EFFECTIVENESS OF CONCEPT MAPPING STRATEGY ON STUDENTS' ACHIEVEMENT IN BIOLOGY IN RELATION TO INTELLIGENCE AS COVARIATE

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ABSTRACT

The reason of this research is to identify the concept mapping strategy of training impact on achievement in biology in relation to intelligence quotient as covariate of secondary school students. For this purpose 60 grade IX standard students from co-educational state syllabus schools from two classes were selected. The idea mapping instructional technique was assigned to the individuals at random for the objectives of the study. This study included an experimental group and a control group that was taught using a more traditional teacher-centered approach. There were 60 students in the class. One class (n = 30, 16 boys, and 14 girls) was designated as the idea mapping group, while the other (n = 30, 16 boys, and 14 girls) was designated as the control group. The Achievement Test in Biology produced by the researcher was used in this study, and the Ravens Progress Test was used to determine intelligence. ANOVA and ANCOVA were used to examine the data descriptively and inferentially, with Scheffe's post hoc analysis. The level of significance was set at 0.05 and the level of confidence at 0.01. The statistical analysis was performed using the SPSS Package and Microsoft Office software. The findings confirmed that students taught using the idea mapping teaching technique outperformed control group students in Biology achievement. So, when IQ is controlled statistically, it can be determined that the Concept Mapping Teaching Strategy is effective since it accounts for increased achievement.

Keywords: Effectiveness, Concept Mapping, Strategy, Achievement, Biology, Intelligence, School Students

I. INTRODUCTION

Concept mapping allows students to organize and visualize the relationships between different concepts, making it easier for them to understand complex information. It is a valuable tool for students as it helps to improve understanding, enhance critical thinking, encourage active learning, improve retention, support creativity, and facilitate collaboration.

Concept mapping is a strategy used to help individuals organize and represent knowledge and information. It involves creating a visual representation of the relationships between different concepts and ideas, typically using a diagram or graph. oncept mapping is used in a variety of educational and professional settings, including science, social studies, and business, to help individuals understand complex information, promote active learning, and foster critical thinking skills.

Concept mapping is a valuable strategy for science learning in children as it helps topromote understanding of complex concepts by breaking them down into smaller, more manageable parts and Enhance critical thinking skills by encouraging children to identify and make connections between different pieces of information as well as Promote active learning by requiring children to actively engage with and reflect on the material they are learning. concept mapping helps children to better understand and retain scientific information, promotes critical thinking and active learning, and fosters a positive approach to learning and growth.

The Ausubel-Novak-Gowin idea of meaningful learning is the foundation for concept mapping as a metacognitive teaching approach. Gowin (1981); Novak and Gowin (1984). Regularities in things or occurrences indicated by some label, usually a term, can be defined as concepts (Wandersee, 1990). To fulfill this requirement, the material to be taught must be conceptually clear and presented with language and examples connected to the learner's past knowledge; concept maps are particularly beneficial. Concept maps are visual tools for organizing and displaying information. They include concepts, which are normally enclosed in circles or boxes of some kind, as well as relationships between concepts, which are shown by a connecting line joining two concepts.

Intelligence can play a role in the success of using concept mapping as a learning tool, but it is not the only determining factor. Intelligence can certainly aid in the process of creating a concept map, as individuals with higher levels of intelligence may be able to more easily understand and analyze complex information. However, concept mapping is a skill that can be developed and improved with practice, regardless of one's level of intelligence. In addition, concept mapping can actually enhance intelligence, as the process of creating a map requires individuals to engage in critical thinking and problem-solving. By actively processing information and making connections between different concepts, individuals can develop their cognitive abilities and improve their intelligence.

1.1 SIGNIFICANCE OF THE STUDY

Concept mapping is a powerful tool for learning and can have a positive impact on a student's education. It provides a visual representation of information and helps to organize and clarify complex concepts, making it easier for students to understand and retain the information they are learning. The process of creating a concept map also encourages critical thinking and active learning, as students are required to analyze and synthesize information,

and actively engage with the material. This can lead to deeper engagement and understanding of the subject matter, as well as an increase in confidence and motivation. It is used as an assessment tool, allowing teachers to gauge a student's understanding of a subject and identify areas where additional support may be needed. It can also be used to facilitate collaboration and teamwork, as students can work together to create a shared concept map.

Concept mapping is a versatile and effective learning tool that can have a positive impact on a student's education by promoting understanding, encouraging critical thinking, and supporting active, creative learning. Concept maps are also useful for recognizing both legitimate and flawed ideas possessed by pupils, as will be addressed further in a subsequent section. For detecting relevant knowledge a learner has before or after teaching, they can be as effective as more time-consuming clinical interviews (Edwards & Fraser, 1983). Novak (1984) created concept maps based on Ausubel's cognitive theories, which emphasized the significance of prior knowledge in order to obtain deep learning on new concepts. Meaningful deep learning can readily occur by understanding what is previously known and relating new concepts to the known.

