“Effect of Concept mapping on the Cognitive Processes and Scholastic performance in General Science for Standard VII Students within Pune City”

(Abstract)

The factors affecting achievement and cognitive processes of students have been a matter of concern amongst educators. Many studies have been conducted to find the various factors affecting achievement and cognitive processes. One of the factor affecting these are instructional strategies. Various studies have pointed out Lecture method though time tested has its own limitations. One of the draw back is the learner is made passive. In the sub continent of India, Science teaching in schools is primarily oral. The teacher recites the book knowledge. This is partly due to the large enrollment and Kothari commission (1964-66) has mentioned the verbatim mode has made teaching dull and monotonous.

An extensive study was done by the EI in ICSE and CBSE schools of the major metros of India The study shows that there is an alarming gap in student learning. They found out the schools irrespective of their affiliations, basically demonstrated rote learning and application of the learning was very low. In order to shift from rote learning to meaningful learning new teaching strategies required to be implemented by the teachers.

One of the strategies used in the construction of ideas was concept mapping. Students’ prior conceptual networks can be mapped and assessed for the development of knowledge. Through teacher mediation the maps are continuously reconstructed and thus in-depth knowledge in the particular concept is developed. This strategy is based
on Constructivist Cognitive Based Model, which is designed to engage the learner in the active processing of information throughout the learning experience. The use of concept maps as a teaching strategy was first developed by J. D. Novak of Cornell University in the early 1980's. It was derived from Ausubel's learning theory, which places central emphasis on the influence of students' prior knowledge on subsequent meaningful learning. A concept map provides a visual lens of learners' limited or inappropriate hierarchical propositions and cross-links that require conceptual change.

The objectives of the study were:
1) To study the effect of concept mapping on the development of higher mental abilities of standard VII students in General Science.
2) To study the impact of teaching through Concept Mapping on the achievement of standard VII students in General Science (Chemistry, Biology).
3) To investigate the opinion of the students on concept mapping as a pedagogical tool in the learning process.

The present study was aimed at finding the comparative effectiveness of concept mapping as a pedagogical tool, on the cognitive processes and scholastic performance of ICSE students of Standard Seven, for selected units of the subject, General Science. In the school set up random assignment of subjects was not possible for the researcher hence Quasi - Experimental Design was selected. The sample was a matched group, hence the design used for the study is called The Matching only Pre-Post test Control group Design. The target population is seventh standard students of ICSE schools and the sample is a purposive sample of 83 wherein it became a matched group of 60. The internal validity was maintained using the experimental – control matched group. The external validity was maintained using ecological generalization (text books & methods) and matched sample from the
population. The Group test of intelligence by Pramila Ahuja was used for selecting the matched group. The instruments used for the study of the variables were 1) Instrument to measure higher mental abilities in Science. 2) Unit test I 3) Unit test II.and 4) Trifone opinionnaire on concept mapping. Since the study was a quantitative study inferential statistics were employed. Mean, standard deviation, t – tests were conducted. Effect sizes were also calculated.

The study is reported in six chapters which is as follows:

**Chapter one** deals with background of the study, the context of the problem, the statement of the problem, and the significance of the study. Also from the statement of the problem research questions, objectives and hypotheses were formulated for the study. The limitations and delimitations, and definitions and operational definitions of the study are also mentioned.

In the **second chapter** various problem areas under study are reviewed. The theory base of concept map and the philosophical foundations of concept map is discussed. Since Concept maps are included in Graphic Organizers a brief survey of different types of graphic Organizers are mentioned along with their use. The concept maps can be confused with mind maps, hence mind maps are explained and the difference was also highlighted.

In the chapter the characteristics of concept maps are discussed and steps in the construction of concept maps are also described. A good concept map and a poorly made concept map are displayed so that one might know to construct a meaningful map. After the thorough description of the maps, researches related to concept map done in India and abroad are discussed.

**Chapter three** deals with the methodology of the study. The design of the experiment is quasi – experimental and is discussed in the first part of the chapter followed by the
plan of the study. Then the variables selected for the study are discussed. The discussion is then focused on the experimental validity and the techniques used to control the threats to internal validity and external validity.

The population and the procedure of the selection of the sample are described. Later justification for a small sample is discussed followed by the instruments used in the study. The instruments used in the study, and their construction is explained in detail, along with item analysis, validity and reliability of the test were found out. In the procedure of the study content analysis was done, a comparison with the textbook and the syllabus was prepared, and the reason of the selection of the topic is clearly explained. Further pedagogical analysis was done, lesson plans using concept maps are explained and the process of the treatment is discussed to a larger extent. The precautions taken during the experiment and a note on the problems faced during the study are also mentioned.

