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IMPACT OF MIND MAPPING ACTIVITIES ON STUDENTS LEARNING IN GENERAL SCIENCE SUBJECT AT ELEMENTARY LEVEL

Sana Khan[1]
Lecturer Education Department at Government College Women University, Faisalabad
PhD Scholar in ELT Department Cyprus International University (TRNC),
Sanar708@gmail.com

Dr. SairaTaj[2]
[2]Assistant Professor Department of STEM Education, Faculty of Education, Lahore College for Women University Lahore, sairataj@lcwu.edu.pk

Asifa Younas[3]
[3]PhD Scholar, Department of STEM education, Lahore College for Women University (LCWU), Lahore, Pakistan, ayeshaishfaq8@gmail.com

Abstract

This study was be conducted to examine the impact of mind-mapping learning model on students learning, academic achievement and retention of knowledge. The study was carried out in the subject of General Science at elementary level. The main objective of the study was to measure the effect of mind mapping learning model on students learning in General Science at elementary level. The specific objective was to find out the effect of mind mapping activities for student learning in the subject of General Science at elementary level. Hypotheses were the mind mapping activities have positive effect on students learning in the subject of General Science at elementary level. Grade 8 students of GGHS johar town, Lahore was taken as sample through random sampling technique. Mind mapping method was used to teach students. Researcher selected all the 60 students of grade 8 as a population by cluster sampling. Two groups were made, one as experimental and one as control group. Researcher was take 30 students in each group by random sampling. In the beginning, pretest was taken then teach by mind mapping activities to observe the students learning, motivation, engagement and self-efficacy. Posttest was conducted at the end of intervention to measure student achievement. Researcher used appropriate statistical technique and analyze the data through SPSS. Researcher concluded and finalized the result according the objectives and made recommendation.

Key words: mind mapping, elementary level, public school

Introduction

Natural science is a rational and objective knowledge that discusses the universe and everything in it in detail. Natural science deals with natural phenomena that occur systematically and arranged in such a way based on the results of experiments and observations carried out directly by human beings. According to Fowler, that natural science is related to natural phenomena and material arranged in a systematic and orderly way. A collection of systematic observations and experiments means that all the knowledge is compiled in a unit of a system. It cannot stand alone. Each element is bound, interrelated, and can be mutually explained, thus,

forms the entire components in one unified system (Samatowa, 2011).

Natural science is a discipline of theories obtained or prepared in its own way, which is by observing, experimenting, concluding, theorizing, and so on, and is interrelated with each other. Science learning is a teaching and learning process on natural phenomena (Agustiningsih, 2013). Understanding the concept of science in elementary school before learning is essential in training children to think critically and objectively to a problem, generate curiosity in nature, and develop the ability to ask question in order to find answers based on evidence. The concept of science can thrive when students have firsthand experiences, discover, solve problems, and draw their own conclusions of what they observe. In the process of learning science, teachers can select and use a variety of teaching methods to develop students' knowledge, skills, understanding, and moral values with regard to the progress of the development of science.

In order to make students understand the message given in learning, either spoken or written or graphic, teachers need to construct learning so that students are easier to understand the knowledge. Thus, students can discover the facts of science, build the concept themselves, relate theories, and nurture scientific attitude by emphasizing on the activity or process of student learning. To achieve the goal of learning science, teachers are obliged to enhance students' learning experience. It is important to choose a suitable learning method which is appropriate with the instructional materials and the physical and mental condition of the students. Before starting teaching, teachers need to know what has been known to students. Teachers should consider learning strategies that can be easier for students to understand the concepts or materials in science. Mind mapping is a creative and effective way of note taking which literally maps the mind and is very simple (Buzan, 2020).

Statement of the Problem

The study was an attempt to investigate the effect of mind mapping learning model on students learning in general science subject at elementary level. In essence, mind mapping is a powerful strategy for learning to brainstorm a topic to establish a deeper impression. Mind mapping use the entire utilization of the brain by using visuals and graphics (Huda, 2013).

