

## EFFECT OF CONCEPT MAPPING ON ACHIEVEMENT IN MATHEMATICS AT SECONDARY LEVEL

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### Abstract

*Mathematics is a core subject in our education system both at primary and secondary levels. In Mathematics, logical sequence of basic concepts is very important. Therefore a thorough understanding of concepts and development of logical processes of thinking are essential for effective learning of Mathematics. Concept mapping is one such instructional strategy which can aid to better understanding of Mathematical concepts. The present investigation attempts to study the effect of concept mapping on achievement in mathematics at secondary level for district Ludhiana. A purposeful sample of 30 pupils of ninth grade was taken and divided into two groups i.e. A and B comprising 15 students. Group A was taught concepts of mathematics with the help of Concept Mapping (CM) and Group B was taught with traditional method. While comparing these strategies, it was found that Group "A" achieved more than Group "B". It means that Novak's concept mapping was more effective than traditional method in the teaching of Mathematical concepts. The study also revealed that both males and females improved through Novak's concept mapping as well as traditional method.*

**Key Words:** Mathematics, education, concept mapping, achievement.

Advancement and complexities of modern times have completely revolutionized our education system and the world of work. There has been an increasing demand for literate individuals who can analyze and solve novel problems rather than memorize disparate facts, and have potential to change and adapt. Inculcating analytical and problem solving abilities, deepening levels of understanding and sharpening the mental faculties is thus a challenge before our schools. The purpose of school is to enhance the achievement of a child in multiple areas through set methods of teaching. Therefore, we can say that good schools lead to better achievement. Achievement is the extent to which a learner is profiting from instructions in a given area of learning. It is the outcome of general and specific learning experiences.

Mathematics is a core subject in our education system both at primary and secondary levels. The study of Mathematics is indiscernible in one's life due to the wide range of its application in the present technological society. The National Policy on Education (1986) has visualized Mathematics as a vehicle to train children to think, reason, analyze and articulate logically. Since the quantitative treatment, measurement, analyses and reasoning are being increasingly used in many other subjects, the relevance of Mathematics is emphasized both in the context of the day to day problems in the child's environment and in the context of the child's learning in other concerned subject areas. In Mathematics, logical sequence of basic concepts is very

important. Therefore a thorough understanding of concepts and development of logical processes of thinking are essential for effective learning of Mathematics. Since, Experience has shown that for majority of students, Mathematics is an area of difficulty and many students fail in Mathematics at the end of class 10<sup>th</sup> (N.C.E.R.T., 2000). Hence, it is a problem of concern for teachers, educators and researchers to devise techniques, strategies, methods and models for improving achievement in Mathematics. Concept mapping is one such instructional strategy which can aid to better understanding of Mathematical concepts. Concept mapping is currently gaining popularity in the field of education. It is a product of recent advances in cognitive science. Concept mapping, a technique for externalizing concept and prepositions, was developed by Novak and his colleagues at Cornell University (Novak 1979, p. 466). A concept map is a conceptual tool that has been used in several ways mainly in knowledge areas different from mathematics. However, there are some research reports (Hasemann & Mansfield, 1995; Doerr & Browsers, 1999; McClure, 2001) that prove that concept map can also be an interesting tool for the mathematics education community. One of these interests is its uses as an assessment tool in order to assess students' structural or declarative knowledge (Biggs & Collis, 1991) in mathematics. Patrick (2011) conducted a study about effect of concept mapping on students' achievement and all the students interviewed agreed that the concept maps helped them to determine

relationship among concepts, sharpened their understanding and increased their critical thinking. Sood (2010) examined that concept maps might be efficient tools for students as for building structures in mathematics. Adeneye & Adeleye (2011) reported that concept mapping is an effective strategy for teaching and learning mathematics. The strategy is also capable of improving students' mastery of content at the higher-order levels of cognition. Similarly, Haiyue and Yoong (2010) conducted a network analysis of concept maps of triangle concepts and found that these measures allow examination of the links in concept maps from multiple views to ensure a fuller understanding of concept maps as well as their relations with students' conceptual understanding and mathematics achievement. A careful review of the above literature reveals that concept mapping strategy definitely improved achievement and imparted clarity to various subjects. Hence, the present investigation attempts to study the effect of concept mapping on achievement in mathematics at secondary level for district Ludhiana.

**Objectives**

1. To compare achievement in mathematics of students taught with Concept Mapping Instructional Strategy and Traditional Method.
2. To compare the effectiveness of Concept Mapping Instructional Strategy on achievement of boys and girls in mathematics.
3. To compare the effectiveness of Traditional Method on achievement of boys and girls in mathematics.

