Impact of Concept Mapping on Interest among Secondary School Physics Students in Katsina State, Nigeria

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ABSTRACT

The study investigates the Impact of Concept Mapping on Interest among Secondary School Physics Students in katsina State, Nigeria. A total of 196 students from 2 public secondary schools in Katsina education zone were purposively selected from a population of 3,968 science students, using simple random sampling technique. This study adopted pre-test, post-test quasi-experimental control group designs. Two groups were formed: the Experimental and the Control group. The Experimental group students were taught Motion concept using Concept Mapping strategy while the Control group students were taught the same concept using lecture method. The instrument used for data collection was Motion Concept Physics Interest Inventory Questionnaire (MCPIQ). The instrument was validated by both Physics teachers and lecturers in psychology department. The reliability coefficient of MCPIQ was found to be 0.89. Spearman Rank Order Correlation was used in determining the reliability coefficient of MCPIQ. Based on the objective, this study was guided by a research question and answered using descriptive statistics, and null hypothesis stated was tested at 0.05 level of significance using statistical tool of Mann-Whitney u-test statistics. The results obtained from data analysis show that students in Experimental group have higher interest than the students in Control group. Based on the findings of the study, it is recommended among others that Concept Mapping Strategy was found to be effective in enhancing students' Interest as a result Teachers should be encouraged to use Concept Mapping instructional strategy in teaching Physics through adequate and frequent supervision as well as reward by the ministry of education.

KEYWORDS: Concept Mapping, Interest, Secondary School Physics Students, Katsina State, Nigeria.

Introduction

The National Policy on Education of the Federal Republic of Nigeria (FRN, 2013) has stressed on the teaching and learning of science subjects in Nigerian schools. The science subjects in senior secondary schools are Physics, Chemistry, Agricultural Science, Biology, Geography among others. According to Josiah (2012), Physics as a physical science, is a subject that is concerned mainly with matter as it relates to energy and deals with the study of laws that

determine the structure of the universe with reference to matter and energy in the universe. Josiah (2012) further stated that the knowledge of Physics facilitates the understanding of other disciplines such as health, agriculture, water resources, energy, information technology, medicine, as well as engineering. On this note, the importance of Physics in the development of mankind includes bringing about such wonderful changes in the social life of human being that could not be thought of in the past: Developments in the field of energy are being made and new weapons are being developed which put the world in a new era. In spite the important of physics, students at secondary school level have poor performance in their WAEC and NECO. Josiah (2012) stated that there are many reasons for the students' poor academic performance in Physics such as large population of students, method of instruction used in teaching Physics but the experts suggested that the main reason is that physics is taught with traditional lecture method.

Lecture Method involves verbal presentation of ideas, concept and generalization of facts (Atadoga, 2008). It is a method in which the teachers deliver pre-planned lessons to the students with little or no instructional aids. In using this method, the teachers talk about science while the students read about science. It is a science teaching instructional method that encourages note learning and regurgitation of information. Lecture Method is used largely to build up basic theoretical knowledge which must be acquired by the students before they are able to display practical skills and undertake practical tasks in the laboratory. The method is highly valued in a situation where the number of students, who are benefiting from it, is quite large and in a situation where there is inadequate number of competent and qualified teachers coupled with the insufficient instructional materials.

Concept Mapping, according to Kinchin (2005), is a strategy that helps students organise their cognitive frameworks into more powerful integrated patterns. Concept Mapping is used to deliver instruction for brain strumming, note-taking, memory retention, and summary, new knowledge creation and to increase meaningful learning (Brown in Imoko, 2005). According to Cakir (2008), Concept Mapping is a schematic representation of ideas or concepts, showing their relationship in form of flow chart. It is a visual representation which allows the development of a holistic understanding that words alone cannot convey (Plotnick in Imoko & Agwagah, 2006).

