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EFFECT OF MIND MAPPING TECHNIQUES ON FIFTH GRADE STUDENTS WHILE TEACHING AND LEARNING SCIENCE

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Abstract: This study aims to investigate the effect of mind mapping technique on fifth grade students. Presenting the information in a meaningful way is considered as the fundamental responsibility of teachers. Teachers can use mind mapping techniques for constructing, organizing, and relating the information with prior concepts. For this purpose the researchers used a quasi-experimental design with a sample of sixty students. Two sections of grade five were taken as intact groups to fulfill the requirement of the study. Both the groups comprised equal participants (thirty in each section).Participants were pre tested and then the intervention was exposed to teach experimental group. Mind mapping technique was used to teach the Participants of experimental group whereas traditional mode of teaching was used for control group. After the completion of treatment, both groups were post tested and their scores were compared by using paired sample t-test. Findings of this study disclosed a significant difference between scores of two groups and the results were in favor of mind mapping technique.

Keywords: **Mind Mapping, Effect, Science, Techniques, Teaching, Learning**

I. INTRODUCTION

The systematic process of getting knowledge and information in a formal way is a basic need of every student. Most of the students suffer with a serious issue of recalling and sorting out the acquired information at the time of assessment or examination (Mitchell, etal., 2017). There are number of learning techniques used by the learners while learning like charts, maps, sticky notes etc. Mind map is simply a graphical depiction of a concept. It is a thinking tool which helps the learner to generate new ideas by recalling previous information and organize them in a specific manner (Fardhila, & Istiyono, 2019). Presenting the information in a meaningful way is a key for effective learning.

Mind map is a thinking strategy and note-taking model developed by Tony Buzan, the British psychologist, mathematician and brain researcher in early 1970s. Teachers can use mind mapping techniques for constructing, organizing, and relating the information with prior concepts. Presenting the information through mind maps make the concepts meaningful and easier to understand for learners (Hector, 2011). This is considered as an effective learning & teaching technique which follows the theory of constructivism (Yolanda, et al., 2018; Everkli, et al., 2010). An individual can construct his own thoughts and ideas about specific topic and represent them on a page by using key words, phrases and images which are interconnected with each other (Balim, et al., 2007).

Tony Buzan first introduced mind mapping techniques in early1970 when he found a problem while gaining understanding about a specific topic and this made him to explore a new method of learning which is termed as mind mapping technique (Hector, 2011). He prescribed in his book “Mind Mapping for Smarter Thinking” that mind maps are the ingenious tool to map someone’s thinking and perceptions (Buzan 2009). It is simply a graphical depiction of beliefs or views. This technique helps the learner to think about the new and novel ideas and bring them together on a sheet of paper in an organized way (Muraya & Kimamo, 2011). It enhances the learner’s thinking capacities and capabilities by enabling them to develop a relationship among their thoughts and ideas (Stokhof, et al., 2017; Agustiningsih, 2013). This technique involves different actions to be performed like drawing lines of equal length, connected to the central idea and selection of appropriate phrases and words by using creativity and imagination. It’s a natural phenomenon that human mind perceives the things through associations. This technique helps the users to develop schemas in their minds that result in the definite and unambiguous associations of thoughts (Trochim, 2006).

According to Buzan (2004), mind mapping is a non-linear activity to show information about the topic through branches or sub branches which are directly linked to the central theme. This technique works on the principle of brain functioning via writing the key word at the center of the page and then draws different branches and sub branches for showing associated detail and information in an organized

manner (Khanlari , et al., 2017; Edward, 2009). In this way, the data and information is arranged in such a way that gives a view of the picture that looks like a web. Human mind is more responsive to pictures and images (Budd, 2004; Adam & Mowers, 2007).

