

## EFFECT OF PEER-TUTORING AND SPIDER CONCEPT MAPPING STRATEGIES ON ACADEMIC PERFORMANCE AND SKILLS ACQUISITION AMONG SECONDARY SCHOOL CHEMISTRY STUDENTS IN KATSINA STATE

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### Abstract

*The study examined the effect of peer-tutoring and spider concept mapping strategies on academic performance and skills acquisition of secondary schools chemistry students. 2 hypotheses were developed and used in the study. The study adopted a quasi-experimental design, using pre-test, post-test nonequivalent experimental and control group. The population of the study consist of a total number of 4554 students derived from 26 government senior secondary schools year two chemistry students of Katsina zonal education quality assurance out of which 176 SS II students were sampled and used in the study. Data were collected using two validated instruments with reliability coefficient of 0.81 and 0.73 namely chemistry performance test (CPT) and checklist rating scale. The data collected were analyzed using ANOVA test hypotheses 1 and 2 with the aid of statistical package for social science (SPSS). All test of significant difference was at 0.05 level of significance. The outcome of the study shows that, there exist significant difference in the academic performance mean score of senior secondary school chemistry students exposed to peer-tutoring, spider concept mapping and lecture method in favor of peer tutoring. There exist significant difference in the skills acquisition mean score of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method in favour of spider concept mapping. Based on the findings of this study, the researchers recommended that the federal government of Nigeria through Katsina state ministry of education should collaborate with professional bodies such as STAN and train teachers through workshops and seminars on using Peer-tutoring and spider concept mapping strategies in teaching chemistry at secondary school level.*

**Keywords:** Peer Tutoring, Spider Concept Mapping, Academic Performance, Skills Acquisition,

### Introduction

Chemistry is an artistic enterprise which offers a lot of occupational opportunities in the areas like manufacturing of goods such as pharmaceuticals, food stuffs, packaging, detergents, soaps, flavors, fragrance, paints, candles, agricultural product etc. Chemistry as a science is the study of material substances that occurs on earth and elsewhere in the universe. It is concerned with the utilization of natural substances and the creation of artificial ones (Are & Are, 2017). In other word, chemistry is defined as a science that studies the composition and the ways in which their properties are related to their composition (Oluwaseun & Alabi, 2016). It was as a result of the recognition given to chemistry, in the development of the individual and the nation that it was made as a core subject among natural sciences and other science related courses in the Nigerian educational system.

Scholars (Zakari 2020) identified several method of teaching chemistry to include but not limited to lecture method, discovery method, demonstration method, peer-tutoring method, spider concept mapping etc This suggests that, researchers in the field of education pointed out that, there is a good correlation between proper teaching method and students' academic performance and skills acquisition. The modern teaching techniques include among others concept mapping, peer-tutoring, discovery approach, computer base assessment test etc.

A spider concept map is a kind of map that is used to investigate and enumerate various aspects of a single theme or topic. It helps student to organize their thoughts. Outwardly radiating sub-themes surround the center of the map. It looks a bit like a spider's web, as its name suggests. On the other hand, peer-tutoring is a process in which expert and trained people help and support other people who are less skilled and have low level of knowledge (or expertise), in an interactive, meaningful and organized way.

Skills acquisition is the form of training by individuals or group of individuals that can lead to acquisition of knowledge for self-sustenance. It involves the training of people in different fields of trade under a legal agreement between the trainers and the trainees for certain duration and under certain conditions. Skills acquisition is the manifestation of idea and knowledge through training which is geared towards instilling in individuals, the spirit of entrepreneurship needed for meaningful development. Cletus (2014) further maintains that skills acquisition increases competition and cooperation among people. Therefore, the responsibility of chemistry teachers in schools and colleges is not only to teach students the particular content of knowledge needed for their professional discipline but also to help them develop successful lifelong skills of acquiring knowledge. It is widely agreed that, the backbone of any development is the development in education. Development in education is attaining through quality teaching methods, close supervision and monitoring.

Uchenna and Ayore (2018) investigated concept mapping strategy and its effects on students' performance in senior secondary school Organic Chemistry in Imo State, Nigeria. The findings showed that students in experimental group (concept mapping) had a higher mean performance score than students in the control group (Conventional teaching method). In line with the above Abd El-Hay, El Mezayen and Ahmed (2018) investigates the effect of concept mapping on problem solving skills, competence in clinical setting and knowledge among undergraduate nursing students. The result showed that, there were significant improvements among students knowledge about concept map, simulation case study rubric and problem solving skills, in addition to more than three quarter from students had positive perceptions regarding application of concept mapping in the clinical settings. However, Fatoki (2019) investigated the skills acquisition programmed and youth empowerment in Ondo State of Nigeria. The result revealed that the skills acquisition programmed has been able to provide employment opportunities for youth beneficiaries, reduce their involvement in social vices, improved their standard of living.