Interest is a feeling of curiosity or concerned of subject, topic that makes attention towards it. Renninger and Hiddi (2011) defined interest as a critical cognitive and affective motivational variable that guides attention, facilitates learning in different content areas, for all students of all ages, and develops through experience. Mangal (2010) reported that ideal learning environment and methods, functional teaching materials and a motivating teacher have positive effect on students'interest in learning. Okigbo and Okeke (2011) posits that the aim of teaching is to secure the students' attention through arousing and maintaining interest in lessons of multidimensional instructions. Against this background, this study examines the impact of Concept Mapping on Interest among secondary school students in Katsina state, Nigeria.

Theoretical Framework

The study is based on a Constructivist theories of learning which has its root in cognitive psychology. Constructivism stems from the work done by several theories including information processing theory, David Ausubels Theory, Brunnier learning theory. Concept Mapping is rooted in Ausubel`s Assimilation Theory (Ausubel, Novak &Hanessian, 1978). Concept mapping is a

meta-cognitive learning strategy based on the Ausubel assimilation theory (Ausubel 1978). It has its origin in a research done at Cornell University with a view in studying changes in students understanding of science concepts over a 12-year span of schooling (Novak, 1990). The research group led by Novak worked with the idea that new Concept meanings were acquired through assimilation into existing concept/proposition frameworks. Assimilation theory posits that new knowledge can be learned most effectively by relating it to previously existing knowledge. Concepts Mapping may be viewed as a methodological tool of assimilation theory that displays fundamental elements of the theory such as subsumption, integrative reconciliation and progressive differentiation. Concepts Mapping allow for the representation of non-hierarchical relationships or cross-links, as well as other types of non-hierarchical arrangements.

Statement of the Problem

The persistent poor performance of students in SSCE Physics for quite some times now has become a major concern to Science Educators, Parents and other stake holders in Science Education. The West African Examination Council (WAEC, 2017) has reported that there is increasing mass failure in Physics WAEC over the years. A eight years (2010-2017) analysis of students' Academic Performance in Physics is revealed in Table 1.

Table 1: Performance of Students in Physics at SSCE Level (WACE) in Katsina State, from 2010-2017.

Year	No. of students in attendance	No. of students that passed at credit level	No. of Students that Failed	% Passed	% Failed
2010	21,606	2,427	19,179	11.24	88.76
2011	30,707	699	30,008	2.28	97.72
2012	38,602	4,146	34,456	10.74	89.26
2013	33,720	7,954	25,766	23.58	76.42
2014	37.223	11,337	25,766	30.46	69.54
2015	39,577	8,578	30,999	21.67	78.33
2016	14,513	8,272	6,241	56.99	46.01
2017	25,737	2,411	23,326	9.37	90.63

Source: Katsina State Ministry of Education (2018)

The data in Table 1 reveals that Physics students have difficulties in the learning of Physics which has resulted in poor Academic performance at Senior Secondary School level (WAEC) in all the years except for the year 2016 where the percentage pass is 56.99 and the percentage failed is 46.01.

Objective of the Study

The objective of the study is to determine the impact of Concept Mapping on interest of Physics students in secondary schools of Katsina state Nigeria.

Research Question

What is the difference in mean interest between students taught Physics before and after treatment using Concept Mapping and using Lecture Method?

Null Hypothesis

The null hypothesis was constructed and tested at $P \leq 0.05$ levels of significance:

HO: There is no significant difference in the interest of students taught Physics using Concept Mapping and those taught the same concept using Lecture Method.

METHODOLOGY

Research Design

Quasi Experimental and Control Group design of pretest, post-test was employed for this study. Intact class (non-randomized groups) was used for the study. In this study, two groups were used which are the Experimental Group (EG), and Control Group (CG). Students in the Experimental Group were taught using Concept Mapping (X) and the Control Group were taught using Lecture Method (XO). A concept of Motion was used in teaching the students. The duration of the experiment was six weeks. After treatment, interest inventory questionnaire was administered to both Control and Experimental Groups.