Objectives of the Study

The study will be based on the following objectives:

1: To find out mind mapping activities for student learning in the subject of General Science at elementary level.

2. To evaluate the effect of mind mapping learning activities on the conceptual learning of general science subject at elementary level

3. To develop a model in context of mind mapping learning activities.

Research Hypotheses

The study will be based on the following three hypothesis:

H_1

There is no significant effect of mind mapping learning model on student learning in the subject of general science at elementary level

H_2

Mind mapping learning activities has positive effects on students learning in the subject of general science at elementary level

H_3

Mind mapping learning activities has negative effect on students learning in the subject of general science at elementary level.

Significance of the Study

This study aims at finding out the impact of mind mapping activities on students learning in general science at elementary level. This study will help teachers and policy makers to:

- improve factual recall from written information
- increase students engagement
- stimulate interest in learning general science encourage students towards intrinsic motivation and science self-efficacy
- improve memory for general science facts and figures
- improve effective student questioning for learning the curriculum

Limitations

Due to shortage of time, money, and resources study was limited to grade eight students of GGHS johar town. Lahore.

Review of Related Literature

This part mainly focuses the concept of mind mapping by different experts. It includes the types of mind mapping techniques i.e. concept mapping, knowledge mapping and mind mapping, steps to make mind maps and advantages of mind mapping.

Mind mapping

Buzan and Buzan (1997) investigated that mind mapping is a study technique in which information from a variety of sources is converted into a diagrammatic representation of the important key words associated with a study topic. During production, an image representing

the main study topic is initially drawn in the centre of the mind map. Extending from this central image are several major branches containing keywords representing the topic subheadings, which are accompanied by an image whenever possible. The important detail included under each subheading is written upon smaller branches projecting from the subheadings with more detailed information being connected to this information.

According to Bektiarso (2015) the mind mapping strategy is defined as an art that is used to improve the skills and resources to achieve the objectives or learning outcomes which are optimized through effective relationship between the learning environment and students' most favorable physical and psychological conditions.

Buzan (2012) studied that mind mapping is a creative and effective way of note taking which literally maps the mind and is very simple.

Huda (2013) examined that in essence, mind mapping is a powerful strategy for learning to brainstorm a topic. To establish a deeper impression, mind mapping use the entire utilization of the brain by using visuals and or graphics. In other words, mind mapping is a graphical technique that encourages brain to process visually by demonstrating a wide range of relationships between ideas and improves the ability to look at problems from all sides.

Characteristics of Mind Mapping

According to Budd (2003) there are four main characteristics of mind mapping:

a. Each mind-map has a central picture as a starting location containing the main theme or idea. The central point in the mind-map commonly used picture because picture can helps brain to generate idea easily. The ideas of the mind-map “released” from the central topic or image as branches with sub- topics connected to each other. The sizes of the branches are different and the connecting words are used to support relations to main topic.

b. The final structure of the mind-map becomes a hierarchy of linked ideas. Palmberg (2011) claimed that our consciousness always analyses how things are connected to each other. And when that is done, the mind creates an image to symbolize the structure.

c. Each branch has keywords or colorful pictures connected to each other. It is recommended to use the picture in the entire mind-map. A traditional outline is often lack of color whereas the use of color is important in creating mind-maps. In particular, many mind-maps use one color for each major topic to help in organization. Each branch used a single keyword, not a phrase or sentence. The ideas of the mind-map “released” from the central topic or image as branches with sub- topics connected to each other. The sizes of the branches are different and the connecting words are used to support relations to main topic.

d. Each branch has keywords or colorful pictures connected to each other. It is recommended to use the picture in the entire mind-map. A traditional outline is often lack of color whereas the use of color is important in creating mind-maps. In particular, many mind-maps use one color for each major topic to help in organization. Each branch used a single keyword, not a phrase or sentence.

e. The ideas of the mind-map “released” from the central topic or image as branches with sub-

topics connected to each other. The sizes of the branches are different and the connecting words are used to support relations to main topic.

