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## EFFECTIVENESS OF CONCEPT MAPPING STRATEGY OF TEACHING SCIENCE ON ACHIEVEMENT IN BIOLOGY OF SECONDARY SCHOOL STUDENTS



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### ABSTRACT :

The aim of this study was to investigate how the Concept Mapping Strategy of teaching affects secondary school students' achievement in Biology. Participants in this study were 60, grade IX students from co-educational state secondary school from two classes of a general science course taught by the same teacher. For the purposes of the study, concept mapping with visualization instructional method was assigned. This study is a comparative research that employed an experimental group and a second group that was taught by lecture method in a more conventional teacher-centered manner (called the control group). The subjects were 60 students. One class (n = 30, 16 boys and 14 girls) was assigned as a concept mapping group and the other (n = 30, 16 boys and 14 girls) as the control group. The Achievement Test in Biology developed by the researcher was employed in this study. The data obtained was analyzed descriptively and inferentially by calculating 't' value. The results concludes that Concept Mapping Instructional Strategy was more effective than

conventional method of teaching in increasing Achievement in Biology of IX grade students and also found that both boys and girls had similar improvement in Achievement in Biology taught by Concept Mapping Instructional Strategy. Since the concept mapping strategy had significant positive effect on the Achievement in Biology of the students. The researcher suggests that the faculty development program should be periodically conducted for the preparation of teachers as a facilitator exposing and training teachers for new and effective methods of teaching.

**KEY WORDS:** Effectiveness, Concept Mapping, Strategy, Biology.

## **INTRODUCTION:**

Education has been undergoing a revolutionary change in recent times in almost every part of the world, this is partly due to the explosion of knowledge, partly due to new problems in all spheres of life and partly due to the development of new tools of teaching and learning under the influence of variety of forces like these. Thus system of education has to be remodeled.

At present, explosion of knowledge is being achieved through development of science and technology. The prosperity of any country depends on the effective use of man power resources, which can be cultivated only by the study of science and its application. A proper well taught science education programme would help to inculcate those scientific and technical skills which are required for the development of a country.

Science is an international activity which strengthens national economics, creates new resources, accelerates employment and attempts to build global outlook. The common implication of both facts is that teacher should use such strategies of teaching which would match the instructional objectives of learning styles. Teaching is an activity, designed and performed for the attainment of a larger number of objectives in terms of desirable changes in pupils' behaviour, which is also complex set of attitudes, knowledge, skills, motivation and values. Effective teaching varies from mere teaching there is no single method for effective teaching-learning effective teaching leads to engaged and intelligent learning. It may be differed as showing or helping students to learn how to do something, giving instruction, guiding in the study, providing with knowledge. It is also guiding and facilitating learning, enabling the learner to learn, setting conditions for learning. One such effective strategy is concept mapping, which motivate the students to learn and to develop skills like creative thinking, interest in inquiry activities, problem solving etc. This paper studies the effectiveness of concept mapping strategy in teaching biology.

## **CONCEPT MAPPING**

Concept mapping is an instructional tool that is currently gaining popularity in the field of science education. It is a product of recent advances in cognitive science and the new philosophy of science. Contemporary perspectives of cognitive psychologists and the new philosophers of science on cognition view learning as an active internal process of construction where the learner's prior knowledge plays a significant role in further conceptual learning (Ausubel, 1968, Ausubel, Novak and Hanesian, 1978; Hewson, 1986; Novak, 1991). These educators consider learners to be the architects of their knowledge for they construct their own idiosyncratic meanings of concepts and natural phenomena. They consider teaming, therefore, to be more than verbatim repetition of what has been presented to the learner or as a change in behaviour (Ausubel, Novak and Hanesian, I.M.: Novak, 1983). They view teaming as a process of conceptual change (Hewson, 1982; Novak, 1993; Posner, 1970). Novake and Gowin (1984) developed an offshoot from Ausubel's theory of meaningful verbal learning a

concept mapping. It is a technique of hierarchically arranging the concepts in a deductive manner with the broader concepts placed at the top followed by the less inclusive concepts to facilitate meaningful learning. Concept map is an 'interlocking' network of 'newly and previously acquired knowledge' of the learner, which is a visual representation of linkage or connection between a major concept and other knowledge student have learnt.