Science educators, researchers, and curriculum architects have utilized concept mapping to track student learning patterns, assess student knowledge, and redesign curricula. Concept maps are founded on the notion that hierarchical concept relationships are knowledge building blocks. Teachers may obtain insight into the substance and arrangement of students' knowledge by analyzing their concept maps.

Concept mapping strategy had greater achievement in English grammar. Salehi; Jahandar and Khodabandehlou (2013) Spider and hierarchy modes of concept mapping instructional strategies are not gender bias at retention level (Wushishi; Danjuma and Usman, 2013) Concept mapping strategy was improved science achievement as well as scientific aptitude and problem solving ability of students (Jagadeesh, 2012). Despite the fact that many studies have been completed on concept mapping, no one has conducted a study on the usefulness of concept mapping on science achievement and problem-solving abilities independently. Although various studies on idea mapping as an instructional approach have been undertaken (Akin, 1977; Bello, 1997; Esiobu and Soyibo, 1995), several significant elements have been either ignored or underreported. In conclusion, while intelligence may play a role in the success of using concept mapping as a learning tool, it is not the only determining factor. Concept mapping can be an effective tool for individuals at any level of intelligence and can even help to enhance cognitive abilities over time. As a result, the

researcher is curious to learn to what degree idea mapping influences accomplishment in Biology when intelligence is considered a covariate.

1.2 STATEMENT OF THE PROBLEM

The aim of this research is to identify the concept mapping strategy of teaching impact on achievement in biology in relation to intelligence quotient as covariate of secondary school students.

1.3 OBJECTIVES OF THE STUDY

To know the usefulness of concept mapping strategy of instruction on achievement in biology in relation to intelligence quotient as covariate of secondary school students when compared to conventional teaching method.

1.4 STATEMENT OF HYPOTHESES

The hypothesis for this study is that there is no significant difference in corrected mean Achievement in Biology scores between control and experimental groups when intelligence quotient (IQ) is considered as a covariate.

II. METHODOLOGY

The reason of this research is to identify the concept mapping strategy of training impact on achievement in biology in relation to intelligence quotient as covariate of secondary school students. For this purpose 60 grade IX standard students from co-educational state syllabus schools from two classes were selected. The idea mapping instructional technique was assigned to the individuals at random for the objectives of the study. This study included an experimental group and a control group that was taught using a more traditional teacher-centered approach. There were 60 students in the class. One class (n = 30, 16 boys, and 14 girls) was designated as the idea mapping group, while the other (n = 30, 16 boys, and 14 girls) was designated as the control group. The Achievement Test in Biology produced by the researcher was used in this study, and the Ravens Progress Test was used to determine intelligence. ANOVA and ANCOVA were used to examine the data descriptively and inferentially, with Scheffe's post hoc analysis. The level of significance was set at 0.05 and the level of confidence at 0.01.

III. ANALYSIS AND INTERPRETATION OF DATA

The preliminary phase involves assessing the data on pre-test mean scores and post-test mean scores of the concept mapping teaching strategy group (CMTSG) and Control

Group (CG) on Achievement in Biology using analysis of variance and analysis of covariance. The post-test means were adjusted for changes in the pre-test means as the final phase of covariance analysis, and the adjusted post-test mean scores were assessed for significance. The Covariance Analysis was used to see if the idea mapping teaching technique resulted in significant improvements in the criteria variables. As a result, the data was evaluated, and the post-test and corrected post-test findings are as follows:

Table-1: Significance changes between mean achievement scores in biology of the CMTSG and CG taking into account IQ as a covariate

Variable	Group	N	IQ Mean Scores	Mean Score of Achievement in Biology	Adjusted Mean scores of Achievement in Biology
Achievement in Biology	CG	30	25.266	17.300	17.298
	CMTSG	30	25.033	19.966	19.968

Table-2: Analysis of Covariance results pertaining to Achievement in Biology of IX standard students

Variable	Sources of Variance	Sum of Square	Df	Mean Squares	F ratio	P Value
Achievement in Biology	Group	106.791	1	106.791	11.290**	0.001
	Error	539.142	57	9.459		

** This indicates significant @ 0.01 confidence level.

According to the preceding statistics, the CG CMTSG group is comprised of 30 subjects. These two groups' mean IQ values were 25.266 and 25.033, respectively. After ANCOVA removed the effect of IQ, the adjusted mean Achievement in Biology scores of the CG and CMTS groups were 17.298 and 19.9268, respectively.

The 'F' value for the difference in adjusted mean accomplishment scores between the CG and CMTS groups was 11.290, which was significant at the 0.01 level. As a result, the null hypothesis that "there was no significant difference between corrected means of Achievement in Biology of control and experimental groups by considering IQ as a covariate" was rejected, and it is possible to conclude that "there was a significant difference between adjusted mean scores of Achievement in Biology between the controlled group and the concept mapping teaching strategy group by considering IQ as a covariate."

