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Teaching With Concept Mapping Instructional Strategy in Nigeria Secondary Schools

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Abstract

The research study investigated the effects of teaching with Concept Mapping instructional strategy on learning achievement in Nigeria Secondary Schools. The research study adopted the Quasi-Experimental Research design. The population comprised of a sample of 168 Senior Secondary School Class-two Physics students purposively selected from Senior Secondary Schools across Ekiti State, Nigeria. The Instrument used consisted in two parts: a) Motion Concept Map developed for the research study and; b) printed materials in the form of tutorial test items developed and used to elicit responses to the treatment. The research hypotheses tested were; there is no significant effect of treatment on students' learning achievement; there is no significant effect of treatment on students' retention; there is no significant effect of treatment on students' learning attitude. The research study revealed that: Concept Mapping Instructional strategy contributed to learning achievement in physics; there is significant effect of treatment on students' retention of learned materials; there is significant effect in students' learning attitude. Result established that the instructional strategy when integrated with any method of instruction resulted in improved learning achievement.

Keywords: Concept Mapping; Concept Mapping Instructional Strategy, Generalized Motion of Movement of Particles or Objects, Motion Concept Map

Introduction

Science has brought to education many valuable new instruments of learning and teaching of which considerable emphasis is being placed on the importance of the visual approach to teaching. According to Clarence (1944), and Dean (2008), all around the world teachers are becoming more aware of new teaching strategies and tools that can be used in the classroom with initiatives in teaching-learning that integrates the inquiry based learning with Information Communication Technology, Audio-visual interactivity packages, Visual models, and Concept mapping instructional strategies in an effort to aid and effect student-centred learning. Several research in education show the efficacy of these new teaching strategies (Nahum, 1987; Cañas, Novak & Gonzalez, 2004; Choi & Gennaro, 1987; Edward, 1996; Hay, Kinchin & Lygo-Baker, 2008; Kathy et al., 2006). Despite these advances, physics teaching and learning in Nigeria still retain the old and conservative approach to teaching and learning. According to Aladejana, (2007), for the old and conservative approach to teaching and learning to change to contemporary approach, there is need for a diagnostic study.

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This research study is therefore conceptualized on exploring the effects of the use of Concept Mapping Instructional Strategy, CMIS, in the teaching and learning of motion, based on the fact that Motion is fundamental and basic in the understanding of several aspects of physics, and indeed the sciences in general. The instructional strategy so conceived is believed to be an innovation especially when integrated with conventional lecture method of teaching. It is also an attempt at introducing to the Nigerian physics teaching-learning audience that the instructional strategy is a veritable tool and an effective innovation in the teaching-learning process.

Why use Concept mapping in teaching and learning?

CMIS falls into the broad family of graphic organizing tools that include mind mapping and spider diagrams, and was firstly developed by Novak and his research group in Cornell University in the early 1970's as an approach to identifying knowledge structures of an individual learner. The outcome of the procedure of concept-mapping a particular concept is called a Concept Map, *cm*, which is a visual representation of knowledge structure of the concept in a two-dimensional, hierarchical, node-linked diagram that depicts declarative knowledge in succinct graphic form (Novak, 1990; Cañas, Novak & Gonzalez, 2006; Uniserve Science, 2009; Valadares, Fonseca & Soares, 2004).

According to Shea, McCall & Özdoğru (2006), Zollman & Robert (2008), learners can only think critically about contents of subject matter to be learnt if they understand the basic terms and the relationship between associated concepts, in this wise, learning a particular subject matter becomes a mental building process. Thus CM enable learners to actively construct a conceptual framework to which new ideas and knowledge are added, related, and refined thereby improving on their learning capability and strategy. All & Havens (1997), affirmed that unless there is understanding of the contents of materials to be learnt in terms of the basic concepts, students are bound to commit unassimilated data into short-term memory and so no meaningful learning occurs, according to the authors, meaningful learning occur when information is presented in a potentially meaningful way, and the learner is encouraged to anchor new ideas with the establishment of links between old and new materials.

In particular, CM offers a technique for revealing students' cognitive structure, and involves the following systemic steps:

i) Identifying the major components of the concept (of motion)

ii) Arranging the concept's components in hierarchical order

iii) Linking the components with linking phrases

iv) Making cross links with directed lines

The components of Motion used in this research study were:- Definition of; cause of motion; guiding principle; characteristics; types; respective equations; as shown in Figure 1 below.