Types of Mind Mapping Techniques

The means of representing ideas in diagrams with node-link assemblies has been termed concept mapping (Novak & Gowin, 1984), knowledge mapping (O‟Donnell, Dansereau, & Hall, 2002), and mind mapping (Buzan & Buzan, 1993). When used as a part of instruction, these types of mapping techniques have been shown to increase students‟ achievement scores (Horton et al., 1993) and knowledge retention (Nesbit & Adescope, 2006).

Concept of Map

Concept maps have being defined as two-dimensional, hierarchical, node-linked diagrams that depict verbal, conceptual, or declarative knowledge in succinct visual or graphic forms (Quinn et al., 2004; Horton el al., 1993).

A concept map is a visual representation of an individual‟s knowledge structure on a particular topic. The maps contain several elements, which as a whole organise and represent students‟ knowledge. They include concepts which are defined as “perceived regularities in objects or events that are designated by a sign or symbol” (Novak, 1991). The concepts are usually enclosed in circles and linked together using linking phrases that identify the relationship between adjacent concepts. The smallest unit of meaning of a concept map is a proposition which includes two concepts linked together using a linking phrase.

Nesbit and Adesope (2006) defined a concept map as “a type of graphic organizer that is distinguished by the use of labeled nodes denoting concepts and links denoting relationships among concepts”. Typically, when used in an instructional setting, students who complete a concept map place concepts or ideas in ovals (or any shape), organize the ovals in some type of logical manner that shows the relationship among them (which may or may not be hierarchical), and connect the concepts to one another with lines that might or might not be labeled (Novak and Gowin, 1984).

Concept Mapping is a practical learning tool which falls into the broad family of graphic organizing tools that includes mind mapping and spider diagrams. However the characteristics of Concept Mapping set it apart from the others. Concept Mapping was firstly developed by Novak and his research group in Cornell University in the early 1970‟s as an approach to identifying knowledge structures of an individual. It is now used as a vehicle to represent and assess changes in students‟ understanding of science (Horton et al., 1993; Novak, 1990).

Boxtel, et al., (2002) suggest that concept mapping promotes meaningful learning as follows: (a) helps students become aware of and reflect on their own misunderstanding; (b) helps students to participate in developing meaning in learning concepts; (c) provides opportunity for student interaction, thus the more students talk about science concepts and the more elaborative the talk, the higher the learning out- comes.

Knowledge Map

According to McCagg and Dansereau (1991) Knowledge maps are node-link representations in which ideas are located in nodes and connected to other related ideas

through a series of labeled links. They differ from other similar representations such as mind maps, concept maps, and graphic organizers in the deliberate use of a common set of labeled links that connect ideas. Some links are domain specific (e.g., *function* is very useful for some topic domains but not others) whereas other links (e.g., *part*) are more broadly used. Links have arrowheads to indicate the direction of the relationship between ideas. Three main categories of links can be used dynamic links that denote a changing relationship between the linked ideas (e.g., a cause and effect relationship such as "Heavy rain *caused* a flash flood"); static links that describe structural relationships between ideas (e.g., an arm is a *part* of a human body), and elaborative links that extend information (e.g., Einstein is anexample ofagenius).

Mind Map

Mind mapping is slightly different from concept mapping in that the mind mapping process starts with a topic at the center of the graphic (Buzan & Buzan, 1993). Important concepts and phrases are then linked to the center topic on branches which can continue to branch into other concepts and phrases. In addition, the text can be accompanied by images, and color can be used for emphasis or to facilitate organization.

Mind mapping activities require students to actively engage in their learning, often by

Connecting their prior knowledge to new information. When creating a mind map, a student frequently interacts with a textbook, notes from class, an instructor, classmate, or study group. Viewed from a sociocultural perspective, the student's learning in all of these interactions would be mediated by a social agent: an individual, group, or a cultural tool such as a textbook or set of class notes (Salomon & Perkins, 1998).

Mind mapping is a creative and effective way of note taking which literally maps the mind and is very simple (Buzan, 2012). In essence, mind mapping is a powerful strategy for learning to brainstorm a topic (Huda, 2013).

