

Study of Concept Mapping Strategy for Teaching Science Concepts at Middle Level in Terms of Creativity

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Abstract

The Concept Mapping is the strategy which is used to develop concept maps. Concept mapping is a visual representation of the relationships between concepts held by an individual, materials of a lecture, textbook, or laboratory exercise. Concept mapping is an innovative classroom tool and technique that can deepen our curricula as students advance through an accounting program. The present study was experimental in nature. It was employed on the line of pre-test posttest control group design. Sample consists of 102 students, the experimental group comprised of 46 students and 56 students were in control group. The age range of students was 11 to 13 years. The finding of the present study reveals that there was a significant effect of Treatment of Concept Mapping Strategy on creativity of students. There was no significant effect of Gender on Creativity of middle school students when they are treated with Concept Mapping Strategy and Traditional Method. Concept Mapping Strategy is more effective as compare to Traditional Method in terms of Creativity of Students. There is no significant effect of interaction between Gender and Treatment on Creativity of middle school students.

Keywords: *Creativity, Concept Mapping Strategy*

Introduction:

As the twenty first century ushers in the information age, we experience new ways of living and working. We are living in the world of science and technology so understanding of science concepts is very important for each and every learner. The learner can understand the concept better through concept mapping.

In traditional learning process, the teacher transmits the facts and assumes students as passive receptors of knowledge. This teaching-learning process is teacher-centred. Science learning as accumulation of fact which is to be stored in memory by the process of rote learning. The passive learning forbids the students to construct their knowledge and understand the concepts to apply them in their day-to-day life.

Gradually the understandings about learning of science has changed with the developments in psychology. Inclusion of newer models of learning from psychologists like J.S. Bruner, David P. Ausubel and Jean Piaget have prompted the science education community to focus on how students learn science and it has started viewing teaching-learning of science from a transmission model to construction of knowledge by the students. Therefore, a pedagogical shift is required from teacher-centred to learner-centred teaching-learning process

Concept map is a tool that is used to elicit student's knowledge and help the learner in learning of concepts. Concept mapping has proven to be an effective tool and a meaningful learning strategy. Researcher will investigate the use of concept mapping as a strategy to enhance meaningful learning and improve the concepts of students in science.

Statement of Problem:

The problem of the present research is worded as follows: -

“Study of Concept Mapping Strategy for Teaching Science Concepts at Middle Level in Terms of Creativity.

Objectives:

The following objectives for the present study are as follows:

- To compare the mean Pre and Post Creativity scores of middle school student of Experimental group.
- To study the effect of Gender, Treatment and their interaction on Creativity of middle school students by considering Pre Creativity as a covariate.

Hypotheses:

- There is no significant difference in the mean Pre and Post Creativity scores of middle school students of experimental group.
- There is no significant effect of gender, treatment and their Interaction on creativity of middle school class students.

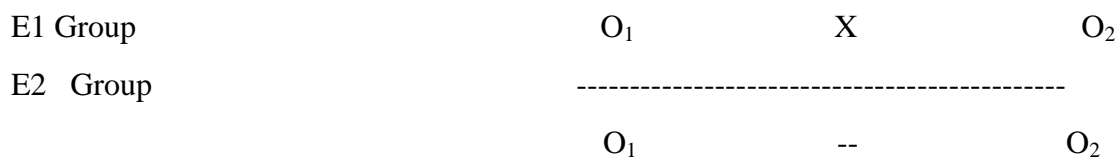
Methodology:

Sample:

The present study was experimental in nature and it was conducted in two schools of Indore city. The population comprises of all students studying in class VII in the session 2014-2015 in Central Board of Secondary Education, Delhi affiliated schools. From these schools two schools were selected using purposive sampling technique. The selected schools were Ilva Higher Secondary School and Shree Krishna Public School. From the selected schools VII class students were taken for the present study. The selected schools assigned randomly to two levels of treatment. Ilva higher Secondary school formed the experimental group and was treated with Concept Mapping Strategy while Shree Krishna Public school formed the control group and treated with Traditional strategy. The sample consist of 102 students, the experimental group comprised of 46 students and 56 students were in control group. The age range of students was 11 to 13 years. The medium of instruction in both the schools was English and both the school belongs to urban area of Indore District. The student were from different socio-economic status and were able to read, write and understand English and Hindi language properly.