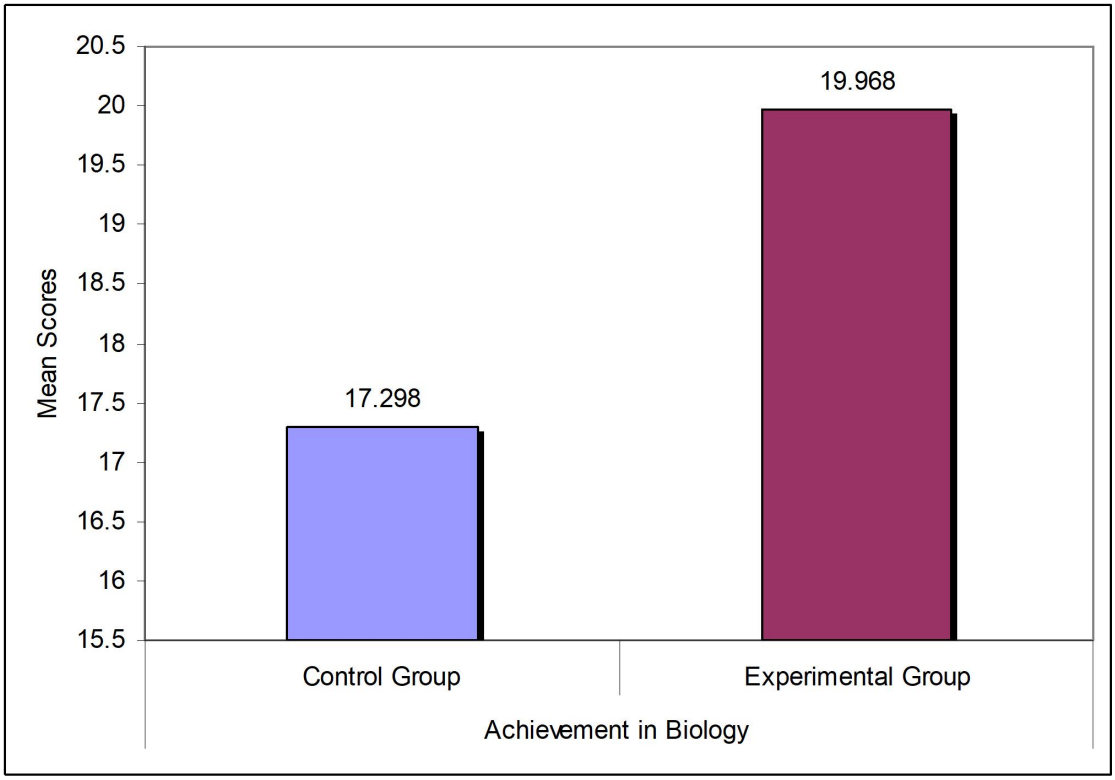

Fig: Bar graph shows comparison of adjustment mean scores of Achievement in Biology between CMTSG and CG after considering IQ as covariate.

IV. DISCUSSION OF FINDINGS AND RESULTS

According to the ANCOVA results, the adjusted mean scores of the control group and CMTS for Achievement in Biology were 17.298 and 19.968, respectively. When intelligence was used as a covariate variable, students taught using the idea mapping teaching technique outperformed control group students in Biology achievement. So, when IQ is controlled statistically, it can be argued that the Concept Mapping Teaching Strategy is effective because it accounts for increased achievement in biology. The effect of concept mapping on achievement in biology is dependent on several factors, including IQ. When IQ is used as a covariate, it can help to control for individual differences in intelligence and provide a clearer understanding of the relationship between concept mapping and achievement in biology. Studies have found that concept mapping can have a positive impact on achievement in biology, particularly when it comes to enhancing students' understanding of complex biological concepts and improving their critical thinking skills. However, the magnitude of this effect can vary based on the individual's IQ and other factors such as prior knowledge, motivation, and learning style.

V. CONCLUSION AND EDUCATIONAL IMPLICATIONS

The concept mapping teaching strategy was highly effective as it accounts for higher achievement in biology, when intelligence was controlled statistically. Concept mapping helps students organize and connect new information to existing knowledge, leading to a deeper understanding of complex biological concepts. By actively creating a visual representation of their understanding, students are more likely to retain information and recall it later. Creating concept maps requires students to analyze and synthesize information, strengthening critical thinking skills. Intelligence Quotient can be an important covariate in studies examining the impact of concept mapping on achievement in biology, it is not the only factor to consider. Further research is needed to fully understand the relationship between these variables and the best ways to maximize the benefits of concept mapping in the biology classroom.

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