Effect of concept mapping on achievement in mathematics of secondary school students in relation to their intelligence

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INTRODUCTION: Mathematics has been recognized as one of the central strings of human intellectual activity throughout the centuries. From the very beginning, Mathematics has been a living and growing intellectual pursuit. It has its roots in everyday activities and forms the basic structure of our highly advanced technological developments.

The teaching of Mathematics is aimed at developing power, proper abilities, right appreciations and correct attitudes. But it is very discouraging and an admitted fact that there is general dissatisfaction with the results of Mathematics. If a student achieves high in one exam. It is not guaranteed that he would sustain that Achievement. The teaching of Mathematics in our schools is in a chaotic state today because it is generally based on lectures or drill theory aimed at imparting the dead material to the pupils without offering them opportunities to sharpen their intellect and form insight and concepts of numerous mathematical computations.

If Mathematics is to be taught in our schools it must be taught well and for that purpose the existing conditions under which it is being taught must be changed, rather revolutionized. To achieve this end, various instructional strategies are used for learning. One of those new strategies that is currently emerging out in the field of Mathematics is Concept Mapping. It is a product of recent advances in cognitive sciences.

A Concept Map is a diagram showing the relationships among concepts. They are graphical tools for organizing and representing knowledge. In a Concept Map, each word or phrase is connected to another and linked back to the original idea, word or phrase. The technique of Concept Mapping was developed by Joseph D. Novak and his research team at Cornell University in the 1970.

Concept Maps are very useful in a number of ways. Concept Maps help to organize information on a topic, facilitate meaningful learning and are a powerful tool for identifying students' knowledge structures, especially misconceptions. Concept Maps may serve as a memory aid, and may be used for revision of a topic. Concept Maps are used to stimulate the generation of ideas, and are believed to aid creativity. Concept Maps help to examine the symmetry of complex ideas and arguments and associated terminology. Concept Maps assess the learner's understanding of learning objectives, concepts, and the relationship among those concepts.

Moreover, Mathematical knowledge has the character of a network, as mathematical objects, i.e. for example concepts, definitions, theorems, proofs, algorithms, rules, theories; are not only interrelated but also connected with components of the external world. Accordingly, there is a widespread consensus in the actual didactical discussion that Mathematics should be experienced by students in its interrelatedness rather than a collection of isolated rules and facts. The network character of Mathematics may be experienced and also learned by visualizing graphically structure in Mathematics. To give the students a real understanding of concept and problems of Mathematics, CONCEPT MAPPING can work as a miracle.

According to David Ausubel's statement: "The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly". (Ausubel et al, 1980). Consequently, Concept Mapping has been used also as an educational tool, in sciences, whereas it's use in Mathematics education is rather seldom and not well-documented.

It has been seen that this tool of learning is already very much popular among few students during their examination days. Students develop their own maps to give meaning to their learning.

The present study was undertaken to see that if conscious efforts are made by the teacher in helping the students to map there concepts how does it effect their Achievement in mathematics, which may result in an overall shift from rote learning to the meaningful learning in Mathematics.

statement of the problem

Effect of concept mapping on Achievement in mathematics of secondary school students in relation to their Intelligence.

DELIMITATION OF THE STUDY

The present study was delimited to:

1.Schools affiliated to PSEB.

2.Students of 9th grade were taught.

3.Six topics out of prescribed syllabus for class 9th in the subject of Mathematics viz:

Algebraic Expression,

Polynomials,

Addition of Polynomials,

Multiplication of Polynomials,

Division of Polynomials.

OBJECTIVES OF THE STUDY

To compare the effect of teaching through the Concept Mapping and the Conventional Method on Achievement in Mathematics.

To compare the effect of teaching through the Concept Mapping and the Conventional Method on Achievement in Mathematics in relation to Intelligence.To study the effect of teaching through the Concept Mapping on Achievement in Mathematics in relation to Sex variation.

HYPOTHESES OF THE STUDY

The present study was designed to test the following hypotheses:

There is no significant difference between the mean gain scores of the students in Mathematics taught through Concept Mapping and Conventional Method.

There is no significant difference between the mean gain scores of the students in Mathematics when taught through Concept Mapping and Conventional Method in relation to Intelligence.

There is no significant difference between mean gain scores of boys and girls in Mathematics when taught through Concept Mapping.