Design:

In the present study non-equivalent control group design was employed. Firstly the pre-test will be administered and then treatment was given. After treatment post-test will be administered by the researcher. The layout of design is as follows:-



O₁= Pre-test

O₂= Post-test

X=Treatment with concept mapping

E1=Experimental Group

E2=Control Group

-----Non-equivalent group

The treatment will be randomly assigned to both the groups E1 group will receive the treatment of concept mapping strategy while E2 group will be taught through traditional strategy.

Tool: Creativity

In the present study age of sample ranged from 12 to 14 years of students. The creativity test for the present study was assessed by Non-verbal test of creative thinking. Non-verbal test of creativity includes four subtests-namely consequence test, unusual users test, relationship test, and product improvement test.

Name of test	Author's name	Age	Language	Test – retest reliability	Interscore-reliability
Non-Verbal test of creative thinking (age 12 to 15)	Baquer mehdi	12 to 15 yrs.	Hindi	0.932to 0.947	0.981,0.980, 0.917

Procedure of Data Collection:

The permission from the head of the both the schools were taken. The rapport was established with the students. The present study was experimental in nature and hence employed two groups i.e. experimental and control group. Treatments were assigned randomly to both groups that is experimental and control group. For the present study 20 concepts of science were selected. The pre- test of Creativity was administered on both the group. After administering the test orientation of concept mapping was given to the experimental group students. For the experimental group, 20 concepts of science were selected. The concepts of

science were selected from the Textbook of science prescribed by NCERT and also the syllabus of science of central board of secondary education, Delhi. The Treatment was started simultaneously to both the group. Researcher has prepared the concept maps of 20 concepts of science. Concept map are used to explain the concepts of science. During the explanation doubts of students were cleared. In this way the selected concepts of science are taught in the classroom. The treatment continues for 20 working days for both the group. The duration of one period was 35 minutes. After giving the treatment the post-test of Creativity was administered on both the experimental group and control group.

Statistical Technique used:

Objective wise statistical techniques are as follows:-

1. To analyze the data related with objective “To compare the mean pre and post Creativity scores of middle school students of experimental group” correlated t test will be used.
2. To analyze the data related with objective “To study the effect of Gender, Treatment and their interaction on Creativity of middle school students by considering pre Creativity as a covariate” Two Way ANCOVA will be used.

Result and Interpretation:

1. Comparison of mean Pre and Post Creativity scores of middle school students of Experimental group

The first objective of the present study is “To compare mean Pre and Post Creativity scores of middle school students of experimental group. Before administering parametric test the assumption of Normality was tested with the help of Shapiro-Wilk test. The obtained result are given in Table 1.1

Distribution of Creativity	Shapiro-Wilk
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Table 1.1.
value of
for Post
scores of

Post-Creativity	Statistic	Df
	0.946	46

Statistic
Normality
Creativity

Experimental group.

It is clear from the table 1 that the statistic value of Post Creativity test is 0.946 whose significance value is 0.32 with degree of freedom 46 which is not significant at 0.05 level of significance, therefore the null hypothesis “The mean post scores of experimental group taught through Concept Mapping Strategy is not normally distributed “is rejected. Therefore we conclude that the mean post creativity scores of experimental group taught through concept mapping strategy are normally distributed. Hence, the assumption of normality holds true. As only experimental group is been tested so homogeneity of variance is not tested for the present objective.

As the assumption of normality holds true so the data related with this objective were analyze with the help of correlated t-test.The obtained results were given in the table 2

Table2. Mean standard deviation, Co-related t-value of Pre and Post Creativity of Experimental Group

Groups	Mean	N	Std deviation	Co-related t-value
Pre-Creativity	59.4783	46	20.35653	6.137**
Post-Creativity	78.6304	46	17.02724	

**0.01 level of significance.

It is clear from the table that the co-related t value for Pre-Post Creativity score of Experimental group was 6.137 which is significant at 0.01 level of significance, therefore null hypothesis “There is no significant difference between the mean Pre and Post Achievement scores of middle school students treated with Concept Mapping Strategy” is rejected. It is clear from the table that the mean Pre Creativity scores are 59.4783 while the Post Creativity scores are 78.6304, so mean

of Post Creativity scores are higher. Therefore we can conclude that there was a significant effect of Concept Mapping on Creativity of middle school students. This reveals that there was a significant effect of treatment of Concept mapping on Creativity of middle school students. **This finding cannot be supported by Vishav Jyoti 2012 who found no significant effect of Concept Mapping on creativity of students.**

The following reasons may be responsible for this finding.

