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AN INNOVATIVE METHOD OF TEACHING-LEARNING STRATEGY TO ENHANCE THE LEARNER'S EDUCATIONAL PROCESS: PARADIGM SHIFT FROM CONVENTIONAL APPROACH TO MODERN APPROACH BY NEUROCOGNITIVE BASED CONCEPT MAPPING

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ABSTRACT

This study examines the effectiveness of Neurocognitive Based Concept Mapping (NBCM) on students' learning in a science course. A total of 32 grade IX of high school Central Board of Secondary Education(CBSE) students were involved in this study by pre-test and post-test measurements. They were divided into two groups: NBCM group as an experimental group and non- NBCM group as a control group. Both the groups were pre-tested with the basic knowledge on the topics "The fundamental unit of life & Is matter around us pure" before instruction. The control group was treated with routine traditional method of teaching whereas the experimental group was instructed with NCBC for three weeks. The researchers were developed a new strategy of teaching science through advanced concept mapping called Neurocognitive Based Concept Mapping for the first time and this strategy was adopted to the experimental group in the post test. The results were analysed using Sciences statistical techniques by Statistical Package for Social Science (SPSS) software. The experimental study revealed that extremely statistically significant between pre-test and post test at 0.01 level of significance. Hence neurocognitive based concept mapping strategy enhances the students to secure good scores and this strategy can be implemented to various level of subjects as well as students.

KEYWORDS: Concept Mapping, Experimental, Neurocognitive Based Concept Mapping, Science

INTRODUCTION

The process of cognition associated to one or more specific areas of the brain is referred as Neurocognition. It involves complex neural pathway in human. Sasikumar *et al.*, [1] had reviewed the impact of neurocognition on teaching competency. The authors pointed out neurocognitive process includes a number of human functions through neuronal network in the human brain and also discussed how the brain and its functions are useful to the teachers in teaching and bringing out the various aspects of teaching competency such as pedagogy, assessment etc.

The basic anatomy and function of brain and learning process are the two important aspects in Neurocognition. Richard Ridderinkhof *et al*., [2] had discussed Neurocognitive mechanisms of cognitive control and recent progress from cognitive neuroscience such as dynamic decision making, goal-directed action selection, response activation and inhibition, performance monitoring and reward-based learning in the main integral processes of cognitive control.

What is Neurocognitive Based Concept Mapping?

Neurocognitive based concept mapping is an advanced tool for representing knowledge and gathering information by neuronal pathway in human brain. This advanced approach can be inculcated among the learners through keyword repetition techniques, brain based learning, Learning by doing method, information processes model, whole brain technique, color coding method etc. for the enhancement of long term memory.

Need for Neurocognitive Based Concept Mapping

In general, cognitive learning approaches to enhance memory among the learners. It also elevates the problem solving and creative skills among the learners. Cognition means acquisition of knowledge. But acquisition of knowledge is a process that involves a series of mental skills.

Purpose of Neurocognitive Based Concept Mapping

i. To generate complex idea
ii. To design complex structure in the form of large web
iii. To aid learning by explicitly integrating new and old knowledge

Significances for Neurocognitive Based Concept Mapping

i. NBCM stimulates long term memory.
ii. It upraises the learning ability among learners.
iii. Mainly involved in the easy way of learning the content.
iv. Information can be easily retrieved by the brain.
v. It develops creative and thinking skills.

Human Learning process in the Brain [3]
Our brain is composed of a multitude of simple chemical building blocks and mainly composed of water, protein, inorganic salts, lipids, carbohydrates, oxygen and nucleic acid. These chemical substances come together to form the fundamental biological building blocks in the human brain called *neurons* or *nerve cells*.

The two most important functions every neuron plays in the body are (i) to monitor and relay information or messages from one neuron to another using a combination of what are called *nervous impulses* and *neurotransmitters*; and (ii) to 'learn', as it were, by forming sophisticated networks of neuronal patterns with other cells of its type as though they were simple mini-brains.

Carlos M. Gomez *et al*., [4] reviewed a neurocognitive model for short-term sensory and motor preparatory activity in humans.

The relationship between the brain and cognition
Cognition is the product of the brain. Understanding the structure and role of brain helps in cognitive theories.

Neural basis of cognition
The structural and functional unit of nervous system is Nerve cell or Neuron. The neural basis of cognition is related to small collection of individual neurons or a network of neurons performing specific function. All cognition is the result of neurological activity.
According to Neurocognition of memory, long-term potentiation can be achieved by enhancing the nerve cell repeatedly to improve permanent memory. This can be attained by ameliorating Neurocognitive skills.

To the best of our knowledge, concept mapping as an advanced tool to build through neurocognition has not been investigated. The purpose of this present study was to study the impact of neurocognitive based concept mapping strategy on the academic achievement of high school students in science course and to access the utility of advanced concept map in ameliorating test scores.

REVIEW OF RELATED LITERATURE

Martin [5] states that concept maps help ‘teachers design units of study that are meaningful, relevant, pedagogically sound, and interesting to students’.