The Mind Map is a way of noting the creative, effective, and quite literally would be "mapped" human's thoughts (Buzan, 2008). Mind mapping methods can be used as a means of fitting to make learning methods because, with the methods, a student can take notes with full colors. Researchers employ mind mapping learning model as it is appropriate for learning and widely used in various fields of research.

Silberman (2013), conceived that mind mapping is a creative way for students to record what they have learned, generate ideas, or a new task decision.

Parikh (2016) revealed that mind mapping techniques are more effective than the traditional method. Mind mapping is conceived to have a better ability to memorize than regular way of text writing (Kalyanasundaram, 2017).

Moreover, Liu (2016) advocates that Mind Mapping potentially promote teaching efficiency and improve students' ability of practical application. Students tend to cultivate a good habit of thought, aiming at the application of mind mapping in learning.

Advantages of Mind Map

Murley (2007) explained that the radiating design of a mind-map keeps the main topic or idea central stand together with all its major sub-topics neighboring it. Similarly, sub-subtopics stay close to their topics. This arrangement keeps the big picture in focus and makes relationships and connections easier to notice.

Mind mapping allows student be conveniently capturing their thought as it is facilitating the development. It works well both collaboratively or during the individual learning (Betsy et al., 2012). Mind mapping is beneficial for creative processes such as writing (Yunus and Chien, 2016). Students participating in an open-ended questionnaire research responded that mind mapping helps them organize their ideas effectively. Topic comprehension and their writing were improved to the extent that they can be easily articulating ideas.

Furthermore, mind mapping is more flexible that students' creativity will be encouraged. Memory storage is enhanced as mind mapping allows displaying all related topics on the same mind map, with keywords and connections indicated by images, symbols, and colors. Mind map is not only enhancing students' creativity, but also attracting students' attention. The benefits of mind mapping include providing the students with a more attractive and enjoyable format for their eye and brain.

Research Methodology

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Brief Description of Research Location

The research of this study was take place in Government GGHS (Government Girls High School located in johar town Lahore).

The Facilities

In order to support teachers and students in teaching and learning process, Government Girls High School (GGHS) johar town, Lahore has enough facilities as follows:

Table 3.1 The Facilities at GGHS johar town Lahore

No	Facilities	Unit
1.	Classrooms	**58**
2.	Library	**1**
3.	Science Laboratory	**1**
4.	Computer Laboratory	**1**
5.	Sports Field	**1**
6.	Teachers Office	**3**

The teaching learning process at GGHS johar town, lahore takes place from 07:30 am to 01:30 pm.

The school also provides multimedia room, computer and science laboratory. Multimedia room is used as language laboratory that is aimed at helping students to learn science subject. Meanwhile, computer laboratory is proposed to facilitate students in operating computer to improve students' knowledge of technology. The school also offers science laboratory to the students to learn the science material in practice. Thus, the students can use the science

Design of Research Study

Pretest-posttest control group design; quasi experimental method served its purpose where in the subjects of the study were assessed before and after the experimental manipulation (Cuttler, 2018). Both groups were stood homogenous by determining through pretest. Elemantry level students (science subject), belonging to Public Sector school (N =60), which was located in GGHS, johar town district Lahore, Pakistan. Given that affiliated groups were chosen using a combination of random selection and, random allocation, having pretest and control group altogether served as a control against any internal validity threat (Brundtland, 2019). Manipulation or intervention was identified as model of mind mapping learning, an independent variable and its direct effect on the dependent variable was assessed by the researcher in terms of academic achievement of elementary science students (Khan, 2023).