EG $\longrightarrow O_1 \longrightarrow X_1 \longrightarrow O_2$

CG $\longrightarrow O_1 \longrightarrow X_0 \longrightarrow O_2$

Fig. 1: Research Design Illustration

Population of the Study

The population for this study covers all public senior secondary schools Physics students in Katsina education zone. There are 20 public senior secondary schools offering Physics as one of the science subjects with population of 3,968 out of which 17 are co-educational and 3 are single sex in Katsina education zone (2 boys only and 1 girls only). From this figure, 2,812 are males while 1,156 are females. Detail of the population of this study is presented in Table 2.

Table 2: Population of the Study

SN	School	Male	Female	Total
1.	Government Girls College (Senior) Katsina	-	305	305
2.	Government Senior Secondary School KofarYandaka	467	269	736
3.	Government College (Day Wing) Katsina	289	118	407
4.	Government College Pilot Katsina	183	-	183
5.	Government Pilot Secondary School KofarSauri	75	23	98
6.	Government Senior Secondary School Kambarawa	185	65	250
7.	Government Senior Secondary School KofarKaura	248	107	355
8.	Government School for Blind Katsina	14	5	20
9.	Government Senior Secondary School Dutsen Safe	89	21	110
10.	Katsina College Katsina (Senior)	568	169	737
11.	Sir Usman Nagogo College of Arabic & Islamic Studies	56	33	89
12.	Family Support Senior Secondary School, Katsina	54	21	75
13.	Government Senior Secondary School Natsinta	65	23	88
14.	Government Senior Secondary School Jibia	187	40	227
15.	Government Senior Secondary School Daddara	26	9	35
16.	Government Senior Secondary School MagamaJibia	59	39	58
17.	Government Senior Secondary School Dankama	36	20	56
18.	Government Senior Secondary School Yandaki	87	24	111
19.	Government Secondary School Girka	18	10	28
20.	Government girls senior secondary school jibia	-	58	58
TOTAL		**2,812**	**1,156**	**3,968**

Source: (Katsina State Ministry of Education, 2018)

Sample and Sampling Technique

In this study, a total number of 196 students from two Senior Secondary Schools were selected. To select the sample of students, purposive sampling technique was used, in this study, three arms of science students (SS II A, B and C) were identified in each school. From each of the schools, intact classes of SS IIA offering Physics were selected for use in the study. The schools were sampled using simple random sampling technique. To select the sample schools, the names of the 17 co-educational public senior secondary schools were written on pieces of paper, squeezed and put in a container and one piece of paper was picked at a time by the researcher. Each time, a piece was picked, the container was reshuffled before the next was picked.

Table 3: Sample of the Study

SN	SCHOOLS	STATUS	M	F	T
1	A	Experimental group	39	52	91
2	B	Control group	46	59	105
TOTAL			**85**	**111**	**196**

Instrumentation

Motion Concept Physics Interest Inventory Questionnaire (MCPIQ)

To measure the interest of the students on motion concepts, Motion Concept Physics Interest Inventory Questionnaire (MCPIQ) consisted of 30 items was developed by the researcher using Likerts' five-point scale which was made up of Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD). Each option carries weight in the order of priority from 5-1 in positive interest responses and from 1-5 in negative interest responses. The students were asked to freely indicate their interest on Motion concepts by simply ticking one of the five options that suit their interest.

Data Analysis Procedure

The research question was answered using data collected and analysed using descriptive statistics in form of mean rank and sum of rank, while the Null hypothesis was tested using Mann-Whitney U-test statistic using data of pretest and Posttest interest score of students in Experimental Group and control group.

Results and Discussions

Research Question 1:

What is the difference in interest between students taught Physics before and after treatment using Concept Mapping and those taught using Lecture Method?

Mean rank of students' interest score before and after the treatment of the experimental and control group are compared and presented in Table 4.

