

Promoting Learning Outcome in Geography of Secondary Students through Concept Mapping Strategy

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Abstract

The effect of concept mapping strategy on learning outcome in Geography of Class IX students was investigated. A quasi-experimental pre-test and post-test control group design was adapted. Two Government-sponsored bengali medium schools in Kolkata were selected randomly. The experimental group (n=40) and the control group (n=40) were assigned randomly. The sample for this study consisted of 80 students of Class IX. The Learning Outcome Test with a reliability coefficient of 0.75 and a validity coefficient of 0.86 developed by the researcher was used for collecting the data. For analysing the data, one-way Analysis of Covariance (ANCOVA) and 2×2 factorial design ANCOVA were employed. The findings of the study showed that the experimental group students achieved higher learning outcome in comparison to the control group students. Further, finding of this study also revealed that there was no significant effect of interaction between treatment and type of family on students' learning outcome in Geography, when pre-learning outcome was considered as a covariate. Therefore, it can be recommended that concept mapping strategy might be incorporated in teaching-learning of Geography as well as in other school subjects at different grades for enhancing learning outcomes.

Keywords: Concept Mapping Strategy, Learning Outcome, Geography, Secondary Students.

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INTRODUCTION

The domain of Social Science forms an important part of general education. At the secondary level of school education, Social Science incorporates diverse concerns of society and encompasses a wide range of contents drawn from the disciplines of Geography, History, Political Science and Economics (NCERT, 2019). Geography plays a crucial role in the school curriculum for its need and relevance in the society. As an individual and as a member of the society, knowledge of Geography is very much necessary for enhancing the economic competitiveness, sustaining the environment, preserving the quality of life, and ensuring national security (Utami et.al., 2018). However, it was revealed that learning outcomes in Geography of high school students are low (Utami et al., 2018; Homoki and Sütő, 2013). According to Stoltman (1991), the geographical knowledge of students at the secondary level was seemed to be poor due to rote learning practices. An effective teaching strategy may result in meaningful learning which in turns helps to enhance the learning outcomes (Kubat, 2018; Yadav, 2006).

A concept map is a graphical tool for organising and representing knowledge (Novak and Cañas, 2007). Concept map-based education helps to avoid rote learning (Ullah, 2020) and results in meaningful learning which leads to improvement of learning outcomes. Concept mapping

strategy is an effective instructional strategy which helps to present the subject matters effectively before the learners (Novak and Cañas 2006; Sungar, Tekkaya and Gebbon 2001). Moreover, concept mapping strategy leads learners towards enhancing their learning outcome (Hay et al., 2008). Concept map method can be considered as a valid alternative to classical lectures as it positively effects students' grades and learning outcomes (Wagner et al., 2023).

The present study aimed to examine the effect of concept mapping strategy on learning outcome in Geography of students at the secondary level.

REVIEW OF LITERATURE

Several researches were undertaken to investigate the effect of concept mapping on students' academic achievement in various subjects. Concept mapping strategy helped students in the acquisition of deeper understanding of the concepts (Novak & Gowin, 1984). Willerman and Mac (1992) reported that concept mapping strategy had a positive effect on achievement in Science of eighth-graders. Further, Slotte and Lonka (1999) showed that concept mapping strategy helped in the improvement of students' performance in different tasks. Askin (2007) reported that concept mapping strategy had a significant impact on students' achievement in Science. Moreover, concept mapping strategy contributed effectively to understand the process

of Science at seventh grade (Chacko, 2009).

