INFLUENCE OF INDIVIDUAL AND COLLABORATIVE CONCEPT MAPPING STRATEGY OF TEACHING SCIENCE ON CONCEPTUAL CLARITY AMONG SECONDARY SCHOOL STUDENTS

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ABSTRACT :

The present scenario requires people who are self learners, who have developed problem solving abilities and who are capable of change management. To develop problem solving ability and abstract thinking, education must use constructivist approach to teaching. Efforts are being made by the educationists as to how to improve teaching-learning methods so as to result in better understanding of the concepts and better learning skills. This has led to 'constructivism' as a trend in the pedagogy where teacher's role is that of a facilitator and the students 'construct' their own understanding and are made responsible for their own learning. Bruner, Ausubel and Vygotsky are the psychologists who advocate constructivism. It makes necessary for us to look for methodologies to achieve an effective instruction, that is, a teaching that is conducive to meaningful learning. Concept mapping is one such effective constructivist approach to teaching of science. The author in this paper presents the effectiveness of an instructional module involving concept mapping strategy of teaching science on conceptual clarity and attitude towards learning among secondary school students.

INTRODUCTION

The good learning of specific scientific subject requires not only the knowledge of different concepts that the subject contains, but also the adequate relation among such concepts in order to obtain a satisfactory meaning of them. In this sense, it makes necessary to look for methodologies to achieve an effective instruction, that is, a teaching that conduces to meaningful learning. Concept mapping is one such effective constructivist approach to teaching of science. Concept maps are two –

dimensional graphical representation of a knowledge in a given domain (Novak and Gowin, 1984) developed for achieving meaningful learning in classroom (Ausubel, et.al. 1978).

Concept mapping was developed by Novak and his team of researchers at Cornell University, Ithaca, New York. The concept mapping was developed based on Ausubel's (1968) Assimilation theory of cognitive development. Concept maps are two-dimensional graphical representation of a knowledge in a given domain (Novak and Gowin, 1984) developed for achieving meaningful learning in classroom (Ausubel, et.al. 1978).Concept mapping is a technique for representing knowledge in graphs. Knowledge graphs are networks of concepts. Networks consist of nodes (points/ vertices) and links (arcs/ edges). Nodes represent concepts and links represent the relations between concepts. Studying science, using strategies to learn terminology and concepts effectively will help students to attain the conceptual clarity. Therefore the researcher decided to experiment with the concept mapping strategy in the teaching of science.

STATEMENT OF THE PROBLEM

The present research is an experimental study seeking to assess the Influence of Individual and Collaborative Concept Mapping Strategy of Teaching Science on Conceptual Clarity among Secondary School Students. The following was the aim and objective of the study.

AIM OF THE STUDY

- To study the practice effect of the skill of concept mapping on the conceptual clarity of secondary school students in Science.

OBJECTIVE OF THE STUDY

The study sought to realize the following objectives:

- To study the practice effect of the skill of concept mapping on the conceptual clarity of secondary school students in Science.

HYPOTHESIS OF THE STUDY

In pursuit of the objective of the study, the following null hypothesis was formulated**:**

H_0. There is no significant difference in the conceptual clarity of secondary school students in Unit.1(Atomic Structure) and Unit.2 (Atmospheric Pressure) learnt by concept mapping strategy.

OPERATIONAL DEFINITION OF THE TERMS

Concept Mapping Strategy: It is a constructivist method of learning Science wherein both the teacher and the learner make use of concept maps represent in an organized manner, the knowledge of the subject matter. This method involves instructional scaffolding with the teacher taking charge of the instructional process to a greater extent in the beginning and then allowing students greater freedom and flexibility in drawing their own concept maps. (The difference between concept maps and context maps is that a context map has only one main concept, while a concept map may have several concepts at the same hierarchy level. This comes down to the point that a context map can be represented as a tree, while a concept map may need a network representation.)

Individual Concept Mapping Strategy : It is the strategy of instructional scaffolding wherein the teacher explains the scientific concepts using the concept maps and facilitates drawing of the concept maps by the students ***individually*** for the given scientific concepts.

Collaborative Concept Mapping Strategy : It is the strategy of instructional scaffolding wherein the teacher explains the scientific concepts using the concept maps and facilitates drawing of the concept maps by the students ***collaboratively*** for the given scientific concepts.