Concept maps are very useful to meet the material to be learned must be conceptually clear and presented with language and examples related to the learner's prior knowledge. Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some types and relationships between concepts indicated by a connecting line linking two concepts.

Although several studies have been conducted on concept mapping as an instructional strategy (Akin, 1977; Bello, 1997; Esiobu and Soyibo, 1995), some important factors were either not investigated at all or insufficiently reported. For instance, gender influence seems to be an important factor in concept mapping as noted by Novak and Mausonda (1991), but surprisingly, gender influence was not sufficiently reported on concept-mapping studies as reported by McConney, Galio, Wood, Senn and Hathelin (1993). The remarkable efficacy of concept-mapping instructional strategies in enhancing meaningful learning in science has been widely reported in science education literature (Bello, 1997; Esiobu & Soyibo, 1995). Therefore, it is important to investigate the influence of gender on concept-mapping ability and achievement.

Concept mapping is a teaching and learning strategy that enables learners to organize concepts and their relationships a hierarchical manner from the most general, most inclusive concepts to most specific, least inclusive concepts (Novak, Gowin & Johansen, 1984). In other word, Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts. Words on the line referred to as linking words or linking phrases, specify the relationship between the two concepts. There are two features of concept maps that are important in the facilitation of creative thinking: the hierarchical structure that is represented in a good map and the ability to search for and characterize new cross-links.

Research has shown that poor performance in sciences is largely due to the use of conventional teaching methods (Johnson & Johnson, 1991; Wachanga & Mwangi, 2004). These teaching approaches are mainly expository in nature hence makes learners to be passive recipients rather than active participants in the construction of knowledge (Tsuma, 1998). Using concept maps in different fields of science education, such as biology chemistry, geology, economics and physics have had positive results. Fajunyomy (2000) compared the effects of instructional methods of concept mapping and speech methods on student learning. Results showed that concept mapping technique in comparison with speech has more impact on student achievement.

### **NEED AND SIGNIFICANCE OF THE STUDY**

There are varying instructional goals for different classes and different subjects we can refer Bloom's taxonomy of educational objectives or goals, which is categorized in to three domains: Cognitive, affective and psychomotor. To achieve these educational objectives or goals, the teacher must practice different teaching strategies.

Concept mapping has been used by the science educators, researchers and curriculum developers to track student's learning patterns to assess student's understanding and to redesign curriculum. Concept maps are based on the assumption that hierarchical concept relationships are



building blocks of knowledge. Analysis of student's concept maps may allow teachers to gain insight in to both content and organization of student's knowledge.

Raghavan (1991) studied the concept mapping in learning physical science and its relation to scholastic performance, cognitive ability and attitude towards concept mapping and science interest among standard IX students. It can be said that concept mapping strategy had a significant positive influence over scholastic performance. Kumuda (1999) studied a comparative study on the effects of traditional lecture method and concept mapping on achievement in physics of higher secondary students. It can thus be said that the concept mapping method is very effective in achievement of standard XII studies. Palnakar, Baviskas and Padmini (2005) studied concept mapping, A new technique for science education, they stated that the hierarchical structure for a particular domain of knowledge depends on the context in which that knowledge is being applied or considered. They emphasized that it is best to construct concept maps with reference to the question that we seek to answer through the organization of knowledge in the form of concept maps.

Since many studies have been made on concept mapping, no one has conducted a study on effectiveness of concept mapping on achievement in science and problem solving ability in science separately. Therefore the researcher is interested to know to what an extent concept mapping influences on achievement in science of students of Bangalore city.

### **STATEMENT OF THE PROBLEM**

The study sought to investigate the Effectiveness of Concept Mapping Strategy of Teaching Science on Achievement in Biology of Secondary School Students.

### **OBJECTIVES OF THE STUDY**

In order to achieve the purpose of the study, the following objectives were stated:

- 1.To compare the achievement in biology of students who are taught through Concept Mapping Strategy (CMS) with that of those who are taught through Conventional Teaching Method (CTM).
- 2.To determine whether students' achievement in biology is affected by sex, when they are taught through Concept Mapping Strategy.