SAMPLE OF THE STUDY

A sample of 80 students of 9th grade from a PSEB school of Amritsar city was selected for the purpose of the study. This sample was selected for the purpose of the study in order to confine the study to a specific age group and educational level. The sample comprised of 40 boys and 40 girls.

DESIGN OF THE STUDY

As the present study intended to study the effect of Concept Mapping on Achievement in Mathematics of secondary school students, it fell in the domain of experimental research. In this study, first of all the students were equated on the basis of Intelligence and Achievement with the help of Raven's Intelligence test and an Achievement test (i.e. pre-test) prepared by the experimenter. Then they were divided into two groups. Out of these two groups, one group was taught with Conventional Method and other group with the help of Concept Mapping. Then the Achievement of both groups was compared.

Table 1.1

't' ratio of Mean Gain Scores of Experimental and Control Groups in Mathematics

INSTRUMENTS OF MEASUREMENT/TOOLS

1)Raven's Intelligence test (The Advanced Progressive Matrices) was used to study the Intelligence level of 9th grade students.

2)Achievement tests (Pre & Post) prepared by experimenter herself were used.

3)Concept Maps on the selected topics of Mathematics were prepared and used by the experimenter.

EXPERIMENTATION

Groups equated on the basis of Intelligence and pre-test scores were taught daily with separate teaching methods for one period each in the morning and in the afternoon on alternate days. All topics were taught in the same sequence to experimental as well as to control group.

ANALYSIS AND INTERPRETATION OF DATA

Hypothesis-I

"There is no significant difference between the mean gain scores of the students in Mathematics taught through Concept Mapping and Conventional Method".

In order to test this hypothesis, raw scores obtained on Intelligence test, pre-test and post-test were tabulated and analyzed.

Coefficient of correlation was calculated between Intelligence test scores and gain scores of Achievement in Mathematics.

't' value was computed to study the significance difference between mean gain scores of experimental and control group.

The results so obtained have been entered in Table 1.1

Grade	Groups	N	Mean	S.D.	R	$S.E_D$	Mean Difference (D)	df	t-ratio	Remarks
9th	Experimental	40	11.28	4.261	0.327	0.967	3.26	77	3.37	Significant at 0.01 level
	Controlled	40	8.02	4.400						

It reveals that 't' value (t=3.37) is significant at 0.01 level which shows that significant differences in Achievement of students in Mathematics of experimental and control groups exist.

The mean gain scores of experimental and control group are 11.28 and 8.02 respectively which reveals that group taught with Concept Mapping exhibited better performance as compared to group taught with Conventional Method.

Hence, on first hypothesis is not accepted.

Hypothesis-II

"There is no significant difference between the mean gain scores of the students in Mathematics taught through Concept Mapping and Conventional Method in relation to their Intelligence".

In order to test this hypothesis, raw scores of students on Intelligence test were tabulated and analyzed. The students belonging to high, average and low level of Intelligence of experimental and controlled group were identified by using the formula M±S.D. The mean gain scores and the S.Ds. of students belonging to high, average and low level of Intelligence of both the groups were calculated to test this hypothesis. This hypothesis was further examined by applying t-test of significance. The results of this analysis are being reported in Table 1.2

Table 1.2

'Mean Scores', 'S.D.' and 't' ratio of Mean Gain Scores in Mathematics Across Different Levels of Intelligence

Intelligence Level	Groups	N	Mean	S.D.	$S.E_D$	Mean Difference (D)	df	t-ratio	Remarks
High	Experimental	7	12.89	3.689	1.49	5.389	12	3.612	Significant at 0.01 level
	Control	7	7.50	4.400					
Average	Experimental	26	11.67	3.485	1.10	4.481	50	4.078	Significant at 0.01 level
	Control	26	7.19	4.306					
Low	Experimental	7	12.86	3.716	1.45	5.429	12	3.726	Significant at 0.01 level
	Control	7	7.43	3.735					

Table 1.2 reveals that mean gain scores of high Intelligence students of experimental and control group are 12.89 and 7.50 respectively and mean difference (D) is 5.389. Further, 't' value (t=3.612) is significant at 0.01 level, which shows that students belonging to high level of Intelligence of both the groups differ significantly in their Achievement. Moreover, the mean gain scores of high intelligent students are in favor of experimental group (M=12.89) which means that high intelligent students in the experimental group performed better than high intelligent students in the control group.