Dhaaka (2012) revealed that teaching through concept mapping strategy was found to be more effective than the conventional method in enhancing achievement in Biology of ninth graders. Obianuju (2012) reported that students taught Chemistry through concept mapping strategy, gained higher achievement than students taught using conventional method. Sharma (2012) demonstrated that concept mapping strategy, was found to be superior in comparison to the conventional method for everlasting understanding of the concepts in social studies. According to Cheema and Mirza (2013), concept mapping strategy was observed to be effective for enhancing the academic achievement in General Science of seventh grade students. Taie (2014) revealed that concept mapping was capable of improving student's meaningful learning. Sakiyo and Waziri (2015) found that concept mapping method helped to enhance academic achievement of students in Biology. Ogonnaya et al. (2016), reported that the concept mapping approach positively affect students' academic achievement in Basic Science. Students' learning outcomes in History was improved significantly by using concept mapping as an instructional strategy (Subadrah & Narayanasamy, 2017). Rajawat (2018) established that concept mapping was more effective than lecture method in promoting

meaningful learning. Nath and Sahoo (2019) reported that concept mapping had a significant effect in the academic achievement in Life Science. A quasi-experimental study was undertaken on the effectiveness of metacognitive strategy on learning outcome and showed enhanced learning outcome in Physical Science of ninth graders (Uddin, Panda and Agarwal, 2022).

According to Chauhan (2019) concept mapping strategy seemed to be very effective for a better understanding of the concepts in the Social Sciences. Performance in Social Studies of students taught by concept mapping instructional strategy was better than the students taught by lecture method (Misan-Ruppee and Akpochafo, 2020). Proper construction and application of concept mapping strategy in teaching enhance dissemination of knowledge which leads to an effective and creative learning (Ullah, 2020). Earlier studies revealed that students who were taught by concept mapping strategy scored higher in academic performance than the students who were taught by conventional methods (Enebechi and Nzewi, 2021; Iroko and Olaoye, 2021). Achor and Bileya (2022) demonstrated that concept mapping strategy helped to improve the achievement in Physics. Dorji (2022) reported that concept mapping enhanced students' academic performance in Economics. Ijeh (2022) found that concept mapping strategy significantly helped students

in understanding complex problems and improved their achievement in Mathematics. Students taught through concept maps showed higher academic achievement than those taught by conventional methods (Izci and Akkoc, 2023). Susetyarini et al. (2023), in their study suggested that concept map-based learning can improve students' achievement and cognitive learning outcome as there is a correlation between them. The concept map-based learning process can also increase students' interest and involvement in learning, which results in higher learning outcome of students.

Effiong and Igri (2015) reported that there is significant difference in the academic achievement in Basic Science of students belonging to polygamous and monogamous family. Students who belong to monogamous family reflect higher achievement in Basic Science than those who belong to polygamous family. Adenuga and Adeleke (2020) examined the relationship between family structure and academic performance of students, and found that there was no statistical difference in the academic performance of students of nuclear family and extended family. Some of the previous studies indicated that family structure had no significant effect on students' academic performance (Azumah et al., 2018; Maurine et al., 2022). On the other hand, Adeyeye (2023) revealed that students belonging to nuclear family performed far better than

the students belonging to extended family and single-parent family.

From the above discussion, it is noticed that most of the researches have been conducted in Science and very few in Social Science. But no research has yet been found on investigating the effect of concept mapping strategy on learning outcomes in Geography at the secondary level. Based on the above literature, researchers of this study motivated to examine the effect of concept mapping strategy on learning outcome in Geography at the secondary level. For this study the following objectives and hypotheses have been formulated.

OBJECTIVES

1. To compare the adjusted mean scores of learning outcome in Geography of students taught through concept mapping strategy and conventional strategy by taking pre-learning outcome as a covariate.
2. To study the effect of treatment, type of family and their interaction on learning outcome in Geography of students by considering their pre-learning outcome as a covariate.

HYPOTHESES

H₁: There is no significant difference of adjusted mean scores of learning outcome in Geography of students taught through concept mapping strategy and conventional strategy

by taking pre-learning outcome as a covariate.

H₂: There is no significant effect of treatment, type of family and their interaction on students' learning outcome in Geography by considering their pre-learning outcome as a covariate.

METHOD

Research Design

Quasi-experimental pre-test and post-test control group design was employed for the present study. Concept mapping strategy was taken as an independent variable, type of family as a moderator variable and learning outcome as a dependent variable.

Population

Students of Class IX of Government-sponsored Bengali medium high schools in Kolkata, West Bengal were

considered as population for this study.