Pandia Vadivu [6] had developed an innovative instructional strategy through Concept mapping for student-teachers of Biology subject.

Jagadeesh [7] had studied the effect of concept mapping strategy on science achievement in relation to scientific aptitude and problem solving ability of secondary school students. The constructed concept mapping in science and science achievement test were used to collect the date by the researcher.

Laxmi Sharma *et al*., [8] had studied the effectiveness of using concept map in science among VI grade students of C.B.S.E School located at Faridabad, India. The researchers designed pre-test post-test equivalent group of experimental group design. The results concluded that pre-test achievement scores of students of control group were significantly higher than their pre-test achievement scores.

The related literature clearly showed that there are substantial studies on Concept mapping strategy to the students. However, studies on neurocognitive based instruction are scanty. Therefore, the current study was undertaken to examine NBCM strategy on science course of high school students.

OBJECTIVES

The main purpose of this present study was to examine the effect of NBCM strategy in teaching high school students in science.

i. To examine the difference between the pre-test and the post-test scores of Control group.
ii. To examine the difference between the pre-test and the post-test scores of Experimental group.

METHODOLOGY

Method

Experimental study using pre-test and post-test measurement was adopted.

Sample of the study

The study involves a sample of 32 of class IX students of Thiruvallur district, Tamilnadu. Stratified random sampling procedure was employed to select the students into control and experiment groups.

Hypotheses

i. There is no statistically significant difference between the pre-test and the post-test scores of Control group.
ii. There is no statistically significant difference between the pre-test and the post-test scores of Experimental group

Procedure

The experimental study was conducted to the students of IX standard studying at Thiruvallur and which was affiliated to Central Board of Secondary Education (CBSE), New Delhi. The permission was obtained from the Principal to conduct the study. The stratified random sampling technique was applied to two different sections of the same standard. A total of 32 students were selected and divided into control (N=16) and experimental (N=16) groups respectively. Both the groups were pre-tested with selected topics in the science subject (the fundamental unit of life and is matter around us).The conventional teaching method was taught to the control group. On the other hand, for the experimental group the modern method of teaching was taught for 3 week with respect to importance of advanced concept mapping, building concept mapping based on coding and encoding processes of human brain through Neurocognition, points to be remembered while constructing Neurocognitive based concept mapping. Finally, data on post-test was obtained from the students for statistical analysis.

Statistical Techniques Used

Mean, Standard deviation, t-test, Standard Error of Mean (SEM) were used in the present study [9].

RESULTS AND DISCUSSION

The collected data from the study was tabulated and analysed using statistical techniques
The distribution of sample on the basis of gender is summarized in the Table-I
The graphical representation of the scores (pre-test and post-test) obtained in the experimental group is depicted in the Figure 1.

Testing of hypothesis 1
There is no significant difference between pre-test and post-test scores of Control group
The above hypothesis tested and interpreted below

The Scores on the achievement of the paired t-test for Control group Pre-test and post-test is tabulated in Table 2.

Testing of hypothesis 2
There is no significant difference between pre-test and post-test scores of Experimental group

The above hypothesis tested and interpreted below
The Scores on the achievement of the paired t-test for Experimental group Pre-test and post-test is tabulated in Table 3.I

Askin Asan [10] had experimentally studied the implementation of concept map in science class of fifth grade students. A total of 23 students were tested with teacher-constructed pre-test and post-test containing 20 multiple-choice questions. The pre-test and post-test results were statistically analysed. The investigator concluded that the concept mapping has a noticeable impact on student achievement in science classes.

Nemati *et al.,* [11] had investigated the impact of applying mind mapping technique as a pre-writing tool on enhancement of organization and overall quality of Iranian EFL learners' easy writing ability at the advanced level. A total of 40 learners were involved in this experimental study. The result revealed that the remarkable improvement was observed in experimental group treated with mind mapping techniques and was proven by statistical analysis using MANCOVA test.

Sridhar Ramachandran and Pandia Vadivu P [12] had reviewed the emerging trends in educational neuroscience approaches to teaching and learning by adopting various modern method of teaching such as brain based learning, cognitive tutoring, virtual learning, e-learning etc.

Several studies had been conducted with reference to the Concept mapping, but no studies have been conducted by applying advanced concept mapping. To the best of our knowledge, this constitutes the first study by employing Neurocognitive Based Concept Mapping (NBCM) on science course among high school students. The graphical representation of the scores (pre-test and post-test) obtained in the experimental group is depicted in the Figure-I

SUMMARY

In the present study an attempt has been made to assess the effectiveness of NBCM strategy on science course among high school students. Primarily, to identity the modern method of teaching and learning for the present generation teachers and students for developing instructional strategy. Secondly, how to construct, develop and learning the science course through NBCM was taught to the students. Finally, experimental study was conducted to the groups by examining pre-test and post-test measurements.

MAJOR FINDINGS

i. There is no significant difference between pre-test and post-test of control group.
ii. There is extremely significant difference between pre-test and post-test of experimental group.