- The concept mapping strategy include brainstorming which enhances the fluency and critical thinking of students.
- It involves cross link in concept map which help in establishing relationship between two concepts.
- Pictorial representation of concepts increases the Creative ability.
- It involves organizing the concept which enhances their flexibility.
- It involves revising the concept map, which lead to increase in the elaboration.

2. Effect of Gender, Treatment and their interaction on Creativity of middle school students when Pre Creativity scores is taken as covariate.

The second objective of the study is “To study the effect of Gender, Treatment and their interaction on creativity of middle school students when Pre Creativity is taken as a covariate. Before administering parametric test the assumption of Normality was tested with the help of Shapiro-Wilk Test. The obtained result are given in the table 2.1

Table 2.1. Statistic value of Normality for Creativity Scores of Concept Mapping and Traditional Method.

Post-Creativity	Shapiro-Wilk	
	Statistics	df
Method of Teaching		
Concept-Mapping	0.946	46
Traditional Method	0.933	56

It is clear from the table 3 that the observed value of Shapiro Wilk statistics for Creativity scores of Concept Mapping Group and Traditional Group are 0.946 with df 46 and 0.933 with df 56 which are greater than 0.05 level. Hence it is not significant at 0.05 level of significance. Therefore, the null hypothesis “The Creativity scores of Concept Mapping Strategy does not significantly deviate from Normality” is not rejected. Thus, the assumption of Normality holds true. Therefore, we conclude that the students treated with Concept Mapping Group and Traditional Group having mean Post Creativity scores, which is normally distributed. Hence the assumption of Normality holds true.

Table 2.2 Statistic value of Normality for Creativity Scores of Concept Mapping and Traditional Method.

Post-Creativity	Shapiro-Wilk	
	Statistics	df
Gender		
Male	0.962	64
Female	0.938	38

It is clear from the table 2.2.the observed value of Shapiro Wilk statistics for Creativity scores of Concept Mapping of Male is 0.962 with df 64 and female is 0.938 with df 38 which is greater than 0.05.Hence it is not significant at 0.05 level of significance. Therefore, the null hypothesis “The Creativity scores of Concept Mapping Strategy for Male and female does not significantly deviate from Normality” is not rejected.Thus,the assumption of Normality holds true. Therefore we conclude that, the Post-Creativity scores of male treated with Concept Mapping normally distributed. Hence the assumption of Normality holds true.

Now after testing the Normality of the test we proceed for the Test of Homogeneity of Variances. The test of homogeneity of variance has been given in the table 2.3

Table 2.3. Test of Homogeneity of variance Levene’s Test of equality of Error Variances.

F	df1	df2

1.102	3	98
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It is clear from the table 2.3. that the observed F value of Levene's Statistics is 1.102 with df (3,98) whose significance value is 0.352 which is more than 0.05 so the null hypothesis "There is no significant difference in variances of the Creativity scores treated with Concept Mapping Strategy and Traditional Method" is not rejected. Thus the assumption of Homogeneity of variances holds true.

It is clear from the assumption of Normality and Homogeneity was found to be true for the present objective. So to analyze the fourth objective 2x2 Factorial design ANCOVA was used. The obtained results were given in table 2.4.

Table 2.4. Summary of 2x2 factorial ANCOVA.For creativity of VII class students by taking Pre-creativity as a covariate.

Source	SS _{y.x}	df	MSS _{y.x}	F _{y.x}
Treatment	9078.642	1	9078.642	34.682*
Gender	12.278	1	12.278	.047
Mot*gender	72.654	1	72.654	.278
Error	25391.525	98	261.768	
Total	43480.520	101		

**0.01 level of significance.

It is clear from the table that 2.4.that the adjusted value of F for Treatment is 34.682 with df (1,98),which is significant at 0.01 level of significance. Therefore the null hypothesis "There is no significant effect of Treatment on Creativity of middle school students when they are treated with concept mapping and Traditional method when Pre Creativity is taken as a covariate."is rejected.