Teaching of Science : It means the facilitation of construction of knowledge by students by processing of information (related to science topics) given in the text book or handouts into meaningful organization of knowledge in the form of concept maps.

Conceptual clarity : This refers to the understanding of the concepts and sub concepts

involved in the science topics taught by concept mapping strategy as indicated by the concept maps drawn by the students in the post test. This is indicated by the post test scores of secondary school students on the topics *Atomic Structure* and *Atmospheric Pressure.*

Secondary school students: These are the students studying in class 8, 9 or 10 of schooling as per the pattern offered by Maharashtra State Secondary Certificate Board (SSC).

REVIEW OF RELATED LITERATURE

Concept mapping is being researched of late as an alternative strategy to teaching and testing. It has been found to be an effective teaching method which enhances meaningful learning. Feeling like more active learners, concept mappers are empowered to move toward more meaningful learning. Concept mapping appeared to enhance clarity of learning, integration and retention of knowledge *(Novak, J.D. and Heinze-fry 1990).* Concept mapping as an instructional tool had an effect on the achievements of students who also reflected a positive attitude towards concept mapping as an effective teaching strategy *(Manjula Rao 2003).* Some have suggested improvements in constructing the concept maps: concept maps should be construction of concept maps should be based on certain kind of discipline and evaluation of it should also be based on semantics of linking words and not on graphical criteria alone *(Kharatmal Meena 2004).* Concept mapping was found to be an effective alternative teaching and testing strategy for the inclusive science classroom *(Thomas. S and Kharade. K 2008).*

Some studies have showed that the participants hold idiosyncratic concepts not consistently coincident with those of the prescribed curriculum, and that everyday concepts are retained more than are scientific concepts *(Ross, B. and Hugh, M (1991).* The process of mapping concepts in group activity may be more important than the concept map itself. It was also found that students tended to engage not often enough in the processes which foster the construction of meaning *Roth, M. and Roychoudhury (1992).* Concept mapping can be a useful strategy in tracking student's evolving constructions of knowledge in a particular subject area and in promoting

reflection *(Barbara B. and Joyce S. 1990).* Concept mapping offers a valid and potentially useful technique for documenting and exploring conceptual change in biology *(Josephine W. and Joel M. 1990).* It is felt that research on student's facility in using concept maps, on training techniques, and on the effect on teaching is needed if concept map assessments are to be used in classrooms and in large-scale accountability systems *(Araceli, M. and Shavelson, R.1996).*

Many researchers have studied the concept maps as a research and evaluation tool. The concept map provides a theoretical powerful and psychometrically sound tool for assessing conceptual change in the experimental and classroom settings *(Markham, K. M. and Mintze, J. 1994).* Collaborative concept mapping was found to provide a context for teachers in changing their classroom environments from objectivist to constructivist metaphor *(Roth, M. and Roychoudhury 1994).* The mapping led to sustained discourse on the topic and showed declarative knowledge of several students both in terms of the hierarchical organization and brief configuration of the concepts *(Roth, M. and Roychoudhury 1993).*

A few researchers have showed concept mapping to be beneficial for learning, and to support sustained small-group discussion of scientific ideas. The concept map as an interview tool facilitated the evaluation of student's understandings about Global Atmospheric Change. Regression analysis revealed that most POSTICM students perceived the concept mapping interview component helpful and affect positively their answers to the interview questions *(Rye, J.A. and Rubba, P. A. 1998)* . Concept mapping/learning cycle and concept mapping treatment groups significantly outperformed from the expository treatment group in conceptual understanding of diffusion and osmosis *(Odom, A. and Kelly, P. 2001).* The cyclic structure, the quantification of the header concept and the focus question "How" in concept maps significantly increased dynamic thinking *(Derbentseva, N., Safayeni, F***.** 2007). The teaching of environmental studies through concept mapping strategy helped students in enhancing the retention rate, stimulating creativity among the students. It also helped in motivating them, increasing the level of interest, high level of critical thinking and reducing anxiety *(Mary, R. and Raj, P. 2007).* Concept mapping was significantly more effective than the traditional /expository teaching strategy in

enhancing learning in biology and reduced student's anxiety towards the learning of biology(especially in males) **(***Olugbemiro J., Folusho A., Peter A. 1990).*

While several studies have already demonstrated the potential of concept mapping strategy as an instructional tool, it is yet to be tried on the vernacular medium students. Therefore, the researcher decided to try out the concept mapping strategy to enhance the conceptual clarity of Marathi medium students in Science subject.

