board, 2016). The choice of SS2 Agricultural Science students was because it was not yet an examination class, but preparing for the Senior Secondary Certificate Examination. The sample consisted of 400 students comprising 220 students for the Control group and 180 for Experimental group who form the intact classes. The Control group comprised 97 male students and 123 female students while the Experimental group comprised 88 male students and 92Female students.

Simple random sampling technique was used in selecting one local government area out of the four L. G. As' in Umuahia Education Zone. Following this, Umuahia North L.G.A was picked. Simple random sampling technique was used in selecting two schools from the L.G.A. Simple random sampling technique was used in order to pick the schools with common characteristics such as well-equipped laboratory, school farm experienced Agricultural Science teacher and two intact streams. Simple random sampling technique was used to assign classes to experimental and control groups.

The instrument used for this study is Agricultural Science Achievement Test (ASAT).The instrument covered crop diseases and pest contained in the SS2 Agricultural Science Curriculum was developed. It was a thirty (30) items achievement and retention test constructed using a Table of

specification. The instrument was face and content validated by three experts, with two from the Department of Agricultural Education and one from Educational Measurement and Evaluation. The reliability of the instrument was done using Kuder-Richardson (K-R) formula 21 and the value was 0.86. Lesson plans for both the experimental and the control groups were used for the study.

The experimental procedure began with the training of the Agricultural Science teachers in both schools. This took place during the mid-term break of the school which lasted for one week. The teachers were trained on the use of two teaching methods. Also the contents, objectives and activities of the students were discussed during the training. The lesson plans are the same in terms of their content, instructional objectives and evaluations. The students were pre-tested before the teaching. The experiment lasted for four weeks after which the post-test was administered to two groups. The scores for both tests were collected and the teachers scored the scripts. To reduce error which might arise as a result of teacher differences, all the four Agricultural Science teachers that were used for the study were the regular class teachers in the schools. The teachers taught both the experimental and the control group in each school. All the teachers were given the same lesson plans to maintain uniformity. The lesson plans were extensively discussed during the training under the supervision of the researcher. The teaching for both experimental and control groups was not done by the researcher but by the regular class teachers. This was to avoid Hawthorns effect. The Agricultural Science teachers taught the students in their normal classrooms and Laboratory and school farms. There was training programme for the teachers. During the period, the validated lesson plans for both the experimental and the control groups were discussed between the teachers and the researcher. The researcher gave the teachers common instructions. There were trial teaching by the teachers and the researcher watched and corrected them. All these were to ensure uniformity. All the students received the lessons in their respective normal classrooms. The researcher instructed the teachers not to give notes or assignments to the students so as to avoid exchange of ideas outside the classroom. The pretest and posttest administration gap was four weeks and the period was long enough not to permit pretest to affect posttest scores and also to prevent students from becoming familiar with test items.

The mean and standard deviation scores were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at the 0.05 alpha levels.

RESULTS

Table 1: Pre-test and posttest mean achievement scores and standard deviations scores of Senior Secondary School Students in Agricultural Science due to teaching methods.

Teaching Method	Number of Students	Types of Test				Achievement Gains
		Pre-test		Post test		
		$\bar{X}$	S.D	$\bar{X}$	S.D	
Concept Mapping	180	54.78	9.44	71.66	20.07	16.88
Lecture Method	220	54.37	7.70	60.50	13.75	6.13

The data presented in Table 1 indicated that the students taught using the concept mapping method had a mean achievement score of 54.78 and a standard derivation of 9.44 in the pre-test and a mean score of 71.66 and a standard deviation of 20.07 in the post test, making a pre-test posttest gain to be 16.88 The data also showed that the students taught using lecture method had a mean achievement score of 54.37 and a standard deviation of 7.70 in the pre-test and a mean of 60.35 and a standard deviation of 13.75 in the post-test with a pre-test post-test gain of 6.13