EDUCATIONAL IMPLICATION

The present study investigated that how the modern method of teaching especially advocating an advance method of concept mapping to enhance the learner to achieve in

the academic aspect. This study portrait the present scenario of students' level of learning by adopting coding and encoding processes of human brain through Neurocognitive based concept mapping. This educational implication will definitely help the future facilitators and learner community.

RECOMMENDATIONS

The following recommendations were made on the basis of the finding of the study:

The students in the experimental group were scored better than other students. Since the modern method of teaching was employed in this present study using Neurocognitive based concept mapping strategy. Therefore the teachers of science should use such an advance strategy in their class to improve the understanding capability of the concept and the academic achievement of the students.

Incorporation of advanced strategy using Neurocognitive based concept mapping in the textbook for the benefit of the learner.

Orientation class will be conducted to student-teacher as well as in-service teachers to employ NBCM strategy in the classrooms.

REFERENCES

[1]. Sasikumar N, Parimala Fathima M and Mohan S. Impact of neurocognition on teaching competency. *Innovare Journal of Education*, 2013, 1(1): 7-9.

[2]. Richard Ridderinkhof K, Wery P.M. van den Wildenberg, Sidney J. Segalowitzd and Cameron S. Cartere. Neurocognitive mechanisms of cognitive control: The role of prefrontal cortex in action election, response inhibition, performance monitoring, and reward-based learning. *Brain and Cognition*, 2004, 56: 129-140.

[3]. Pandia Vadivu, P. Concept Mapping in Science Education. Kancheepurum, Tamilnadu, India, Excellent publisher, 2014.

[4]. Carlos M. Gomez, Encarna Vaquero and Manuel Vazquez-Marrufo. A neurocognitive model for short-term sensory and motor preparatory activity in humans. *Psicologica*, 2004, 25: 217-229.

[5]. Martin. Tied Knowledge: Power in Higher Education. Lanzing Cognitive Support for Learning: Imagining the Unknown edited by Piet A. M. Kommers. 11. 1998.

[6]. Pandia Vadivu P. Concept Mapping – An instructional Strategy in a B.Ed. Biology Class. *International Journal of Education, Technology and Social Media*. 2010, APA-Publishing Corporation.

[7]. Jagadeesh B. Effect of concept mapping strategy on science achievement in relation to scientific aptitude and problem solving ability of secondary school students. *Indian Stream Research Journal*, 2012, 2(10): 1-16.

[8]. Laxmi Sharma, Geeta Harsana and Komal Shrama. Study of Effectiveness of using concept maps in science among VI grade students. *International Journal of Scientific and Research Publications*, 2013, 3(4): 1-14.

[9]. Statistical Package for Social Sciences (SPSS). Version 19. IBM Corporation. Available at http://www-01.ibm.com/software/analytic/spss/, 2010.

[10]. Askin Asan. Concept mapping in science class: A case study of fifth grade students. *Educational Technology and Society, 2007*, 10(1): 186-195.

[11]. Azadeh Nemati, Shahrokh Jahandar and Morteza Khodabandehlou. The effect of mind mapping techniques on the enhancement of advanced Iranian EFL learners' essay writing ability through organizing information and thoughts. *Indian Journal of Fundamental and Applied Life Sciences*, 2014, 4(1): 96-104.

[12]. Sridhar Ramachandran and Pandia Vadivu P. Emerging trends in Educational Neuroscience approaches to teaching and learning-A narrative review. *Excellence in Education-An International Journal of Education and Humanities (*APH publishing corp. New Delhi, India), 2014, 3(1): 6-10.

Table 1: Distribution of sample on the basis of gender

S.No.	Groups	N	Percentage Distribution	Total
1	Control group	Male-10	62%	32
		Female-6	38%	
2	Experimental group	Male-8	50%	
		Female-8	50%	

Table 2: Scores on the achievement of the paired t-test for Control group Pre-test and post-test

Control group	N	M	SD	SED	df	t-value
Pre-test	16	27.81	9.11	2.28	14	0.3612*
Post-test	16	28.20	9.78	2.52		

*Not-significant t-value at 0.01 level=2.9768

The above table reveals that calculated 't' value is 0.3612. It is lesser than the table value 2.9768 at 0.01 level of significance. Hence the framed hypothesis is accepted and there is no significant difference between pre-test and post-test of control group.

Table 3: Scores on the achievement of the paired t-test for Experimental group Pre-test and post-test

Experimental group	N	M	SD	SED	df	t-value
Pre-test	16	28	4.69	1.17	14	6.4940*
Post-test	16	34.73	7.52	1.96		

*Significant t-value at 0.01 level=2.9768

The above table reveals that calculated 't' value is 6.4940. It is greater than the table value 2.9768 at 0.01 level of significance. Hence the framed hypothesis is rejected and hence there is significant difference between pre-test and post-test of experimental group.

Figure-I Comparison of Pre-test and post-test scores of Experimental group