### **STATEMENT OF HYPOTHESES**

- 1.There is no significant difference between the pre test and post test mean scores of Achievement in Biology of control group by Conventional teaching method.
- 2.There is no significant difference between the pre test and post test mean scores of Achievement in Biology of experimental group after intervention of Concept Mapping Teaching Strategy
- 3.There is no significant difference between secondary school boys and girls mean scores of Achievement in Biology of experimental group by Concept Mapping Strategy.

### **METHODOLOGY**

Participants in this study were 60 grade IX students from co-educational state secondary school from two classes of a general science course taught by the same teacher. For the purposes of the study, one of two instructional methods was randomly assigned to each class. This study is a comparative research that employed an experimental group and a second group that was taught in a more conventional teacher-centered manner (called the control group). The subjects were 60 students. One class (n = 30, 16 boys and 14 girls) was assigned as a concept mapping group and the other (n = 30, 16 boys and 14 girls) as the control group. The researcher self prepared Achievement Test in Biology was

employed in this study. A 30-item multiple choice pre-test of internal consistency 0.80 measured through Cronbach alpha was developed by the researcher and administered to the subjects prior to the experiment and after the intervention of concept mapping instructional strategy. The test items were derived from Karnataka State board IX standard biology content. The data obtained was analyzed descriptively and inferentially by calculating percentages, mean, Standard Deviation and 't' values.

## ANALYSIS AND INTERPRETATION OF DATA

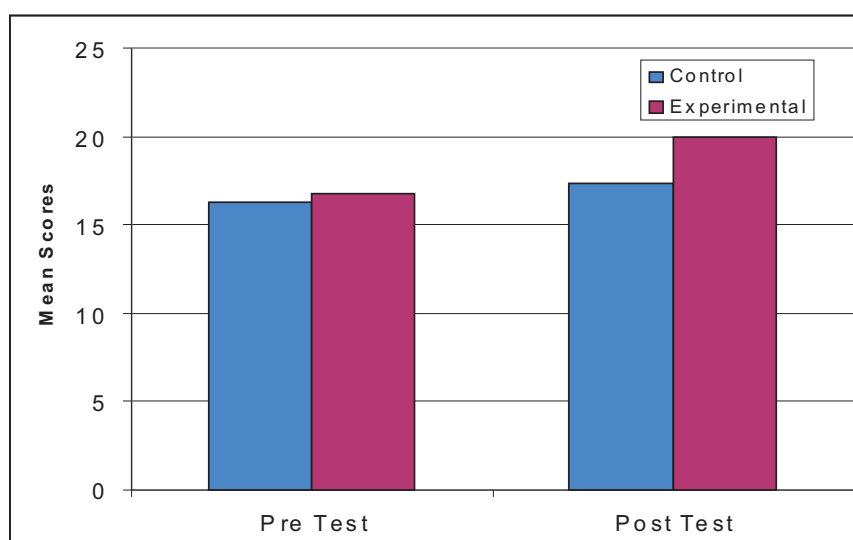
**Table-1**

**Table showing effect of concept mapping on achievement in Biology between pre test and post test scores of Control and Experimental groups.**

Group	N	Pre Test			Post Test		
Experimental	30	16.766	2.812	0.65	19.966	3.112	3.38**
Control	30	16.266	3.106		17.300	2.984	

<sup>NS</sup>Not Significant \*\* Significant at 0.01 level

The analysis of data revealed that the experimental group students had performed better when compared to the control group on the achievement test in biology on the post test scores. This was evidenced through the 't' values obtained for achievement in biology ('t' = 3.38) which is significant at 0.01 level.



Graph shows comparison of pre test and post test mean scores in Achievement in Biology of Controlled and Experimental Groups.