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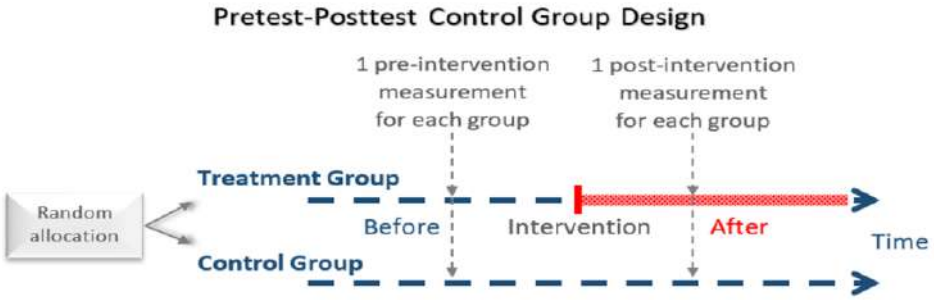

Population

In this study, researcher need to decide the population to collect the data. Creswell (2008) explains population is "a group of individuals who have the same characteristic". Considering this statement, researcher determined the total population of this study were all the sixty eighth grade students of elementary section at GGHS, johar town LAHORE.

Sample

Arikunto (2010) stated that sample is a limited number of elements from a population to be representative of the population. There is only one section of grade 8 students at GGHS, JOHAR TOWN, LAHORE. A sample was selected based on the teacher's recommendation to take whole students of grade 8 as experimental and control group. For the reason, they have been studying general science in GGHS LHR. Since junior high school until now. Therefore, the sample of this study were all the 60 students of grade 8. Researcher selected the whole 60 students, 30 students in control group and 30 in experimental group.

Plan of intervention

The participants of the study; experimental and control groups, were taked pre-test, first in a traditional environment then researcher was intervention the experimental group and at the end researcher taked the post test

Dynamics involved in Mind Mapping Learning Model

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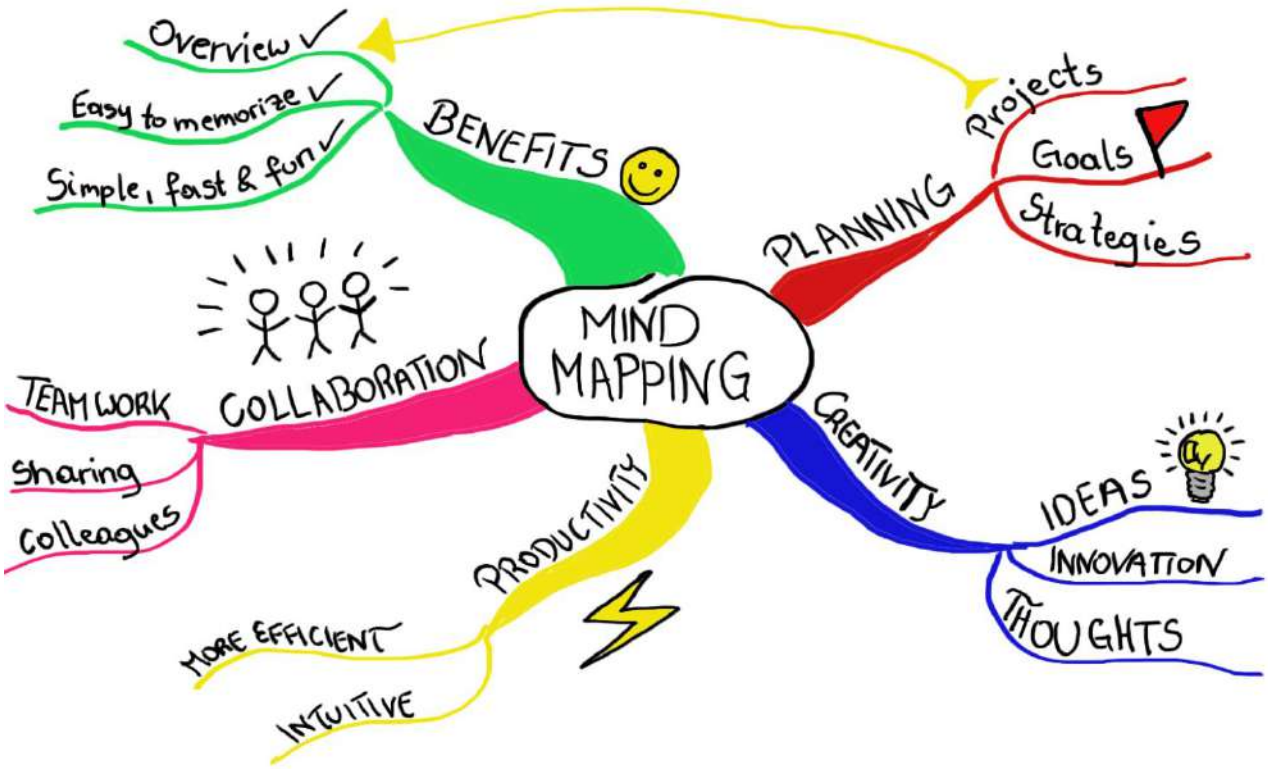


