A COMPARATIVE STUDY ON EFFECTIVENESS OF CONCEPT MAPPING & CONSTRUCTIVIST APPROACH IN TEACHING LIFE SCIENCE AT SECONDARY LEVEL IN WEST-BENGAL

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ABSTRACT:

The present study compared the effect of concept mapping and constructivist approach in teaching life science at secondary level. The pre-test post-test design was adopted for the purpose of data collection. A secondary school in Kolkata was randomly selected and made into experimental and control group. Life science Achievement Test was prepared by the researchers followed by item analysis and checking reliability. A reliability co-efficient r=0.79 was arrived after pilot study. Life science Achievement Test was administered to the students by the researchers. Data collected was analyzed using t-test statistics. The result indicated that the concept mapping groups taught using concept-mapping strategy performed significantly better than the constructivist group exposed to constructivist teaching strategy. This showed that the concept mapping strategy was found to be more effective than the constructivist teaching strategy for understanding of life science concepts. Based on verbal feedback from the students it was also concluded that although concept mapping strategy is very effective but in some field based chapters if teachers can use constructivist approach it will more fruitful to students.

KEYWORDS:
Concept mapping, Constructivist approach, Effectiveness, Life science

INTRODUCTION:

There are several perspectives in ways in which pupils learn (Bennett, 2003). In this study researchers try to identify which teaching strategy (concept mapping and constructivist approach) is best effective for teaching life science. Concept mapping is a type of instructional strategy for organizing concepts in a hierarchical manner and linking the related concepts in such a way that the students make meaning of what they learn. The steps in concept mapping activities are (Ezenwa 1993):

- Identity and list the keywords or terms or concepts.
- Rank the listed concepts from most abstract and inclusive to the most concrete and specific.
- Clusters the concepts according to criteria, concepts that function at a similar level of abstraction and concepts that interrelate closely.
- Link related concepts with lines and label each line in propositional form (Ault, 1985). When a student completes the above steps for a given concepts, the concepts become meaningful to him.

According to Novak (1985), concept mapping strategy helps students learn how to learn meaningfully and help teachers as well more effective in their teaching. Most of the researchers on concept mapping were done overseas by the initiators of the strategy (Novak,

1985; 1988; 1990; Novak and Gowin, 1984; Novak, Gowin and Johansen, 1983; Ault, 1985 and Watt, 1988). The researchers were on earth science concepts (Ault, 1985), on physics concepts (watt, 1988) and on biological concepts (Carter and Kahle1987; cliburn, 1987). In Nigeria, Jegede and Okebukola (1990); Okebukola (1990) studied the utilization of concept mapping instructional strategy in biology. They are all in agreement that the strategy could bring about meaningful learning. Therefore a seemingly fruitful method of bringing about understanding of science concepts could be through the use of concept mapping. A study conducted by Ajaja (2011) determined the effects of concept mapping as a study skill on students' achievement in biology. The major findings of this study indicated a significant and consistent improvement in biology achievement as the period of experience with the use of the method increased. Also students who used concept mapping as a study skill retained biological knowledge longer than those who reviewed the concepts they were assigned to. All the students in the concept mapping classroom interviewed agreed that concept maps helped them not only in the determination of the relationships among the concepts but also shaped their understanding of the concepts and increased their critical thinking. The findings of Hall et al. (1992) and Kinchin (2000a, 2000b) are similar to this research finding. Kinchin (2000a) found a significant impact of concept mapping when used for instructing secondary school biology students. Kinchin (2000b), in a study comparing the effect of the use of concept mapping as a study skill on students' achievement, found a positive effect on students who used concept maps to revise and summarize the materials given. On the effect of concept mapping for attitudinal change, the studies by Markow and Lonning (1998) and Eravwoke (2011) found a significant and positive effect on students' attitude when used for better understanding of chemistry concepts. Naskar & Das (2017) studied the effectiveness of concept mapping approach in teaching life science at secondary level in West-Bengal. They found that concept mapping approach is more effective than lecture method.

Another instructional strategy for teaching biology is constructivist approach. Constructivist view is not new in education, the ideas that humans construct their own meaning from prior experience goes back as far as the Greek and Roman times. The constructivist view is similar to what Piaget (1953) described as the equilibrium of learning. It consists of the process of assimilation and accommodation i.e. adding new knowledge to an old existing one and attaining a state of equilibrium.

Lesson activities planned in the constructivist manual were designed on the format of the 5Es constructivist instruction model developed by Bybee (Trowbridge et al., 2004).