Further, the mean gain scores of average intelligent students of experimental and control group are 11.67 and 7.19 respectively and mean difference (D) is 4.481. 't' value (r=4.078) is significant at 0.01 level which shows that students belonging to average level of Intelligence of both the groups differ significantly in their Achievement and mean gain scores of average intelligent students of experimental group (M=l 1.67) are higher than that of control group (M=7.19). It implies that students of average Intelligence in the experimental group performed better than students of average Intelligence in the control group.

A glance at Table 1.2 reveals that mean gain scores of low intelligent students of experimental and control group are!2.86 and 7.43 respectively and mean difference (D) is 5.429. Further, 't' value (t=3.726) reported in the table is significant at 0.01 level which means students belonging to low level of Intelligence of experimental and control group differ significantly in their Achievement. Also, mean gain scores are in favor of low intelligent students of experimental group (M=12.86). It means that students of low Intelligence in the experimental group gave better performance than students of low Intelligence in the control group.

So from the above interpretation of results reported in Table 1.2, it is clear that significant difference exist between the mean gain scores of the

students in Mathematics of experimental and control group in relation to their Intelligence.

Hence, second hypothesis is not accepted.

Hypothesis-III

"There is no significant difference between the mean gain scores of boys and girls in Mathematics taught through Concept Mapping".

In order to locate the significance of difference between mean gain scores of boys and girls of experimental group, 't' value was calculated. The results have been entered in Table 1.3.

Table 1.3

't' ratio of Boys and Girls of Experimental Group

Grade	N	Mean	S.D.	$S.E_D$	Mean Difference (D)	df	t-ratio	Remarks
Girls	20	12.70	4.143	1.658	2.85	38	1.719	insignificant at 0.05 level
Boys	20	9.85	3.977					

Table 1.3 reveals that mean gain scores of girls and boys are 12.70 and 9.85 respectively and mean difference (D) is 2.85. Calculated 't' value (t=1.719) is not significant at 0.05 level which clearly shows that boys and girls do not differ significantly in their mean gain scores when taught through Concept Mapping.

Therefore, the third hypothesis stands accepted.

CONCLUSION:

The present experimental study has helped in the realization of the objectives with which it was started and following conclusions were drawn on the basis of analysis of data and discussion of results:

1.A careful examination of the results entered in Table 1.1 showed that Concept Mapping is effective in improving the Achievement of students in Mathematics. This means that the group taught with Concept Mapping exhibited better performance as compared to group taught with Conventional Method. So Concept Mapping has a positive effect on Achievement of students in Mathematics.

2.Table 1.2 revealed that mean gain scores of students of high, average and low level of Intelligence of both experimental and control groups differ significantly. This showed that high intelligent students of experimental group performed better than high intelligent students of control group and students of average Intelligence level of experimental group performed better than students of average Intelligence level of control group while low intelligent students of experimental group performed than low intelligent students of controlled group. So we conclude that there is significant difference in Achievement of both the groups in relation to high, average and low level of Intelligence.

3. Results reported in Table 1.3 show insignificant difference in the mean gain scores of boys and girls (t=1.719) when taught with the help of Concept Mapping. It means that boys and girls do not differ significantly in their Achievement when taught with Concept Mapping. Thus we conclude that boys and girls may get equal benefit from teaching through Concept Mapping.

EDUCATIONAL IMPLICATIONS

The very first objective of Mathematics led us to think that the greatest emphasis is laid on development of cognitive domain and Concept Mapping plays a significant role in teaching and improving the Achievement.

- Teaching with Concept Mapping has caused significant differences in Achievement in Mathematics as compared to teaching with Conventional Method. It means that Concept Mapping strengthens the cognitive structure by providing deep rooted understanding of the concept and the relations. So it can be used effectively to teach Mathematics.
- Teaching with Concept Mapping has caused significant differences in Achievement in Mathematics as compared to teaching with Conventional Method irrespective of the level of Intelligence. It means that it can enhance the Achievement level of all the categories of the students viz. high, average and low intelligent students. Thus it can be used with all the categories of the students.
- Teaching with concept mapping has caused insignificant differences in Achievement in Mathematics between boys and girls. Thus it is beneficial for boys as well as girls.

Hence it is suggested that teachers should use the technique of concept mapping while teaching mathematics which is considered as a tough subject at school level. Moreover teachers should be trained to develop and use such maps.

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