Table 2: Pre-test and posttest mean achievement score and standard deviations scores of Male and Female students in Agricultural Science due to teaching methods and Gender

Teaching method	Types of test	Gender							
		Male				Female			
		No.of Student			Achievement gain	No. of students			Achievement gain
			$\bar{X}$	S.D			$\bar{X}$	S.D	
Concept Mapping	Pre-test	88	54.90	9.60	17.23	92	54.66	10.18	16.56
	Post-test		72.13	19.72			71.22	20.49	
Lecture method	Pre-test	97	55.81	8.69	5.43	123	53.24	6.61	6.67
	Post test		61.24	15.41			59.91	12.31	

The data presented in Table 2 indicated that the male students taught using the concept mapping method had a mean achievement score of 54.90 and a standard derivation of 9.60 in the pre-test and a mean achievement score of 72.13 and a standard deviation of 19.72 in the post test, making a pre-test posttest gain to be 17.23. the result also shows that the female student in the experimental group had a mean achievement score of 54.66 and a standard deviation of 10.18 in the pre-test of experimental group which is lower than that of male students in the pre-test of experimental group, while the female students also had a mean score of 71.22 and a standard deviation of 20.49 in the post-test of the experimental group, which is lower than that of the male students in the post-test score in the experimental group.

The data presented on Table 2 also indicated that male students had a mean score of 55.81and a standard deviation of 8.69 in the pre-test of the control group which was higher than the pre-test of the experimental group, while in the post-test, the male students had a mean score of 61.24 and a standard deviation of 15.41 which was lower than the experimental group. The result also shows that the female students had a mean score of 53.24 and a standard deviation of 6.61 in the pre-test of the control group which is lower than that of the male students score in the pre-test of the control group, while the female students had a mean score of 59.91 and a standard deviation of 12.31 which is lower than that of the male students in the post-test of the control group.

Table 3: Analysis of covariance for mean achievement scores of students in Agricultural Science taught using concept mapping and lecture method.

Sources of variation	Type II sum of square	Df.	Mean sum of square	F.Cal	Significance
Correlated model	14906.213[a]	2.	7453.106	26.678	0.000
Intercept	25109.273	1	25109.273	89.878	0.000
Pre-test	2563.696	1	2563.696	9.177	0.003
Teaching method	12077.405	1	12077.405	43.231	0.000
Error	110909.627	397	279.369		
Total	1842964.000	400			
Corrected total	125815.840				

a R square = .118 (adjusted R squared = 0.114)

The data in Table 3 shows that the Teaching method (lecture method and concept mapping) is a significant factor in the mean achievement scores of the students in the Agricultural Science; this is because the p-value of 0.000 is less than 0.05. This indicates the rejection of the null hypothesis which states that

there is no significant difference between the mean achievement scores of the students in Agricultural Science taught using the lecture method and concept mapping. Thus, this implies that there was a significant difference between the mean achievement scores of students in Agricultural taught using the lecture method and concept mapping.

Table 4: Analysis of covariance for the mean achievement scores of Male and Female students in Agricultural Science taught using concept mapping and lecture method.

Source of Variation	Type II sum of square	Df	Mean sum of square	F.Cal	Significance
Correlated model	14973.369[a]	4	3743.342	13.410	0.000
Intercept	25142.677	1	25142.677	85.559	0.000
Pre-test	2495.380	1	2495.380	8.893	0.024
Teaching method	12120.907	1	12120.907	43.194	0.000
Gender	0.021	1	0.021	0.000	0.993
Teaching method *Gender	66.801	1	66.801	0.310	0.626
Error	110842.471	395	280.614		
Total	1842964.000	400			
Corrected total	12515.840	399			

a. R square = 0.119 (adjusted R squared = 0.110)
Depended variable post -test

The data on Table 4 do revealed that gender was not a significant factor in student's achievement in Agricultural Science. This was indicated by the p value of 0.993 which is greater than 0.05. This implies that we retain the null hypotheses which states that there is no significant difference between the achievement scores of male and female students in Agricultural Science taught using concept mapping and lecture method.