Table 4: Mean Rank Interest Scores of the Subjects in the Experimental and Control Group

Variable		N	Mean Rank	Sum of Rank	Mean Difference
Experimental:	Before treatment	91	46.19	4203.50	
					90.62
	After treatment	91	136.81	12449.50	
Control:					
	Before treatment	105	107.53	11291.00	
					4.06
	After treatment	105	103.47	10864.00	

The Table 4 shows the change in interest of the subject toward motion concepts in experimental and control groups. From the table, the mean rank value of 46.19 was obtained in the interest level of experimental group before treatment and 136.81 in the interest level after treatment with sum of ranks of 4203.50 and 12449.50 while in the control group, a mean rank value of 107.53 and 103.47 was obtained in the interest level before and after treatment with a sum of ranks of 11291.00 and 10864.00 was obtained. Difference in the mean rank signifies difference in the interest ability of the subjects in motion concepts due to exposure to concept mapping teaching strategy and lecture method. This shows that experimental group developed higher interest in motion concepts than control group as revealed in their mean rank score. Hence, concept

mapping Strategy has a positive impact in generating students' interest towards motion concepts. However, to find out whether the difference is significant, null hypothesis was tested.

HO: There is no significant difference in the interest of students taught Physics before and after treatment using Concept Mapping and those taught using lecture method.

Table 5: Mann-Whitney U-test Analysis of Interest Change of the Subjects in the Experimental and Control Group

Variable		N	Mean Rank	Sum of Rank	Man-Whitney U-test	P.	Decision
Experimental	Before treatment	91	46.19	4203.50			
					17.50	0.00	Sig.
	After treatment	91	136.81	12449.50			
Control	Before treatment	105	107.53	11291.00			
					5299.00	0.06	Not Sig.
	After treatment	105	103.47	10864.00			

Table 5 compares the interest change of the subjects in experimental and control groups. From Table 5, the mean rank value of 46.19 was obtained in the interest level of experimental group before treatment and 136.81 after treatment. The Mann-Whitney U-test observed in the experimental group is 17.50 and the p-value observed was 0.00. Since the p-value of 0.00 is less than alpha value of 0.05, there is a significant difference in the interest level of the subject in motion concepts due to exposure to concept mapping teaching strategy. The significant difference is in favour of experimental group as revealed in the mean rank score. A significant difference implies rejection of null hypothesis and retaining alternate hypothesis. Hence, null hypothesis which states that there is no significant difference in the interest of Physics students exposed to motion concepts using concept mapping strategy and those taught the same concepts using lecture method is rejected. There is significant difference.

Similarly, in the interest level of control group before treatment, a mean rank of 107.53 was obtained and 103.47 after treatment. The Mann-Whitney U-rest observed in the control group is 5299.00 and the p-value observed was 0.06. Since the p-value of 0.06 is greater than alpha value of 0.05, there is a no significant difference in the interest ability of the subjects in motion concepts due to exposure to lecture method instructional strategy.

Discussion

From the findings, the study reveals that Table 4 and 5 compared the interest change of the subjects in experimental and control group. The result revealed significance difference in the interest ability of the subject in motion concept due to exposure to concept mapping strategy and lecture method. The significance difference is in favour of experimental group. By Implication, the concept mapping was able to foster a significantly higher interest than the lecture method. This may be due to the fact that activities based on concept mapping to which the experimental group was exposed to provided the opportunity for students in the experimental group to experience interactive learning. There by promoting their interest ability in motion concepts. The finding is in agreement with that of Liaquat and Ali (2012), Bello (2015) and Oviawe and Lukmon (2017). Result of the study conducted by Liaquat and Ali (2012) investigated the interest and retention of secondary school students using computer assisted instruction to teach the students, showed that students taught using computer assisted instruction displayed greater

interest in the course contents of Physics than lecture method group. Bello (2015), claims that students' interest towards wave concepts in Physics is enhanced with the use of computer assisted instruction and laboratory facility enriched with lecture method. Oviawe and Lukmon (2017), further confirms that concept mapping strategy surely explain contents more explicitly to students and makes them more interested in the lesson.

Conclusion

Based on the findings from this study, it is concluded that: Students taught Motion concepts using Concept Mapping strategy developed interest in Physics after the treatment.

Recommendations

The forgone finding leads to recommendation that:

Since the study established that the use of Concept Mapping Strategy enhances Interest of Physics students in motion concepts, Teachers should be encouraged to use concept mapping instructional strategy in teaching Physics through adequate and frequent supervision as well as reward by the ministry of education.

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