Effect of Concept-Mapping in Science on Science Achievement, Cognitive Skills and Attitude of Students

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Theoretical framework of the study

In order to improve instructional methods carried out in the classroom and improvement of students' learning, there have always been a search for more potential ways of instruction. One of the strategies that has evolved as a useful tool in leading students towards meaningful learning is 'Concept Map'. Concept mapping is seen as a useful tool for helping students learn about the structure of knowledge and the process of knowledge production or meta-knowledge. In contrast to students who learn by rote, students who employ meaningful learning are expected to retain knowledge over an extensive time span and find new related learning progressively easier.

The use of concept maps as a teaching strategy was first developed by J.D.Novak in the early 1980's, derived from Ausubel's learning theory which places central emphasis on the influence of students' prior knowledge on subsequent meaningful learning. Concepts maps are diagrammatic representations which show meaningful relationships between concepts in the form of propositions which are linked together by words, circles, and cross links. Concepts are arranged hierarchically with the Super ordinate concepts at the top of the map, and subordinate at the bottom which are less inclusive than higher ones. "Cross links" are used to connect different segments of the concepts hierarchy, which indicate syntheses of related concepts, a new interpretation of old ideas, and some degree of creative thinking.

In recent years, along with the various innovative methods ,constructivism in the classrooms as an interpretative process involving individual's constructions of meanings in science is being suggested. New constructions are built through their relations to prior knowledge and it is a pedagogic challenge for teacher to focus on students' learning with understanding. To learn science from a constructivist philosophy implies direct experience with science as a process of knowledge generation in which prior knowledge is elaborated and changed on the basis of fresh meaning negotiated with peers and teacher. Concept mapping stimulates this process by making it explicit.

This research paper is an outcome of an ERIC project, NCERT which aimed at investigating the use of concept mapping as a strategy to enhance meaningful learning and to improve upon the process skills of students in science.

Objectives of the Study

- To develop and implement concept mapping as a strategy in the selected few units of science for VIII standard students and study its effect on the achievement , concept attainment, and the process skills of students belonging to different intelligence groups.
- To study the attitude of students towards concept mapping in science.
- To study the gender differences in science achieve-

ment, process skills and attitude towards concept mapping.

Design and Sample of the Study

The study was quasi-experimental in nature wherein non-randomized pre and posttest design was used. The intact classes of eighth standard as a whole were considered as experimental (47) and control group(42) for the study, from two local schools of Mysore city.

Tools used in the study

Raven Progressive Matrix was used to group the students according to their intelligence. An achievement test based on selected units of the eighth standard syllabus, a process skills test and a concept attainment test were developed to measure the students' achievement, process skills and attainment of concepts in science. An attitude scale was developed to measure students' attitude towards concept mapping.

Procedural Details of the Study

The lessons in the selected units of science were developed based on constructivist model which included i) planning student exploration ii) explanation iii) expansion and iv) evaluation. The tools and the lessons were tried out and Item analysis was carried out in case of achievement and process skills test. The tools were administered to both experimental and control groups as pre-test. The project was implemented to the students of Experimental Group during which they were oriented about the steps involved in concept mapping followed by the implementation of the science lessons. Concept maps were evolved during the process of instruction along with the explanation. Concept maps were developed at the review stage on the blackboard with the help of students. The student constructed maps in groups as well as individually, were made to be presented and discussed. The concept maps were used as assessment tools in all the units.

The data obtained was analysed descriptively and inferentially by calculating percentages, mean, SD and "t" values and ANOVA.

Major Findings of the Study

i) The analysis of data revealed that the experimental group students had performed better when compared to the control group on the achievement test, process skills and concept attainment test on the post test occasion. This was evidenced through the "t" values obtained for achievement test (9.66); process skills (6.34) and the concept attainment test (4.40).

The analysis of students' (experimental) attitude towards concept mapping revealed that almost 90% of them had a very positive attitude.

ii) The F values obtained (5.921) showed that there is a difference between and within the different intelligence groups of the experimental group in their post-achievement test implying that the concept mapping strategy has had a differential effect on students belonging to different intelligence groups. Similarly, the F value obtained for concept attainment test was found significant implying that there is a difference within and between the students of different intelligence in their concept attainment ability. But there was no difference found either between or within the different grades of students in their performance of process skills.

iii) There was no difference observed between girls and boys in their achievement, process skills, concept attainment and in their attitude towards concept mapping.

Based on the results of this study, it is concluded that there is a need to include concept mapping with the constructivist basis as one of the major approaches to teach science in schools and provide workable strategies to help students "learn how to learn".

References

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