1.1 Rationale of the Study

Education system in Pakistan is based on traditional teaching so there is a desperate need to develop student's mental abilities to enhance their critical thinking, creativity and memory. Mind mapping technique introduced by Tony Buzan in early 1970s is being widely utilized in teaching and learning processes. Mind mapping technique enables the students to learn, organize and retains information for a longer time and recall it when needed. Learners can create their own point of views, save data and information in their mind, retrieve information when needed, or take new decisions with the help of this technique. So, this technique is portrayed as the best and productive approach to enter, save, recall and retrieve information and knowledge from or to the mind. It works in accordance with the normal functioning of the brain, to enhance the general potential and capabilities of the human mind. This perspective guided the researchers to conduct an experiment to check whether mind mapping would be effective in our context as shown by the previous studies.

1.2 Problem Statement

The study aimed to examine the impact of the mind mapping technique to understand concepts and ideas in science teaching at primary level. In order to improve teaching and learning process, mind mapping technique should be used in the classroom at primary level because it is the foundation of further education. So, the primary level is appropriate to conduct such type of experimental study. The study aimed to explore the effect of mind mapping techniques on fifth grade students while teaching and learning science.

1.3 Objectives of the Study

The study aimed to:

1. Investigate the effectiveness of mind mapping technique in teaching and learning Science.
2. Compare the performance of students taught by mind mapping technique vs. the traditional method of teaching.

II. LITERATURE REVIEW

Mind maps are characterized as 'web of thoughts which are connecting to the main idea through branches and sub branches' (Biktimirov & Nilson 2006).Knowledge mapping techniques (O'Donnell, et al., 2002) are also known as the procedure to demonstrate the ideas in a pictorial form. These maps increase performance (Horton et al., 1993) and retention rate when used in classroom during instructional processes ((Nesbit & Adescope, 2006). It starts by writing a main topic at the center of the page (Buzan & Buzan, 1993) and then bringing out different branches in order to highlight key thoughts and views related to topic. Colors and images can also be used to highlight the word and phrases (Balım et al., 2011). It provides a graphical representation of topic or concept by drawing out braches and sub branches having specific word and phrases on it (Weideman & Kritzinger, 2011). These branches must be connected with each other and with the central theme or idea (Yaşar, 2006). It improves the learning by enabling the learner to shape their thoughts and ideas on a paper and draw out a specific meaning of their thoughts. These maps prove to be very useful to evaluate the learning processes as well (Goodnough & Long, 2012).Everyone can draw mind maps in their own style, but there are some points that need to be considered while drawing maps (Buzan, 2000). The main topic should be written at the center of the page .Main topic should be in the form of image or code. Use appropriate words and phrases to express their thoughts. There should be only one key word or phrase on a single branch (Arikunto, 2013). All the branches must have a connection with the main idea. All the branches should be of equal length. Learner can use different colors to highlight the relationship between terms and to make it attractive. And the most important thing is to maintain the sequence and organization of ideas to make it clear and legible (DePorter, & Hernacki, 2015).

Initially, this technique requires a student to clearly understand the phenomenon and then enables them to store that information by drawing it on a paper (Bektiarso, 2015). Learner can elaborate the topic by

drawing out branches and sub branches from the main idea. Sometimes, mind mapping is considered as a storing technique which utilizes and integrates the working of both left and the right hemisphere of the brain to store data and information in the form of maps (Melvin &Silberman, 2013).

Recently, this technique emerges as a tool to enhance creativity, increase memorization and guarantee the effective teaching and learning. It assists the students to organize the knowledge and information by relating it to the previous concepts (Evrekli, İnel, & Balım, 2010).In the way this technique establishes a relationship between concepts and ideas through key words and phrases (Balım et al., 2011; Suryani, 2015). This technique also organizes the learner's thoughts and ideas in order to help them in decision making while solving a specific problem. It enables the users to map their thoughts and ideas on a paper through creative abilities. As a teaching and learning method this technique makes both the teacher and the learner to actively participate in a classroom discussion (Buzan, 2007).