METHODOLOGY OF THE STUDY

The present study is a **quasi-experimental study** following the Counter Balance Design / Two Groups Equivalent Materials Post Test Only Design.

X_1	MA_1	O_1
X_2	MB_1	O_2
X_1	MB_2	O_3
X_2	MA_2	O_4

Two units of approximately equal difficulty level in Science subject were selected and modules were prepared for instructional intervention by Individual concept mapping strategy and Collaborative concept mapping strategy in order to find the conceptual clarity and attitude towards learning of secondary school students. In the first stage, the first unit was taught to the first group ($X_{1)}$ by Individual concept

mapping method (MA1) and the second group ($X_{2)}$ by Collaborative concept mapping strategy (MB1). After completing the unit, a criterion test (post test) on that unit was administered to both the groups to assess the conceptual clarity of the unit taught (O1 and O2).

In the second stage, the second unit was taught to X_1 by collaborative concept mapping strategy (MB2) and X_2 by individual concept mapping strategy (MA2). After completing the unit, criterion test (post test) was administered to both the groups to assess the conceptual clarity of the unit taught (O_3 and O_4).

INSTRUMENT:

The researcher prepared the following instruments for collecting data:

Criterion Referenced Post Test in Science: Criterion referenced test was developed in Science by the researcher on the topics *Structure of Atom* (AS) and *Atmospheric Pressure* (AP) to test the conceptual clarity of the participants in both the units.

Instructional Module: The Instructional Module consisted of the objectives of the lesson, content description, and the expert concept maps. The overview of the module is given below:

PARTICIPANTS

In the present study, the researcher made use of **convenient and purposive sampling technique** in order to select the experimental groups for the study. The two schools affiliated to the SSC board viz., private-aided and government-aided were selected. From each of the schools selected, two intact classes of Standard VIII were selected. Total 252 students were selected which was the sample for this study. Care was taken to see that the sample characteristics represented the population from which it was drawn: girls and boys, who came from different family and academic backgrounds. For this, the researcher selected the schools from various localities in Mumbai. They belonged to the age group between 13 to 14 years.

FINDINGS OF THE STUDY

The following table presents the inferential statistics and the verification of hypothesis:

Table

Inferential Statistics (t test) showing the Significance of the Difference between the Means of AS and AP Posttest Scores of the Participants

Unit	N	Mean		Table Value		t value	Level of Significance
				.05	0.01level		
AS	252	15	SD	1.97	2.6	3.17	Significant (0.01 level)
AP	252	48	17.89				

The verification of hypothesis has revealed the following:

- There is significant difference in the conceptual clarity of secondary school students in Unit.1(Atomic Structure) and Unit.2 (Atmospheric Pressure) learnt by concept mapping strategy. While the post test mean score on AS indicates negligible gain in the conceptual clarity, the post test mean score on AP indicate a substantial conceptual clarity.

Conclusion

It means that there is significant difference in the conceptual clarity in Unit 1 and Unit 2, though both were learnt by concept mapping technique, which the students were not familiar with. In Unit 1 on AS, the participants had to master the technique of concept mapping in addition to the concepts to be understood. Then, the post test was unique in the sense that the participants had to answer the questions by drawing their own concept maps. The students might have taken some time to master the new technique. The benefit of the practice effect of concept mapping could be seen in the results of Unit 2 where there is a definite, drastic improvement in the posttest scores of the participants on AP. The findings agree with that of Sizmur, S. and Osborne, J. (1997) who found concept mapping to be beneficial for learning.

No two concept maps were alike in the post test answers. That means that the students wrote the answers in the form of concept maps out of their

understanding and not from rote memory. If the students could improve in their concept mapping within such a short time, the researcher feels that they may benefit substantially if concept mapping is used regularly as a teaching as well as testing strategy.

The present study throws light on the effectiveness of concept mapping strategy, which in turn will influence the educational policy by promoting constructivism in place of objectivism, concept mapping as a tool of teaching as well as testing. This, in turn, could influence curriculum developers and textbook writers who may promote concept mapping as a tool for learning.

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