Each lesson progressed through five stages of activities. The stages are: Engagement, Exploration, Explanation, Elaboration and Evaluation. Here follows brief explanation of activities that took place in the various stages during the lesson(s).

- At the engagement stage, lesson activities were basically meant to engage the students into the activities of the day and involved an introduction to the lesson, presentation of the lesson objectives and presentation of the day's learning tasks to the participants. The engagement activities took a maximum of 10 minutes and then participants broke into groups for exploration stage.
- In the exploration stage, participants carried out investigations on primary and secondary sources of information. Investigations on primary sources of information involved participants going out to the open fields to investigate and collect information and photo. Investigations on secondary sources involved participants searching for information on different textbooks, magazine and internet. From exploration stage, lesson activities moved to explanation stage.
- During the explanation stage, members of a group discussed the challenges and outcomes of what they encountered during the engagement and exploration stages. Difficult terminologies and field experiences were the main challenges met by the participants during the engagement and exploration stages. However, all the challenges were pulled and collaboratively discussed in the groups during the explanation stage. All definitions, information and explanations are critically discussed in the groups for individual and group ownership.
- From the explanation stage, different groups in the class converged for a whole class discussion shifting the lesson activity into the elaboration stage where each group presented its findings before the whole class. The shift from group to class discussion was guided by the researcher who gave each group few minutes to present their findings to the whole class. Once a group had presented, a critique session by the whole class would follow and the group members elaborated on their findings. The researcher also presented new questions to the participants in addition to harmonizing the findings from different groups. Members of different groups presented their findings with the help of learning aids like tables and diagrams on manila papers or flip-charts. Elaboration stage provided participants with opportunity for individual and group reflection on the learning activities.

Now the present study is designed to look at the effects of concept map instructional strategy and constructivist teaching strategy in the academic achievement of secondary school students' in life science.

OBJECTIVE OF THE STUDY:

The major objective of this present study is to compare the effectiveness of concept mapping & constructivist teaching strategies on students' academic achievement in life science.

HYPOTHESIS OF THE STUDY:

$H_0$1: There is no significant difference in the mean academic achievement of students taught life science using constructivist teaching strategy and those taught using concept mapping.

VARIABLE:

- **Independent Variable:** The independent variable that was used in the present study is effect of constructivist instruction and concept mapping.
- **Dependent Variable:** Students learning out come.
- **Intervening Variable:** Certain variables which couldn't be manipulated or measured directly, may have an important effect upon the outcome of learning. In an experimental study, some major intervening variables should also be considered viz. Socio-economic status, Grade level, School variable, Learner variable, Physical environment of the class room. During the planning of experiment it was necessary to identify as well as to control those variables other than the independent variables that may affect the dependent variable. The following measures may be considered to control the intervening variables:

■Socio economic status : This were controlled by the process of random selection of sampled students, especially belonging to the families approximately of the same socioeconomic status in view of their livings viz. the urban areas of Kolkata district.

■ Grade level: In the present study, the grade level would hold constant by taking students from the grade X only.

■ School variable: Investigator was taken randomly one school from one district. Thus the effect of schools was controlled through randomization.

■ Physical environment of the classroom: The experiment was conducted in the normal classroom situation in school. Students were always taught under the same seasonal condition. The primary variation due to physical environment of the classroom, seasonal condition of learning was controlled by direct physical manipulation, as far as practicable.

DELIMITATION OF THE STUDY:

To make study precise and intensive and to complete it within a reasonable time it was necessary to delimit of the study under the following:

- **Geographical area:** This type of study could be conducted in all the districts of West Bengal taking a large number of schools but it was very difficult to control the experimental design with a large number of schools. Hence, only one district (Kolkata) was randomly selected among the twenty three district of West Bengal for the study.
- **School:** The study could be conducted in all secondary schools in Kolkata. But to make the study in-depth only one secondary school was selected randomly from Kolkata district.
- **Sample:** The study could be conducted with the entire secondary school student but to conduct the survey the study was restricted to 50 students from one secondary school.
- **Class:** The study was restricted to class X.
- **Topic:** The study could be conducted to all the chapter of life science, but due to time and availability of student limitation study was conducted on only 2 topics of the chapter Continuity of Life.