**METHOD**

**Design**

Experimental method of research was applied and pre-test post-test matched two group design was used to study the present problem

**Sample**

A purposeful sample of 30 pupils of ninth grade was taken from K V No. 2, Air Force Station, Halwara, Distt. Ludhiana and divided into two groups i.e. A and B comprising 15 students each after matching in terms of intelligence, achievement in science and socio economic status. Group A was taught concepts of mathematics with the help of Concept Mapping (CM) and Group B was taught with traditional method. Group 'A' had 9 male and 6 female students, Group 'B' had 8 male and 7 female students,

respectively.

**Measures**

The following measures were used to match the two groups.

1. Lesson plans in Mathematics based on Concept Mapping Instructional Strategy covering topics of concepts of number system, polynomials, algebraic identities and properties of quadrilateral.
2. Pre-test and post test to measure achievement in Mathematics prepared by the investigator.
3. Ravens Progressive Matrices developed by J. C. Ravens.

**Results and discussion**

The data collected during the investigation was analysed using various statistical tools. The pre-test scores, i.e. achievement test scores of the sample were normalized by using mean, median, mode, skewness and kurtosis.

**Table 1:** Pre test scores of Group 'A' and Group 'B'

Group	N	Pre test scores		
		Mean	SD	t value
A	15	9.0	3.6	0.75 <sup>NS</sup>
B	15	10.0	3.7	

NS Non significant

On the basis of pre-test scores of achievement test, intelligence test, two matching groups were formed i.e Group 'A' and 'B'. A teacher made mathematical achievement test was administered to both the groups and their mean score were calculated. Group 'A' achieved a mean pre-test score of 9.0 and Group 'B' attained a mean pre-test score of 10.0, respectively (Table 1). The t-ratio indicated that the difference between means was non-significant thereby implying that both the Groups were equal in terms of achievement in mathematics before the treatment. After which the two groups were subjected to two teaching approaches, experimental Group 'A' was taught through Novak's concept mapping, and control Group 'B' was taught through traditional method.

**Table 2:** Post test scores of both the groups

Group	N	Mean	SD	t-value
A	15	16.0	2.5	2.7*
B	15	13.0	3.6	

\* t-value significant at 0.05.

The data shows that the mean of post-test score of Group "A" was 16 which was significantly higher than the mean of post-test score of 13 for Group "B". This clearly implies that the students achieve more if they are taught concepts of mathematics through Concept Mapping rather

than the traditional method (Table 2). This finding is a great indicator for teacher, curriculum makers and text book writers that the best of schools and best of teacher cannot effectively deliver education till the method and techniques of teaching are not moulded to suit the cognitive structure of students mind.

Especially for complex concept based subjects like mathematics, it is essential that knowledge is presented in the same fashion as it can be assimilated by students mind. Hence concept mapping is a useful tool for the deliverers of education as it would ensure significantly effective learning than the same old traditional method.

Table 3. Post test scores of males and females of Group "A" and "B"

Group	N	Males		Females		t-value
		Mean	SD	Mean	S.D.	
A	15	16.1	2.1	15.3	2.8	0.68 <sup>NS</sup>
B	15	12.6	3.4	12.4	4.0	0.10 <sup>NS</sup>

NS Non significant

Further, analysis of data also shows that mean of post-test mathematical achievement scores of males (16.1) and females (15.3) of Group "A" did not vary significantly. The "t" value (0.68) was found to be non-significant at both 0.05 and 0.01 levels (Table 3). It was clear from the data that both the genders benefited equally in terms of achievement after teaching through Concept Mapping. Similarly, the mean scores of post-test of males (12.6) and females (12.4) of Group "B" did not differ significantly indicating that teaching through traditional method was equally effective for both the genders. The "t" value (0.10) was found to be non-significant at both 0.05 and 0.01 levels (Table 3).

**Conclusions and implications**

The present educational system is passing through a phase of revolutionary changes. The modern educational system is based on aims and objectives and strives to achieve them. The principle of student centered education has got impetus during the past few decades. But it is sad that still majority of Indian schools have not adopted new techniques and methodologies of teaching. Therefore, in present investigation Concept Mapping Instructional Strategy was chosen which can definitely make learning mathematics easy and comprehensible by making concept organized and thus meaningful. It is a wonderful strategy which a teacher can use in his classroom. It is not only beneficial to enhance the achievement in mathematics but useful for understanding difficult concepts also. It enables the students to investigate the connections between various concepts and topics within

mathematics. The present research problem is indeed very useful to investigate the effect of Concept Mapping Instructional Strategy and to establish its utility.

The present experimental study has brought the following facts into light:

- While comparing these strategies, it was found that Group "A" achieved more than Group "B". It means that Novak's concept mapping was more effective than traditional method in the teaching of Mathematical concepts.
- The study revealed that both males and females improved through Novak's concept mapping as well as traditional method.

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