**Chapter four** deals with the construction of the THMAGS test. The preliminary discussions and planning of the test construction is dealt with in beginning of the chapter. The importance of instructional objectives and Blooms taxonomy is discussed followed by the objectives and weight ages to the objectives. The opinionnaires of the experts, the content of the test, selection of test items from various sources such as ASSET, TIMSS were discussed followed by the implementation in various schools. The chapter also discusses the table of specifications for the THMAGS, item analysis, the degree of difficulty of test items and validity and reliability of the test.

**Chapter five** deals with the critical analysis of the data. The chapter begins with the procedure of matching the sample using PGTI followed by the design of the collection of data and then analysis of each hypothesis.
**Chapter six** deals with Discussion, Conclusion and Recommendations for the study. Each hypothesis is taken and the results were discussed in depth with the support of the earlier researches. Conclusions were drawn from the study and future line of study was also recommended.

The major findings and conclusion of the study were presented briefly according to each research objective

1) **To study the effect of concept mapping on the Cognitive Processes (higher mental abilities) of standard VII students in General Science.** This major objective was subdivided into sub hypothesis

1) *There is no statistically significant difference at 0.05 level in the Cognitive Processes, between the Experimental group and the Control group of Standard Seven students.*

   – It was found that the cognitive processes of the students improved significantly after the treatment. (Post t- value was 9.89 which was above the expected t – value of 2.048). The effect size was 0.72 showing the treatment had a high positive impact on the higher mental abilities of students.

2) *There is no statistically significant difference at 0.05 level in the Cognitive Processes (mental abilities), of the experimental group and control group, in the selected units of General Science (Chemistry & Biology).* – It was found that the cognitive processes of the student improved significantly after the treatment.( t- value was 3.83 which was above the expected t- value of 2.048). The effect size was 0.92 showing the treatment had a high positive impact on the cognitive processes ( higher mental abilities ) of the students.

3) *There is no statistically significant difference at 0.05 level in the Cognitive Processes (mental abilities) of the experimental group and control group, in the*
It was found the cognitive process of students in selected units of chemistry significantly improved after the treatment (the observed t-value 4.054 is higher than the expected t-value of 2.048) and the effect size is 0.96 showing a high positive impact.

4) **There is no statistically significant difference at 0.05 level in the Cognitive Processes (mental abilities) of the experimental group and control group, in the selected units of Biology.** – It was found the cognitive processes of experimental students in selected units of Biology significantly improved after the treatment (the observed t-value of 3.46 is higher than the expected t-value of 2.048) and the effect size is 0.83 showing a high positive impact.

**II) To study the immediate impact of teaching through Concept Mapping on the achievement of standard VII students in General Science (Chemistry, Biology).** This objective was subdivided into minor hypothesis –

1) **There is no statistically significant difference at 0.05 levels in the achievement between the experimental group and control group, in selected units of General Science.** – It was found the achievement of experimental students significantly improved (the t-value of 4.33 is higher than the expected value of 2.048) and the effect size was 1.1 showing a very high positive impact.

2) **There is no statistically significant difference at 0.05 level in the achievement between the experimental group and control group, in selected units of Chemistry.** – It was found out the achievement of experimental students significantly improved (the t-value of 3.96 exceeds the expected value of 2.048) and the effect size is 1.2 showing the impact was very large.

3) **There is no statistically significant difference at 0.05 levels in the achievement between the experimental group and control group in selected units of Biology.** – It
was found the achievement of experimental students in Biology significantly improved (the t-value of 3.57 exceeds the expected t-value of 2.048) and the effect size is 0.84 showing the impact was large.

III) To investigate the opinion of the students on the use of concept mapping as pedagogical tool in the Science learning process

The results of the study of the opinion of the students suggested that –

1) Concept mapping as pedagogical tool enhanced their effort and encouraged them to take a more active role in learning science. 2) Concept mapping served as an aid in understanding the concepts, in their achievement, and pace of learning science.

3) They felt their interest in science was increased due to use of concept mapping strategy.

4) They reflected more on science concepts and enhanced their perception of being able to learn science in a better way. 5) 80% of the students indicate improvement in their learning process due to the use of concept map as a pedagogical tool. Thus the hypothesis is accepted.

The study contributes to the effect of concept mapping on cognitive processes and the scholastic achievement of the seventh standard students. This in depth study has shown there is a direct relation between the pedagogy used (concept mapping strategy) on cognitive processes and achievement of the students. The opinions of the students show they felt concept mapping helped their effort in understanding concepts. They also believe that concept mapping had a direct effect on their achievement, ability to reflect on science concepts and increased their interest in science. These data and opinions from the study will benefit the teachers to reformulate their teaching strategy. Such a simple teaching strategy bringing a great impact in the achievement and cognitive processes of students will benefit, teachers,
policy makers, administrators, academicians to have a fresh look at concept mapping as a pedagogical tool.

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