Sample and Sampling Technique

For this study, two schools located in Kolkata were selected randomly. There was only one section in each school. Intact class from both the schools was selected for balancing the individual differences when both the groups are compared. The students of intact groups were randomly assigned as control group and experimental group. The 80 students from Class IX of academic session 2023–24, were taken as samples for the study. School-wise, group-wise and family type-wise description of sample has been given in Table 1.

From Table 1, it is evident that the students of VIP Nagar High School were randomly assigned as experimental group (N=40) and the students of Jana Kalyan Siksha

Table 1
Description of Sample

S. No.	Name of the School	Group	Type of family		Total
			Joint	Nuclear	
1.	Jana Kalyan Siksha Mandir High School Co-Ed (H.S), Kolkata, West Bengal	Control	20	20	40
2.	VIP Nagar High School (H.S) Kolkata, West Bengal	Experimental	14	26	40
		Total	34	46	80

Mandir High School were assigned as control group (N=40) for the experimentation.

Tools Used for the Data Collection

In this study, following two tools were used:

(i) Learning Outcome Test: A Learning Outcome Test (LOT), developed and standardised by the researcher for assessing learning outcome was administered for collecting data. Initially Learning Outcome Test on 'Hazards and Disaster' unit, comprised of 25 multiple-choice items, was constructed. After item analysis, 20 items were retained. Reliability coefficient

of the test was computed using split-half method and found to be 0.75. Its validity coefficient was calculated and found to be 0.86. Further, opinions collected from three subject experts were incorporated to validate the test. Thus, the test finally consisted of 20 multiple-choice items, having four options with one mark for each correct response and zero for each wrong response.

(ii) Concept Map: 'Hazards and Disaster' unit was divided into ten sub-units. For each sub-unit, one concept map was developed. All the concept maps were validated by incorporating the opinions collected from three subject

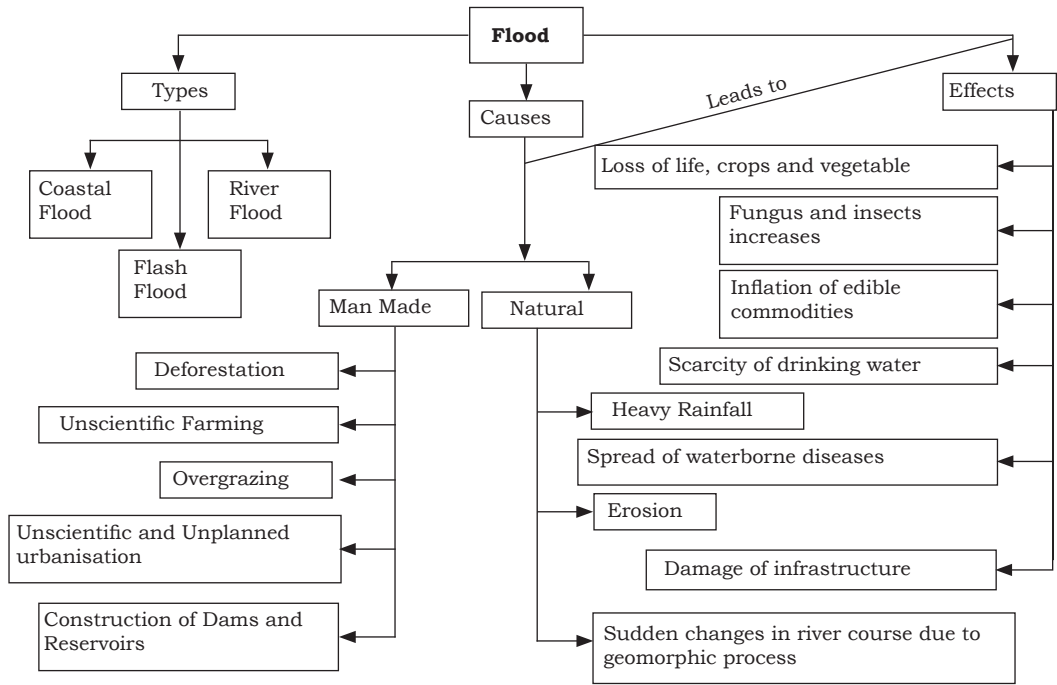


Fig. 1: Concept map on sub-unit 'flood'

experts. For instance, the concept map prepared for teaching a sub-unit namely 'flood' has been given in Fig. 1.