Table 2.5. Estimates mean of Treatment

Treatment	Mean	Std Error
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Cmap	77.592	2.429
Lecture	57.777	2.316

It is clear from the table 2.5. mean Post Creativity scores of students, when treated with Concept Mapping Strategy is significantly better than mean Post Creativity scores of students when they are treated with Traditional Method. It means Concept Mapping Strategy is more effective as compare to Traditional Method. This finding cannot be supported by Vishav Jyoti (2012) who found no significant effect of Concept Mapping on creativity of students.

The findings of the study revealed that the concept mapping method is more effective as compare to lecture method. The following reason may be responsible for the finding:

- Concept mapping is an interesting method.
- It arouses divergent thinking in the mind of the learner for thinking about a topic.
- It help in making pictorial presentation of a topic which help in enhancing the creativity.
- Cross-linking helps in establishing relationships.

It is clear from the table that 2.4.that the adjusted value of F for gender is 0.047 with df (1,97),which is not significant at 0.05 level of significance. Therefore the null hypothesis “There is no significant effect of Gender on Creativity of middle school students when they are treated with Concept Mapping and Traditional method when Pre Creativity is taken as a covariate.” is not rejected.The following reasons may be responsible for this finding:-

- Students were working independently so they do not get the opportunity of positively interacting with their peers about mapping procedures.

It is clear from the table that 2.4.that the adjusted value of F for interaction of treatment and Gender is 0.278 with df (1,97),which is not significant at 0.05 level of significance. Therefore the null hypothesis “There is no significant effect of interaction of treatment and Gender on Creativity of middle school students when they are treated with Concept Mapping Strategy, when Pre Creativity is taken as a covariate.” is not rejected. We can conclude that there is no significant effect of interaction between Gender and Treatment on Creativity of middle school students. The following reason may be responsible for this finding: -

- Male and female both were aware about the treatment.
- There was no chance of interaction in male and female when taught with Concept Mapping Strategy as researcher is very conscious about Gender Equality while giving both the treatment.
- The Ability to construct properly integrated and complex concept maps was observed among both male and female students.
- Students were working independently so they do not get the opportunity of positively interacting with their peers about mapping procedure.

Findings:

1. There was significant effect of Concept Mapping Strategy on Creativity of students.
2. Concept Mapping Strategy is more effective as compare to Traditional Method in terms of Creativity of Students.
3. There is no significant effect of interaction between Gender and Treatment on Creativity of middle school students.
4. There was no significant effect of Gender on Creativity of middle school students when they are treated with Concept Mapping Strategy and Traditional Method.

Research Implication:

The above findings from the present study reveal that the concept mapping strategy on science subject was found to be effective in terms of Creativity was also found to be favorable. The findings have implication for teachers, students, teacher-educator, curriculum constructors, and text-book writers. Finding wise implications are as follows:

1. According to finding first “There was a significant effect of Concept Mapping Strategy on Creativity of students”. The utility of this finding for teachers is that the **teacher** should give more emphasizes on brainstorming stage of concept mapping strategy while teaching to students as it will help in enhancing the creativity of students in different subjects. Some brainstorming sessions should be organized by the teacher related to the chapters of science. The utility of this finding for **students** is that Concept mapping help in enhancing the creativity of students.

2. According to finding second “Concept Mapping Strategy is more effective in terms of Creativity”. The utility of this finding for **teachers** is that the teacher should teach with concept mapping strategy for enhancing the creativity of students. The utility of this finding for students is that it will help the students in generating novel and innovative ideas in science as well as other subjects also which help in making their projects and assignment creative. The utility of this finding for text-book writers is that **text-book writers** should use the psychological principles in writing the book; they should try to develop Concept Map for basic Concepts. Concept Maps should be develop in different subjects so that it become easy to understand the reviewing the topic.

3. According to finding third “There is no significant effect of interaction of Treatment and Gender on Creativity of middle school students”. The utility of this finding for teachers is that the **teacher** should give the proper and clear introduction and instructions about the topic so that student not interact with each other during teaching learning process. The utility of this finding **for students** is that students should do their work independently. Both male and female students possess the opportunity to construct new and novel things.

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Annexure:

CMAP 1

Focus Question:-What Are Acids?