With respect to the Gardener's theory of multiple intelligences mind maps provide a platform to link the verbal and nonverbal intelligences (Abi-El-Mona & Adb-El-Khalick, 2012). Understanding of the complex phenomenon and individual capacities can be enhanced by using the mind mapping technique (Gömleksiz & Yetkiner, 2012). Sujana (2009) asserted that teachers must have to use such method of teaching which ensures the active participation of students as compared to conventional method of teaching which makes the students to be passive and leads to one way communication.

Knowledge mapping technique unzips the intellectual potentials of individual by enabling the user to organize their ideas and views. This results in the formation of an interconnected network of thoughts and imagination as compared to traditional note taking method (Buzan 2010). Moreover, it enforces the user to use both of their right and the left hemisphere which results in the construction of concepts, understanding, memorization, motivation and improved academic performance (Hutama, 2014). He thinks that by stimulating both of the hemispheres, the incredible results can be achieved (Abi-el-Mona & Khalick, 2008). As compared to traditional note taking technique, mind mapping technique typically motivates the user to develop a habit of self-learning and get a better understanding about the phenomenon (Carlson & Daniel, 2011).

Different researchers studied mind mapping technique for different purposes. For example Parikh (2016) uncovered that mind mapping techniques are more constructive and successful as compared to conventional teaching methodologies. Ideas can be easily memorized and retained for a long time than the other note taking techniques (Kalyanasundaram, et al., 2017). It is indicated that knowledge mapping technique can enhance the retention rate of science concepts and knowledge by ten percent as compare to the conventional learning strategy (Evrekli, et al., 2009).

Liu (2016) asserts that knowledge mapping technique actually enhances the students' capacities of learning as well as develops teaching competencies. This technique also motivates the learners to develop a habit of thinking, and enables them to implement their thoughts and ideas in daily life situation (Masyhud, 2016). Although, mind mapping technique has been used in different fields of studies, but it's use in teaching and learning has not been sufficiently expounded (Buzan 2009). So, there was a need to explore the effects of the knowledge mapping techniques in instructional processes. In this study, researcher used a mind mapping technique to study its effects on the fifth grade students.

2.1 Conceptual Framework

Mind map is a thinking strategy and note-taking model developed by Tony Buzan, in 1960. Practor (2012) reported, "Mind mapping was a note-taking technique. Buzan was suggesting this technique; he considered full utilization of brain capabilities. He also emphasized that mind mapping was a learning technique based on not only either left or right hemispheres of the brain, instead considering and integrating all functioning processes of them."

In recent years, they have been visual tools which came to prominence based on distinctive characteristics such as creativeness, enhancing memorizing, ensuring effective learning and assisting students to reveal preliminary knowledge of students (Evrekli, İnel, & Balım, 2010).

Yaşar (2006) said, "Mind map is used to create, visualize, design and classify thoughts within education, organization, problem solving and decision making processes. It is an illustrative diagram which indicates semantic or other connections among information. In general, diagrams, illustrations, words and lines."

Mind maps could be utilized in both learning process and in evaluation of learning products. Mind mapping offers students opportunities to structure meaning in both individual and group environments within the classroom (Goodnough & Long, 2012). Additionally, Abi-El-Mona and Adb-El-Khalick (2008) emphasized with regard to multiple intelligence theory that mind maps could be significantly useful in association of visual and verbal intelligence.

2.2 RESEARCH HYPOTHESIS

This research was conducted to test the following hypotheses:

Ho 1: There will be statistically no significant effect of mind mapping in learning and teaching of Science subject.

Ho 2: There will be statistically no significant effect of the mind mapping technique on fifth grade learners.

III. METHODOLOGY

The study used a systematic procedure of collecting, organizing and analyzing the research data in order to increase precision and build a relationship based on their empirical results. For this reason, the researcher was following a positive paradigm in order to get more authentic and reasonable empirical findings.

Comparison Group Pre-test/Post-test Design was used for the study. The most common quasi-experimental design is the same as the classic controlled experimental design except that the subjects cannot be randomly assigned to either the experimental or the control group, or the researcher cannot control which group will get the treatment. In other words, participants do not all have the same chance of being in the control or the experimental groups, or of receiving or not receiving the treatment.