Research instrument

The researcher used pretest and posttest to measure the achievement of students before and after teaching through mind mapping techniques respectively.

A set of achievement tests consisting of the concepts of content taught through mind mapping learning model was used for pre-test and post-test examination for each experimental and control group students. A researcher made pre-test was administered using the short and structured questions in order to make sure that the groups are homogenous or approximately homogenous and to assess the knowledge and analytical skills of participants at the beginning of the term. For this purpose, independent sample t-test was used for the results of total scores on pre-test of experimental and control groups as initial base scores.

Validity and reliability of research instrument

The instrument was undergo an evaluation of face validity that is, whether each of the measuring items matched to the given conceptual lerning and content validity was indicate the extent to which items are adequately measured the content of the representative trait, which researcher want to measure. Firstly, the review experts, subject specialists of the subject matter was validate the preparation of pre-tests and post-tests and secondly, before giving the instruments a final shape, tests was pilot-tested to a selected number (10%) of respondents.

The vagueness or any unclear terms from the questionnaire was removed. An item analysis was conducted based on pilot testing. Extremely difficult and very easy items were removed in the light

of the result of the pilot testing and the final form of the test was prepared. At this stage, it cannot be predetermined that how many items may be the final form of the test items after pilot testing.

Data Collection

It was quasi experimental study. Grade eight students were divided into two groups (control and experimental). Teacher teach them according to mind mapping techniques. At the end test was taken to find out students achievement.

Data analysis

Data was analyzed through SPSS. After cleaning the data descriptive analysis was conducted. Independent sample T test was applied to find out the differences between the achievement scores of control and experimental group.

Before providing intervention, a normality test was run on participant pretest results. The achievement scores for both groups were compared using an independent sample t-test. The analysis of the pretest and posttests scores determined that conceptual clarity for those participants (experimental group) was increased who received treatment (intervention) when the paired sample t-test was served. Creswell (2020) theme analysis method was used to analyze the reflections.

Results

Table Work. 1.

Response percentages and frequencies established from the respondents' demographics for both groups.

Demographic Variables	*F*	*%*
Gender		
Female	60	100
Current Educational Level (Elementary)	60	100
Total	**60**	**100**

Note: F=frequency, %= Percentage

From public school female respondents were selected, two groups was 60(N =60) were selected for this study. Class 8th students were entered, which was calculated mean ages as M=18.21, and the standard deviation of the individual ages was around 1.25.

Table 2.

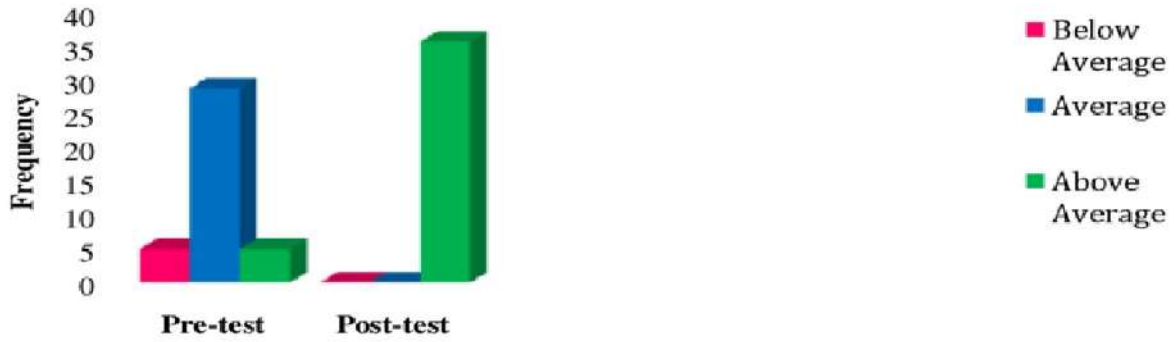
After Sixteen consecutive weeks of exposure to the treatment to the experimental group, the difference on the mean scores of both groups