### **Statement of the Problem**

Despite the impacts of chemistry to the students and society, the rate of student's failure in chemistry is still on the increase which may be link to many factors such as the use of outdated or traditional teaching strategies and the fact that a lot of chemistry concepts are abstract in nature and hence cannot be fully understand by students. According to the report by Katsina state ministry of education (2020) the rate of chemistry students failure in WAEC increase from 55.07% in 2016 to 62.08%, 61.8%, 57.9%

and 54.2% in 2017, 2018, 2019 and 2020 respectively, (KSMOE, 2020). Factors attributed to the students failure are the continuous increasing class population which makes it difficult for the tutor to handle the class effectively especially with the use of traditional teaching strategies which require too much of talking and hence became more tedious which make teachers tired of the profession and consequently inability to deliver effectively. As stated earlier, development in education is the backbone of national development, therefore with current status of poor man power quality in the country translate the poor situation of the educational quality in the country.

Reference to this fact with the Katsina state secondary schools, the researcher discover the use of traditional teaching strategies such as lecture method, chalk talk method and demonstration method in teaching chemistry in the Nigeria secondary schools as the reasons for massive failure in chemistry as asserted by WAEC chief examiners report (2020). The highlight of the above gap remain number one reason that suit my interest in investigating the effect of peer-tutoring and spider concept mapping strategies on academic performance and skills acquisition among secondary school chemistry students in Katsina zonal education quality assurance by making reference to the concept of organic chemistry.

### **Objectives of the Study**

The study seek to find out:

1. difference in the academic performance mean score of secondary school chemistry students exposed to peer-tutoring, spider concept mapping strategies and those taught using lecture method in Katsina ZEQA.
2. difference in the skills acquisition mean score of secondary school students exposed to peer-tutoring, spider concept mapping strategies and lecture method in Katsina ZEQA.

### **Hypotheses**

The study formulated and is tested the following hypotheses at 0.05 significant level.

H<sub>01</sub>: There is no significant difference in the academic performance mean score of secondary school chemistry students exposed to peer-tutoring, spider concept mapping strategies and those taught using lecture method in Katsina ZEQA.

H<sub>02</sub>: There is no significant difference in the skills acquisition mean score of secondary school students exposed to peer-tutoring, spider concept mapping strategies and lecture method in Katsina ZEQA.

### **Methodology**

The study adopted a quasi-experimental design, using pre-test, post-test nonequivalent experimental and control group. This design is considered suitable for this study because the independent variables (peer-tutoring, spider concept mapping and lecture method) were manipulated so as to observe their effects on the dependent variables (skills acquisition and academic performance).

The study has three groups, (EG<sub>1</sub>), (EG<sub>2</sub>), and (CG<sub>3</sub>). The experimental group 1 was taught using peer-tutoring (X<sub>1</sub>), experimental group 2 was treated using spider concept mapping (X<sub>2</sub>) while the control group (CG) was treated using conventional lecture method of teaching (X<sub>0</sub>). For a period of six weeks, prior the application of treatment to the groups, a pretest (O<sub>1</sub>) was conducted to determine the entry performance of the three groups. A post-test (O<sub>2</sub>) was conducted after the treatment to determine the effect of the peer-tutoring and spider concept mapping on the academic performance and skills acquisition.



**Figure 1: Research plan for the study**

The population of the study consists of a total number of four thousand five hundred and sixty four (4564) students derived from 26 government senior secondary schools year two chemistry students of Katsina zonal education quality assurance.

The students' samples for this study were drawn from year two senior secondary students in three secondary schools offering chemistry from each of the three local governments in Katsina zonal education quality assurance. The researcher divided the entire population in to three clusters (local government). Therefore, using intact class, 176 students were drawn from the three sample secondary schools across the three local government areas to satisfy the requirement of the quasi experimental research design. For the GDSS Magama Jibia (School A) SS2A students were used with a total number of 54 students, in GSSS Yandaki (School B) SS2A class with 60 students were used, while in GDSS Dutsin safe (School C) SS2A class with a total number of 62 students were used.

The instruments of data collection for the study were chemistry performance test (CPT) and the CPT was a multiple choice questions which developed by the researcher from the chemistry content area used in year two senior secondary schools. The instrument comprised of options A-D for each of the test question. The questions were drawn using the curriculum unit in the senior secondary school science curriculum under organic chemistry viz: 1. Liquid Soap 2. Alkanoates 3. Saponification 4. Detergents.

The CPT was obtained using PPMC while that of skills acquisition was obtained using SARS using split half method of odd and even numbered items. The results of the analysis revealed a CPT coefficient of 0.81 where skills acquisition questionnaire shows 0.73 which is reliable enough. Hence from these results, the instrument can be said to be reliable and adequate for the study.

The data collected was analyzed using mean and standard deviations to answer the research questions. Hypotheses 1 and 2 were tested using ANOVA with aid of statistical package for social science (SPSS). All test of significant difference was at 0.05 level of significance.