Experimentation Procedure

Pre-experimental Phase

At first, permission from both the schools was taken from the concerned Headmaster by the researcher. A pre-test, based on 'Hazards and Disaster' unit in Geography, was administered on the students of both the schools, to check if the students of both the schools achieve equal mean score.

Experimental Phase

After pre-test, both the groups were taught the same chapter, viz, 'Hazards and Disaster' of Class IX Geography syllabus of West Bengal Board of Secondary Education (WBBSE). Both the groups were taught by different teaching strategies, i.e., experimental group by concept mapping strategy

and control group by conventional lecture strategy. The experimentation continued for four weeks at the rate of forty minutes duration for each class.

Post-experimental Phase

After the intervention, same test was administered as post-test to both the groups. The effectiveness of treatment in terms of learning outcome in Geography was evaluated by comparing the post-test scores achieved by the students of both groups.

Statistical Techniques Used for Data Analysis

One-way ANCOVA, 2x2 factorial design ANCOVA and an independent samples t-test were applied for analysis of data with the help of Statistical Package for Social Science and interpretation was done accordingly.

RESULTS

Assumptions for normality of the data were verified and the data were found

Table 2
Summary of One-way ANCOVA of the effect of treatment on students' learning outcome in Geography by considering pre-learning outcome as a covariate

Source of Variance	Degree of Freedom (df)	Sum of Suquare (SS_{yx})	Mean Sum of Suquare (MSS_{yx})	Adjusted F (F_{yx})	Remark
Treatment	1	61.71	61.71	27.03	$p < 0.01$
Error	77	175.77	2.28		
Total	80				

to be normal. Hence, parametric statistical techniques were applied to analyse the data.

Testing of H_1 : For acquiring the objective, data were analysed using one-way ANCOVA and the results are given below in Table 2

From Table 2, it is observed that the adjusted F value for treatment is 27.3, which is significant at the 0.01 level with $df=1/77$. It reveals that there is a significant difference in the adjusted mean scores of learning outcome between the students instructed using concept mapping strategy and the students instructed by conventional strategy when pre-learning outcome is considered a covariate. Thus, the null hypothesis that there is no significant difference of adjusted mean scores of learning outcome in Geography of students taught through concept mapping strategy and conventional strategy by taking pre-learning outcome as the covariate is rejected. Hence, it can be said that concept mapping strategy had a positive effect on students' learning outcome in Geography when pre-learning outcome is considered as a covariate.

Adjusted mean scores were further analysed using an independent samples t-test, and the outcomes are presented in Table 3.

Table 3 shows that the t-value is 3.84, which is significant at the 0.01 level with $df=78$. It implies that the adjusted mean scores of the students of experimental group and the control group differ significantly. Further, the adjusted mean score of learning outcome of experimental group students were found to be 13.00, which is greater than that of control group students and which is 10.55 when pre-learning outcome is taken as a covariate. Hence, it can be said that the concept mapping strategy was found to be superior to the conventional strategy.

Testing of H_2 : For acquiring the objective, data were analysed using 2x2 factorial design ANCOVA and the results are given in Table 4.

The adjusted F value of treatment is 25.38 which is significant at 0.01 level with $df=1/75$. This indicates that the treatment through concept mapping strategy is effective in comparison to its counterpart which is almost similar as interpreted, in Table 2.