Tests	Groups	N	Mean	Std. Deviation	t	Df	P
Pretest	C.G.	30	2.67	1.15	0-.42	53	0.69
	E.G.	30	2.79	1.02			
Posttest 2	C.G.	30	8.54	1.28	2.84	53	0.00

E.G.	30	7.61	1.28

Note: M=Mean, df= Degree of freedom, S.L.= Situate Learning, T.L.=Traditional Learning, SD=Standard Deviation, p > 0.05.

The independent sample t-test was employed to analyse inter-group disparities and measure student performance on scientific achievement evaluations, as indicated by the data presented in the Table. In the domain of General Science, the data shown in this table indicates that there is no statistically significant distinction in the average pretest scores between the two groups. The t-value for this comparison is -.42 (53), with a p-value of .69, which is greater than the predetermined significance level of .05. However, when examining the pre-test and post-test scores, a statistically significant difference is observed. The t-value for this comparison is 2.84 (53), with a p-value of .00.05. The null hypothesis of the study was rejected, indicating that a statistically significant difference existed between the mean achievement scores of the control group, which was instructed using the traditional technique, and the treatment group, which was instructed using the mind mapping learning model.



Comparison diagram between pretest scores and posttest scores. (Author's Compilation, 2022)

The average of the students' test scores in the scientific subject area is visually represented, and a statistical analysis using an independent sample t-test was conducted to investigate the differences in test scores between the two groups, which reflect the students' academic achievements. Consequently, a discernible disparity is observed among the participants in the therapy group when evaluating the average results. The group that received contextual learning instruction demonstrated a significant disparity in their performance on the posttest's measure of accomplishment test in science.

Discussion

This study aims to present research that is based on a quasi-experimental design incorporating pretest, posttest, and control group features. In order to assess the civic awareness, mind mapping activities, and sympathetic dispositions of participants upon completion of the term, the researcher developed a mind mapping learning model that was implemented for student's services including elementary level. The current study's results validated the findings of previous research conducted by Esty (2017) which advocated for the use of participatory learning. The research focused on the conceptual comprehension and willingness of elementary level students to actively participate. According to Anderson (2021), the advancement of these theoretical constructs and the inclinations of the individuals involved facilitated their direct or indirect involvement in issues pertaining to the community. The research facilitated the students in developing a conceptual understanding of their coursework in order to effectively address practical scenarios through the use of reflective evaluation.

Conclusion of the Research Study

The current study demonstrated that various outcomes were observed as a result of the treatment, including improvements in mental health and well-being, the implementation of campaigns promoting mind mapping activities and awareness mind mapping model,training, engagement in classroom activities, min mapping technique, organization, recognition of the importance of mind mapping activities, and The involvement of elementary level science students in the classroom facilitated their acquisition of sustainability. This engagement also resulted in a transformation of their learning approach, aligning it with the actual implementation of the mind mapping activities. Additionally, their attitudes towards conceptual understanding about mind mapping activities and mind mapping.

Recommendations

Further research should explore the long-term effects of mind mapping activities on students' civic awareness and sympathetic dispositions across different educational levels. Expanding the study to include diverse student populations and varied educational contexts will provide a broader understanding of its impact. Additionally, investigating the specific elements of mind mapping that most effectively enhance conceptual comprehension and practical application can help refine the learning model. Employing mixed-method approaches and longitudinal studies will offer deeper insights into how these activities influence students' mental health, well-being, and sustainable learning practices over time.

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