## Results

**H01:** There is no significant difference in the academic performance mean score of senior secondary school chemistry students exposed to peer-tutoring, spider concept mapping lecture method in Katsina ZEQA

**Table 1: ANOVA of difference in the mean academic performance of senior secondary school chemistry students in experimental and control groups**

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3082.72	2	1541.36	78.38	.00
Within Groups	3402.00	173	19.67		
<b>Total</b>	<b>6484.73</b>	<b>175</b>			

Table 1 presents ANOVA of significant difference in the academic performance mean scores of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method. From the result, sum of square between groups is 3082.72 and within is 3402.00 mean sum of square between groups is 1541.36 and within is 19.67. An f value recorded is 78.38 and p-value observed is 0.00. The difference is significant because p-value is less than 0.05, hence hypothesis which stated that there is no significant difference in the academic performance mean scores of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method is rejected. To determine the location of disparity, result of Schaffer's test is presented in Table 2.

**Table 2: Schaffer's Posthock Test of Location of Disparity of Performance of Students in Experimental and Control Groups.**

(I) GROUPING	(J) GROUPING	Mean Difference (I-J)	Std. Error	p-value	Remark
Experimental Group 1	Experimental Group 2	1.80	.83	.099	Not significant
	Control Group	9.58	.83	.000	Significant
Experimental Group 2	Experimental Group 1	-1.80	.83	.099	Not significant
	Control Group	7.78	.80	.000	Significant
Control Group	Experimental Group 1	-9.58	.83	.000	Significant
	Experimental Group 2	-7.78	.80	.000	Significant

\*. The mean difference is significant at the 0.05 level.

Table 2 presents Schaffer's Posthock test of location of disparity of academic performance of students in experimental and control groups. Result shows no significant difference in the academic performance mean score of experimental groups ( $p=0.99>\alpha$ ) but significant difference exist between the academic performance mean score of the two experimental and control ( $p=0.00<\alpha$ ).

**H02:** There is no significant difference in the skills acquisition mean score of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method in Katsina ZEQA

**Table 3: ANOVA of Difference in the Mean Skills Acquisition of Senior Secondary School Chemistry Students in Experimental and Control Groups.**

	Sum of Squares	Df	Mean Square	F	P value	Remark
Between Groups	27312.17	2	13656.08	115.05	.000	Sig
Within Groups	20534.19	173	118.70			
Total	47846.36	175				

Table 3 presents ANOVA of significant difference in the skills acquisition mean score of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method. From the result, sum of square between groups is 27312.17 and within is 20534.19, mean sum of square between groups is 13656.08 and within is 118.70. The f value recorded is 115.05 and p-value observed is 0.00. The difference is significant because p-value is less than 0.05, hence hypothesis which stated that there is no significant difference in the skills acquisition mean score of senior secondary school students exposed to peer-tutoring, spider concept mapping and lecture method is rejected. To determine the location of disparity, result of Schaffer's test is presented in table 4.

**Table 4: Schaffer's Post hock test of location of disparity of skills acquisition of students in experimental and control groups.**

(I) GROUPING	(J) GROUPING	Mean Difference(I-J)	Std. Error	Sig.	Remarks
Experimental Group 1	Experimental Group 2	-15.14	2.04	.000	Significant
	Control Group	14.79	2.03	.000	Significant
Experimental Group 2	Experimental Group 1	15.14	2.04	.000	Significant
	Control Group	29.93	1.97	.000	Significant
Control Group	Experimental Group 1	-14.79	2.03	.000	Significant
	Experimental Group 2	-29.93	1.97	.000	Significant

\*. The mean difference is significant at the 0.05 level.

Table 4 presents Schaffer's test of location of disparity of skills acquisition mean score of students in experimental and control groups. Result shows significant difference in the skills acquisition of experimental and control groups ( $p=0.00 < \alpha$ )

### Conclusion

The study concluded that peer-tutoring technique is more efficacious in improving academic performance of students than spider concept mapping technique and lecture method. However, in improving skills acquisition, spider concept mapping technique is more efficacious than peer-tutoring and lecture method. Thus, it is concluded that peer-tutoring has significant impact on cognitive development and spider concept mapping has significant impact on psychomotive development. Lastly both peer-tutoring and spider concept mapping techniques are more effective in improving academic performance and skills acquisition of students than lecture method.



## Recommendations

Based on the findings of the study, the researcher proffer the following recommendations for policy purpose:

1. Performance of students is enhanced using peer-tutoring technique better than spider concept mapping technique and lecture method. Teachers should be motivated by the school management, Katsina state MOE and federal ministries of education to adopt the peer-tutoring strategy in their teaching. This can be done through sponsoring researches that involves the use of peer-tutoring technique.
2. Spider concept mapping technique improve skills acquisition better than peer-tutoring technique and lecture method. Therefore, there is a need for Katsina state education trust fund (ETF) and other stakeholders in education industry to organize special training through seminars, conferences and workshops on developing teaching package with spider concept mapping in schools that is more related with skills acquisition such as science and technical schools

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