Table 3
Group-wise adjusted mean scores, standard error and t-value of students' learning outcome in Geography by considering pre-learning outcome as a covariate

Group	Adjusted Mean	Standard Error	t-value	Remark
Control Group	10.55	0.42	3.84	p <0.01
Experimental Group	13.00	0.48		

Table 4
Summary of 2×2 Factorial Design ANCOVA of students' learning outcome in Geography by considering their pre-learning outcome as a covariate

Source of Variance	Degree of Freedom (df)	Sum of Suquare (SS_{yx})	Mean Sum of Suquare (MSS_{yx})	Adjusted F (F_{yx})	Remark
Treatment (A)	1	57.43	57.43	25.38	$p < 0.01$
Type of Family (B)	1	1.92	1.92	0.85	ns
A×B	1	3.87	3.87	1.71	ns
Error	75	169.72	2.26		
Total	80				

*ns = not significant

Further from Table 4, it is evident that for type of family the adjusted F value is 0.85, which is not statistically significant. This means that there is no significant difference in the adjusted mean scores of learning outcome in Geography of students belonging to joint and nuclear family when pre-learning outcome is considered as a covariate. Hence, the null hypothesis that there is no significant difference in the adjusted mean scores of learning outcome in Geography of students belonging to joint and nuclear family when pre-learning outcome is considered as a covariate is not rejected. Therefore, it can be said that students' learning outcome was found to be independent on family types when pre-learning outcome is considered as a covariate.

Furthermore from Table 4, it is seen that the adjusted F value for the interaction of treatment and type of family on students' learning outcome is 1.71, which is also not significant.

It indicates that there is no significant interaction between treatment and type of family on students' learning outcome in Geography when pre-learning outcome is considered as a covariate. Thus, the null hypothesis that there is no significant interaction between treatment and type of family on students' learning outcome in Geography by considering pre-learning outcome as a covariate is not rejected. Thus, it can be said that the interaction between treatment and type of family was found to be independent on students' learning outcome in Geography when pre-learning outcome is considered as a covariate.

DISCUSSION

After analysing the first objective, it was found that concept mapping strategy had a positive effect on students' learning outcome in Geography when pre-learning outcome is considered as a covariate,

which is consistent with the previous studies (Dorji, 2022; Achor and Bileya, 2022; Misan-Ruppee and Akpochafo, 2020; Nath and Sahoo, 2019; Chauhan, 2019; Sharma and Singh, 2016; Willerman and Mac, 1992). The main reason may be the visual display of the relationship of concepts, as it has been proved by cognitive science that visual display always enhances learning (Vekiri, 2002). Concept mapping strategy actively engages the learners in the teaching learning process that leads to better learning (Twardy, 2004). On the other hand, conventional strategy does not engage students actively in the classroom during the teaching learning process and makes learner passive.

Findings of the second objective demonstrate that intervention had significant effect on the experimental group learners. On the other hand, the type of family and interaction between treatment and type of family were noticed to be independent on students' learning outcome in Geography when pre-learning outcome is considered as a covariate. This is in accordance with the findings of the previous studies (Maurine et al., 2022; Adenuga and Adeleke, 2020; Azumah et al., 2018; Bilal et al., 2013).

EDUCATIONAL IMPLICATION

Findings of the current study demonstrated the application of concept mapping strategy in teaching Geography efficiently. Concept mapping strategy is rarely used in

teaching-learning of Social Sciences. Teachers of Social Sciences may be encouraged to use it to make teaching and learning meaningful as well as to enhance the learning outcome of the students. Authors of the textbooks may also be motivated to include concept maps and concept map-based activities in the books. Training may also be given to school teachers for incorporating concept mapping strategy in their teaching by organising conference, seminars, workshops, etc.

CONCLUSION

In the current study, the effect of concept mapping as an instructional strategy on learning outcome in Geography of Class IX students was investigated. Result of the study revealed that concept mapping strategy was found to be effective than the conventional strategy for promoting students' learning outcome. Concept mapping strategy significantly helped to improve students' learning outcome in Geography. Thus, it can be recommended that textbook authors may be encouraged to include concept map and concept mapping activities in the textbooks. Geography teachers might be motivated to use concept mapping during the teaching-learning process to enhance students' learning outcome. Furthermore, this strategy might be implemented for teaching other school subjects in various grades.

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