This design can be diagrammed as follows:

O_1 X O_2

O_1 O_2

Two intact groups were selected. After administering pretest treatment was given just to the experimental group by teaching them through mind mapping technique. Though, control group was taught with conventional method of teaching and then both groups were post-tested.

The population of this study was 5th-grade students of district Sialkot. Intact groups were taken from Government Girls High School Jasserwala, Tehsil Daska, and District Sialkot. Each group comprised thirty students. Both the groups were pretested and treatment was given to the experimental group. Participants in intervention group were taught by using mind mapping techniques while participants in the control group were taught with conventional or traditional method of teaching. After the completion of treatment, both groups were post tested and their results were compared by using paired sample t test in order to check the effectiveness of treatment.

Data was collected by a self constructed test based on textbook of science being taught in the class. The test was administered before and after the execution of treatment as pretest and posttest.

Paired sample t-test was used in order to compare the results of two groups getting through the administration of pretest and posttest.

A. PROCEDURE OF TREATMENT

Following are the procedures taken in to account while teaching science with intervenetion:

1. SLOs were conveyed to students.
2. Prior knowledge was checked by questions and answers session.
3. The topics were introduced to the students according to the specified lesson plan.
4. Clear explanation was delivered to the students,

5. Review of the lesson was given to clear the misconception of students,
6. The teacher provided clear direction regarding mind mapping activity,
7. The teacher involved the students to draw a mind map about each topic
8. The teacher analyzed the mind maps drawn by the students and ascertained that the students completed the worksheet correctly.
9. The students summarized the text based on their mind maps and presented it in front of the classroom.

IV. Findings

Table 1

Paired sample t test to compare mean of of pretest and posttest scores of experimental group

	Group	N	Mean	Std. Dev.	T	df	Sig.
Pre-test	Experimental Group	30	15.13	4.117	-2.342	29	.026
Post-test	Experimental Group	30	16.80	5.365			

The table one shows the post-test and pre-test scores of experimental group. Figures in the table highlight that posttest scores (N: 30, mean: 16.80, standard deviation: 5.365) are greater than the pretest score (N: 30, mean: 15.13, standard deviation: 4.117). Pretest was administered at the beginning of the experiment while the posttest was administered at the completion of experiment to determine the effectiveness of the intervening variable. Participants in treatment group were taught by utilizing mind mapping technique. For this purpose, lesson plans were made before conducting the experiment, which makes sure the actual implementation of mind mapping technique in classroom. The variation between scores of the pretest and posttest of experimental group depict the visible effects of mind mapping technique on the performance of students.

Table 2

Paired sample t test to compare mean of of pretest and posttest scores of of control group

	group	N	Mean	Std. dev.	t	df	Sig.
Pre-test	Control Group	30	14.77	2.897	-1.430	29	.163
Post-test	Control Group	30	15.37	4.030			

The above table shows the scores of pretest and posttest of the control group. The figures show that the posttest scores (N: 30, Mean: 15.37, Standard Deviation: 4.030) are greater than the pretest scores (N: 30, Mean: 14.77, Standard Deviation: 2.897). The posttest was administered after the completion of experiment while the pretest was taken at the beginning of the study. Intervening variable was not introduced to the participants of the control group. Although a slight difference may be noticed in the posttest scores of control group. This may be

Table 3

A Comparison of mean scores on pre-test of control group and treatment group

	Group	N	Mean	Std. deviation
Pre-test	Control Group	30	14.77	2.897
Pre-test	Experimental Group	30	15.13	4.117

The above table demonstrates the pretest scores of the control group and experimental group. Moreover, it also highlights that pre-test scores of the control group (N: 30, Mean: 14.77, Standard Deviation: 2.897) are less than pre-test scores of the experimental group (N: 30, Mean: 15.13, Standard Deviation: 4.117), but the difference in score is not significant. The slight difference in the scores of two groups is observed but it cannot be considered as a higher degree of variation in scores.