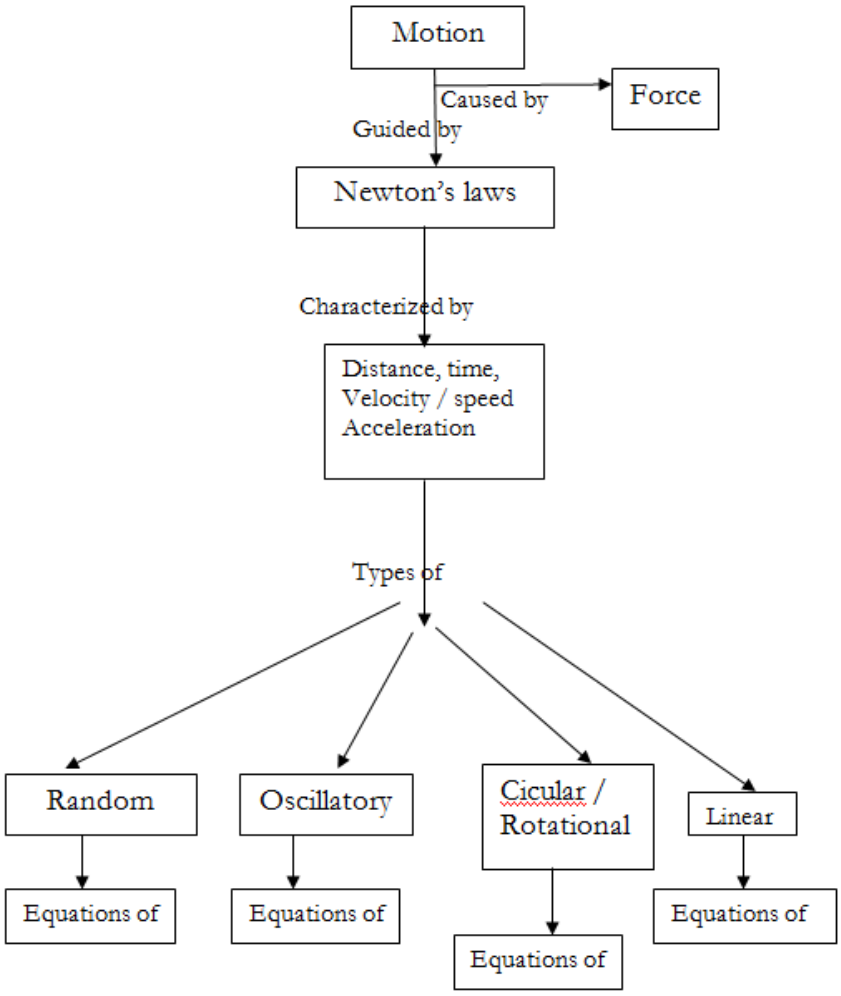

Figure 1: CMIS I – Basic components of motion

The cm of CMIS developed for the research study using the systemic steps highlighted in i) - iv) above is shown in Figure 2 below

Research Hypotheses

The hypotheses that were tested in the research study are:

1. There is no significant effect of treatment on students' learning Achievement
2. There is no significant effect of treatment on student's retention of learned materials.
3. There is no significant effect of treatment on students' attitude to learning physics.