Effect of Concept Mapping on Achievement in Biology between Boys and Girls

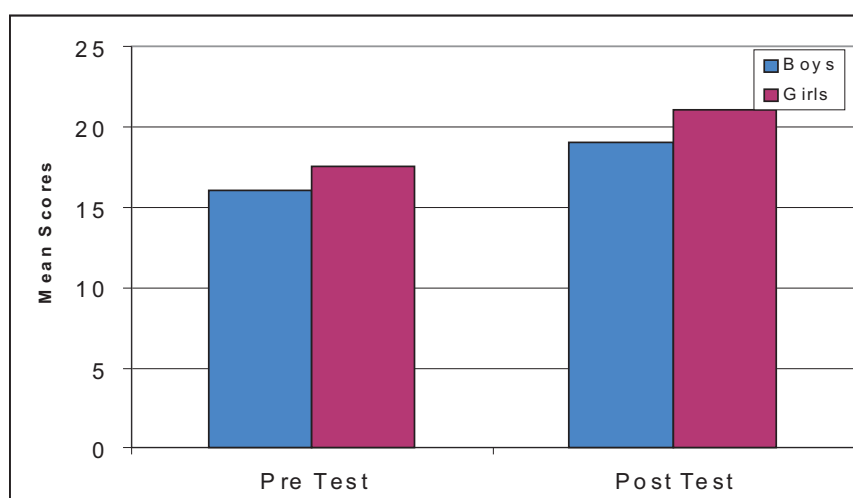
Table-2

Table shows Mean scores and Standard Deviations of boys and girls for the results of the Concept Mapping Strategy after the treatment.

Sex	N	Pre Test		Post Test			
Boys	30	16.062	2.909	1.51 <sup>NS</sup>	19.000	2.762	1.91 <sup>NS</sup>
Girls	30	17.571	2.563		22.071	2.138	

<sup>NS</sup>Not Significant

The analysis of data revealed that the both boys and girls had performed better when compared to the control group on the achievement in biology on the post test scores. This was evidenced through the 't' value obtained for achievement in biology ( $t=1.91$ ) which is not significant at 0.05 level.



Graph shows comparison of pre test and post test mean scores of Achievement in Biology of experimental group after intervention of concept mapping strategy.

#### FINDINGS OF THE STUDY:

By the analysis of data, the following findings emerged. The details are as under :

1. There is no significant difference between the pre test and post test mean scores of Achievement in Biology of control group ( $t=0.65$ ;  $P>0.05$ ).
2. There is a significant difference between the pre test and post test mean scores of Achievement in Biology of experimental group ( $t=3.38$ ;  $P<0.01$ ) after intervention of Concept Mapping Strategy.

#### DISCUSSION OF RESULTS

This empirical study showed that concept mapping is more effective teaching learning strategy than the conventional method, to improve achievement in biology and problem solving ability in biology of IX standard students. The results of the study extend the findings of Ahmad Bilal Cheema (2013) and Yunus Karakyu (2010) recommended that concept mapping should be used in elementary classes for teaching general science and also stated that concept maps also be incorporated in the



textbooks of science subjects at school level. The present results have implications for the preparation of biology teacher, especially in the area of identifying slow learners and adopting effective methods of tackling their problems. Biology educators would need to be aware of the utility value of the concept mapping approach to teaching and learning process. A schedule for learning and using the concept mapping strategy for instructional purposes should be built into the training programmes for pre service biology teachers and in-service teachers.

## CONCLUSION

1. Concept Mapping Instructional Strategy was more effective than conventional method of teaching in increasing average Achievement in Biology of IX grade students.
2. Both boys and girls had similar improvement Achievement in Biology instructed by Concept Mapping Instructional Strategy.

## IMPLICATIONS AND SUGGESTIONS

In the light of the findings and conclusion of the study, following implications and suggestions made by the researcher:

1. Text book being a primary tool to deliver the concept to the students lays a heavy responsibility on the textbook writers to develop a balanced textbook in terms of content; methodology, practical activities and assessment exercises.
2. Since the concept mapping strategy had significant positive effect on the Achievement in Biology of the students so the faculty development programme should be started for the preparation of teachers as a facilitator.
3. Concept mapping is an emerging teaching learning strategy. Pre service and in service teacher education programs ought to incorporate it in the curriculum to prepare teachers with respect to its philosophical background, theoretical based and practical usage.

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