Table 4

A Comparison of mean value and standard deviation of post-test scores of control group and experimental group

	Group	N	Mean	Std. deviation
Post-test	Control Group	30	15.37	4.030
Post-test	Experimental Group	30	16.80	5.365

The above table shows the posttest scores of experimental group and control group. It further exhibits that posttest scores of treatment group (N: 30, Mean: 16.80, Standard deviation: 5.365) are greater than posttest scores of control group (N: 30, Mean: 15.37, Standard Deviation: 4.030). The treatment was just given to the experimental group and the control group was taught under controlled situation with usual method of teaching. After the completion of experiment, both the groups were post tested. Significant difference in posttest scores of experimental group shows the effectiveness of the intervening variable.

The findings of this study rejected the following null hypothesis.

Ho 1: There is statistically no significant effect of mind mapping in learning and teaching of Science subject.

Ho 2: There is statistically no significant effect of the mind mapping technique on fifth grade learners.

V. Discussion and conclusion

Present study was conducted to examine the effects of mind mapping techniques on fifth grade students. The data acquired by the pretest and the posttest scores of control and experimental group indicated that the mind mapping technique helps the learners in understanding the concept, organization of imaginations and thoughts, retention and recall of information, memorization, motivation, creation of new ideas, decision making, enhancement of performance and development of a habit of self-learning etc. So, the mind mapping technique should be implemented in every classroom situation to enhance the students' academic performance, creativity and intellectual capabilities.

Results indicated that mind mapping technique affect the pupils in a number of ways. Knowledge maps help the leaner to shape their thoughts and ideas to get a deeper understanding about the phenomenon. It enables the learner to use both of their hemispheres and improves students' performance (van Schaik & Ling, 2001; Fardhila, & Istiyono, 2019). It helps to perceive, store, organize, memorize and recall the information and knowledge when needed and stimulates to shape the thoughts by drawing them on a sheet of paper and this technique also enhances students' motivation for learning (Mitchell, et al., 2017). It enhances the students' intellectual capabilities, develops a habit of self-learning and transforms the learner thoughts and imagination into a graphical representation. It improves the higher order thinking skills (Novak & Cañas, 2006). It provides a quick and easy review of the topic (Riley and Ahlberg (2004). Mind mapping is an assertion of radiant thinking and thus characterize as the functioning of brain. This technique enhances the capabilities of mind by providing the opportunity to be limitless in using the brain power. It can be used in every situation where the human performance needs to be improved through learning (Yolanda, et al., 2018).

This shows that mapping technique improves t student's performance, memorization, creative abilities and thinking capacities. As this technique follows the principle of learning by doing so it also promotes the habit of self-learning as well. For this purpose, teacher needs to be informed and trained to ensure the effective implementation of this technique in teaching and learning process. Many studies have been conducted to analyze the efficiency of mind mapping technique to enhance the retention rate of knowledge and information printed on a paper. An investigation revealed that information learned through mind map is retained in a mind for longer period. Mind mapping group vigorously enhance their retention rate after seven days of experiment. After 1 week the retention rate of experimental group was increased by ten percent (Farrand, et al.,2002). In the same way, Suryani, (2015) attempted to see if the mind mapping technique supports data recovery and basic intuition in students and observed that mind mapping technique enhanced ability to recall information and basic intellectual abilities in relation to the traditional note taking technique. A smart use of mind mapping technique permitted experimental group to perform better than 'traditional note taking group. This exhibited that students of pharmaceutical department can effectively recall data by using mind mapping technique as compared to traditional note taking strategy (D'Antoni, et al., 2010. Hence, there is point for prospective researchers to investigate long term impacts of mind mapping technique on intellectual abilities. As this research was done to determine the effective utilization of paper and pencil maps but there is a need to explore the effectiveness of digitalized mapping technique too by using the software. In the light of the findings of present study it is recommended for the curriculum experts and textbook writers that content should be presented through attractive mind maps where applicable. It is also recommended that effective use of mind mapping techniques should be the part of teachers' professional training.

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