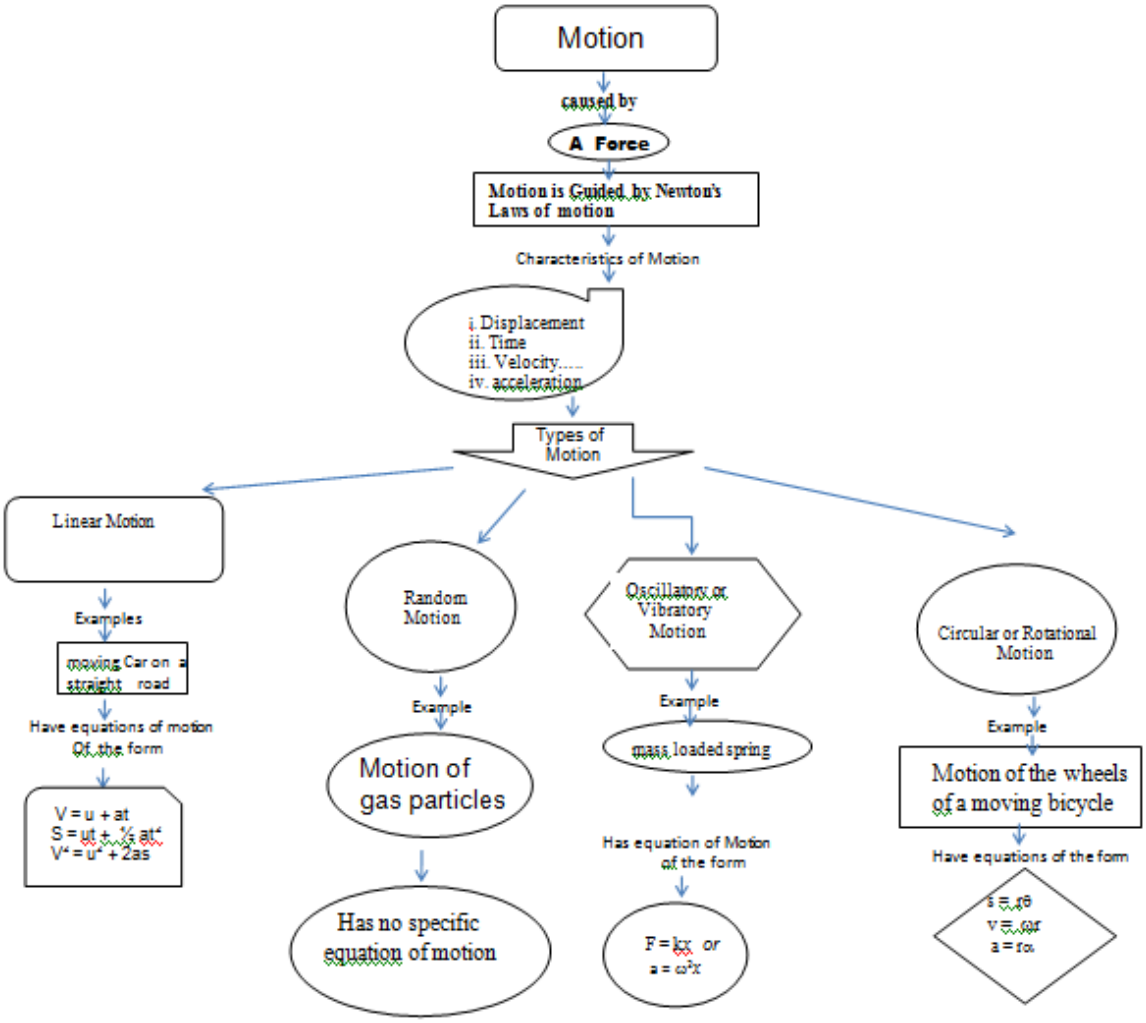

Figure 2: CMIS II - Typical Motion Concept Map

Methodology

The research design adopted is the quasi-experimental research design. The population comprised of Senior Secondary School Class-II Physics Students in Ekiti State, Nigeria, and a sample of 168 students purposively selected. There were two activity groups, the experimental group, and the control group. The instruments used in the research study are of two types, mainly: - (i). Uncompleted *MCM* which the experimental group were required to complete, used as pretest and posttest respectively. (ii). printed materials which comprised of two parts; part *a* consisted of 20 simple structured sample questions relating to the knowledge of the presented concept and used to measure level of cognition, administered to both groups as pretest and posttest respectively, and part *b* which consisted of 10 structured questions administered as posttest to the experimental group only and used to elicit attitudinal response to the treatment. The post-test for both groups was administered two weeks after the treatment. The treatments lasted only 40 minutes in each case. The method of statistical analysis used for the research study is the T-test.

Results

The summary of statistical analysis and test of hypotheses is summarized in tables below:

Table 1: Summary of the effect of treatment on students' learning Achievement

Variables	N	Mean	t – cal.	df	t-tab	Inference
Treatment on students' learning achievement	168	8.28				
	168	7.60	29.05	167	1.96	Significant

From the table t-cal is greater than t-tab at significant level $p<0.05$. The null hypothesis is rejected. We therefore conclude that there is a positive significant effect of treatment on the learning achievement in physics.

Table 2: Summary of the effect of treatment on students' retention of learned materials

Variables	N	Mean	S.D	t – cal.	df	t - tab	Inference
Test of treatment on retention	84	8.76	1.25				
	84	6.41	1.47	11.32	166	1.96	Significant

From table 2 above t-cal is greater than t-tab at significant level $p<0.05$. The null hypothesis is rejected. We therefore conclude that there is a positive significant effect of treatment on the students' retention of learned materials

Table 3: Summary of the effect of treatment on students' learning attitude

Variables	N	Mean	S.D	t – cal.	df	t - tab	Inference
Test of treatment on learning attitude	84	8.79	1.25				
	84	6.78	0.57	6.17	83	1.96	Significant

From table 3 above t-cal is greater than t-tab, at significant level $p<0.05$. The null hypothesis is rejected. We therefore conclude that there is a positive significant effect of treatment on the students' learning attitude to physics

Discussion, Conclusion and Recommendation

The findings revealed by the research study show that post-test mean score of the experimental group (8.28) is higher than the posttest mean score of the control group (7.60), thus there is a significant effect of the instructional strategy on students' learning achievement. Result also indicated the experimental group was able to recall a higher percentage of learned materials after the two weeks interval than the control group, which shows a positive significant effect of treatment on student's retention of learned materials.

This finding is in agreement with research findings by Clarence, (1944), and Abimbade, (1997). Furthermore, the study showed that students in the experimental group were favorably disposed towards the instructional strategy, as they took active part in the class activity. This finding is also in agreement with previous research findings by Kathy, et al. 2006; Jegede, Okebukola & Ajewole, 1992; Choi & Gennaro, 1987 and Wendell, 1970 in which they asserted that learners learned better with concept mapping.

In general, the instructional strategy seemed to have a lingering effect that prompts recall even two weeks after treatment. This might not be unconnected with the ideology that what is heard is often forgotten, what is seen is remembered, and what is practiced is easily remembered, thus making the instructional strategy effective, and complementary to any method of instruction.

However, the observed singular effect may have been as a result of novelty and the excitement of learning with a new method of instructional strategy, and perhaps these feelings might wear off over time. These effect and the effects of some other intervening variables are arguments to support further future study on the strategy, which will serve to establish the efficacy of CMIS in learning.

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