Impact Factor : 1.021 Peer-Reviewed Journal ISSN : 2278 – 5639
Global Online Electronic International Interdisciplinary Research Journal (GOEIIRJ)
{Bi-Monthly} Volume – III, Issue - V February 2015
Theme - " Pedagogy And Teaching Learning "

INFLUENCE OF CONCEPT MAPPING STRATEGY IN SCIENCE

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Abstract :

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 it necessary for all teachers to look for methodologies to achieve an effective instruction, that is, a teaching that is conducive to meaningful learning. According to Ausubel, meaningful learning involves a conscious effort on the part of the learner to relate new knowledge in a non-arbitrary way to relevant existing concepts in the learner's cognitive structure. Rote learning results in arbitrary incorporation of new knowledge into cognitive structure of the learner. Concept mapping is one such effective constructivist approach to teaching of science. This paper discusses about how the practice in the skill of concept mapping influence the conceptual clarity of secondary school students in Science.

Introduction

Teaching of science subjects involves the development of both knowledge skills, including basic concepts laws, theories and principles of different specific sciences and intellectual sills, among them logical thinking, problem solving, design and communication.Teaching of Science subjects must contribute to develop two aspects. It must develop knowledge skills, including basic concepts, laws, theories and principles of the different specific sciences. It must also develop intellectual skills, among them, logical thinking (the ability to make logical decisions), problem solving (the ability to resolve issues, problems and tasks), design (the ability to sketch, plan and work out designs creatively) and communication (the ability to exchange information with other people).

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 it necessary for all teachers to look for methodologies to achieve an effective instruction, that is, a teaching that is conducive to

meaningful learning. According to Ausubel, meaningful learning involves a conscious effort on the part of the learner to relate new knowledge in a non-arbitrary way to relevant existing concepts in the learner's cognitive structure. Rote learning results in arbitrary incorporation of new knowledge into cognitive structure of the learner. Concept mapping is one such effective constructivist approach to teaching of science.

Importance of Concept mapping in Science

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*(ManjulaRao 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*(KharatmalMeena 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).*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).*

Concept Mapping : A Constructivist Approach to the Teaching of Science

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 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.Concepts and sometimes links are labeled.

Concept mapping is a process of meaning making. A concept is a perceived regularity in events or records of events or objects, designated by a Label (Nov 1984). Key to the construction of a concept map is the set of concepts on which it is based.Coming up with the list of concepts to include in a map is really is just an issue of retrieving from long term memory. It is the process of

linking the concepts to create meaningful propositions within the structure of concept map that is the difficult task.

Ausubel assumes that meaningful learning requires that the learner's cognitive framework contain relevant ideas to which new material can be related. He argues that the most important factor influencing learning is what the learner already knows. Meaningful learning results when the learner makes a conscious effort to relate new knowledge to be learned with relevant knowledge they already possess. In contrast, rote learning results when the learner memorizes the new information and makes little or no effort to relate and integrate this with their prior knowledge. Information learned by rote is soon forgotten and there is little chance for the application of this knowledge in new problem solving contexts (Nov 1998).

Concept mapping is the process of organizing concepts and relationships between concepts in a hierarchical manner, from more inclusive concepts to more specific, less inclusive concepts (Novak &Gowin, 1984). Concept maps are hierarchical in that the more general, more inclusive concepts are at the top of the map, with progressively more specific, less inclusive concepts arranged below them. The hierarchical organization of concepts in a concept map is supposed to reflect the hierarchical organization of knowledge in cognitive structure while links between concepts demonstrate the manner in which new concepts are integrated with existing knowledge structure.

Design and Procedure

The present study is **a quasi-experimental study following the Counter Balance Design** -Two Groups Equivalent Materials Post Test Only Design. The researcher made use of **convenient and purposive sampling technique**. 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. They belonged to the age group between 13 to 14 years. In the first stage, the first unit was taught to the first group (X_1)by Individual concept mapping method (MA_1) and the second group (X_2)by Collaborative concept mapping strategy (MB_1). 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 (O_1 and O_2).In the second stage, the second unit was taught to X_1 by collaborative concept mapping strategy (MB_2) and X_2 byindividual concept mapping strategy (MA_2). After

completing the unit, a criterion test (post test) was administered to both the groups to assess the conceptual clarity of the unit taught (O_3 and O_4).

Research Question :

To what extent does practice in the skill of concept mapping influence the conceptual clarity of secondary school students in Science?