Discussions

The result of the analysed research question showed that students taught Agricultural Science using concept mapping (Experimental Group) had a higher achievement score than the students taught Agricultural Science using the lecture method (control method). This finding was in agreement with the findings of Otor (2013) and Ezeudu (2013) who in separate studies found that students taught concept of chemistry and organic chemistry using concept mapping had a higher achievement mean score than those taught with lecture methods. However, the corresponding result of the analysed hypothesis 1 showed that teaching method is a significant factor in the mean achievement score of students in Agricultural Science, this was because there was a

significant difference in the mean achievement score of students in the Agricultural Science taught using concept mapping and lecture method. This finding is in agreement with Otor (2013) whose findings revealed that there is a significant difference in the mean achievement score of students in difficult chemistry concepts when taught using the concept mapping strategies than those taught using lecture method. The reason for this higher performance by the Experimental group is that students were able to link the new concepts to the relevant concepts they were previously acquainted with.

The implication of these findings is that the concept mapping helps the students to achieve better academic achievement in Agricultural Science which will help to stimulate the students interest in Agriculture and ensures their active participation in agriculture for sustainable development.

The result of the analysed research question two showed that the female students taught Agricultural Science using both the concept mapping (Experimental) and lecture method (control) had a higher mean achievement score than the male students taught Agricultural Science using the concept mapping (Experimental) and lecture method (control group) respectively. This finding is in agreement with the finding of Otor (2013) who found out that the female students had a higher mean achievement score on students achievement in difficult chemistry concepts using both the concept mapping (Experimental group) and lecture method (control group). This could be as a result that female students pay more attention to teaching than their male counterpart. However, result of the test of the corresponding hypothesis two show shows that gender is not a significant factor on the mean achievement score in Agricultural Science when taught using the concept mapping and lecture method. This finding is in line with Nzewi (2010), Okeke (2007) who revealed that there is no significant difference between male and female students mean achievement score in Science and technology when taught using concept mapping and lecture method. But the result is in disagreement with the findings of Aguomoh (2010) and Ukozor (2011) who reported that boys achieved better than girls in sciences. The result also confirmed that the interaction of gender and teaching method was not a significant factor in the mean achievement score of students in Agricultural Science Achievement Test. Therefore, it implies that the use of concept mapping and lecture method do not have effects on the achievement of Male and Female Students in the mean achievement Score in Agricultural Science Achievement Test(ASAT).This findings was in disagreement with the findings of Ezeudu (2013) whose finding revealed that the interaction of method and gender on achievement and retention was significant, which implied that the use of concept maps had relative effects on achievement and retention of male and

female students taught with concept maps than those taught with lecture method.

The implication of these findings is that both the male and female students have equal opportunities and perform equally in Agricultural Sciences, hence this will stimulate the students interest in Agriculture and ensures their active participation in agriculture for sustainable development with total disregard for their gender.

Conclusion

Based on the findings of the study, the concept mapping teaching strategy had a significant effect on the students' achievement in Agricultural Science. Also the female students taught Agricultural Science using both the concept mapping and lecture method performed better than the male students who were taught using both the concept mapping and lecture method respectively, but the performance between the male and female students when taught agricultural science using the concept mapping and lecture method did not differ significantly.

Recommendations

1. The Agricultural Science teachers teaching should adopt the concept mapping strategy in teaching students agricultural science since concept mapping have been an effective teaching strategy for improving students achievement in Agricultural Science Achievement Test.
2. The curriculum planners of teacher training institutions should include the concept mapping strategy in their Agricultural Science method course content. This will ensure that pre-service Agricultural Science teachers acquire the basic skill and training on how to apply the concept mapping strategy.
3. The teachers should ensure that both the male and female students are given equal opportunities in adopting different methods for teaching and learning of agricultural sciences in Secondary Schools.

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