RESEARCH DESIGN:

The study was setup to compare the effectiveness of two teaching strategies (concept mapping and constructivist approach) on students' academic achievement. The pre-test—post-test design was adopted for the purpose of data collection. In the first instance, a pre-test was administered to the students. After this, the groups were exposed to the instructional treatment. Concept mapping group

was taught using the concept mapping teaching strategy and other group was taught using constructivist teaching approach. After that a post-test was administered at the end of the teaching treatment period to both groups to evaluate the effectiveness of instruction. The pre-test and post-test are the same.

	O1	**X_1**	**O2**
R			
	O3	**X_2**	**O4**

R= random assignment of student

O_1 & O_3= pre-test measurement (same test)

O_2 & O_4= post-test measurement (same test)

X_1= concept map strategy

X_2= constructivist strategy

POPULATION: All students who has life science as a subject at the Secondary level affiliated to W.B.B.S.E

SAMPLE: Total 50 life science students studying in class X were selected randomly for this study.

INSTRUMENT FOR DATA COLLECTION:

A twenty multiple choice items Life science Achievement Test developed by the researchers was employed for data collection. The topics in life science (class X) covered by the students used in this study are:

- Cell division
- Cell cycle

First a pilot study was conducted among students outside the study area. Then through the item analysis discriminating index and difficulty value was calculated and standardized questionnaire was formed. To check the reliability of instrument a test retest method was employed within 6 days interval. The result of the test were correlated using Pearson Product Moment Correlation Coefficient (PPMCC), the reliability coefficient (r) was calculated in MS Excel and was found to be 0.79 which shows that the instrument is good reliable and used for data collection.

METHOD OF DATA COLLECTION:

There are two experimental groups for this study. Lesson plan was developed by the researchers for one experimental group using concept mapped teaching strategy and another experimental group using constructivist teaching strategy for 5 days. Pre-test was administered to the groups to determine the equivalent of the ability level of the sample subjects. The researchers then administered the post test life science Achievement Test to the students using the same instruments and marking scheme. The answer sheet were collected and marked. The scores were subjected to statistical analysis.

METHOD OF DATA ANALYSIS:

The data was collected from both the experimental and control groups in the pre test and post test were subjected to t-test statistics at $p \leq 0.05$.

RESULT AND DISCUSSION:

Table 1: Means, Standard deviation and t-test of Concept mapping and Constructivist groups on the Pre-test and Post-test scores of Biology Achievement Test:

Test	Group	N	Mean	S.D	t-stat. value	t-crit. value	p-value	remarks

Pre-test	Concept mapping	25	15	1.68	0.34	2.01	0.79	t-value non Significant at 0.05 level
	Constructivist approach	25	14.84	1.57				
Post-test	Concept mapping	25	16.64	1.15	3.10	2.01	0.003	t-value significant at 0.05 level
	Constructivist approach	25	15.52	1.38				

To determine possible post experimental differences between the two teaching strategies, a t-test was applied on the score obtained by the students.

In table 1 it was found that there is no significant differences on the pre-test score ($p>0.05$ & t-stat<t-crit.) of the concept mapping and constructivist treatment groups. This means that the students in the both groups were found to be equivalent with respect to their prior knowledge on the selected subject area before teaching treatment commenced.

In table 1 it was also found that the concept mapping and constructivist treatment groups differed significantly from one another after treatment. As t-stat. value (3.10) is greater than t-crit. value (2.01) and p-value<0.05.

The table revealed that the concept mapping groups taught using concept-mapping strategy (mean=16.64) performed significantly better than the constructivist group exposed to constructivist teaching strategy (mean=15.52). This showed that the concept mapping strategy was found to be more effective than the constructivist teaching strategy for understanding of life science concepts.

CONCLUSION:

From the study it was concluded that the concept mapping groups taught using concept-mapping strategy performed significantly better than the constructivist group exposed to constructivist teaching strategy. This showed that the concept mapping strategy was found to be more effective than the constructivist teaching strategy for understanding of life science concepts. Based on verbal feedback from the students it was also concluded that although concept mapping strategy is very effective but in some field based chapters if teachers can use constructivist approach it will more fruitful to students.

RECOMMENDATION:

Based on the findings of the study, the following recommendations were made:

- Teachers need to use concept mapping teaching method so as to improve the academic achievement of students in life science.
- Using concept map as a tool in science classes will help student to develop better understanding of the complicated content, developing interrelationship and creating meaning schemes and constructing knowledge bases.
- There is a need for proper training of life science teachers on the effective use of concept mapped teaching method in teaching life science.
- Concept map of different topics must be including for benefits of learners.

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