Since concept mapping technique was new to the students, the researcher thought that the performance of the students may improve in the second unit post-test as compared to the first. Therefore, the percent mean scores of the participants in AS and AP were compared to see if the practice in concept mapping led to better performance in AP (second unit) as compared to AS(first unit).The following table shows the percent mean of the post test scores on Atomic Structure (AS) and on Atmospheric Pressure (AP) of the participants:

Table 4.3 PERCENT MEAN OF ATOMIC STRUCTURE (AS) AND ATMOSPHERIC PRESSURE (AP) OF THE PARTICIPANTS

Unit	Total sample (N=252)	Private aided (N=159)		Government Aided (N=93)		Above Average (N=38)	Average (N=178)	Below average (N=36)
		Boys (N=82)	Girls (N=77)	Boys (N=31)	Girls (N=62)			
AS	15	14	15	11.43	16.14	17.68	14.84	10.54
AP	48	51.77	53.68	30.54	44.30	56.81	49.88	28.74

Percent mean scores of the participants on Atomic Structure and Atmospheric Pressure are 15% and 48% respectively which indicates that influence of practice in the skill of concept mapping is moderate.

Conclusion :

There is marked 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 percent mean score of AS indicates negligible gain in the conceptual clarity (15%) that of AP indicates moderate conceptual clarity (48%).*** Such a progressive trend could be observed gender-wise, school-wise and among average, above average and below average students.

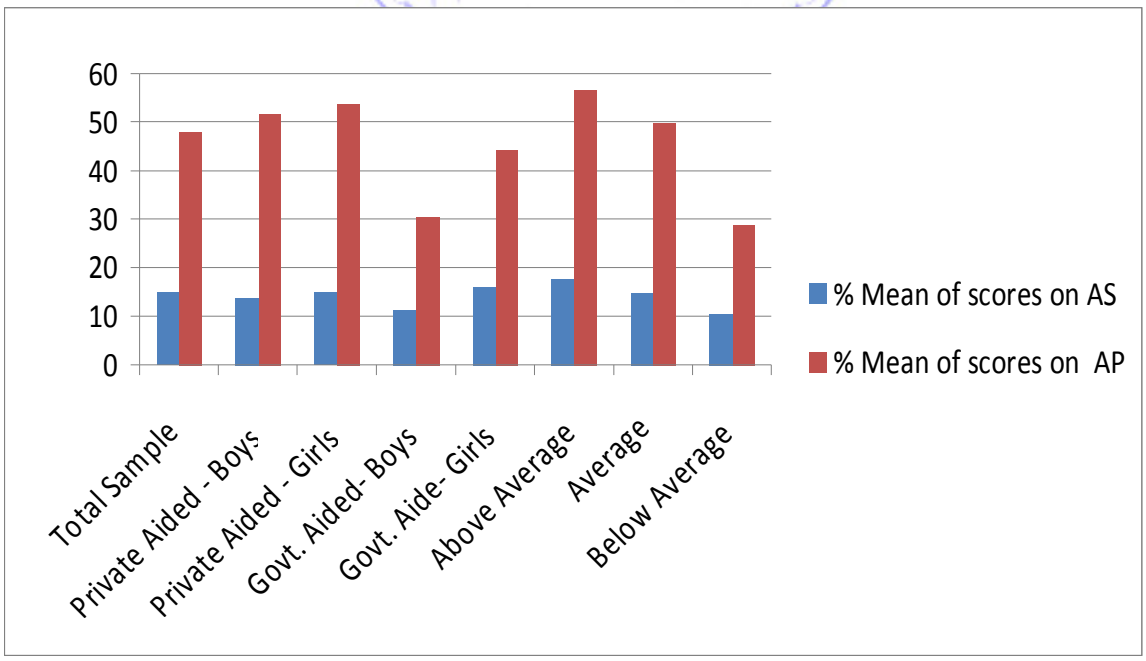
Discussion :

This means that there is a marked difference in the conceptual clarity of the participants in Unit 1 and Unit 2, though both were learnt by concept mapping technique which the students were not familiar with. This may be because of the fact that 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. Therefore, they might not have been able to represent their knowledge through concept maps in the first posttest.

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.

The following figure 4.2 gives the graph of the percent mean scores of post test scores of the participants (unit-wise).

Fig. 4.3 PERCENT MEAN OF POST TEST SORES OF THE PARTICIPANTS (UNIT-WISE)



The concept maps of the participants show the marked improvement in their ability to represent their knowledge in the form of concept maps.

Conclusion

By seeing the students' enthusiasm for learning by this new method and the demonstration of their ability to draw good concept maps within a matter of a short period of time showed that the students will master the skill of concept mapping and will enjoy learning by this method if it is made a regular feature in the school learning.

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